MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

SYLLABUS

BACHELOR OF SCIENCE
IN
AERONAUTICAL ENGINEERING

REVISED ON DECEMBER 2020

DEPARTMENT OF AERONAUTICAL ENGINEERING (AE)
MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY(MIST)
MIRPUR CANTONMENT, DHAKA- 1216, BANGLADESH

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CHAPTER – 1

GENERAL INFORMATION

1.1. Introduction to MIST

The necessity of establishing a technical institute for the Bangladesh Armed Forces was felt in the late eighties. In the absence of such an institution, officers of Bangladesh Armed Forces had been graduating from Bangladesh University of Engineering and Technology (BUET), Bangladesh Institute of Technology (BIT) and other foreign institutions of science and technology. With a view to meet the increasing demand for the development and dissemination of engineering and technological knowledge, Bangladesh Armed Forces established the Military Institute of Science and Technology (MIST) that promises to provide facilities for higher technical education both for the officers of Bangladesh Armed Forces as well as for civil students from home and abroad. The motto of MIST is Technology for Advancement. Founded on 19 April 1998, MIST started its journey on 31 January 1999 by offering a four-year bachelor's degree on Civil Engineering. Bachelor degree on Computer Science Engineering course started on 2001**.** Bachelor courses on Electrical, Electronic & Communication Engineering and Mechanical Engineering started its journey from 2003. Bachelor of Science program on Aeronautical Engineering (AE) and Naval Architecture and Marine Engineering (NAME) program were started from 2008-2009 and 2012-2013 respectively. Besides, four new departments started their academic session from 2014-2015 i.e. Nuclear Science & Engineering (NSE), Biomedical Engineering (BME), Architecture (Arch) and Environmental, Water Resources & Coastal Engineering (EWCE).

1.2 Vision and Mission of MIST.

Vision:

To be a centre of excellence for providing advanced quality education in the field of scientific, engineering and technology advanced to create diverse quality leaders and professionals and conduct innovative research to meet the national and global needs and challenges.

Mission

MIST is working on following missions:

a. To develop as a Centre of Excellence for providing comprehensive education and conducting creative and innovative research in diverse disciplines of engineering, technology, science, management and related fields.

b. To produce technologically advanced intellectual leaders and professionals with high moral and ethical values to meet the national and global needs for sustainable socio- economic development.

c. To provide consultancy, advisory and testing services to government, industrial, educational and other organizations to render technical support for widening practical knowledge and to contribute in sustainable socio-economic advancement.

d. To extend collaborative and research activities with national and international communities for life-long learning and long term interaction with the academician and industry.

1.3 Motto and Values of MIST.

Motto:
As an Institution without gender biasness, MIST is steadily upholding its motto "**Technology for Advancement**" and remains committed to contribute to the wider spectrum of national educational arena, play a significant role in the development of human resources and gradually pursuing its goal to grow into a '**Centre of Excellence**'.

Values:

a. **Integrity and Respect-** We embrace honesty, inclusivity, and equity in all that we do.
b. **Honesty and Accountability-** Our actions reflect our values, and we are accountable for both.
c. **Dedication to Quality and Intellectual Rigour-** We strive for excellence with energy, commitment and passion.
d. **Pursuit of Innovation-** We cultivate creativity, adaptability and flexibility in our students, faculty and staff.

1.4 Eligibility of Students for Admission in MIST.

The students must fulfill the following requirements:

a. **Bangladeshi Students.** Minimum qualifications to take part in the admission test are as follows:

(1) The applicant must have passed SSC/equivalent examination in Science Group obtaining GPA 4.00 (without fourth subject) in the scale of 5.0 and in HSC/Equivalent examination from Board of Intermediate and Secondary Education/ Madrasa Education Board/Technical Education Board in science group the applicant must have obtained minimum 'A+' (Plus) in any TWO(2) subjects out of FIVE (5) subjects including Mathematics, Physics, Chemistry, English, and Bengali and 'A' in rest THREE (3) subjects.

(2) The applicant must have qualified in minimum five subjects including Mathematics, Physics, Chemistry and English Language with minimum 'B' in average in GCE 'O' Level and in 'A' level he/she must have obtained minimum 'A' in ONE subject out of three subjects including Mathematics, Physics, and Chemistry with and minimum 'B' in rest TWO subjects.

(3)Applicants who have passed HSC or Equivalent examination in the current year or one year before the notification for admission can apply.

(4) Sex: Male and Female.

b. **Foreign Students.** Maximum 3% of overall vacancies available will be kept reserved for the foreign students and will be offered to foreign countries through AFD of the Government of the People's Republic of Bangladesh. Applicants must fulfill the following requirements:

(1) Educational qualifications as applicable for Bangladeshi civil students or equivalent.

(2) Must have security clearance from respective Embassy/High Commission in Bangladesh.

(3) Sex: Male and Female.

In the event of non-availability of foreign students, Bangladeshi civil candidates will fill up the vacancies.

1.5 Number of Seats.

The highest number of seats for 04(Four) years Bachelor Degree in Engineering programs (Unit– A) and 5 (Five) years Bachelor Degree of Architecture programs are as follows:

Allocation of Seats

Ser	Unit	**Department**	**Seats**
1	**A**	Civil Engineering (CE)	60
2		Computer Science and Engineering (CSE)	60
3		Electrical, Electronic and Communication Engineering (EECE)	60
4		Mechanical Engineering (ME)	60
5		Aeronautical Engineering (AE)	50
6		Naval Architecture and Marine Engineering (NAME)	40
7		Biomedical Engineering (BME)	40
8		Nuclear Science and Engineering (NSE)	40
9		Environmental, Water Resources & Coastal Engineering (EWCE)	60
10		Industrial and Production Engineering (IPE)	50
11		Petroleum and Mining Engineering (PME)	25
12	**B**	Architecture (Arch)	25
	Total		570

The total number is 570. In general, about 50% seats will be allocated to military officers. However, in case of the requirement of military students vacancy is less in any particular year, the deficient vacancy will be filled up by civil students. MIST also maintains quota as mentioned below:

Ser	**Quota Allocation**	**Seats**
1	General Candidates	54%
2	Children of Military Personnel	40%
3	Children of Freedom Fighters	2%
4	Tribal Citizen	1%
5	International Students	3%
	Total	100%

1.6 Admission Procedure

1.6.1 Syllabus for Admission Test: Admission test will be conducted on the basis of the syllabus of Mathematics, Physics, Chemistry and English (comprehension and functional) subjects of HSC examinations of all boards of secondary and higher secondary school certificates. Admission test will be conducted out of 200 marks and the distribution of marks is given below:

Ser.	Subjects	Marks
a.	Mathematics	60
b.	Physics	60
c.	Chemistry	60
d.	English	20
		Total = 200

1.6.2 Final Selection: Students will be selected on the basis of results of the admission test. Individual choice for selection of departments will be given preference as far as possible. In case of tie in the result of admission test, difference will be judged on the basis of marks obtained in Mathematics, Physics, Chemistry and English respectively in admission test.

1.6.3 Medical Check Up: Civil candidates selected through admission test will go for medical checkup in MIST/ CMH. If the medical authority considers any candidate unfit for study in MIST due to critical/contagious/mental diseases as shown in medical policy of MIST will be declared unsuitable for admission.

1.7 Students Withdrawal Policy

1.7.1 For Poor Academic Performance.

The under graduate (B.Sc.) Engineering programs for all engineering disciplines are planned for 04 regular levels, comprising of 08 regular terms, for Architecture programme it is planned for 3 regular levels, comprising of 10 regular terms. It is expected that all students will earn degree by clearing all the offered courses in the stipulated time. In case of failure the following policies will be adopted:

a. Students failing in any course/ subject will have to clear/pass the said course/subject

by appearing it in supplementary/ self study (for graduating student) examination as per examination policy.

b. Students may also retake the failed subject/ course in regular term/short term as per

examination policy.

c. Maximum grading for supplementary/ self study examination etc of failed subjects will be B+ as per examination policy.

d. One student can retake/reappear in a failed subject/ course only twice. However, With the Permission of Academic Council of MIST, a student may be allowed for third time as last chance.

e. In case of sickness, which leads to missing of more than 40% classes or miss term final examination (supported by requisite medical documents), students may be allowed to withdraw temporarily from that term and repeat the whole level with the regular level in the next academic session, subject to the approval of Academic Council , MIST. However, he/she has to complete the whole undergraduate program within 06 (six) academic years(for Architecture 07 academic years) from the date of his/her registration.

f. Minimum credit requirement for the award of bachelor's degree in Engineering (B.Sc Engg) and Architecture (B. Arch) will be decided by the respective department as per existing rules. However the minimum CGPA requirement for obtaining a bachelor degree in engineering and Architecture is 2.20.

g. Whatever may be the cases, students have to complete the whole undergraduate program within 06 (six) academic years from the date of registration.

h. All other terms and conditions of MIST Examination Policy remain valid.

1.7.2 Withdrawal on Disciplinary Ground

a. **Unfair Means:** Adoption of unfair means may result in expulsion of a student from the program and so from the Institution. The Academic Council will authorize such expulsion on the basis of recommendation of the Disciplinary Committee, MIST and as per policy approved by the affiliating university. Following would be considered as unfair means adopted during examinations and other contexts:

(1) Communicating with fellow students for obtaining help in the examination.

(2) Copying from another student's script/ report /paper.

(3) Copying from desk or palm of a hand or from other incrimination documents.

(4) Possession of any incriminating document whether used or not.

b. **Influencing Grades:** Academic Council may expel/withdraw any student for approaching directly or indirectly in any form to influence a teacher or MIST authority for grades.

c. **Other Indiscipline Behaviours:** Academic Council may withdraw/expel any student on disciplinary ground if any form of indiscipline or unruly behavior is seen in him/her which may disrupt the academic environment/ program or is considered detrimental to MIST's image.

d. **Immediate Action by the Disciplinary Committee of MIST:** The Disciplinary Committee, MIST may take immediate disciplinary action against any student of the institution. In case of withdrawal/ expulsion, the matter will be referred to the Academic Council, MIST for post-facto approval.

1.7.3 Withdrawal on Own Accord

a. **Permanent Withdrawal:** A student who has already completed some courses and has not performed satisfactorily may apply for a withdrawal.

b. **Temporary Withdrawal:** A student, if he/she applies, may be allowed to withdraw temporarily from the program/ subject by the approval of Academic Council of MIST, but he/she has to complete the whole program within 06 (six) academic years (for Architecture 07 academic years) from the date of his/her registration.

CHAPTER - 2

RULES AND REGULATIONS FOR UNDERGRADUATE PROGRAMME AT MIST

2.1 Introduction

MIST has introduced course system for undergraduate studies from the academic session 2017-18. Therefore, the rules and regulations mentioned in this paper will be applicable to students for administering undergraduate curriculum through the Course System. This will be introduced with an aim of creating a continuous, even and consistent workload throughout the term for the students.

2.2 The Course System

2.2.1 The salient features of the Course System are as follows:

a. Number of theory courses will be generally 5 in each term. However, with the recommendation of course coordinator and Head of the Department, Commandant MIST may allow relaxation in this regard. This relaxation is to be reported to Academic Council of MIST.

b. Students will not face any level repeat for failing.

c. Students will get scope to improve their grading.

d. Introduction of more optional courses to enable the students to select courses according to their individual needs and preferences.

e. Continuous evaluation of students' performance.

f. Promotion of student-teacher interaction and contact.

2.2.2 Beside the professional courses pertaining to each discipline, the undergraduate curriculum gives a strong emphasis on acquiring thorough knowledge in the basic sciences of mathematics, physics and chemistry. Due importance is also given on the study of several subjects in humanities and social sciences.

2.2.3 The first two years of bachelor's degree programs generally consist of courses on basic engineering, general science and humanities subjects; while the third and subsequent years focus on specific disciplines.

2.3 Number of Terms in a Year

2.3.1 There will be two terms Spring Term (Jan-Jun) and Fall Term (Jul-Dec) in an academic year. In addition to these two regular terms there will be a short term after the Fall Term of each academic session. During the short term, students can take only failed courses to cover up the credit deficiencies.

2.3.2 Respective departments will take the decisions about courses to be offered during each short term depending upon the availability of course teachers and number of students willing to take a particular course.

2.4 Duration of Terms

2.4.1 The duration of each of Term I(Spring) and Term II(Fall) (maximum 22 weeks) may be as under:

Ser	Events	Durations
1.	Classes before Mid Term	7 weeks
2.	Mid Term Vacation	1 week
3.	Classes after Mid Term	7 weeks
4.	Makeup Classes and Preparatory leave	2/3 weeks
5.	Term Final Examination	2/3 weeks
6.	Term End Vacation	1/2 week

2.4.2 The duration of a Short Term will be around 7 weeks of which about 6 weeks will be spent for class lectures and one week for Term Final Examination. The duration for Short Term and Examination will be as under:

Ser	Events	Durations
1.	Classes	6 weeks
2.	Final Examination	1 week
	Total	**7 Weeks**

2.5 Course Pattern and Credit Structure

The undergraduate program is covered by a set of theoretical courses along with a set of laboratory (sessional) courses to support them.

2.6 Course Designation System

2.6.1 Each course is designated by a maximum of four letter code identifying the department offering the course followed by a three-digit number having the following interpretation:

a. The left most digit corresponds to the year in which the course is normally taken by the students. The second digit is reserved for departmental use. It usually identifies a specific area/group of study within the department.

b. The right most digit is an odd number for theoretical courses and an even number for sessional courses.

2.6.2 The course designation system is illustrated as follows:

<u>AEAS</u> 101 **<u>Introduction to Aeronautical Engineering</u>**

Course Title
Odd digit designates a theoretical course
Reserved for departmental use
Signifies 1st Year/ 1st Level course
Department Identification (Aerospace Discipline)

<u>AEAS</u> 206 **<u>Mechanics of Solids Sessional</u>**

Course Title
Even digit designates a sessional course
Reserved for departmental use
Signifies 2nd Year/ 2nd Level course
Department Identification (Aerospace Discipline)

2.7 Assignment of Credits

The assignment of credits to a theoretical course follows a different rule from that of a sessional course.

a. Theoretical Courses: One lecture per week per term is equivalent to one credit.
b. Sessional Courses: Credits for sessional courses is half of the class hours per week per term.

Credits are also assigned to project and thesis work taken by the students. The amount of credits assigned to such work varies from one discipline to another.

2.8 Types of Courses

The types of courses included in the undergraduate curricula are divided into the following groups:

a. **<u>Core Courses</u>:** In each discipline, a number of courses are identified as core courses, which form the nucleus of the respective bachelor's degree program. A student has to complete the entire designated core courses of his/her discipline.
b. **<u>Prerequisite Courses</u>:** Some of the core courses are identified as prerequisite courses for a specific subject.
c. **<u>Optional Courses</u>:** Apart from the core courses, the students can choose from a set of optional courses. A required number of optional courses from a specified group have to be chosen.

2.9 Course Offering and Instruction

2.9.1 The courses to be offered in a particular term are announced and published in the Course Catalog along with the tentative Term Schedule before the end of the previous term. The courses to be offered in any term will be decided by Board of Undergraduate Studies (BUGS) of the respective department.

2.9.2 Each course is conducted by a course teacher who is responsible for maintaining the expected standard of the course and for the assessment of students' performance. Depending on the strength of registered students (i.e. on the number of students) enrolled for the course, the teacher concerned might have course associates and Teaching Assistants (TA) to aid in teaching and assessment.

2.10 Teacher Student Interaction

The new course system encourages students to come in close contact with the teachers. For promotion of a high level of teacher-student interaction, each student is assigned to an adviser and the student is free to discuss all academic matters with his/her adviser. Students are also encouraged to meet any time with other teachers for help and guidance in academic matters. However, students are not allowed to interact with teachers after the moderation of questions.

2.11 Student Adviser

2.11.1 One adviser is normally appointed for a group of students by the BUGS of the concerned department. The adviser advises each student about the courses to be taken in each term by discussing the academic program of that particular term with the student.

2.11.2 However, it is also the student's responsibility to keep regular contact with his/her adviser who will review and eventually approve the student's specific plan of study and monitor subsequent progress of the student.

2.11.3 For a student of second and subsequent terms, the number and nature of courses for which he/she can register is decided on the basis of academic performance during the previous term. The adviser may permit the student to drop one or more courses based on previous academic performance.

2.12 Course Registration

2.12.1 Any student who uses classroom, laboratory facilities or faculty-time is required to register formally. Upon admission to the MIST, students are assigned to advisers. These advisers guide the students in choosing and registering courses.

2.12.2 **Registration Procedure.** At the commencement of each term, each student has to register for courses in consultation with and under the guidance of his/her adviser. The date, time and venue of registration are announced in advance by the Registrar's Office. Counseling and advising are accomplished at this time. It is absolutely essential that all the students be present for registration at the specified time.

2.12.3 **Pre-conditions for Registration**.

a. For first year students, department-wise enrollment/admission is mandatory prior to registration. At the beginning of the first term, an orientation program will be conducted for them where they are handed over with the registration package on submission of the enrolment slip.

b. Any student, other than the new batch, with outstanding dues to the MIST or a hall of residence is not permitted to register. Each student must clear their dues and obtain a clearance certificate, upon production of which, he/she will be given necessary Course Registration Forms to perform course registration.

c. A student is allowed to register in a particular course subject to the class capacity constraints and satisfaction of pre-requisite courses. However, even if a student fails in a pre-requisite course in any term, the concerned department (BUGS) may allow him/her to register for a course which depends upon the pre-requisite course provided that his/her attendance and performance in the continuous assessment of the mentioned pre-requisite course is found to be satisfactory.

2.12.4 Registration Deadline. Each student must register for the courses to be taken before the commencement of each term. Late registration is permitted only during the first week of classes. Late registration after this date will not be accepted unless the student submits a written application to the registrar through the concerned Head of the department explaining the reasons for delay. Acceptable reasons may be medical problems with supporting documents from the Medical Officer of MIST or some other academic commitments that prohibit enrollment prior to the last date of registration.

2.12.5 Penalty for Late Registration. Students who fail to register during the designated dates for registration are charged a late registration fee of Tk. 100.00 (One hundred only) per credit hours. Penalty for late registration will not be waived.

2.12.6 Limits on the Credit Hours to be taken

A student should be enrolled for at least 15 credit hours and is allowed to take a maximum of 24 credit hours. Relaxation on minimum credit hours may be allowed. A student must enroll for the sessional courses prescribed in a particular term within the allowable credit hour limits.

In special cases where it is not possible to allot the minimum required 15 credit hours to a student, the concerned department (BUGS) may permit with the approval of the Commandant, a lesser number of credit hours to suit individual requirements. Such cases are also applicable to students of Level 4 requiring less than 15 credit hours for graduation.

2.12.7 Course Add/Drop

A student has some limited options to add or drop courses from the registration list. Addition of courses is allowed only within the first two weeks of a regular term and only during the first week of a short term. Dropping a course is permitted within the first four weeks of a regular term and two weeks of a short term.

Any student willing to add or drop courses has to fill up a Course Adjustment Form. This also has to be done in consultation with and under the guidance of the student's respective adviser. The original copy of the Course Adjustment Form has to be submitted to the Registrar's Office, where the required numbers of photocopies are made for distribution to the concerned adviser, Head, Dean, Controller of Examinations and the student.

All changes must be approved by the adviser and the Head of the concerned department. The Course Adjustment Form has to be submitted after being signed by the concerned persons.

2.12.8 Withdrawal from a Term

If a student is unable to complete the Term Final Examination due to serious illness or serious accident, he/she may apply to the Head of the degree awarding department for total withdrawal from the term before commencement of term final examination. However, application may be considered during term final examination in special case. The application must be supported by a medical certificate from the Medical Officer of MIST. The concerned student may opt for retaining the sessional courses of the term. The Academic Council will take the final decision about such applications. However, the total duration for graduation will not exceed 6 academic years.

2.13 The Grading System

The total performance of a student in a given course is based on a scheme of continuous assessment, for theory courses this continuous assessment is made through a set of quizzes, class tests, class evaluation, class participation, homework assignment and a term final examination. The assessments for sessional courses are made by evaluating performance of the student at work during the class, viva-voce during laboratory hours and quizzes. Besides that, at the end there will be a final lab test. Each course has a certain number of credits, which describes its corresponding weightages. A student's performance is measured by the number of credits completed satisfactorily and by the weighted average of the grade points earned. A minimum grade point average (GPA) is essential for satisfactory progress. A minimum number of earned credits also have to be acquired in order to qualify for the degree. Letter grades and corresponding grade points will be given as follows:

Numerical Markings	Grade	Grade Points
80% and above	A+	4.00
75% to below 80%	A	3.75
70% to below 75%	A-	3.50
65% to below 70%	B+	3.25
60% to below 65%	B	3.00
55% to below 60%	B-	2.75
50% to below 55%	C+	2.50
45% to below 50%	C	2.25
40% to below 45%	D	2.00
below 40%	F*	0.00
Incomplete	I	-
Withdrawal	W	-
Project/ Thesis continuation	X	-

* Subject in which the student gets F grade shall not be regarded as earned credit hours for the calculation of Grade Point Average (GPA).

2.14 Distribution of Marks

2.14.1 Theory. Forty percent (40%) of marks of a theoretical course shall be allotted for continuous assessment, i.e. quizzes, home assignments, class tests, observations/ class participation and class attendance. These marks must be submitted to Office of the Controller of Examinations before commencement of final exam. The rest of the marks will be allotted to the Term Final Examination. The duration of final examination will be three (03) hours. The scheme of continuous assessment that a particular teacher would follow for a course will be announced on the first day of the classes.

Distribution of marks for a given course per credit is as follows:

Class Performance	5%
Class Attendance	5%
Class Test/Assignment	20%
Mid Term Assessment (Exam/Project)	10%
Final Examination (Section A & B)	60%
Total	**100%**

Note:

a. Above mentioned distribution of marks will be applicable for 'Assessment Strategy' against each theoretical course mentioned in Chapter 5 and 6 of this syllabus.

b. In final exam, each section can be used for achieving not more than two course outcomes (COs). The remaining COs should be attained from mid-term assessment or class tests. Course teacher has to inform the student the beginning of the terms.

c. Course teacher of a particular course has to inform the department whether he/she wants to assess mid-term through exam or project within first two weeks of beginning of a term. The duration of mid-term examination should not be more than 50 minutes which has to be conducted in between 6^{th} to 9^{th} week of a semester. If mid-term assessment is done through project, then there should be project report and presentation.

d. The weightage of class performance can be assessed through checking attentiveness during classes or arranging unnoticed pop quizzes.

e. The number of class tests shall be n for 3.0 and above credit courses and (n-1) shall be considered for grading where n is the number of credits of the course. However, for courses having credits below 3.0, the considered class tests shall be 2 out of 3.

f. All class test will carry 20 marks each. Exam software system will finally convert these achieved marks into total class test marks as per credit hour. i.e for n=1(20), n=2 (40), n=3 (60), n=4(80) etc.

g. Irrespective of the result of the continuous assessment (class performance, class test, mid-term assessment), a student has to appear in the final examination (where applicable) for qualifying/passing the concern course/ subject.

2.14.2 Sessional/Practical Examinations. Sessional courses are designed and conducted by the concerned departments. Examination on sessional/practical subjects will be conducted by the respective department before the commencement of term final examination. The date of practical examination will be fixed by the respective department. Students will be evaluated in the sessional courses on the basis of the followings (all or as decided by the Examination Sub-Committee):

a.	Class performance/observation/Conduct of lab	25%
b.	Lab Test/Report Writing/project work/Assignment	15%
c.	Mid Term Evaluation (exam/project/assignment)	20%
d.	Final Evaluation (exam/project/assignment)	30%
e.	Viva Voce/ Presentation	10%
	Total	**100%**

2.14.3 <u>Sessional Course in English</u>. The distribution will be as under:

a.	Class performance/observation	10%
b.	Written Assignment	15%
c.	Oral Performance	25%
d.	Listening Skill	10%
e.	Group Presentation	30%
f.	Viva Voce	10%
	Total	**100%**

2.15 <u>Basis for awarding marks for class attendance</u>.

	Marks
90% and above	100%
85% to less than 90%	90%
80% to less than 85%	80%
75% to less than 80%	70%
70% to less than 75%	60%
Below 70%	00%

2.16 <u>Collegiate and Non-collegiate</u>

Students having class attendance of 85% or above in individual subject will be treated as **Collegiate** and less than 85% and up to 70% will be treated as **Non-Collegiate** in that subject. The **Non-Collegiate** student(s) may be allowed to appear in the examination subject to payment of **Non-Collegiate** fee/fine of an amount fixed by MIST/BUP. Students having class attendance below 70% will be treated as **Dis-Collegiate** and will not be allowed to appear in the examination and treated as failed in that subject. But in a special case such students may be allowed to appear in the examination with the permission of Commandant and it must be approved by the Academic Council of MIST also.

2.17 <u>Calculation of GPA</u>

Grade Point Average (GPA) is the weighted average of the grade points obtained of all the courses passed/completed by a student. For example, if a student passes/completes n courses in a term having credits of $C_1, C_2, \dots, C_n$ and his grade points in these courses are $G_1, G_2, \dots, G_n$ respectively then

$$GPA = \frac{Grade\ points\ earned\ in\ the\ semester}{Credits\ completed\ in\ the\ semester}$$

$$= \frac{Summation\ of\ (Credit\ hours\ in\ a\ course * \ Grade\ point\ earned\ in\ that\ course)}{Total\ number\ of\ credit\ hours\ completed}$$

$$GPA = \frac{\sum_{i=1}^{n} Ci * Gi}{\sum_{i=1}^{n} Ci}$$

The Cumulative Grade Point Average (CGPA) is the weighted average of the GPA obtained in all the terms passed/completed by a student. For example, if a student passes/ completes n terms having total credits of TC_1, TC_2, … , TC_n and his GPA in these terms are GPA_1, GPA_2, GPA_n respectively then

$$CGPA = \frac{\sum_{i=1}^{n} TCi * GPAi}{\sum_{i=1}^{n} TCi}$$

2.17.1 Numerical Example

Suppose a student has completed eight courses in a term and obtained the following grades:

Course	Credits, C_i	Grade	Grade G_i	Points, C_I*G_i
AEAS 110	1.50	A-	3.50	5.250
AEAS 101	3.00	A+	4.00	12.000
CHEM 105	3.00	A	3.75	11.250
MATH 121	3.00	B	3.00	9.000
HUM 111	3.00	B-	2.75	8.250
HUM 103	3.00	B	3.00	9.000
PHY 115	3.00	A+	4.00	12.000
CSE112	1.50	A	3.75	5.625
Total	21.00			72.375

GPA = 72.375/21.00 = 3.45

Suppose a student has completed four terms and obtained the following GPA.

Level	Term	Credit Earned,TC_I	Hours GPA Earned, GPA_i	GPA_i*TC_i
1	1	21.00	3.73	78.330
1	2	20.50	3.93	80.565
2	1	19.75	3.96	78.210
2	2	20.25	4.00	81.000
Total		**81.50**		**318.105**

CGPA = 318.105/81.50 = 3.90

2.18 <u>Minimum Earned Credit and GPA Requirement for Obtaining Engineering Degree</u>

Minimum credit hour requirements for the award of bachelor‘s degree in engineering (B.Sc. Engineering) and other discipline will be decided as per existing rules. The minimum CGPA requirement for obtaining a Bachelor‘s degree in engineering and other discipline is 2.20.

2.19 <u>Minimum Earned Credit and GPA Requirement for Obtaining Architecture Degree</u>

Minimum credit hour requirements for the award of bachelor's degree in Architecture (B.Sc. Architecture) will be decided as per existing rules. The minimum GPA requirement for obtaining a Bachelor's degree in Architecture is 2.20.

2.20 Impacts of Grade Earned

a. The courses in which a student has earned a 'D' or a higher grade will be counted as credits earned by him/her. Any course in which a student has obtained an 'F' grade will not be counted towards his/her earned credits or GPA calculation. However, the 'F' grade will remain permanently on the Grade Sheet and the Transcript.

b. A student who obtains an 'F' grade in a core course will have to repeat that particular course. However, if a student gets an 'F' in an optional course, he/she may choose to repeat that course or take a substitute course if available. When a student will repeat a course in which he/she has previously obtained an 'F', he/she will not be eligible to get a grade better than 'B+' in that repeated course.

c. If a student obtains a grade lower than 'B+' in a particular course he/she will be allowed to repeat the course only once for the purpose of grade improvement. However, he/she will not be eligible to get a grade better than 'B+' for an improvement course.

d. A student will be permitted to repeat for grade improvement purposes a maximum of 6 courses in BSc. Engineering programs and a maximum of 7 courses in B. Arch. program.

e. If a student obtains a 'B+' or a better grade in any course he/she will not be allowed to repeat the course for the purpose of grade improvement.

2.21 Classification of Students

2.21.1 At MIST, regular students are classified according to the number of credit hours completed/ earned towards a degree. The following classification applies to all the students:

Level	Credit Hours Earned	
	Engineering	Architecture
Level 1	0.0 to 36.0	0.0 to 34.0
Level 2	More than 36.0 to 72.0	More than 34.0 to 72.0
Level 3	More than 72.0 to 108.0	More than 72.0 to 110.0
Level 4	More than 108.0	More than 110.0 to 147.0
Level 5		More than 147.0

2.21.2 However, before the commencement of each term all students other than new batch are classified into three categories:

Category 1: This category consists of students who have passed all the courses described for the term. A student belonging to this category will be eligible to register for all courses prescribed for the upcoming term.

Category 2: This category consists of students who have earned a minimum of 15 credits but do not belong to category 1. A student belonging to this category is advised to take at least one course less since he might have to register for one or more backlog courses as prescribed by his/her adviser.

Category 3: This category consists of students who have failed to earn the minimum required 15 credits in the previous term. A student belonging to this category is advised to take at least two courses less than a category 1 student subject to the constraint of registering at least 15 credits. However, he will also be required to register for backlog courses as prescribed by the adviser.

2.21.3 Definition of Graduating Student. Graduating students are those students who will have $\leq$ 24 credit hour for completing the degree requirement.

2.22 Performance Evaluation

i. The performance of a student will be evaluated in terms of two indices, viz. Term Grade Point Average and Cumulative Grade Point Average which is the grade average for all the terms completed.
ii. Students will be considered to be making normal progress toward a degree if their Cumulative Grade Point Average (CGPA) for all work attempted is 2.20 or higher. Students who regularly maintain a term GPA of 2.20 or better are making good progress toward the degrees and are in good standing with MIST. Students who fail to maintain this minimum rate of progress will not be in good standing. This can happen when any one of the following conditions exists.
a. The term GPA falls below 2.20.
b. The Cumulative Grade Point Average (CGPA) falls below 2.20.
c. The earned number of credits falls below 15 times the number of terms attended.

iii. All such students can make up their deficiencies in GPA and credit requirements by completing courses in the subsequent term(s) and backlog courses, if there are any, with better grades. When the minimum GPA and credit requirements are achieved the student is again returned to good standing.

2.23 Application for Graduation and Award of Degree

A student who has fulfilled all the academic requirements for Bachelor's degree will have to apply to the Controller of Examinations through his/her Adviser for graduation. Provisional Degree will be awarded by BUP on completion of credit and GPA requirements.

2.24 Time Limits for Completion of Bachelor's Degree

A student must complete his studies within a maximum period of six years for engineering and seven years for architecture.

2.25 Attendance, Conduct and Discipline

MIST has strict rules regarding the issues of attendance in class and discipline.

Attendance. All students are expected to attend classes regularly. The university believes that attendance is necessary for effective learning. The first responsibility of a student is to attend classes regularly and one is required to attend the classes as per MIST rules.

Conduct and Discipline. During their stay in MIST all students are required to abide by the existing rules, regulations and code of conduct. Students are strictly forbidden to form or be members of student organization or political party, club, society etc., other than those set up by MIST authority in order to enhance student's physical, intellectual, moral and ethical development. Zero tolerance in regards of sexual abuse and harassment in any forms and drug abuse and addiction are strictly observed in the campus.

2.26 Teacher-Student Interaction

2.60 The academic system in MIST encourages students to come in close contact with the teachers. For promotion of high level of teacher-student's interaction, a course coordinator (CC) is assigned to each course. Students are free to discuss with CC about all academic matters. Students are also encouraged to meet other teachers any time for help and guidance for academic matters. Heads of the departments, Director of Administration, Director of Students Welfare (DSW), Dean and Commandant address the students at some intervals. More so, monthly Commandant's Parade is organized in MIST where all faculty members, staff and students are formed up, thereby increasing teacher-student interaction.

2.27 Absence during a Term

A student should not be absent from quizzes, tests, etc. during the term. Such absence will naturally lead to reduction in points/marks, which count towards the final grade. Absence in the Term Final Examination will result in an F grade in the corresponding course. A student who has been absent for short periods, up to a maximum of three weeks due to illness, should approach the course teacher(s) or the course coordinator(s) for make-up quizzes or assignments immediately upon return to classes. Such request has to be supported by medical certificate from competent authority (e.g. CMH/MIST Medical Officer).

2.28 Recognition of Performance

As recognition of performance and ensure continued studies MIST awards medals, scholarships and stipends will be given as per existing rules and practices.

2.29 Types of Different Examination

Following different types of final Examinations will be conducted in MIST to evaluate the students of Undergraduate Programs:

a. **Term Final Examination:** At the end of each normal term (after 22wk or so), Term Final Examination will be held. Students will appear in the Term Final Examination for all the theory courses they have taken in the Term.

b. **Supplementary Examination:** It will take place twice in a year. Supplementary-I is defined as provision of giving exam in the first week of Spring Term (Jan-Jun) / Fall Term(Jul-Dec) end break and Supplementary-II in the first week of Fall Term (Jul-Dec) / Spring Term (Jan-Jun) end break, respectively. Students will be allowed to register for a maximum of two theory courses (Failed/Improvement) in Supplementary-I and maximum of one theory course (Failed/Improvement) in Supplementary-II.

c. **Improvement Examination:** It will be taken during Supplementary-I and Supplementary-II Examination. Questions will be same as the question of the regular examination of that Supplementary Examination (if any). Student can take maximum two subjects at a time (two subjects in supplementary-I and one subject in supplementary-II) and maximum 6 subjects in the whole academic duration. If a student obtains a grade lower than 'B+' in a course, he/she will be allowed to repeat the course only once for grade improvement. However, he/she will not be eligible to get a grade better then 'B+' for an improvement course. Among the previous result and improvement examination result, best one will be considered as final result for an individual student. However, performance of all examination i,e previous to improvement examination, shall be reflected in the transcript.

2.30 Rules of Different Examinations

2.30.1 Term Final Examination. Following rules to be followed:

a. Registration to be completed before commencement of the Term. A student has to register his desired courses paying registration, examination fee and other related fees.

b. Late registration will be allowed without penalty within first two weeks of the term.

c. Within 1st two weeks of a term a student can Add/Drop course/courses. To add a course, in the 3rd week, one has to register the course by paying additional fees. To drop a course, one has to apply within three weeks and paid fees will be adjusted/ refunded. If anyone wants to drop a course after three weeks and within 4 weeks, that will be permitted but paid fees will not be refunded in that case.

d. Registrar office will finalize registration of all courses within 7 (seven) weeks, issue registration slip and that will be followed by issuing Admit Card.

e. Term Final Examination to be conducted in the 18-20th week of the term as per approved Academic Calendar.

2.30.2 Supplementary Examination. Following rules to be followed:

a. Supplementary-I is defined as provision of giving exam in the first week of Spring Term (Jan-Jun) / Fall Term (Jul-Dec) end break and Supplementary-II in the first week of Fall Term (Jul-Dec) / Spring Term (Jan-Jun) end break, respectively.

b. Students will be allowed to register for a maximum of two theory courses

(Failed/Improvement) in Supplementary-I and maximum of one theory course (Failed/Improvement) in Supplementary-II.

c. No class will be conducted.

d. 40% marks will be considered from the previous exams.

e. Maximum grading in Supplementary Exam will be ‘B+’.

f. No Sessional Exam will be conducted.

g. Examination will be taken on 60% marks like Term Final Examination.

h. If a student fails in a course more than once in regular terms, then for calculating 40% marks best one of all continuous assessment marks will be counted.

j. If anyone fails in the laboratory/sessional course, that course cannot be taken in the supplementary examination.

k. If any student fails in a course, he can clear the course retaking it 2nd time or, he can clear the examination appearing at the supplementary examination as well. Any one fails twice in a course, can only retake it in the regular term for appearing third time. But anyone fails even after appearing third time. He/she has to take approval of Academic Council of MIST for appearing 4th (last) time in a course and need to pay extra financial penalty. If any student fails even 4th time in a course, will not be allowed to appear anymore in this same course.

l. Registration of Supplementary-I Exam to be done within 5th wk after completion of Fall Term (July to Dec) and registration of Supplementary-II exam to be done during the Mid-Term break of Spring Term (Jan to Jun), paying all the required fees.

m. There will be no provision for add/drop courses after registration.

n. Question Setting, Moderation, and Result Publication to be done following the same rules of Spring (Jan to Jun) / Fall (July to Dec) Term Final Exam as per existing Examination Policy.

p. Moderation of the questions for Supplementary-I will be done in the 5th week after completion of Fall Term (July to Dec) Final Exam and Supplementary- II with the moderation of the questions of Spring Term(Jan to Jun).

q. Separate Tabulation sheet to be made.

r. Thesis: if a student cannot complete thesis in two consecutive terms, with the recommendation of the supervisor, he/she may continue for next one/two term within six academic years.

2.30.3 Improvement Examination. Following rules to be followed:

a. Improvement examination is to be taken during the Supplementary-I and Supplementary-II examinations.

b. For Improvement examination, registration is to be done during the registration of Supplementary-I and Supplementary-II examinations by paying all the fees.

c. Question Setting, Moderation and Result Publication to be done with courses of Supplementary-I and Supplementary-II examinations.

d. Any student gets a grading below ‘B+’ and desires to improve that course, he will be allowed to appear the improvement examination for that particular course.

e. Highest grade of Improvement examination will be ‘B+’.

f. One student is allowed to appear at Improvement exam in 6 (six) courses in his whole graduation period taking maximum two courses at a time (two courses at supplementary-I and one course at supplementary-II).

2.31 Irregular Graduation

If any graduating student clears his/her failed course in Term-1 and his graduation requirements are fulfilled, his graduation will be effective from the result publication date of Term-1 and that student will be allowed to apply for provisional certificate.

CHAPTER 3

DEPARTMENT OF AERONAUTICAL ENGINEERING (AE)

3.1 Introduction to the Program

The necessity of induction of B.Sc. in Aeronautical Engineering (AE) program at Bangladesh has long been felt and MIST is the pioneer technical institute to introduce Aeronautical Engineering Program in Bangladesh. Compared to any other institute of engineering including BUET, MIST has the highest preparedness to introduce Aeronautical Engineering because of the requirement of defense where study and practice of Aeronautical Engineering is a part of service requirement as well as Aeronautical Engineering is required to introduce space-based research in our country.

The proposed B.Sc. in Aeronautical Engineering (AE) program has 02 (two) major disciplines namely Aerospace and Avionics. The proposed syllabus comprises a total of 160 credits & 194 + 8 weeks contact hours for both Aerospace and Avionics discipline.

Aeronautical Engineering plays a vital role in all fields of modern human activities. It has established itself as one of the most important branches of engineering. The Aeronautical Engineering undergraduate program provides an excellent technical background for persons who want to work in the field of Aerodynamics, Jet Propulsion, Structural Analysis, Avionics and other disciplines. In addition to lectures and practical sessions in the classroom, the undergraduate program also includes industrial/educational visits to different reputed industries/places both home and abroad. The new generation of Aeronautical engineers is encouraged to undertake research and development activities in the above areas and this department is committed to the study and analysis of fundamental as well as applied problems. Problems of military and national importance have consequently received great emphasis in the activities of this department. Aeronautical Engineering program of MIST was accredited by BAETE (Board of Accreditation for Engineering and Technical Education) on 14th November 2016 for the period of 3 year.

In addition to the above there are opportunities for postgraduate studies and research leading to higher degrees i.e. M. Sc. (Engg), M. Engg and Ph.D.

3.2 Vision and Mission of the Program

Vision: To be a part of an internationally recognized center of excellence offering a study program of high quality teaching, research, aviation related consultancy and activities with national relevance innovation and creativity in the field of Aeronautical Engineering.

Mission:

1. To produce engineers and researchers with sound knowledge on fundamentals of traditional, modern and emerging areas of Aeronautical Engineering.
2. To achieve professional knowledge of aircraft design and maintenance along the innovative design research abilities and managerial skills, which are essential for sustainable national and global development.

3. To provide aviation related consultancy and promote student an awareness of the life-long learning and work as part of teams on disciplinary projects.

3.3 Program Objectives/Program Educational Objectives (PEO)

1. Our graduates will be able to solve critical technical problems related to Aeronautical Engineering.

2. Our graduates will be able to build up successful professional careers in the field of aviation (civil and military), government organizations, academia and military in the associated field.

3. Our graduates will be able to pursue continuous learning through professional development, practical training and specialized certifications.

4. Our graduates will be able to undertake post graduate and doctorate and excel in academic and research careers.

5. Our graduates will be able to positively contribute in national and global socio economic development.

3.4 Learning Outcomes/Program Outcomes (PO)

Based on the suggestion of Board of Accreditation for Engineering and Technical Education (BAETE), Bangladesh, the Bachelor in Aeronautical Engineering (AE) program will have following learning outcomes:

a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
b) **Problem analysis:** Identify, formulate, research the literature and analyze complex engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences.
c) **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.
d) **Investigation:** Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.
e) **Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) **The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
g) **Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.

h) **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice.
i) **Individual work and teamwork:** Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.
j) **Communication:** Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.
k) **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multidisciplinary environments.
l) **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

3.5 Program Objectives/Program Educational Objectives and Learning Outcomes/Program Outcomes Matrix

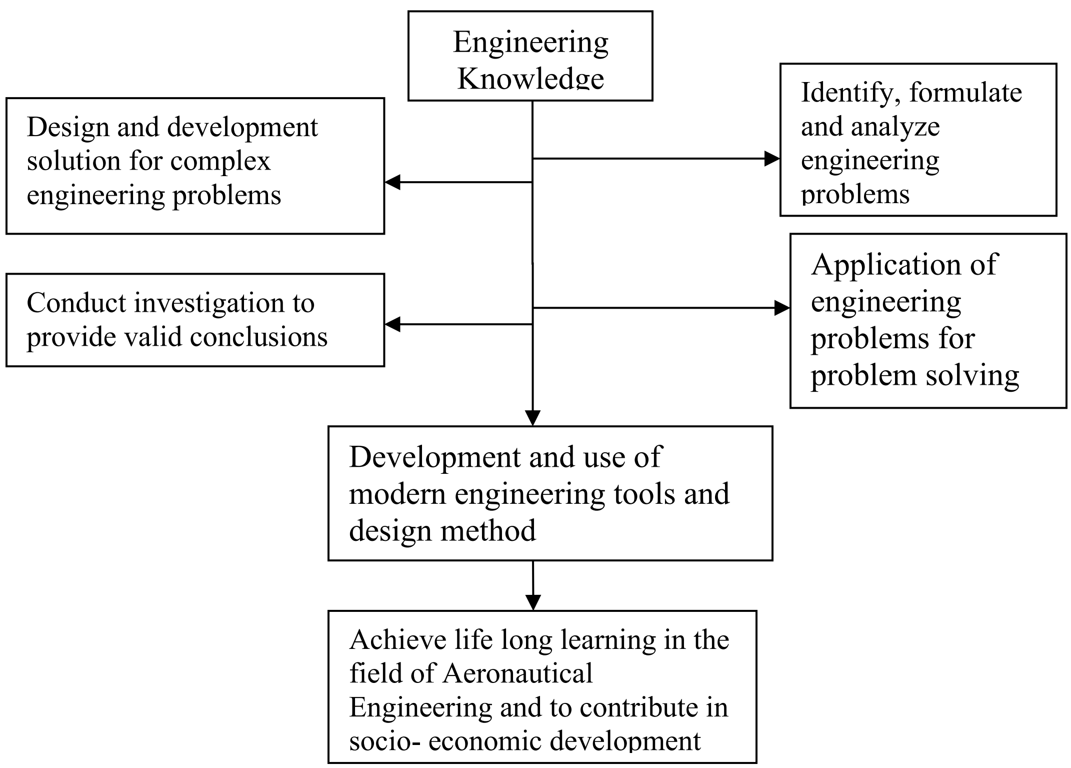
No	POs Statement	PEO-I	PEO-2	PEO-3	PEO-4	PEO-5
I.	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.	**Yes**	No	No	No	No
2.	**Problem analysis:** Identify, formulate, research the literature and analyze complex engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences.	**Yes**	**Yes**	No	No	No
3.	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.	No	No	No	**Yes**	**Yes**
4.	**Investigation:** Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.	No	No	No	**Yes**	No
5.	**Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools	No	**Yes**	**Yes**	**Yes**	No

	including prediction and modeling to complex engineering activities with an understanding of the limitations.					
6.	**The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.	No	No	No	No	**Yes**
7.	**Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development.	**Yes**	No	No	No	**Yes**
8.	**Ethics:** Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice.	No	**Yes**	No	No	No
9.	**Individual work and teamwork:** Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.	No	**Yes**	No	No	**Yes**
10.	**Communication:** Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.	No	**Yes**	No	No	**Yes**
11.	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multidisciplinary environments.	No	**Yes**	No	No	**Yes**
12.	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.	No	No	**Yes**	No	No

3.6 Generic Skills

1. Apply the principles and theory of aeronautical engineering knowledge to the requirements, design and development of different aviation systems with appropriate understanding.
2. Define and use appropriate research methods and modern tools to conduct a specific project.
3. Learn independently, be self- aware and self- manage their time and workload.
4. Apply critical thinking to solve complex engineering problems
5. Analyze real time problems and justify the appropriate use of technology
6. Work effectively with others and exhibit social responsibility

3.7 Curriculum/ Skill mapping



CHAPTER 4

COURSE CURRICULUM OF BACHELOR IN AE

4.1 Course Schedule

The course schedule for the undergraduate students of the Department of Aeronautical Engineering (AE) is enumerated below:

Summary of Course Curriculum for Aerospace Discipline

Level/ Term	Language/ Communicative language	General Education/Non-Skill Course	Basic Science	Math	Inter disciplinary Course	Program Core	Technical Elective	Total
1-I	0.00	2.00	4.50	3.00	5.25	4.50	0.00	19.25
1-II	1.50	4.00	7.50	3.00	5.25	0.00	0.00	21.25
2-I	1.50	2.00	0.00	3.00	4.00	8.25	0.00	18.75
2-II	0.00	2.00	0.00	4.00	0.00	16.50	0.00	22.50
3-I	0.00	2.00	0.00	0.00	0.00	15.75	3.00	20.75
3-II	0.00	2.00	0.00	0.00	0.00	15.50	3.00	20.50
4-1	0.00	2.00	0.00	0.00	0.00	13.50	3.00	18.50
4-II	0.00	2.00	0.00	0.00	0.00	13.50	3.00	18.50
% of Total Course	**1.875%**	**11.25%**	**7.50%**	**8.125%**	**9.06%**	**54.68%**	**7.50%**	**100%**
Total Credit Hr	**3.00**	**18.00**	**12.00**	**13.00**	**14.50**	**87.50**	**12.00**	**160.00**

Summary of Course Curriculum for Avionics Discipline

Level/ Term	Language/ Communicative language	General Education/ Non-Skill Course	Basic Science	Math	Inter disciplinary Course	Program Core	Technical Elective	Total
1-I	0.00	2.00	4.50	3.00	5.25	4.50	0.00	19.25
1-II	1.50	4.00	7.50	3.00	5.25	0.00	0.00	21.25
2-I	1.50	2.00	0.00	3.00	4.00	11.25	0.00	21.75
2-II	0.00	2.00	0.00	4.00	0.00	16.50	0.00	22.50
3-I	0.00	2.00	0.00	0.00	0.00	15.00	3.00	20.00
3-II	0.00	2.00	0.00	0.00	0.00	15.25	3.00	20.25
4-1	0.00	2.00	0.00	0.00	0.00	13.50	3.00	18.50
4-II	0.00	2.00	0.00	0.00	0.00	11.50	3.00	16.50
% of Total Course	**1.875%**	**11.25%**	**7.50%**	**8.125%**	**9.06%**	**54.68%**	**7.50%**	**100%**
Total Credit Hr	**3.00**	**18.00**	**12.00**	**13.00**	**14.50**	**87.50**	**12.00**	**160.00**

4.2 Contact hours and credit hours' distribution in eight terms

For Aerospace Discipline

Level/Term	Theory Contact Hours	Sessional Contact Hours	Theory Credit Hours	Sessional Credit Hours	Total Contact Hours	Total Credit Hours
1/I	14.00	10.50	14.00	5.25	24.50	19.25
1/II	16.00	10.50	16.00	5.25	26.50	21.25
2/I	15.00	7.50	15.00	3.75	22.50	18.75
2/II	18.00	9.00	18.00	4.50	27.00	22.50
3/I	17.00	7.50	17.00	3.75	24.50	20.75
3/II	16.00	7.00+8 weeks	16.00	4.50	23.00+8 weeks	20.50
4/I	14.00	9.00	14.00	4.50	23.00	18.50
4/II	14.00	9.00	14.00	4.50	23.00	18.50
For (Aerospace)	124.00	70.00+8 weeks	124.00	36.00	194.00+8 weeks	160.00

For Avionics Discipline

Level/Term	Theory Contact Hours	Sessional Contact Hours	Theory Credit Hours	Sessional Credit Hours	Total Contact Hours	Total Credit Hours
1/I	14.00	10.50	14.00	5.25	24.50	19.25
1/II	16.00	10.50	16.00	5.25	26.50	21.25
2/I	18.00	7.50	18.00	3.75	25.50	21.75
2/II	18.00	9.00	18.00	4.50	27.00	22.50
3/I	17.00	6.00	17.00	3.00	23.00	20.00
3/II	15.00	8.50+8 weeks	15.00	5.25	23.50+8 weeks	20.25
4/I	14.00	9.00	14.00	4.50	23.00	18.50
4/II	12.00	9.00	12.00	4.50	21.00	16.50
For (Avionics)	124.00	70.00+8 weeks	124.00	36.00	194.00+8 weeks	160.00

4.3 Final Year Design and Research Project

Final Year Design and Research Project will have to be undertaken by students under a supervisor in partial fulfillment of the requirement of his/her degree. Credits allotted to the Final Year Design and Research Project will be 6 corresponding to 12 contact hours.

4.4 Term wise Distribution of Courses

LEVEL 1, TERM-I (Aerospace & Avionics)

Course No	Course Name	Type of Course	Contact hours	Credits	Pg. No
PHY 101	Waves and Oscillations, Optics and Modern Physics	Theory	3.00	3.00	617
EECE 161	Electrical Circuit Analysis-I	Theory	3.00	3.00	767
MATH 101	Differential and Integral Calculus	Theory	3.00	3.00	650
AEAS 103	Fundamentals of Aeronautical Engineering	Theory	3.00	3.00	41
GEBS 101	Bangladesh Studies	Theory	2.00	2.00	691
		Subtotal (Theory)	**14.00**	**14.00**	
PHY 102	Physics Sessional	Sessional	3.00	1.50	624
EECE 162	Electrical Circuit Analysis-I Sessional	Sessional	3.00	1.50	773
SHOP 108	Workshop Technology Sessional –I	Sessional	1.50	0.75	782
AEAS 110	Aeronautical Engineering Drawing-I	Sessional	3.00	1.50	49
		Subtotal (Sessional)	**10.50**	**5.25**	
Total = Contact hours: 24.50; Credits: 19.25					

LEVEL-1, TERM- II (Aerospace & Avionics)

Course No	Course Name	Type of Course	Contact hours	Credits	Pg. No
PHY 111	Electricity and Magnetism, Thermal Physics and Mechanics	Theory	3.00	3.00	630
CHEM 101	Fundamentals of Chemistry	Theory	3.00	3.00	637
MATH 103	Differential Equations and Matrix	Theory	3.00	3.00	656
CSE 173	Computer Programming and Application	Theory	3.00	3.00	757
GEA 101	Principles of Accounting	Theory	2.00	2.00	698
GES 101	Fundamentals of Sociology	Theory	2.00	2.00	712
		Subtotal (Theory)	**16.00**	**16.00**	
CHEM 102	Chemistry Sessional	Sessional	3.00	1.50	644
LANG 102	Communicative English-I	Sessional	3.00	1.50	677
CSE 174	Computer Programming and Application Sessional	Sessional	3.00	1.50	762
SHOP 112	Workshop Technology Sessional –II	Sessional	1.50	0.75	787
		Subtotal (Sessional)	**10.50**	**5.25**	
Total = Contact hours: 26.50; Credits: 21.25					

LEVEL 2, TERM-I (Aerospace)

Course No	Course Name	Type of course	Contact hours	Credits	Pg. No
ME 249	Engineering Mechanics (Statics and Dynamics)	Theory	4.00	4.00	776
AEAV 205	Numerical Analysis and Applications	Theory	3.00	3.00	378
AEAV 203	Electronics-I	Theory	3.00	3.00	362
MATH 201	Vector Analysis, Laplace Transform and Co-ordinate Geometry	Theory	3.00	3.00	662
GEE 201	Fundamentals of Economics	Theory	2.00	2.00	704
		Subtotal (Theory)	**15.00**	**15.00**	
AEAV 206	Numerical Analysis and Applications Sessional	Sessional	3.00	1.50	394
AEAV 204	Electronics-I Sessional	Sessional	1.50	0.75	389
LANG 202	Communicative English-II	Sessional	3.00	1.50	677
		Subtotal (Sessional)	**7.50**	**3.75**	
Total = Contact hours: 22.50; Credits: 18.75					

LEVEL 2, TERM-I (Avionics)

Course No	Course Name	Type of course	Contact hours	Credits	Pg. No
AEAV 203	Electronics-I	Theory	3.00	3.00	362
AEAV 201	Electrical Circuit Analysis- II	Theory	3.00	3.00	371
AEAV 205	Numerical Analysis and Applications	Theory	3.00	3.00	378
ME 249	Engineering Mechanics (Statics and Dynamics)	Theory	4.00	4.00	776
MATH 201	Vector Analysis, Laplace Transform and Coordinate Geometry	Theory	3.00	3.00	662
GEE 201	Fundamentals of Economics	Theory	2.00	2.00	704
		Subtotal (Theory)	**18.00**	**18.00**	
AEAV 202	Electrical Circuit Analysis- II Sessional	Sessional	3.00	1.50	385
AEAV 226	Numerical Analysis and Applications Sessional	Sessional	1.50	0.75	398
LANG 202	Communicative English-II	Sessional	3.00	1.50	677
		Subtotal (Sessional)	**7.50**	**3.75**	
Total = Contact hours: 25.50; Credits: 21.75					

LEVEL 2, TERM-II (Aerospace)

Course No	Course Name	Type of course	Contact hours	Credits	Pg. No
AEAS 203	Fundamentals of Fluid Mechanics	Theory	3.00	3.00	54
AEAS 205	Mechanics of Solids	Theory	3.00	3.00	66
AEAS 207	Thermodynamics	Theory	3.00	3.00	77
AEAS 215	Aircraft Aerospace Systems	Theory	3.00	3.00	94
GELM 275	Leadership and Management	Theory	2.00	2.00	734
MATH 217	Complex Variable, Fourier Analysis and Statistics	Theory	4.00	4.00	670
		Subtotal (Theory)	**18.00**	**18.00**	
AEAS 206	Mechanics of Solids Sessional	Sessional	3.00	1.50	73
AEAS 204	Fundamentals of Fluid Mechanics Sessional	Sessional	1.50	0.75	63
AEAS 208	Thermodynamics Sessional	Sessional	1.50	0.75	85
AEAS 210	Aeronautical Engineering Drawing-II	Sessional	3.00	1.50	89
		Subtotal (Sessional)	**9.00**	**4.50**	
Total = Contact hours: 27.00; Credits: 22.50					

LEVEL 2, TERM-II (Avionics)

Course No	Course Name	Type of course	Contact hours	Credits	Pg. No
AEAV 215	Electronics-II	Theory	3.00	3.00	402
AEAV 217	Aircraft Electrical System	Theory	3.00	3.00	411
AEAS 203	Fundamentals of Fluid Mechanics	Theory	3.00	3.00	54
AEAS 207	Thermodynamics	Theory	3.00	3.00	77
GELM 275	Leadership and Management	Theory	2.00	2.00	734
MATH 217	Complex Variable, Fourier Analysis and Statistics	Theory	4.00	4.00	670
		Subtotal (Theory)	**18.00**	**18.00**	
AEAV 216	Electronics-II Sessional	Sessional	3.00	1.50	418
AEAV 218	Aircraft Electrical System Sessional	Sessional	1.50	0.75	422
AEAS 208	Thermodynamics Sessional	Sessional	1.50	0.75	85
AEAS 210	Aeronautical Engineering Drawing-II	Sessional	3.00	1.50	89
		Subtotal (Sessional)	**9.00**	**4.50**	
Total = Contact hours : 27.00 ; Credits hours : 22.50					

LEVEL 3, TERM-I (Aerospace)

Course No	Course Name	Type of course	Contact hours	Credits	Pg. No
AEAS 301	Heat Transfer	Theory	3.00	3.00	103
AEAS 335	Applied Aerodynamics	Theory	3.00	3.00	115
AEAS 3XX	Elective I	Theory	3.00	3.00	
AEAS 307	Aircraft Loading & Structure Analysis	Theory	3.00	3.00	127
AEAS 331	Material Science & Aerospace Materials	Theory	3.00	3.00	135
GEEM 339	Engineering Ethics and Moral Philosophy	Theory	2.00	2.00	718
	Subtotal (Theory)		**17.00**	**17.00**	
AEAS 336	Applied Aerodynamics Sessional	Sessional	1.50	0.75	123
AEAS 338	Aerospace Propulsion Sessional	Sessional	1.50	0.75	146
AEAS 322	Heat Transfer Sessional	Sessional	3.00	1.50	110
AEAS 332	Material Science & Aerospace Materials Sessional	Sessional	1.50	0.75	142
	Subtotal (Sessional)		**7.50**	**3.75**	
Total = Contact hours : 24.50 ; Credits : 20.75					

LEVEL – 3, TERM – I (Avionics)

Course No	Course Name	Type of course	Contact hours	Credits	Pg. No
AEAV 301	Digital Systems	Theory	3.00	3.00	426
AEAV 303	Signals and Systems	Theory	3.00	3.00	434
AEAS 3XX	Elective I	Theory	3.00	3.00	
AEAV 309	Aircraft Avionics Systems	Theory	3.00	3.00	462
AEAS 335	Applied Aerodynamics	Theory	3.00	3.00	115
GEEM 339	Engineering Ethics and Moral Philosophy	Theory	2.00	2.00	718
	Subtotal (Theory)		**17.00**	**17.00**	
AEAV 302	Digital Systems Sessional	Sessional	3.00	1.50	442
AEAS 338	Aerospace Propulsion Sessional	Sessional	1.50	0.75	146
AEAS 336	Applied Aerodynamics Sessional	Sessional	1.50	0.75	123
	Subtotal (Sessional)		**6.00**	**3.00**	
Total = Contact hours: 23.00; Credits hours: 20.00					

Note: List of AEAS 3XX is given in para 4.5

LEVEL 3, TERM-II (Aerospace)

Course No	Course Name	Type of course	Contact hours	Credits	Pg. No
AEAS 315	Aircraft Stability and Control	Theory	3.00	3.00	149
AEAS 317	Mechanics of Structures, Structural Vibration and Aero Elasticity	Theory	4.00	4.00	157
AEAS 319	Machine Design	Theory	3.00	3.00	167
AEAV 3XX	Elective II	Theory	3.00	3.00	
AEAS 325	Computational Fluid Dynamics	Theory	3.00	3.00	175
		Subtotal (Theory)	**16.00**	**16.00**	
AE 300	Industrial Training	Sessional	8 Weeks	1.00	232
AEAV 330	Measurement and Aircraft Instruments Sessional	Sessional	1.50	0.75	485
AEAS 326	Computational Fluid Dynamics Sessional	Sessional	1.50	0.75	183
GERM 352	Fundamentals of Research Methodology	Sessional	4.00	2.00	724
		Subtotal (Sessional)	**7.00+8 weeks**	**4.50**	
Total = Contact hours: 23.00+8weeks; Credits: 20.50					

LEVEL –3, TERM – II (Avionics)

Course No	Course Name	Type of course	Contact hours	Credits	Pg. No
AEAV 305	Communication Engineering	Theory	3.00	3.00	446
AEAV 307	Electro-Magnetic Field Theory	Theory	3.00	3.00	453
AEAV 313	Digital Signal Processing	Theory	3.00	3.00	470
AEAV 3XX	Elective II	Theory	3.00	3.00	
AEAS 315	Aircraft Stability and Control	Theory	3.00	3.00	149
		Subtotal (Theory)	**15.00**	**15.00**	
AE 300	Industrial Training	Sessional	8 weeks	1.00	232
AEAV 306	Communication Engineering Sessional	Sessional	1.50	0.75	477
AEAV 324	Digital Signal Processing Sessional	Sessional	1.50	0.75	481
AEAV 330	Measurement and Aircraft Instruments Sessional	Sessional	1.50	0.75	485
GERM 352	Fundamentals of Research Methodology	Sessional	4.00	2.00	724
		Subtotal (Sessional)	**8.50+8 weeks**	**5.25**	
Total = Contact hours: 23.50 +8 weeks; Credit hours: 20.25					

Note: List of AEAV 3XX is given in para 4.5 & 4.6

LEVEL 4, TERM-I (Aerospace)

Course No	Course Name	Type of Course	Contact hours	Credits	Pg. No
AEAS 437	Aerospace Vehicle Design	Theory	3.00	3.00	186
AEAS 439	Rotor-dynamics and Aircraft Performance	Theory	3.00	3.00	199
AEAS 447	Space Engineering	Theory	3.00	3.00	205
GESL 409	Environment Sustainability and Law	Theory	2.00	2.00	742
AEAS 4XX	Elective III	Theory	3.00	3.00	
		Subtotal (Theory)	**14.00**	**14.00**	
AEAS 400	Final Year Design and Research Project	Sessional	6.00	3.00	235
AEAS 438	Aerospace Vehicle Design Sessional	Sessional	3.00	1.50	194
		Subtotal (Sessional)	**9.00**	**4.50**	
Total = Contact hours :23.00; Credit hours : 18.50					

LEVEL 4, TERM-I (Avionics)

Course No	Course Name	Type of Course	Contact hours	Credits	Pg. No
AEAV 401	Microwave Engineering	Theory	3.00	3.00	503
AEAV 407	Radar Engineering	Theory	3.00	3.00	510
AEAS 447	Space Engineering	Theory	3.00	3.00	205
GESL 409	Environment Sustainability and Law	Theory	2.00	2.00	742
AEAS 4XX	Elective III	Theory	3.00	3.00	
		Subtotal (Theory)	**14.00**	**14.00**	
AEAV 400	Final Year Design and Research Project	Sessional	6.00	3.00	536
AEAV 408	Radar Engineering Sessional	Sessional	1.50	0.75	515
AEAV 442	Microwave Engineering Sessional	Sessional	1.50	0.75	519
		Subtotal (Sessional)	**9.00**	**4.50**	
Total = Contact hours :23.00; Credit hours : 18.50					

Note: List of AEAS/AEAV 4XX is given in para 4.5 & 4.6

LEVEL 4, TERM-II (Aerospace)

Course No	Course Name	Type of course	Contact hours	Credits	Pg. No
AEAS 407	Turbo Machinery	Theory	3.00	3.00	213
AEAV 411	Control Systems Engineering	Theory	3.00	3.00	489
AEAS 413	High Speed Aerodynamics	Theory	3.00	3.00	224
GEPM 469	Project Management and Finance	Theory	2.00	2.00	750
AEAS 4XX	Elective IV	Theory	3.00	3.00	
		Subtotal (Theory)	**14.00**	**14.00**	
AEAS 400	Final Year Design and Research Project	Sessional	6.00	3.00	235
AEAS 408	Turbo Machinery Sessional	Sessional	1.50	0.75	221
AEAV 412	Control Systems Engineering Sessional	Sessional	1.50	0.75	498
		Subtotal (Sessional)	**9.00**	**4.50**	
Total = Contact hours : 23.00 ; Credits : 18.50					

LEVEL – 4, TERM – II (Avionics)

Course No	Course Name	Type of Course	Contact hours	Credits	Pg. No
AEAV 411	Control Systems Engineering	Theory	3.00	3.00	489
AEAV 443	Aircraft Communication and Navigation	Theory	4.00	4.00	523
GEPM 469	Project Management and Finance	Theory	2.00	2.00	750
AEAS 4XX	Elective IV	Theory	3.00	3.00	
		Subtotal (Theory)	**12.00**	**12.00**	
AEAV 400	Final Year Design and Research Project	Sessional	6.00	3.00	536
AEAV 412	Control Systems Engineering Sessional	Sessional	1.50	0.75	498
AEAV 444	Aircraft Communication and Navigation Sessional	Sessional	1.50	0.75	532
		Subtotal (Sessional)	**9.00**	**4.50**	
Total = Contact hours : 21.00; Credit: 16.50					

Note: List of AEAS/AEAV 4XX is given in para 4.5 & 4.6

4.5 List of Elective Courses for Aerospace Discipline

Sr. No.	Course Code	Course Name	Level/ Term	Contact hours	Credits
1.	AEAS 337	Aerospace Propulsion	3-I/ 3-II	3.00	3.00
2.	AEAV 329	Measurement and Aircraft Instruments	3-I/ 3-II	3.00	3.00
3.	AEAS 419	Maintenance Management and Repair of Aircraft	4-I/ 4-II	3.00	3.00
4.	AEAS 421	Aviation Safety	4-I/ 4-II	3.00	3.00
5.	AEAS 423	Aerospace Management	4-I/ 4-II	3.00	3.00
6.	AEAS 443	Pressurization and Air Conditioning systems	4-I/ 4-II	3.00	3.00
7.	AEAS 427	Noise, Control and Vibration	4-I/ 4-II	3.00	3.00
8.	AEAS 429	Rotorcrafts Performance	4-I/ 4-II	3.00	3.00
9.	AEAS 431	Weapons Engineering	4-I/ 4-II	3.00	3.00
10.	AEAS 435	Aircrafts Structural Design	4-I/ 4-II	3.00	3.00
11.	AEAS 455	Human Performance and Limitations	4-I/ 4-II	3.00	3.00
12.	AEAS 457	Airworthiness Legislations	4-I/ 4-II	3.00	3.00
13.	AEAS 459	Entrepreneurship Development	4-I/ 4-II	3.00	3.00
14.	AEAS 461	Advanced Materials Processing Technologies	4-I/ 4-II	3.00	3.00
15.	AEAS 463	Fluid Power and Control	4-I/ 4-II	3.00	3.00
16.	AEAS 449	Space Engineering-II	4-I/ 4-II	3.00	3.00
17.	AEAV451	Avionics Technology	4-I/4-II	3.00	3.00

4.6 List of Elective Courses for Avionics Discipline

Sr. No.	Course Code	Course Name	Level/ Term	Contact hours	Credits
1.	AEAS 337	Aerospace Propulsion	3-I/ 3-II	3.00	3.00
2.	AEAV 329	Measurement and Aircraft Instruments	3-I/ 3-II	3.00	3.00
3.	AEAV 413	Mobile Cellular Communication	4-I/ 4-II	3.00	3.00
4.	AEAV 415	Satellite Communication	4-I/ 4-II	3.00	3.00
5.	AEAV 417	Optoelectronics	4-I/ 4-II	3.00	3.00
6.	AEAV 419	Electronics Warfare	4-I/ 4-II	3.00	3.00
7.	AEAV 421	Optical Fiber Communication	4-I/ 4-II	3.00	3.00
8.	AEAV 435	Computer Networks	4-I/ 4-II	3.00	3.00
9.	AEAS 419	Maintenance Management and Repair of Aircraft	4-I/ 4-II	3.00	3.00
10.	AEAS 421	Aviation Safety	4-I/ 4-II	3.00	3.00
11.	AEAS 423	Aerospace Management	4-I/ 4-II	3.00	3.00
12.	AEAS 431	Weapons Engineering	4-I/ 4-II	3.00	3.00
13.	AEAS 455	Human Performance and Limitations	4-I/ 4-II	3.00	3.00
14.	AEAS 457	Airworthiness Legislations	4-I/ 4-II	3.00	3.00
15.	AEAS 459	Entrepreneurship Development	4-I/ 4-II	3.00	3.00
16.	AEAV 409	Microprocessors and Interfacing	4-I/ 4-II	3.00	3.00
17.	AEAS 449	Space Engineering- II	4-I/ 4-II	3.00	3.00

Sr. No.	Course Code	Course Name	Level/ Term	Contact hours	Credits
18.	AEAV 403	Electric and Magnetic Properties of Materials	4-I/ 4-II	3.00	3.00

4.7 Equivalence of Courses

Syllabus September 2018		Syllabus September 2020	
Course Code	**Course Name**	**Course Code**	**Course Name**
PHY 115	Physics I (Waves and Oscillation, Optics and Thermal Physics) (3.00)	PHY 101	Waves and Oscillations, Optics and Modern physics (3.00)
PHY 116	Physics Sessional (1.50)	PHY 102	Physics Sessional (1.50)
PHY 117	Physics II (Electricity and Magnetism, Modern Physics and Mechanics) (3.00)	PHY 111	Electricity and Magnetism, Thermal Physics and Mechanics. (3.00)
CHEM 107	Chemistry (Atomic Structure, Thermo-chemistry and Chemistry of Engineering Materials) (3.00)	CHEM 101	Fundamentals of Chemistry (3.00)
CHEM 108	Chemistry Sessional (1.50)	CHEM 102	Chemistry Sessional (1.50)
MATH 121	Math I (Differential and Integral Calculus) (3.00)	MATH 101	Differential and Integral Calculus (3.00)
MATH 127	Vector Analysis, Matrix& Co-ordinate Geometry (3.00)	MATH 201	Vector Analysis, Laplace Transform & Co-ordinate Geometry (3.00)
MATH 129	Ordinary and Partial Differential Equations (3.00)	MATH 103	Differential Equations and Matrix (3.00)
MATH 223	Complex Variable and Laplace Transform (3.00)	MATH 217	Complex Variable, Fourier Analysis and Statistics (4.00)
MATH 225	Fourier Analysis and Statistics (3.00)		

Syllabus September 2018		Syllabus September 2020	
Course Code	**Course Name**	**Course Code**	**Course Name**
HUM 112	Technical Report Writing and Presentation (1.50)	LANG 102	Communicative English-I (1.50)
HUM 421	Society, Culture and Engineering Ethics (3.00)	GES 101	Fundamentals of Sociology (2.00)
HUM 211	Principles of Accounting (3.00)	GEA 101	Principles of Accounting (2.00)
HUM 305	Economics (3.00)	GEE 201	Fundamentals of Economics (2.00)
AEAV 206	Numerical Analysis and Application Sessional (1.50)	AEAV 206	Numerical Analysis and Application Sessional (1.50)
		AEAV 226	Numerical Analysis and Application Sessional (0.75)
AEAV 209	Electro-Mechanical System (3.00)	AEAV 217	Aircraft Electrical System (3.00)
AEAV 210	Electro-Mechanical System Sessional (0.75)	AEAV 218	Aircraft Electrical System Sessional (0.75)
AEAS 450	Capstone Project/Integrated Design Project (IDP) (6.00)	AEAS 400	Final Year Design and Research Project (6.00)
AEAS 480	Thesis (3.00)		

Syllabus September 2018		Syllabus September 2020	
Course Code	**Course Name**	**Course Code**	**Course Name**
AEAV 450	Capstone Project/Integrated Design Project (IDP) (6.00	AEAV 400	Final Year Design and Research Project (6.00)
AEAV 480	Thesis (3.00)		
AEAV 101	Electrical Circuit Analysis-I (3.00)	EECE 161	Electrical Circuit Analysis-I (3.00)
AEAV 102	Electrical Circuit Analysis-I Sessional (1.50)	EECE 162	Electrical Circuit Analysis-I Sessional (1.50)
AEAV 103	Computer Programming and Application (3.00)	CSE 173	Computer Programming and Application (3.00)
AEAV 104	Computer Programming and Application Sessional (1.50)	CSE 174	Computer Programming and Application Sessional (1.50)
AEAS 201	Engineering Mechanics (Statics and Dynamics) (4.00)	ME 249	Engineering Mechanics (Statics and Dynamics) (4.00)
AEAS 313	High Speed Aerodynamics (3.00)	AEAS 413	High Speed Aerodynamics (3.00)

CHAPTER 5

COURSE CONTENTS

5.1 Detailed Curriculum and Outcome Based Mapping of Undergraduate Courses

5.1.1 Core and specialized courses offered by Aerospace Discipline is given below:

COURSE INFORMATION			
Course Code Course Title	AEAS 103 Fundamentals of Aeronautical Engineering	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
The purpose of this course is to serve as an introduction into the basics of aircraft aerodynamic-characteristics, components, structures and avionics systems.			
OBJECTIVES			
1. To provide the knowledge about basic Aeronautical Engineering and the aerodynamic characteristics of aircraft. 2. To identify the forces acting on aircraft and learn how to analyze them. 3. To interpret the aircraft basic Structure, different aircraft component configurations. 4. To explain about the Mechanics of flight and fight performance.			

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **explain** basics of Aeronautical Engineering.	PO2	C2			K3	T, F, ASG.
CO2	Be able to **Identify** the forces acting on aircraft.	PO1	C3			K4	T, F, ASG.
CO3	Be able to **describe** the aircraft Structure and basic configurations.	PO2	C2			K3	F, Mid Term Exam.
CO4	Be able to **explain** about Mechanics of flight.	PO2	C2			K3	T, F, ASG.

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Introduction to Aeronautical Engineering: Classification of aircraft, Different parts of aircraft (airframe, engine, avionics systems, communication systems, instrumentation and navigation systems) and their function.

Introduction to Aerodynamics: Standard atmosphere, Dimensional analysis, Bernoulli's theorem for incompressible flows and its applications in aeronautical engineering. Local and free stream characteristics.

Airfoil Classification and Characteristics: Pressure distribution over airfoil and its variation with angle of attack. Centre of pressure and its movement, Forces and moments acting on airfoil, centre of gravity, centre of pressure and aerodynamic centre concepts. Characteristics of Lift, drag and pitching moment curves. Stall and its effects.

Flight Mechanics: Aircraft maneuvers- Take off, climb, cruise, glide, descend and landing. Aircraft performance parameters such as endurance, aircraft ceiling and range. Aircraft control surfaces and High lift devices.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **explain** basics of Aeronautical Engineering		3										
CO2	Be able to **identify** the forces acting on aircraft.	3											
CO3	Be able to **describe** the aircraft Structure and basic configurations.		3										
CO4	Be able to **explain** about Mechanics of flight.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week-1	**Topic**	**CT**
Class-1	Introduction to Aerospace Engineering.	CT-1
Class-2	Aerodynamics, Astronautics.	
Class-3	Types of aircraft	
Week-2		
Class-4	Basic forces acting on an aircraft.	
Class-5	Lift and drag, Flow over airfoils.	
Class-6	Mechanics of flight, analyze how airfoil generate lift.	
Week-3		Mid Term Exam
Class-7	Familiarization to high lifting devices.	
Class-8	Distinguish between different types of flaps.	
Class-9	Analyze the lift generation of different types of flaps.	

Week-4		
Class-10	Learn about parameters: endurance, aircraft ceiling and range.	
Class-11	Learn climb, descent and glide, take off, cruise, landing.	
Class-12	Analyze different phases of flight.	
Week-5		
Class-13	Aircraft basic configurations.	
Class-14	Aerospace structures – familiarization to construction of wing, fuselage, horizontal stabilizer, vertical stabilizer.	
Class-15	Aerospace structures – familiarization to construction of wing, fuselage,	
Week-6		
Class-16	Structures of fuselage and empennage.	
Class-17	Basic control surfaces.	
Class-18	Analyze the movement of aircraft.	
Week-7		CT-2
Class-19	Airfoil Nomenclature.	
Class-20	Types of airfoil.	
Class-21	Review on Aerospace engineering.	
Week-8		
Class-22	Introduction to Avionics Engineering.	
Class-23	Instrumentation, Introduction to the cockpit and its instruments.	
Class-24	Introduction to Basic 6 instruments and their functions.	
Week-9		CT-3
Class-25	ASI, VSI, ALT, Directional Gyro.	
Class-26	Glass cockpit, HUD.	
Class-27	Types of HUD, Functions of cockpit display and types.	
Week-10		
Class-28	Fundamentals of aircraft communication system.	

Class-29	ATC, Functions of communication system.
Class-30	Communication block diagram, TCAS.
Week 11	
Class-31	Difference between Ground and air communication, ADC.
Class-32	Black box and its functions.
Class-33	Review on aircraft communication system.
Week 12	
Class-34	Fundamentals of aircraft navigation system
Class-35	Continue
Class-36	Stages of flight, Heading, drift angle, Math.
Week 13	
Class-37	VOR, Radio RADAR, Doppler RADAR.
Class-38	ILS, DME, GPS.
Class-39	ADF, Functions of Navigation systems, Math.
Week 14	
Class-40	Local & free stream characteristics, Calculate Temperature of different altitude, Math relating aircraft speed.
Class-41	Aero-engine, Principles of Jet reaction, types of aero-engine.
Class-42	Review of whole Syllabus.

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C3
			CO 4	C2
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO3	C2
Final Examination (Section A & B)		60%	CO 1	C2
			CO 2	C3
			CO 3	C2
			CO 4	C2
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Airframe and Power Plant – C A Zweng; Galotia Publications.
2. Spacecraft Systems Engineering –Peter Fortescue and John Stark; John Wiley and Sons.
3. Introduction to Flight -John D Anderson Jr; Tata McGraw-Hill.
4. Introduction to Aerospace structural Analysis –David H Allen, Publisher ;Weley and Sons.

5. Avionics Navigation Systems, 2nd Ed – Myron Kayton
6. Aerodynamics – Clancy
7. Flight without Formulae – Kermode
8. Fundamentals of Aerodynamics- John D. Anderson; McGraw-Hill
9. Principles of Avionics – 6th Ed.– Albert Helfrick.

COURSE INFORMATION			
Course Code Course Title	: AEAS 110 : Aeronautical Engineering Drawing- I	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This sessional is intended to teach the students basics, concepts of different engineering drawing and give the students practical idea of engineering drawing in the field of Aviation.

OBJECTIVE

1. To know about different types of lines & use of different types of pencils in an Engineering Drawing
2. To know how to represents letters & numbers in drawing sheet
3. To know projection of points, straight lines, solids etc.
4. To know development of different types of surfaces.

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **demonstrate** the use of appropriate standards and conventions in drawing sheet preparation and layout	2	Psychomotor/ Precision			K3	R,Q,T , F
CO2	Be able to **create** orthographic projection auxiliary, sectional views from the practical object	3	C6	P1, P2		K5	R,Q,T , F
CO3	Be able to **develop** a 3-D object from the given orthographic projection of the object	3	Psychomotor/ Articulation			K5	R,Q,T , F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ;PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

Exp No	Exp Name
1.	Introduction, Familiarization with drawing tools and types of projections
2.	Drawing orthographic views of simple blocks
3.	Drawing orthographic views of objects with round features.
4.	Drawing orthographic views of objects with fillets, rounds
5.	Drawing sectional views
6.	Drawing auxiliary views..
7.	: Drawing isometric views of simple blocks
8.	Drawing orthographic views of objects with round features
9.	Drawing orthographic views of objects with fillets and rounds
10.	Lab Test and Lab Quiz

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **Demonstrate** the use of appropriate standards and conventions in drawing sheet preparation and layout		3										
CO2	Be able to **Create** orthographic projection auxiliary, sectional views from the practical object.			3									
CO3	Be able to **Develop** a 3-D object from the given orthographic projection of the object			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical Total	 14 28 42
Self-Directed Learning Preparation of Lab Reports Preparation of Lab Test Preparation of presentation Preparation of Quiz Engagement in Group Projects	 10 10 5 10 20
Formal Assessment Continuous Assessment Final Quiz	 14 1
Total	112

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Introduction, Familiarization with drawing tools and types of projections
Week 2	Drawing orthographic views of simple blocks
Week 3	Drawing orthographic views of objects with round features.
Week 4	Drawing orthographic views of objects with fillets, rounds
Week 5	Drawing simple sectional views
Week 6	Drawing complex sectional views
Week 7	Drawing auxiliary views..
Week 8	Drawing complex auxiliary views
Week 9	Drawing isometric views of simple blocks
Week 10	Drawing isometric views of blocks with round features
Week 11	Drawing isometric views of blocks with fillets and rounds
Week 12	Lab Quiz
Week 13	Lab Test
Week 14	Viva

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P3/Precision
		CO 2	C6/ Create
Report Writing/Programming	15%	CO 1	P3/Precision
		CO 2	C6/ Create
Mid Term Evaluation (exam/project/assignment)	20%	CO, CO2	P4/ Articulation C6/ Create
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	P3/Precision, C6/ Create, P4/ Articulation
Viva Voce/ Presentation	10%	CO1, CO2, C03	P3/Precision, C6/ Create, P4/ Articulation
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. Mechanical Engineering Drawing- Dr. Amalesh Chandra Mandal
2. Engineering Drawing- N. D. Bhat

COURSE INFORMATION			
Course Code Course Title	AEAS 203 Fundamentals of Fluid Mechanics	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn the concept of a fluid and hence to provide knowledge on the fundamentals of static and dynamic flows

OBJECTIVES

1. To introduce the properties of fluid mechanics, hydrostatic pressure, fluid static forces.
2. To be able to determine hydrostatic pressure, centre of pressure, forces, stability of immersed or floating bodies.
3. To be able to calculate the flow field for in viscid fluid flow.
4. To apply the Bernoulli equation and continuity equation for flow measurements.
5. To be able to calculate the losses in piping system and use the dimensional analysis.
6. To introduce the Rotordynamic machines (pumps).

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **recall** the basic laws of (i) Hydrostatic forces, (ii) Buoyancy forces, (iii) Stability of floating body, (iv) Losses in pipes and Fittings etc.	PO1	C1			K3	T, F, ASG
CO2	Be able to **analyze** fluid in motion using continuity, momentum and energy equation.	PO2	C4	P1, P2		K4	T, F, Mid Term Exam
CO3	Be able to **explain** the design of different types of pipe flow measuring devices and their measurement system.	PO1	C2			K3	T, F, ASG
CO4	Be able to **apply** basic similitude analysis in fluid flow.	PO1	C3	P1, P2		K3	T, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Fundamental concept of fluid, Properties of fluid, Fluid statics; manometers, hydrostatic forces on submerged surfaces, buoyancy and stability, Fluids in rigid body motion.

Fluid kinematics, Lagrangian and Eulerian descriptions of fluid flow, Reynolds transport theorem, Continuity, Momentum, Energy and Bernoulli's equations and their applications.

Dimensional analysis and similitude, dimensional homogeneity, Experimental testing and modeling.

Introduction to two dimensional incompressible flows, boundary layer, laminar and turbulent flows, losses in pipes, minor losses in pipe fittings, pressure, velocity and flow measurements.

Introduction to the rotordynamic machines (pumps).

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **recall** the basic laws of (i) Hydrostatic forces, (ii) Buoyancy forces, (iii) Stability of floating body, (iv) Losses in pipes and Fittings etc.	3											
CO2	Be able to **analyze** fluid in motion using continuity, momentum and energy equation		3										
CO3	Be able to **explain** the design of different types of pipe flow measuring devices and their measurement system	3											
CO4	Be able to **apply** basic similitude analysis in fluid flow.	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week-1	**Topic**	**CT**
Class-1	Concept of fluid	CT-1
Class-2	Properties of fluid	
Class-3	Fluid Statics	
Week-2		
Class-4	Manometers	
Class-5	Mathematical problems of manometer	
Class-6	Buoyancy and stability	
Week-3		
Class-7	Fluids in rigid body motion	
Class-8	Lagrangian descriptions of fluid flow	
Class-9	Eulerian descriptions of fluid flow	
Week-4		
Class-10	Reynolds transport theorem	
Class-11	Continuity equation and its applications	

	Class-12	Momentum equation and its applications	Mid exam
	Week-5		
	Class-13	Energy equation and its applications	
	Class-14	Bernoulli‘s equations and its applications	
	Class-15	Mathematical problems	
	Week-6		
	Class-16	Dimensional analysis and similitude	
	Class-17	Dimensional homogeneity	
	Class-18	Mathematical problems	
	Week-7		CT-2
	Class-19	Experimental testing	
	Class-20	Experimental modeling	
	Class-21	Mathematical problems	
	Week-8		

	Class-22	Incompressible flow	
	Class-23	Boundary layer	
	Class-24	Different boundary layer formation on flat plate.	
	Week-9		CT-3
	Class-25	Laminar boundary layer and its characteristics	
	Class-26	Turbulent boundary layer and its characteristics	
	Class-27	Losses relating flow types	
	Week-10		
	Class-28	Different losses in pipes	
	Class-29	Flow of fluid in pipes	
	Class-30	Minor losses in pipe fittings	
	Week 11		
	Class-31	Fundamentals of measuring instruments	
	Class-32	Density and different types of pressures,	
	Class-33	Mathematical problem	
	Week 12		

	Class-34	Mathematical problem solving of dimensional analysis.	
	Class-35	Mathematical problem solving of losses in pipes	
	Class-36	Mathematical problem solving of Flow velocity calculation	
	Week 13		
	Class-37	Mathematical problem solving of Continuity equation.	
	Class-38	Mathematical problem solving of Energy equation	
	Class-39	Mathematical problem solving of Momentum equation.	
	Week 14		
	Class-40	Mathematical problem solving of Bernoulli's Equation	
	Class-41	Review	
	Class-42	Review	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment	Class Test/ Assignment 1-3	20%	CO1, CO3	C1, C2
			CO 4	C3

(40%)	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO2	C4
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C4
			CO 3	C2
			CO 4	C3
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Mechanics of Fluids – Irving H. Shames
2. Fluid Mechanics – Frank M. White
3. Fluid Mechanics – Yunus A. Cengel & John M. Cimbala
4. Fluid Mechanics – E. John Finnemore & Joseph B. Franzini

COURSE INFORMATION			
Course Code Course Title	: AEAS 204 : Fundamentals of Fluid Mechanics Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE

Course Code: AEAS 203
Course Title: Fundamentals of Fluid Mechanics

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This sessional is intended to teach the students basic concepts and principles of fluid mechanics based on real-life experimental scenarios.

OBJECTIVE

1. To develop an understanding of hydrostatic law.
2. To imbibe basic laws and equations used for the analysis of fluid flow.
3. To inculcate the importance of fluid flow measurement and its applications in industries.
4. To determine the losses in a flow system and flow through pipes.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **show** the performances of fluids subject to friction in the pipe with different flow conditions.	2	Psychomotor/ Precision			K4	R, Q, T, PR
CO2	Be able to **analyze** how to measure flow nature precisely through venturi meter and orifice meter.	5	C4			K6	R, Q, T, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	Determination of Center of Pressure of a Submerged Surface
2.	Proof of Bernoulli's Equation
3.	Flow Through a Venturi Meter
4.	Flow Through an Orifice
5.	Fluid Friction in a Pipe

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **show** the performances of fluids subject to friction in the pipe with different flow conditions.		2										
CO2	Be able to **analyze** how to measure flow nature precisely through venturi meter and orifice meter.					2							

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	7
Practical	14
Total	21
Self-Directed Learning	
Preparation of Lab Reports	5
Preparation of Lab Test	5
Preparation of presentation	2
Preparation of Quiz	5
Engagement in Group Projects	10
Formal Assessment	
Continuous Assessment	7
Final Quiz	1
Total	56

TEACHING METHODOLOGY

Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Determination of Center of Pressure of a Submerged Surface
Week 2	Proof of Bernoulli's Equation
Week 3	Flow Through a Venturi Meter
Week 4	Flow Through an Orifice
Week 5	Fluid Friction in a Pipe
Week 6	Lab Test and Lab Quiz
Week 7	Presentation on Assigned Problems and Project Demonstration

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P3/Precision
		CO 2	C4/Analyse
Report Writing/Programming	15%	CO 1	P3/Precision
		CO 2	C4/Analyse
Mid Term Evaluation (exam/project/assignment)	20%	CO1	P3/Precision
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2	P3/Precision, C4/Analyse
Viva Voce/ Presentation	10%	CO1, CO2	P3/Precision, C4/Analyse
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. Mechanics of Fluids - Irving H. Shames
2. Fluid Mechanics - Frank M. White
3. Fluid Mechanics - Yunus A. Cengel& John M. Cimbala
4. Fluid Mechanics - E. John Finnemore& Joseph B. Franzini

COURSE INFORMATION			
Course Code Course Title	AEAS 205 Mechanics of Solids	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To enhance student knowledge on the basic principles of solid mechanics and design problem solution.			
OBJECTIVES			
1. To evaluate stress and deformation of simple deformable structural under shear, flexure and torsional loadings. 2. To analyze statically indeterminate structure. 3. To analyze deflection of beam and shaft. 4. To establish the stress transformation equations and determine the absolute maximum normal and shear stress. 5. To analyze various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **explain** the concepts and principles, and perform calculations, relative to the strength and stability of structures and mechanical components.	PO1	C2			K3	T, ASG, F
CO2	Be able to **analyze** various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress.	PO2	C4			K4	T, PR, Q, F
CO3	Be able to **evaluate** stresses & strains for structural elements.	PO2	C5			K4	T, ASG, F
CO4	Be able to **evaluate** the deflection at any point on a beam subjected to a combination of loads.	PO2	C5	P1, P2		K4	Q, PR, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Stress analysis: Stress-strain concept and their inter-relationship, axially loaded member, thermal and centrifugal stresses; Stresses in thin and thick-walled cylinders and spheres.

Beams: Forces under different loading conditions and its effect on the resisting member; Shear force and bending moment diagrams; Various types of stresses i.e., bending, torsion, shear etc. in beams; Flexure formula; Deflection analysis of beams: integration and area moment methods; Introduction to reinforced concrete beams and slabs.

Torsion formula; Angle of twist; Modulus of rupture; Helical springs;

Combined stresses: principal stress, Mohr 's Circle.

Columns: Euler 's formula, intermediate column formulas, the Secant formula; Flexure formula of curved beams; Problem-based applications in aerospace, mechanical and biomedical engineering.

Introduction to experimental stress analysis techniques: Strain energy; Failure theories.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **explain** the concepts and principles, and perform calculations, relative to the strength and stability of structures and mechanical components.	3											
CO2	Be able to **analyze** various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress.		3										
CO3	Be able to **evaluate** stresses & strains for structural elements.		3										
CO4	Be able to **evaluate** the deflection at any point on a beam subjected to a combination of loads.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE		
	Topic	**CT**
Week-1	**Stress analysis**	CT-1
Class-1	Stress-strain concept and their inter-relationship	
Class-2	Axially loaded member	
Class-3	Continue	
Week-2	**Stress Analysis**	
Class-4	Thermal and centrifugal stresses	
Class-5	Stresses in thin and thick walled cylinders and spheres	
Class-6	Numerical	
Week-3	**Beams**	
Class-7	Forces under different loading conditions	

	Class-8	Numerical	
	Class-9	Continue	
	Week-4	**Beams**	
	Class-10	Force effect on the resisting member	Mid Exam
	Class-11	Numerical	
	Class-12	Numerical	
	Week-5	**Diagram**	
	Class-13	Shear force diagram	
	Class-14	Bending moment diagram	
	Class-15	Examples	
	Week-6	**Various types of stresses**	
	Class-16	Bending, torsion, shear etc. in beams	
	Class-17	Flexure formula and numerical	
	Class-18	Continue	
	Week-7	**Deflection analysis of beams**	
	Class-19	Integration and area moment methods	
	Class-20	Continue	CT-2
	Class-21	Numerical	
	Week-8	**Introduction to reinforced concrete beams and slabs.**	
	Class-22	Introduction	
	Class-23	Effect of loading	
	Class-24	Numerical	
	Week-9	**Torsion**	
	Class-25	**Torsion**	
	Class-26	Terminologies (angle of rupture, modulus of rupture)	
	Class-27	Helical spring	
	Week-10	**Combined stress**	
	Class-28	Principle stress	
	Class-29	Continue	

	Class-30	Numerical	
	Week 11	**Mohr's circle**	
	Class-31	Introduction	CT-3
	Class-32	Application	
	Class-33	Numerical	
	Week 12	**Columns**	
	Class-34	Euler's formula	
	Class-35	Intermediate column formulas	
	Class-36	The Secant formula	
	Week 13	**Beams**	
	Class-37	Numerical	
	Class-38	Numerical	
	Class-39	Flexure formula of curved beams;	
	Week 14	**Problem-based Applications in Aerospace, Mechanical and Biomedical Engineering.**	
	Class-40	Introduction to experimental stress analysis techniques	
	Class-41	Strain energy and Failure theory	
	Class-42	Review Class	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C2, C4
			CO 2	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO 2, CO4	C4, C5
Final Examination (Section A & B)		60%	CO 1	C2
			CO 2	C4
			CO 3	C5
			CO 4	C5
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Strength of Materials – James M. Gere & Barry Goodno.
2. Strength of Materials (4th edition) – Andrew Pytel, Ferdinand L. Singer.
3. Strength of materials (4th edition) -William Nash; McGraw-hill International Editions, Schaum's Outline Series.
4. Strength of Materials – Beer and John Stone.

COURSE INFORMATION			
Course Code Course Title	: AEAS 206 : Mechanics of Solids Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE
Course Code: AEAS 205 Course Title: Mechanics of Solids

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This sessional is intended to apply the concept of Mechanics of Solids and determine the internal forces and deformations in common structural members.

OBJECTIVE

1. To demonstrate the knowledge of stress, strain and bucking in different experiments.
2. To evaluate the mechanical properties of materials and design of the structural members.
3. To analyze the performances of different materials under different loading.
4. To learn the strength, stiffness and stability design and construction requirements.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **demonstrate** the knowledge of stress, strain and buckling in different experiments using tools	5	Psychomotor/ Precision			K6	R, Q, T
CO2	Be able to **implement** the concept of solid mechanics for testing materials	1	Psychomotor/ Manipulation			K3	R, Q,T
CO3	Be able to **show** the failure patterns of testing materials	2	Psycho motor/ Precision			K3	Pr, PR/T

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	Tension Test of Mild Steel Specimen
2.	Hardness Test on Metal Specimen
3.	Compression Test of Timber Specimen
4.	Izod And Charpy Impact Test of Metal Specimen
5.	Rockwell Hardness Test of Metal Specimens
6.	Brinell Hardness Test of Metal Specimens
7.	Torsion Test of Mild Steel Specimen
8.	Basics of Shear Force And Bending Moment Diagram
9.	Deflection Test on Cantilever Beam
10.	Compression Test on Open Coil Helical Spring

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **Demonstrate** the knowledge of stress, strain and bucking in different experiments using tools					1							
CO2	Be able to **Implement** the concept of solid mechanics for testing materials	3											
CO3	Be able to **show** the failure patterns of testing materials.		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical Total	 14 28 42
Self-Directed Learning Preparation of Lab Reports Preparation of Lab Test Preparation of presentation Preparation of Quiz Engagement in Group Projects	 10 10 5 10 20
Formal Assessment Continuous Assessment Final Quiz	 14 1
Total	112

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Tension Test of Mild Steel Specimen
Week 2	Hardness Test on Metal Specimen
Week 3	Compression Test of Timber Specimen
Week 4	Izod And Charpy Impact Test of Metal Specimen
Week 5	Rockwell Hardness Test of Metal Specimens
Week 6	Brinell Hardness Test of Metal Specimens
Week 7	Torsion Test of Mild Steel Specimen
Week 8	Basics of Shear Force And Bending Moment Diagram
Week 9	Deflection Test on Cantilever Beam
Week 10	Compression Test on Open Coil Helical Spring
Week 11	Lab Test-1
Week 12	Lab Teast-2
Week 13	Lab Quiz
Week 14	Presentation on Assigned Problems

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P3/Precision
		CO 2	C4/Analyse
Report Writing/Programming	15%	CO 1	P3/Precision
		CO 2	C4/Analyse
Mid Term Evaluation (exam/project/assignment)	20%	CO3	P4/ Articulation
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	P3/Precision, C4/Analyse, P4/ Articulation
Viva Voce/ Presentation	10%	CO1, CO2, C03	P3/Precision, C4/Analyse, P4/ Articulation
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. Strength of Materials – James M. Gere & Barry Goodno.
2. Strength of Materials (4th edition) – Andrew Pytel, Ferdinand L. Singer.
3. Strength of materials (4th edition) -William Nash; Mcgraw-hill International Editions,
   Schaum‘s Outline Series.
4. Strength of Materials – Beer and John Stone.

COURSE INFORMATION			
Course Code Course Title	AEAS 207 Thermodynamics	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
Physics I (Waves and Oscillation, Optics and Thermal Physics)			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To introduce the fundamental concepts of energy, work and heat, as well as to provide understanding on the thermodynamic concepts, first and second thermodynamic laws.			
OBJECTIVES			
1. To develop the basic concepts of Thermodynamics. 2. To describe Thermodynamics Laws. 3. To apply basic of thermodynamics to thermal equipment. 4. To determine the performance of various steam and air thermodynamics cycle.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **develop** the basic concepts of Thermodynamics.	PO1	C1			K3	T, F, ASG.
CO2	Be able to **describe** Thermodynamics Laws.	PO1	C1			K3	T, F, ASG.
CO3	Be able to **apply** basic of thermodynamics to thermal equipment.	PO2	C2			K3	F, Mid Term Exam.
CO4	Be able to **determine** the performance of various steam and air thermodynamics cycle	PO2	C2	P1, P2		K4	T, F, ASG.

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Fundamental concepts and first law: Concept of continuum, macroscopic approach, thermodynamic systems; closed, open and isolated. Property, state, path and process, quasi-static process, work, modes of work, Zeroth law of thermodynamics- concept of temperature and heat, internal energy, specific heat capacities, enthalpy - concept of ideal and real gases. First law of thermodynamics - applications to closed and open systems - steady flow processes.

Second law and entropy: Second law of thermodynamics; kelvin planck and clausius statements of second law. Reversibility and irreversibility - carnot theorem, carnot cycle using steam, reversed Carnot cycle, efficiency, COP - thermodynamic temperature scale - clausius inequality, concept of entropy, entropy of ideal gas, principle of increase of entropy.

Thermodynamic availability: Basics; energy in non- flow processes: expressions for the energy of a closed system – equivalence between mechanical energy forms and energy – flow of energy associated with heat flow – exergy, consumption and entropy generation - exergy in steady flow processes: expressions for exergy in steady flow processes – exergy dissipation and entropy generation.

Properties of pure substance: Properties of pure substances; thermodynamic properties of pure substances in solid, liquid and vapor phases, Use of property tables, phase rule, PVT surfaces, standard Rankine cycle.

Air standard and Refrigeration cycles: Equations of state for ideal gases, Properties of gases and vapors; Properties of atmospheric air; Non-flow and flow processes; air standard cycles; Brayton, Otto and Diesel cycles. Refrigeration cycles; phase change of working substance.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **develop** the basic concepts of Thermodynamics.	3											
CO2	Be able to **describe** Thermodynamics Laws.	3											
CO3	Be able to **apply** basic of thermodynamics to thermal equipment.		3										
CO4	Be able to **determine** the performance of various steam and air thermodynamics cycle		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week-1	Topic	CT
Class-1	Concept of continuum & macroscopic approach.	CT-1
Class-2	Closed, open and isolated system.	
Class-3	Property, state, path and process.	
Week-2		
Class-4	Work, modes of work.	
Class-5	Zeroth law of thermodynamics.	
Class-6	Concept of temperature and heat.	
Week-3		Mid Term Exam
Class-7	Internal energy and specific heat capacities.	
Class-8	Enthalpy.	
Class-9	Concept of ideal and real gases.	
Week-4		
Class-10	First law of thermodynamics.	
Class-11	Applications to closed and open systems.	
Class-12	Steady flow processes.	
Week-5		
Class-13	Second law of thermodynamics.	
Class-14	Kelvin planck and clausius statements of second law.	
Class-15	Reversibility and irreversibility.	
Week-6		
Class-16	Carnot theorem.	
Class-17	Carnot cycle using steam.	
Class-18	Reversed Carnot cycle	
Week-7		CT-2
Class-19	Efficiency	
Class-20	COP	

	Class-21	Thermodynamic temperature scale - clausius inequality.	
	Week-8		
	Class-22	Concept of entropy.	
	Class-23	Entropy of ideal gas.	
	Class-24	Principle of increase of entropy.	
	Week-9		CT-3
	Class-25	Energy in non-flow processes.	
	Class-26	Expressions for the energy of a closed system.	
	Class-27	Equivalence between mechanical energy forms and exergy.	
	Week-10		
	Class-28	Consumption and entropy generation.	
	Class-29	Expressions for exergy in steady flow processes.	
	Class-30	Exergy dissipation and entropy generation.	
	Week 11		
	Class-31	Thermodynamic properties of pure substances in vapour.	
	Class-32	Thermodynamic properties of pure substances in solid	
	Class-33	Thermodynamic properties of pure substances in liquid	
	Week 12		
	Class-34	Use of property tables.	
	Class-35	Phase rule & PVT surfaces.	
	Class-36	Standard Rankine cycle.	
	Week 13		
	Class-37	Equations of state for ideal gases and Properties of gases & vapours. Properties of atmospheric air, Non-flow and flow processes.	
	Class-38	Air standard cycles, Brayton cycle.	
	Class-39	Otto and Diesel cycles.	
	Week 14		
	Class-40	Refrigeration cycles.	
	Class-41	Thermodynamic relations and equations of state.	

	Class-42	Mixtures of gases and vapours; Fuels and combustion.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1 CO2	C1
			CO4	C2
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO3	C2
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C1
			CO 3	C2
			CO 4	C2
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Thermodynamics – Yunus A. Cengel, Michael A. Boles
2. Fundamentals of Thermodynamics – R E Sonntag, C. Borgnakke, G J. Van Wylen; John Wiley & Sons, Inc, 5th edition, 2000.
3. Thermodynamics - Kenneth Wark, 6th Ed; McGraw-Hill, Singapore, 1999.

COURSE INFORMATION			
Course Code Course Title	: AEAS 208 : Thermodynamics Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE

Course Code: AEAS 207
Course Title: Thermodynamics

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To describe the concepts of heat, work, and energy and correctly use thermodynamic terminology.

OBJECTIVE

. To determine the identity of an unknown metal.

. To prove the whether the laws of thermodynamics hold when determining this identity.

. To calculate the approximate specific heat of unknown metal.

. To evaluate the relationship between the heat that is transferred and change in temperature

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **demonstrate** the understanding of thermodynamic properties and application of thermodynamic tools / apparatus.	5	Psychomotor/ Precision			K6	R, Q, T
CO2	Be able to **analyze** the concepts of heat, work, and energy.	2	C4			K3	R, Q,T

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	Determination of Flash Point of Liquid Fluid
2.	Study of Sling Psychrometer
3.	Viscosity Test of Liquid Substance.
4.	Determination of Carbon Residue of a given fuel.
5.	a. Proximate Analysis of Coal b. Study of Different Speed Measuring Devices
6.	Study of a Refrigeration and Air Conditioning Unit.
7.	Study and Calibration of pressure gauge by Dead Weight Tester.
8.	Determination of the Calorific value of Fuel.
9.	Determination of Calorific value of Gaseous by Gas Calorimeter.
10.	Concept of pressure and pressure sensor behavior.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **demonstrate** the understanding of thermodynamic properties and application of thermodynamic tools / apparatus.					1							
CO2	Be able to **analyze** the concepts of heat, work, and energy. .		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	07
Practical	14
Total	21
Self-Directed Learning	
Preparation of Lab Reports	05
Preparation of Lab Test	10
Preparation of presentation	05
Preparation of Quiz	05
Engagement in Group Projects	10
Formal Assessment	
Continuous Assessment	07
Final Quiz	1
Total	66

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Determination of Flash Point of Liquid Fluid. Study of Sling Psychrometer
Week 2	Viscosity Test of Liquid Substance. Determination of Carbon Residue of a given fuel.
Week 3	a. Proximate Analysis of Coal b. Study of Different Speed Measuring Devices Study of a Refrigeration and Air Conditioning Unit.
Week 4	Study and Calibration of pressure gauge by Dead Weight Tester. Determination of the Calorific value of Fuel.
Week 5	Determination of Calorific value of Gaseous by Gas Calorimeter. Concept of pressure and pressure sensor behavior.
Week 6	Lab Test-1
Week 7	Lab Quiz /Presentation on Assigned Problems

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	40%	CO 1	P3/Precision
		CO 2	C4/Analyse
Report Writing/Programming	20%	CO 1	P3/Precision
		CO 2	C4/Analyse
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2	P3/Precision, C4/Analyse,
Viva Voce/ Presentation	10%	CO1, CO2	P3/Precision, C4/Analyse,
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. Thermodynamics – Yunus A. Cengel, Michael A. Boles
2. Fundamentals of Thermodynamics – R E Sonntag, C. Borgnakke, G J. Van Wylen; John Wiley & Sons, Inc, 5th edition, 2000.
3. Thermodynamics - Kenneth Wark, 6th Ed; McGraw-Hill, Singapore, 1999.

COURSE INFORMATION			
Course Code Course Title	: AEAS 210 : Aeronautical Engineering Drawing-II	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE

Course Code: AEAS 110
Course Title: Aeronautical Engineering Drawing-I Sessional

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This sessional is intended to teach the students the technique of engineering graphics as a basis of engineering communication and expression of idea and thought.

OBJECTIVE

To create orthographic projection auxiliary, sectional views, and apply 3-D pictorials to choose the best view to present the drawings.
To able to use the proper and standard technique in lettering, basic geometric constructions, sketching, dimensioning methods.
To understand various features, sketch tools and sketch relations used in Solid Works.
To describe size, shape and position accurately on an engineering drawing.
To apply the knowledge for drawing various components of an RC aircraft and assemble them.

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **apply** the Solid Works software to make drawings of complex mechanical objects.	5	C3	P1,P2		K6	R, Q, T
CO2	Be able to **build** 3-D drawings of various components of an RC aircraft and assemble them.	3	Psychomotor /Manipulation	P1,P2, P4		K5	R, Q,T
CO3	Be able to **demonstrate** the performance of an airfoil using Solid Works Simulation.	5	Psychomotor/Precision			K6	Pr, PR
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

Exp No	Exp Name
1.	Using the Interface
2.	Design Intent, 2D Sketching and Sketch entities
3.	Creating airfoil from co-ordinates
4.	Drawing different shapes of 3D wings
5.	3-D Sketching and Reference Planes
6.	Assembly Basics
7.	Drawings Basics
8.	The performance of an airfoil using Solid Works Simulation

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **apply** the Solid Works software to make drawings of complex mechanical objects.					2							
CO2	Be able to **build** 3-D drawings of various components of an RC aircraft and assemble them.			2									
CO3	Be able to **demonstrate** the performance of an airfoil using Solid Works Simulation.					2							

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	14
Practical	28
Total	42
Self-Directed Learning	
Preparation of Lab Reports	10
Preparation of Lab Test	10
Preparation of presentation	5
Preparation of Quiz	10
Engagement in Group Projects	20
Formal Assessment	
Continuous Assessment	14
Final Quiz	1
Total	112

TEACHING METHODOLOGY

Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Using the Interface
Week 2	Design Intent, 2D Sketching and Sketch entities
Week 3	Review
Week 4	Creating airfoil from co-ordinates
Week 5	Drawing different shapes of 3D wings
Week 6	Review
Week 7	3-D Sketching and Reference Planes
Week 8	Assembly Basics
Week 9	Drawings Basics
Week 10	The performance of an airfoil using Solid Works Simulation
Week 11	Lab Test-1
Week 12	Lab Quiz
Week 13	Presentation on Assigned Problems
Week 14	Project Demonstration

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	C3/Apply
		CO 2	P2/ Manipulation
Report Writing/Programming	15%	CO 1	C3/ Apply
		CO 2	P2/ Manipulation
Mid Term Evaluation (exam/project/assignment)	20%	CO3	P3/ Precision
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	C3/Apply, P2/ Manipulation, P3/Precision.
Viva Voce/ Presentation	10%	CO1, CO2, C03	C3/Apply, P2/ Manipulation, P3/Precision.
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. Mechanical Engineering Drawing – Dr. Amalesh Chandra Mandal, Dr. Md. Quamrul Islam.
2. Mastering SolidWorks - Matt Lombard
3. SOLIDWORKS 2020: A Power Guide for Beginners and Intermediate User - John Willis
4. SolidWorks Simulation 2020 Black Book - Gaurav Verma and Matt Weber

COURSE INFORMATION			
Course Code Course Title	AEAS 215 Aircraft Aerospace Systems	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
Fundamentals of Aeronautical Engineering			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn the basics of different systems of aircraft and their inter-relation for safe operation			
OBJECTIVES			
1. To be able to visualize the importance of different systems for aircraft safe operations 2. To describe avionics systems associated with aircraft control and navigation 3. To understand various features of the systems and subsystems for further courses like aerospace vehicle design. 4. To understand the inter-relation of different systems for safe operation			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **understand** the principles and mechanisms of hydraulic, pneumatic, landing gear systems of aircraft	PO1	C1			K3	T,F,ASG
CO2	Be able to **analyze** different systems of engine, basic cycles of air conditioning, oxygen, anti-icing and de-icing systems of aircraft	PO2	C2			K3	T,F,ASG
CO3	Be able to **analyze** the major electrical loads, power generation & distribution principles and the characteristics of modern aircraft electrical system.	PO2	C2	P1, P2		K4	T,F,ASG
CO4	Be able to **understand** basics of aircraft control, aircraft instrumentation, Flight Data recorders, Cockpit voice recorders.	PO1	C1			K3	T,F,ASG
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Hydraulic systems: Study of typical workable systems, components, hydraulic systems controllers, modes of operation. **Pneumatic systems**, working principles–typical pneumatic power system, brake system, components, anti-skidding, landing gear systems, classifications, shock absorbers. **Airplane control systems**: push pull rod system, operating principles, Cable and pulley system, Power assisted and fully powered flight controls, digital fly by wire systems. **Engine systems**: Starting and ignition systems, Fuel systems of piston and jet engine, multi-engine fuel systems, Fuel system operating modes. **Air conditioning and pressurizing system**: Basic air cycle systems, Oxygen systems, Deicing and anti- icing system. **Electrical Systems**: AC and DC power generations and supply in aircraft, aircraft batteries, external power supplies, Auxiliary Power Unit (APU), Components of power distribution, safety requirements, aircraft electrical wiring and lighting. **Avionics Systems**: Flight data recording system, cockpit voice recording system, Cockpit Display System, Glass Cockpit, HUD, HDD, HMD, Warning Systems, Fire detection and suppression, Emergency power sources, Emergency landing, Full Authority Digital Engine Control (FADEC) System.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **understand** the principles and mechanisms of hydraulic, pneumatic, landing gear systems of aircraft	2											
CO2	Be able to **analyse** different systems of engine, basic cycles of airconditioning, oxygen, anti-icing and de-icing systems of aircraft		3										

CO3	Be able to **analyze** the major electrical loads, power generation & distribution principles and the characteristics of modern aircraft electrical system.		3										
CO4	Be able to **understand** basics of aircraft control, aircraft instrumentation, Flight Data recorders, Cockpit voice recorders.	2											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week-1	**Aircraft Systems**	**CT**
Class-1	Types of Systems	CT-1
Class-2	Aviation authorities	
Class-3	Importance of systems	
Week-2	**Control systems**	
Class-4	Basic control systems	
Class-5	Open and close loop control systems	
Class-6	Elements of basic control system	
Week-3	**Airplane Control Systems**	Mid exam
Class-7	Various control surfaces	
Class-8	Conventional control systems	
Class-9	Different control systems	
Week-4	**Power Assisted Control Systems**	
Class-11	Pascals law and applications	
Class-12	Power assisted and fully powered control systems	
Week-5	**Modern control systems**	
Class-13	Basic fly by wire systems	
Class-14	Operating principle and factors	

	Class-15	Types of fly by wire	
	Week-6	**Auto pilot system**	
	Class-16	Importance , Basic operation	
	Class-17	Different functions of auto pilot	
	Class-18	Modes of operation, basic gyroscope	
	Week-7	**Air conditioning and pressurizing system**	CT-2
	Class-19	Basic air cycle systems	
	Class-20	Basic Oxygen systems	
	Class-21	Principle of operation and safety precautions	
	Week-8	**Fire protection systems**	
	Class-22	Causes of fire in aircraft	
	Class-23	Types of fire protection systems	
	Class-24	Basic deicing and anti- icing system.	
	Week-9	**Deicing and anti-icing system**	CT-3
	Class-25	Types of ice & Principle of ice detection	
	Class-26	Types of ice & Principle of ice detection	
	Class-27	Types of ice & Principle of ice detection	
	Week-10	**Electrical Systems**	
	Class-28	Aircraft electrical systems	
	Class-29	Power generation, Primary power distribution	

	Class-30	Power conversion and energy storage	
	Week 11	**Hydraulic systems & Pneumatic systems**	
	Class-31	Principle of operation of both systems	
	Class-32	Modes of operation, advantages and disadvantages	
	Class-33	Application in aircraft, sources of power, safety precautions	
	Week 12	**Engine systems**	
	Class-34	Different types of engine, thrust generation	
	Class-35	Principle of operation of jet engines, components	
	Class-36	Different types of jet engines	
	Week 13	**Avionics systems**	
	Class-37	aircraft instrumentation	
	Class-38	Basic six instruments	
	Class-39	Principle of ASI, VSI, altimeter	
	Week 14	**Avionics systems**	
	Class-40	Flight data recording system, operation and survival test	
	Class-41	cockpit voice recording system, operation, data	
	Class-42	Review of whole Syllabus	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO 4	C1
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO3	C2
Final Examination (Section A & B)		60%	CO1 C02	C1 C2
			CO3 C04	C2 C1
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Aircraft Power Plants- Mekinley, J.L. and R.D. Bent; McGraw Hill 1993.
2. Aircraft Systems (3rd edition) -- Ian Moir, Allan Seabridge; WILEY Publications.
3. Aircraft Fuel Systems—Roy Langton, Chuck Clark, Martin Hewitt, Lonnie Richards; WILEY Publications.
4. Gas Turbine Technology- Treager, S.; McGraw Hill.
5. Aircraft Maintenance & Repair- Mckinley, J.L. and Bent R.D; McGraw Hill.
6. Handbooks of Airframe and Power plant Mechanics; US dept. of Transportation, Federal, Aviation Administration, The English Book Store, New Delhi, 1995
7. Aircraft Instruments & Principles- Pallet, E.H.J; Pitman & Co 1993.

COURSE INFORMATION			
Course Code Course Title	AEAS 301 Heat Transfer	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
AEAS 207: Thermodynamics			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
The course provides an introduction to heat transfer and introduces practical application in industry.			
OBJECTIVES			
1. To apply principles of heat and mass transfer to basic engineering systems 2. To explain heat transfer by conduction, convection 3. To analyze and design heat exchangers 4. To analyze diffusion processes and calculate the flux in a diffusion process 5. To describe the fundamental principles of radiative emission and absorption			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **explain** heat and different heat transfer mechanisms.	PO1	C2			K3	T, ASG, PR, F
CO2	Be able to **evaluate** basic heat transfer problems occur in engineering field involving Conduction, Convection and Radiation.	PO2	C5	P1, P2		K4	Q, PR, F
CO3	Be able to **know** different types of boiling.	PO1	C1			K3	T, ASG, F
CO4	Be able to **analyze** heat exchanger capacity using LMTD and effective NTU relations	PO2	C4			K4	T, Q, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS
Basic modes of heat transfer; General conduction equations; Steady state conduction in different geometrics and composite structures; Effect of variable thermal conductivity; Heat transfer from extended surfaces. Mechanism of convective heat transfer; General methods for estimation of convective heat transfer coefficient; Heat and momentum transfer associated with laminar and turbulent flow of fluids in forced convection; Free convection from exterior surfaces of common geometrics. Mechanism and laws of radiation heat transfer; Blackbody and gray body emission; Radiative properties of surfaces. Boiling and condensation; pool boiling, forced convection boiling, film condensation, dropwise condensation, condensation number Heat exchanger: basic types, LMTD, exchanger effectiveness-NTU relations; Techniques of heat transfer augmentation; Heat exchanger devices.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **explain** heat and different heat transfer mechanisms.	3											
CO2	Be able to **evaluate** basic heat transfer problems occur in engineering field involving Conduction, Convection and Radiation.		3										
CO3	Be able to **know** different types of boiling.	3											
CO4	Be able to **analyze** heat exchanger capacity using LMTD and effective NTU relations		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE		
	Topic	**CT**
Week-1	**Basic modes of heat transfer**	CT-1
Class-1	Conduction, convection, Radiation.	
Class-2	General conduction equations,	
Class-3	Steady state conduction in different geometrics and composite structures.	
Week-2	**Conduction**	
Class-4	Conduction related problems.	
Class-5	Effect of variable thermal conductivity	
Class-6	Heat transfer from extended surfaces.	
Week-3	**Convection**	

	Class-7	Mechanism of convective heat transfer	
	Class-8	General methods for estimation of convective heat transfer coefficient	
	Class-9	Related mathematical problems.	Mid Exam
	Week-4	**Forced convection**	
	Class-10	Heat and momentum transfer associated with laminar and turbulent flow of fluids in forced convection.	
	Class-11	Equation of Heat and momentum transfer associated with laminar flow.	
	Class-12	Equation of Heat and momentum transfer associated with turbulent flow of fluids in forced convection	
	Week-5	**Free convection**	
	Class-13	Free convection from exterior surfaces of common geometrics	
	Class-14	Mathematical problems relating forced convection.	
	Class 15	Mathematical problems relating free convection.	
	Week-6	**Radiation**	CT-2
	Class-16	Mechanism and laws of radiation heat transfer	
	Class-17	Blackbody emission	
	Class-18	Gray body emission	
	Week-7	**Radiative properties**	
	Class-19	Radiative properties of surfaces.	
	Class-20	Radiation equation,	
	Class-21	Spectrum analysis.	
	Week-8	**Boiling**	
	Class-22	Pool boiling,	
	Class-23	Forced convection boiling,	
	Class-24	Mathematical Problems.	
	Week-9	**Condensation**	CT-3
	Class-25	Film condensation	
	Class-26	Dropwise condensation	
	Class-27	Condensation number	

	Week-10	**Heat exchanger**	
	Class-28	Types of Heat exchanger,	
	Class-29	Fundamentals of Heat exchanger,	
	Class-30	Principles of Heat exchanger.	
	Week 11	**LMTD**	
	Class-31	LMTD relation analysis.	
	Class-32	Heat exchanger performance,	
	Class-33	Mathematical Problems.	
	Week 12	**Exchanger effectiveness**	
	Class-34	NTU relations	
	Class-35	Techniques of heat transfer augmentation	
	Class-36	Mathematical problems.	
	Week 13	**Heat exchanger devices**	
	Class-37	Different heat exchanger devices,	
	Class-38	Working principle of heat exchanger devices,	
	Class-39	Mathematics relating heat exchanger devices.	
	Week 14	**Refrigeration**	
	Class-40	Fundamentals of refrigeration,	
	Class-41	Refrigeration cycle,	
	Class-42	Review.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C2, C5
			CO 2	C5
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO 3, CO4	C1, C4
Final Examination (Section A & B)		60%	CO 1	C2
			CO 2	C5
			CO 3	C1
			CO 4	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Heat Transfer - J. P. Holman
2. Heat & Mass Transfer - Yunus A. Cengel&Afshin J. Ghajar
3. Principles of Heat Transfer - F. Kreith, Mark S. Bohn
4. Heat Transfer - Binay K. Dutta
5. Heat Transfer – A basic approach by M. NecatiOzisik

COURSE INFORMATION			
Course Code Course Title	: AEAS 322 : Heat Transfer Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE

Course Code: AEAS 301
Course Title: Heat Transfer

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

The course provides an introduction to heat transfer and introduces practical application in industry

OBJECTIVE

1. To apply principles of heat and mass transfer to basic engineering systems
2. To analyze heat transfer by conduction, convection
3. To analyze and design heat exchangers
4. To analyze diffusional processes and calculate the flux in a diffusion process
5. To understand the fundamental principles of radiative emission and absorption

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **follow** the instructions given in the lab manual and carry out the experiments relating to heat transfer processes.	5	Psychomotor/ Imitation			K6	R, Q
CO2	Be able to **complete** a conduction, convection or radiation experiment and analyze the obtained results and graph plot.	4	Psychomotor/ Precision			K8	R, Q, F
CO3	Be able to **evaluate** the performance characteristics of different types of heat exchangers through practical observation	2	C5			K4	R, Q, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam;)							

COURSE CONTENT

Exp No	Exp Name
1.	Determination of Thermal Conductivity of a Metal by Steady State Method
2.	Determination of Thermal Contact Conductance
3.	(A) Inverse Square Law for Light Radiation. (B) Lamberts Cosine Law for Light
4.	Study of a Free Convection of Fin/ Flat Plate/ Pipe Bundle
5.	Force Convection Heat Transfer in a Flat Plate
6.	Study of Heat Exchanger
7.	Study of Thermal Radiation Unit.
8.	Study of Heat Transfer by Radiation

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **follow** the instructions given in the lab manual and carry out the experiments relating to heat transfer processes.					2							
CO2	Be able to **complete** a conduction, convection or radiation experiment and analyze the obtained results and graph plot.				2								
CO3	Be able to **evaluate** the performance characteristics of different types of heat exchangers through practical observation		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	14
Practical	28
Total	42
Self-Directed Learning	
Preparation of Lab Reports	15
Preparation of Lab Test	20
Preparation of Quiz	20
Formal Assessment	
Continuous Assessment	14
Final Quiz	1
Total	112

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method

COURSE SCHEDULE	
Week 1	Determination of Thermal Conductivity of a Metal by Steady State Method
Week 2	Determination of Thermal Contact Conductance
Week 3	(A) Inverse Square Law for Light Radiation. (B) Lamberts Cosine Law for Light
Week 4	Study of a Free Convection of Fin/ Flat Plate/ Pipe Bundle
Week 5	Review-1
Week 6	Lab Quiz-1
Week 7	Force Convection Heat Transfer in a Flat Plate
Week 8	Study of Heat Exchanger
Week 9	Study of Thermal Radiation Unit.
Week 10	Study of Heat Transfer by Radiation
Week 11	Review-2
Week 12	Lab Quiz-2
Week 13	Final Review
Week 14	Lab Viva

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P1/Imitation
		CO 2	P3/Precision
Report Writing/Programming	15%	CO 2	P3/Precision
		CO 3	C5/Evaluate
Mid Term Evaluation (exam/project/assignment)	20%	CO3	C5/Evaluate
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	P1/Imitation, P3/Precision, C5/Evaluate
Viva Voce/ Presentation	10%	CO1, CO2, C03	P1/Imitation, P3/Precision, C5/Evaluate
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS
1. Principles of Heat Transfer - F. Kreith, Mark S. Bohn 2. Heat Transfer - Binay K. Dutta

COURSE INFORMATION			
Course Code Course Title	AEAS 335 Applied Aerodynamics	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE

Fundamentals of Aeronautical Engineering,
Engineering Mechanics (Statics and Dynamics),
Mechanics of Solids

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course introduces the students with the fundamental principles of aerodynamics for understanding stability and control, aircraft performance etc.

OBJECTIVES

1. To determine aerodynamic forces and moments on airfoil, wing and body of revolution in subsonic flow.
2. To analyze boundary layer: velocity profile, thickness and friction coefficient.
3. To explain aspects of flight characteristics that relates to lift, drag, thrust and power.
4. To apply presented numerical implementations to basic elements of aircraft configurations.

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **determine** aerodynamic forces and moments on airfoil, wing and body of revolution in subsonic flow.	PO2	C3			K4	T, F, ASG.
CO2	Be able to **analyze** boundary layer: velocity profile, thickness and friction coefficient.	PO2	C4			K3	T, F, ASG.
CO3	Be able to **explain** aspects of flight characteristics that relates to lift, drag, thrust and power.	PO1	C2			K3	F, Mid Term Exam.
CO4	Be able to **apply** presented numerical implementations to basic elements of aircraft configurations	PO2	C3	P1, P2		K4	T, F, ASG.
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Inviscid flows Models of fluid flow, continuity and momentum equations applied to inviscid flows, drag momentum theory, concept of stream lines, stream tubes, streak line, path lines. Angular velocity, strain and vorticity, potential theory applied to Inviscid flows, elementary flows, their combination and applications. Solution of flows past bodies using Panel methods. Theory of 2D airfoils: Kutta-Joukowski theorem, Kutta condition, Kelvin circulation theorem. Classical thin airfoil theory. Types of flow separation and inviscid flow characteristics over a 2D airfoil. Inviscid & incompressible flow over finite wings, Prandtl's lifting line theory, lift distribution over finite wings, effect of aspect ratio; Different types of drags. Viscous Flows Qualitative aspects of viscous flows, Navier-Stokes equations, modification N-S equation for different flows, Exact solutions of N-S equations, Aerodynamic heating, Prandtl Boundary Layer theory; Boundary Layer equations and their solutions. Skin friction and skin friction drag. Laminar flow past flat plate. Concept free shear flows viz. jet, wake and mixing streams. Flow past cylinder and spheres and their applications. Boundary layer separation and its effects. Flow control techniques. Methods to reduce different types of drag. Introduction to turbulence, concept of turbulence modeling, Prandtl mixing length theory.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **determine** aerodynamic forces and moments on airfoil, wing and body of revolution in subsonic flow.		3										
CO2	To analyze boundary layer: velocity profile, thickness and friction coefficient.		3										
CO3	Be able to **explain** aspects of flight characteristics that relates to lift, drag, thrust and power.	3											

CO4	Be able to **apply** presented numerical implementations to basic elements of aircraft configurations		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week-1	**Topic**	**CT**
Class-1	Review of fundamental aerodynamic concepts, classification flows	CT-1
Class-2	Applied aerodynamics: aerodynamic coefficients, their magnitudes and variation	

	Class-3	Review of vector relation gradient, divergence, curl, line integrals, surface integrals and volume integrals	
	Week-2		
	Class-4	Angular velocity, strain rate and vorticity of fluid flows	
	Class-5	Circulation, stream function and velocity potential	
	Class-6	Classification of rotational and irrotational flows, Fluid Stressed and strain rates	
	Week-3		
	Class-7	Flow analysis of Inviscid and incompressible flows, review of Bernoulli's equation and its applications	
	Class-8	Pressure coefficient and its variation on typical airfoils	
	Class-9	Elementary fluid flows. Derivation of equations of stream function velocity potential and velocity for uniform flow	
	Week-4		
	Class-10	Derivation of equations of stream function and velocity potential and velocity for doublet flow and vortex flow.	
	Class-11	Analysis of flow past non-lifting cylinder	
	Class-12	Analysis of flow past lifting cylinder, Derivation of Kutta-Joukowski theory of lift.	Mid Term Exam
	Week-5		
	Class-13	Discussion on airfoil nomenclature and their characteristics.	
	Class-14	Introduction to Classical thin airfoil theory .	
	Class-15	Kutta condition and Kelvin's circulation theorem and starting vortex.	
	Week-6		
	Class-16	Types of flow separation.	
	Class-17	Inviscid flow characteristics over a 2D airfoil.	
	Class-18	Inviscid flow characteristics over a finite airfoil.	
	Week-7		
	Class-19	Lift distribution over finite wings.	CT-2
	Class-20	Different types of drags.	

	Class-21	Effect of aspect ratio.	
	Week-8		
	Class-22	Finite wing theory or Prandtl classical lifting line theory.	
	Class-23	Effect of aspect ratio and physical significance	
	Class-24	Elliptical lift distribution.	
	Week-9		CT-3
	Class-25	Derivation of Navier Stokes equations: Continuity and Momentum equation	
	Class-26	Derivation of Navier Stokes equations: Energy equations and different forms of N-S equation. Modification of N-S Equations for different types of flow	
	Class-27	Solution method of N-S equation for simple problems: Parallel flows	
	Week-10		
	Class-28	Introduction to Boundary layers. Properties of B-L properties.	
	Class-29	Derivation of Boundary layer equations	
	Class-30	Application of Boundary layer equations for laminar boundary layers and interpretation of Laminar B- L properties	
	Week 11		
	Class-31	Modification N-S equation for different flows, Exact solutions of N-S Equations	
	Class-32	Aerodynamic heating.	
	Class-33	Prandtl Boundary Layer theory	
	Week 12		
	Class-34	Skin friction and skin friction drag.	
	Class-35	Laminar flow past flat plate	
	Class-36	Concept free shear flows viz. jet	
	Week 13		
	Class-37	Flow past cylinder and spheres and their applications.	
	Class-38	Boundary layer separation and its effects.	

Class-39	Flow control techniques
Week 14	
Class-40	Introduction to turbulence
Class-41	Concept of turbulence modeling
Class-42	Prandtl mixing length theory

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C2
			CO 4	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO3	C3
Final Examination (Section A & B)		60%	CO 1	C2
			CO 2	C2
			CO 3	C3

		CO 4	C3
Total Marks	100%		

TEXT AND REFERENCE BOOKS:

1. Mechanics of Fluids - Irving H. Shames
2. Mechanics of Fluids - B. S. Messy
3. Fundamentals of Aerodynamics - John D Anderson; McGrawhill.
4. Aerodynamics for Engineering Students –E.L Houghton, P.W. Carpenter, S.H. Collicot and D.T. Valentine; Elsevier.
5. Computational Fluid Mechanics and Heat Transfer - Anderson.

COURSE INFORMATION			
Course Code Course Title	: AEAS 336 : Applied Aerodynamics Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE

Course Code: AEAS 335
Course Title: Applied Aerodynamics

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course introduces the students with the fundamental principles of aerodynamics for understanding stability and control, aircraft performance etc.

OBJECTIVE

1. To understand the fundamental principles of incompressible and compressible fluid mechanics and aerodynamics.
2. To explain the sources of friction, induced, wave, and pressure drag, flight characteristics that relate to lift, drag, thrust and power.
3. To be able to perform calculations involving lift, drag in relation to various aspects of flight and aircraft performance.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **demonstrate** the use of theoretical characteristics of low speed aerodynamics that can be implemented through the wind tunnel operations.	5	Psychomotor/ Precision	P1,P2		K6	R, Q, T, ASG, F
CO2	Be able to **analyze** the Pressure and velocity distribution along the airfoil and cylinder.	2	C4	P1,P3		K4	R, Q,T, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	Experiment on theoretical characteristics of low speed aerodynamics that can be implemented through the wind tunnel operations.
2.	Experiment on pressure distribution around a symmetrical NACA 0012 airfoil with pressure tapping.
3.	Experiment on coefficient of drag for a right circular cylinder
4.	Experiment on the performance of lift and drag characteristics of NACA-0012 airfoil.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **demonstrate** the use of theoretical characteristics of low speed aerodynamics can be implemented through the wind tunnel operations and flow visualization techniques.					2							
CO2	Be able to **analyze** the Pressure and velocity distribution along the airfoil and cylinder. .		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical Total	 07 14 21
Self-Directed Learning Preparation of Lab Reports Preparation of Lab Test Preparation of presentation Preparation of Quiz Engagement in Group Projects	 10 05 5 05 10
Formal Assessment Continuous Assessment Final Quiz	 07 1
Total	64
TEACHING METHODOLOGY	
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method	

COURSE SCHEDULE	
Week 1	Experiment on pressure distribution around a symmetrical NACA 0012 airfoil with pressure tapping.
Week 2	Experiment on pressure distribution around a symmetrical NACA 0012 airfoil with pressure tapping.
Week 3	Experiment on theoretical characteristics of low speed aerodynamics can be implemented through the wind tunnel operations and flow visualization techniques.
Week 4	Experiment on coefficient of drag for a right circular cylinder
Week 5	Lab Test-1
Week 6	Experiment on the performance of lift and drag characteristics of NACA-0012 airfoil.
Week 7	Lab Quiz

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P3/Precision
Report Writing/Programming	15%	CO 1	P3/Precision
		CO 2	C4/Analyse
Mid Term Evaluation (exam/project/assignment)	20%	CO1	C4/Analyse
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2	P3/Precision, C4/Analyse
Viva Voce/ Presentation	10%	CO1, CO2	P3/Precision, C4/Analyse
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. Mechanics of Fluids - B. S. Messy
2. Fundamentals of Aerodynamics - John D Anderson; McGrawhill.
3. Computational Fluid Mechanics and Heat Transfer – Anderson

COURSE INFORMATION			
Course Code Course Title	AEAS 307 Aircraft Loading and Structural Analysis	Lecture Contact Hours Credit hours	3.0 3.0

PRE-REQUISITE

Mechanics of Solids

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn and familiarize the basics of Aircrafts Structure and its components.

OBJECTIVES

1. To get introduction of design philosophies like damage tolerance, fail-safe principle.
2. To get ntroduction of the aircraft data requirements and description of the critical airloads used in the design and analysis of aircraft structures.
3. To get introduction of the aero-elastic stability design constraint.
4. To get an verview of the role and lay-out of main structural members used in aircraft structures.
5. To understand atigue failure consideration and its relation with design philosophies, fatigue loads in aircraft operations and fatigue life analysis methods.

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
1.	Be able to **define** fundamental concepts in the analysis of flight structures.	PO1	C1			K3	T, F, ASG.
2.	Be able to **explain** the aero-elastic stability design constraint.	PO2	C2			K3	T, F, ASG.
3.	Be able to **apply** the theory of elasticity in the solution of engineering problems and apply energy methods in the analysis of statically indeterminate structures.	PO2	C3	P1, P2, P3		K4	T, F, Mid Term Exam.
4.	Be able to **analyze** the design and sizing of aircraft structural configurations subjected to various load combinations.	PO2	C4	P1, P2		K4	T, F, ASG, Mid Term Exam.
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Fundamental equations of elasticity and their applications, stress and deformation in elemental structures/components; General equations and solution techniques; Energy methods in structural analysis: Principles of virtual work and total potential and complementary energies.
Bending of beams with unsymmetrical cross-sections; Basic principles and theory of stressed-skin structural analysis; Determination of direct stresses and shear flows in arbitrary thin-walled beams: unsymmetrical sections, open and closed sections, tapered sections, continuous and idealized sections.
The fundamental theory of plates, including in-plane and bending loads as well as buckling and shear instabilities; Solution techniques for plate problems including Navier's solutions for rectangular plates; Energy methods for plate bending and plate buckling. Analysis of common aircraft components including fuselages, wings, skin-panels, spar, stringers, ribs, frames and longerons.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **define** fundamental concepts in the analysis of flight structures.	3											
CO2	Be able to **explain** the aero-elastic stability design constraint.		3										
CO3	Be able to **apply** the theory of elasticity in the solution of engineering problems and apply energy methods in the analysis of statically indeterminate structures.		3										
CO4	Be able to **analyze** the design and sizing of aircraft structural configurations subjected to various load combinations.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week	Topic	CT
Week-1	**Theory of Elasticity**	CT-1
Class-1	Review of basic concepts: Stress, strain.	
Class-2	Stress-strain relationship : Hook's law in 1-D and 3-D.	
Class-3	Related Numerical.	
Week-2	**Theory of Elasticity (cont'd)**	
Class-4	Strain-displacement relations.	
Class-5	Volumetric strain and determination of limiting value of Poisson's ratio.	
Class-6	Related Numerical.	

	Week-3	**Conditions for Equilibrium and Two Dimensional Elasticity**	
	Class-7	Derivation of equilibrium equations in Elasticity and related numerical.	
	Class-8	Introduction to two dimensional elasticity and plane stress condition.	
	Class-9	Related Numerical.	
	Week-4	**Two Dimensional Elasticity**	
	Class-10	Plane strain condition.	
	Class-11	Solution of 2-D problems: Derivation of compatibility equations.	Mid exam
	Class-12	Related Numerical.	
	Week-5	**Stress Function Formulation and Energy Methods in Structural Analysis**	
	Class-13	Airy's stress function.	
	Class-14	Related Numerical.	
	Class-15	Strain energy and complementary energy.	
	Week-6	**Energy Methods in Structural Analysis**	
	Class-16	Expression for strain energy for a solid bar under various types of loading.	
	Class-17	Related Numerical.	
	Class-18	Castigliano's theorem and related numerical.	
	Week-7	**Energy Methods in Structural Analysis (cont'd) and Beams**	
	Class-19	Minimum potential energy method and related numerical.	

Class-20	Types of beams and differential equation governing deflection of beam.	CT-2
Class-21	Boundary conditions.	
Week-8	**Shearing stresses in beams**	
Class-22	Shear stress distribution and concept of shear flow.	
Class-23	Shear flow in I-section, Channel section and Split tube section.	
Class-24	Shear center and numerical related to shearing stresses in beams.	
Week-9	**Determination of direct stresses and shear flows in arbitrary thin-walled beams**	CT-3
Class-25	Unsymmetrical sections.	
Class-26	Open and closed sections.	
Class-27	Tapered sections, continuous and idealized sections.	
Week-10	**Plate Theory and Applications**	
Class-28	Fundamental theory of plates, bending of thin plates.	
Class-29	Displacement, stress and strain field for thin plates.	
Class-30	Equilibrium equations for thin plates.	
Week 11	**Plate Theory and Applications (cont'd)**	
Class-31	Solution techniques for plate problems including Navier's solutions for rectangular plates.	
Class-32	End conditions for plates	
Class-33	Related numerical.	
Week 12	**Plate Theory and Applications (cont'd)**	
Class-34	Energy methods for plate bending.	
Class-35	Energy methods for plate bending.	

Class-36	Related numerical.
Week 13	**Analysis of common aircraft components**
Class-37	Analysis of fuselage.
Class-38	Analysis of wings.
Class-39	Analysis of skin-panels.
Week 14	**Analysis of common aircraft components (cont'd)**
Class-40	Analysis of spar, stringers.
Class-41	Analysis of ribs, frames and longerons.
Class-42	Related numerical.

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO 4	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO 3, CO4	C3, C4

Final Examination (Section A & B)	60%	CO 1	C1
		CO 2	C2
		CO 3	C3
		CO 4	C4
Total Marks	100%		

TEXT AND REFERENCE BOOKS:

1. Aircraft Structures for Engineering Students- T.H.G Megson
2. Aircraft Structure –David & Perez; Publisher – McGraw-Hill.
3. Strength of Materials (4th edition) – AndrewPytel, Ferdinand L. Singer.
4. Strength of Materials –Beer and Johnston.

COURSE INFORMATION			
Course Code Course Title	AEAS 331 Materials Science and Aerospace Materials	Lecture Contact Hours Credit hours	3.0 3.0
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn the basic properties of different materials and to familiarize with the methods to produce composite materials with new properties using the basic properties.			
OBJECTIVES			
1. To learn the basic scientific facts of Physics/ Chemistry disciplines about different materials and their properties. 2. To use the knowledge of material science to provide solution to related engineering, commercial problems. 3. To be able to evaluate the different materials and their properties and to select them rightly for design and construction. 4. To understand the basic working principle of various methods involving the inspection of materials. 5. To be able to ensure the safety of components with different materials from unwanted decay/corrosion.			

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **define** modern materials chemistry, materials physics and energy physics.	PO1	C1			K3	T/ ASG, F
CO2	Be able to **explain** how to select materials for design and construction.	PO2	C2			K3	T/Mid Term Exam, F
CO3	Be able to **apply** the methods required to inspect material components using different approaches.	PO2	C3			K3	T/Mid Term Exam, F
CO4	Be able to **analyze** how to protect materials from unwanted/untimely decay.	PO2	C4			K3	T/ ASG, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

a. **Main Contents:** Materials Science and Aerospace Materials
b. Detail Contents:

Elements Of Aerospace Materials
Elements of aerospace materials; Structure of solid materials, Atomic structure of materials, crystal structure, miller indices, density, packing factor, space lattices, imperfection in crystals, physical metallurgy, Phase diagram including the Fe-FeC3 equilibrium diagram, general requirements of materials for aerospace applications.

Material Selection For Aerospace Applications
Mechanical behavior of materials; Linear and nonlinear elastic properties, Yielding, strain hardening, fracture, Bauchinger's effect –Notch effect testing and flaw detection of materials and components, creep and fatigue -Comparative study of metals, ceramics plastics and

composites. Introduction to destructive and non-destructive tests.

Corrosion & Heat treatment

Corrosion & heat treatment of metals and alloys; Types of corrosion, effect of corrosion on mechanical properties, stress corrosion cracking, Corrosion resistant materials used for space vehicles, heat treatment of carbon steels, aluminum alloys, magnesium alloys and titanium alloys, effect of alloying treatment, heat resistance alloys, tool and die steels, magnetic alloys.
Introduction to powder metallurgy, modern ceramic materials, cermet, glass ceramic, plastics and rubber, carbon/carbon composites, fabrication processes involved in metal matrix composites, shape memory alloys, applications in aerospace vehicle design, Basic concepts of Nano-science and Nanotechnology.

High temperature materials

Characterization; classification, production and characteristics, methods and testing, determination of mechanical and thermal properties of materials at elevated temperatures, super alloys, high temperature material applications.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **define** modern materials chemistry, materials physics and energy physics.	2											
CO2	Be able to **explain** how to select materials for design and construction.		3										
CO2	Be able to **apply** the methods required to inspect material components using different approaches.		3										
CO4	Be able to **analyze** how to protect materials from unwanted/untimely decay.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE			
	Week 1	**Elements Of Aerospace Materials**	CT 1
	Class 1	Engineering Materials Modern Materials' Needs	
	Class 2	Modern Materials' Needs Structure of Crystalline Solids	
	Class 3	Structure of Crystalline Solids	
	Week 2	**Elements Of Aerospace Materials (Continued)**	
	Class 4	Face-Centered & Body-Centered Cubic Crystal Structure Imperfections in Solids	
	Class 5	Hexagonal Close-Packed (HCP) Crystal Structure	
	Class 6	Crystallographic Points, Directions, and Planes	
	Week 3	**Elements Of Aerospace Materials**	
	Class 7	Equilibrium Diagram	
	Class 8	Iron-Carbon Diagram, Lead–Tin Phase Diagram, Copper–Silver Phase Diagram	
	Class 9	Iron-Carbon Diagram, Lead–Tin Phase Diagram, Copper–Silver	

		Phase Diagram	
	Week 4	**Material Selection For Aerospace Applications**	Mid term
	Class 10	Material Selection Criteria	
	Class 11	Material Types	
	Class 12	Material Forms	
	Week 5	**Corrosion And Heat Treatment Of Metals And Alloys**	
	Class 13	Corrosion of Metals and Its Prevention	
	Class 14	Factors That Control the Corrosion Rate	
	Class 15	How to Keep Aircraft Safe from corrosion	
	Week 6	**Corrosion And Heat Treatment Of Metals And Alloys**	
	Class 16	Main objectives of heat treatment (heat treatment processes)	
	Class 17	Types of Heat Treatment	
	Class 18	Typical Design Guidelines in Heat Treatment	
	Week 7	**Ceramics And Glass**	
	Class 19	Classification of Ceramics	
	Class 20	General Properties of Ceramics	
	Class 21	Common Ceramics	
	Week 8	**Ceramics And Glass**	CT 2
	Class 22	Shaping Methods for Glass	
	Class 23	Glassworking Processes	
	Class 24	Continue	
	Week 9	**Processing Of Plastics**	
	Class 25	Types of Processing of Plastics	
	Class 26	Extrusion, Lamination (Calendaring)	
	Class 27	Thermoforming, Casting	
	Week 10	**Processing Of Plastics**	
	Class 28	Molding	
	Class 29	Expansion, Foaming	
	Class 30	Spinning, Solid-Phase Forming	
	Week 11	**Composite Materials**	
	Class 31	Introduction	
	Class 32	Components of Composite Materials	
	Class 33	Types and General Characteristics of Composite Materials	
	Week 12	**Composite Materials**	CT 3
	Class 34	Polymer Matrix Composites (PMC)	
	Class 35	Metal Matrix Composites (MMC) , Ceramic Matrix Composites (CMC)	
	Class 36	Advantages & Disadvantages of Composites	

Week 13	**Non-Destructive Testing (NDT)**	
Class 37	Introduction	
Class 38	Uses of NDT Methods	
Class 39	NDT methods using time	
Week 14	**Non-Destructive Testing (NDT)**	
Class 40	Methods of NDT	
Class 41	Continue	
Class 42	Common Application of NDT	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO3	C1, C3
			CO 4	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO 2, CO3	C2, C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2

		CO 3	C3
		CO4	C4
Total Marks	100%		

TEXT AND REFERENCE BOOKS:

1. Aircraft Materials and Processes- Titterton.G.; Pitman Publishing Co.
2. Introduction to Physical Metallurgy (2nd edition) -Sidney H Avner; Tata McGraw – Hill Edition.
3. Engineering Materials, Their properties and Applications- Martin, J.W.; Wykedham Publications (London) Ltd.

COURSE INFORMATION			
Course Code Course Title	: AEAS 332 : Materials Science and Aerospace Materials Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE
Course Code: AEAS 331 Course Title: Materials Science and Aerospace Materials

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
The course provides the necessary knowledge about metallurgy and phase diagrams.

OBJECTIVE

1. To learn the basic classification of steel based on the percentage of Carbon present in it and their properties.

2. To visualize the phase diagram of different types of steel in the microscope and analyze the different regions.

3. To be able to explain the use of materials of different properties in order to make alloys of a new property.

4. To gain knowledge about the heat treatment method used in making steel of different properties

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **perform** the task of metal specimen preparation in order to view the microstructure under a light microscope.	5	Psychomotor/ Manipulation			K6	R, Q
CO2	Be able to **analyze** the phase diagram of different materials used in making of alloys.	2	C4			K3	R, Q
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

Exp No	Exp Name
1.	Study of Crystal structure of different types of iron
2.	Study of Phase diagram including the Fe-FeC3 equilibrium diagram
3.	Study of Mechanical behavior of materials
4.	Study of destructive and non-destructive tests
5.	Heat treatment of carbon steels, aluminum alloys, magnesium alloys and titanium alloys

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **perform** the task of metal specimen preparation in order to view the microstructure under a light microscope.					3							
CO2	Be able to **analyze** the phase diagram of different materials used in making of alloys.		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical Total	 7 14 21
Self-Directed Learning Preparation of Lab Reports Preparation of Lab Test Preparation of presentation Preparation of Quiz Engagement in Group Projects	 5 5 5 5 10
Formal Assessment Continuous Assessment Final Quiz	 7 1
Total	59

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method

COURSE SCHEDULE	
Week 1	Study of Crystal structure of different types of iron
Week 2	Study of Phase diagram including the Fe-FeC3 equilibrium diagram
Week 3	Study of Mechanical behavior of materials
Week 4	Study of destructive and non-destructive tests
Week 5	Heat treatment of carbon steels, aluminum alloys, magnesium alloys and titanium alloys
Week 6	Review
Week 7	Lab Quiz and Viva

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO1	P2/Manipulation
Report Writing/Programming	15%	CO2	C4/Analyze
Mid Term Evaluation (exam/project/assignment)	20%	CO1, CO2	P2/Manipulation, C4/Analyze
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2	P2/Manipulation, C4/Analyze
Viva Voce/ Presentation	10%	CO1, CO2	P2/Manipulation, C4/Analyze
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. Aircraft Materials and Processes- Titterton.G.; Pitman Publishing Co.

2. Introduction to Physical Metallurgy (2nd edition) -Sidney H Avner; Tata McGraw – Hill Edition.

3. Engineering Materials, Their properties and Applications- Martin, J.W.; Wykedham Publications (London) Ltd.

4. Composite Materials for Aircraft Structures (2nd edition)- Allan Baker, Stuart Dutton, Donald Kelly; AIAA Education Series
5. Engineering Metallurgy (Part I & II) (6th edition) – Raymond A. Huggins; Viva Books Private Ltd.
6. Materials Science and Engineering: An Introduction – W D Callister, Jr.; John Wiley and Sons, Inc (4th edition) 1997
7. A Text Book of Nano-science and Nanotechnology- T.Pradeep; Tata McGraw Hill.

COURSE INFORMATION			
Course Code Course Title	: AEAS 338 : Aerospace Propulsion Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE
Course Code: AEAS 337 Course Title: Aerospace Propulsion

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This sessional is intended to provide the students with a hands-on experience on the various aspects of reciprocating and gas turbine engines as taught in the Aerospace Propulsion theory course.

OBJECTIVE
1. To compare the structural layout of the Piston & Jet engines. 2. To practically observe the actual operation of a jet engine and match this with the theoretical knowledge. 3. To be able to apply the theoretical knowledge of basic formulas concerning the jet engine. 4. To analyze how the flow property is changed by tweaking the dimensions of the compressor & turbine section (of a jet engine). 5. To be able to evaluate various parameters of the gas turbine cycle associated with a small scale jet engine from the practical operation.

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **solve** for the thrust & cycle efficiency of a small scale jet engine with the parameters obtained from the practical operation.	5	Psychomotor/ Articulation	P1, P2		K6	R, Q, T, Pr
CO2	Be able to **analyze** the dimensional effects of compressor & turbine sections (of a jet engine) on flow properties by plotting graphs from obtained data.	2	C4			K4	R, Q, T, PR
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical Total	 7 14 21
Self-Directed Learning Preparation of Lab Reports Preparation of Lab Test Preparation of presentation Preparation of Quiz Engagement in Group Projects	 5 5 2 5 10
Formal Assessment Continuous Assessment Final Quiz	 7 1
Total	56
TEACHING METHODOLOGY	
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method	

COURSE SCHEDULE	
Week 1	Construction of a Typical Jet Engine (WP7C Jet Engine) of a Fighter Aircraft
Week 2	Dimensional Change of Compression Section and Effects
Week 3	Dimensional Change of Turbine Section and Effects
Week 4	Ground Operation of a CM-14 Jet Engine
Week 5	Construction of a Typical Radial Piston Engine (HUO SAI-7A Engine) of a Trainer Aircraft
Week 6	Lab Test and Lab Quiz
Week 7	Presentation on Assigned Problems and Project Demonstration

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P4/ Articulation
		CO 2	C4/Analyse
Report Writing/Programming	15%	CO 1	P4/ Articulation
		CO 2	C4/Analyse
Mid Term Evaluation (exam/project/assignment)	20%	CO2	C4/Analyse
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2	P4/ Articulation, C4/Analyse
Viva Voce/ Presentation	10%	CO1, CO2	P4/ Articulation, C4/Analyse
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. Aircraft Gas Turbine Engine Technology (3rd edition) - Irwin E. Treager.
2. The Jet Engine - Rolls Royce Limited.

COURSE INFORMATION			
Course Code Course Title	AEAS 315 Aircraft Stability and Control	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE

AEAS-335 (Applied Aerodynamics)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

Demonstrate and Analyzing understanding of Stability (Static and Dynamic) and Controls of the Aircraft and its use towards achievement of Stability

OBJECTIVES

1. To understand basic concept of Stability and Equilibrium
2. To understand the physics and derive mathematical expression for various components of aircraft towards longitudinal, lateral and directional stability.
3. To predict the stability of aircraft using mathematical expressions.
4. To analyze the parameters (neutral point, variation c.g) and its implications on Stability.
5. To derive Equations of Rigid Aircraft Six Degree of Freedom of Motions.
6. To demonstrate Understand basic concept, Fundamental and components involved in Aircraft Flight System Control (AFCS), Principle functioning of Autopilot and types of Autopilot

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **understand** the basic concept of Stability and Equilibrium and **explain** contribution of various aircraft components to Longitudinal Stability	PO1	C2			K3	T, F, ASG
CO2	Be able to **analyze** Parameters like variation of c.g, Power effects on Neutral Point and **demonstrate** understanding of Lateral-Directional Stability	PO2	C4	P1, P2		K4	T, F, ASG
CO3	Be able to **analyze** the six-degree equations of motion of an aircraft based on body axis system.	PO2	C4	P1, P2		K4	T, F, Mid Term Exam.
CO4	Be able to **understand** the Dynamic Modes, AFCS and Principle function of Autopilot and its variants	PO1	C2			K3	T, F, Mid Term Exam.
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Importance and Significance of Flight Stability and Control: Stability and Equilibrium, Static Longitudinal, Directional and Lateral stability with respect to the aircraft axis systems; Effect of various wings design and secondary control surfaces; Origin of symmetric forces and moments; Static and maneuvering longitudinal stability, equilibrium and control of rigid aircraft; Effects of various major components on Static Stability, Critical flight conditions and controls requirement.

Dynamic Stability: The Axes Systems (Inertial, Body and Stability axes) and their Transformations; Treatment of Aircraft Equations of motion / linearization; Aerodynamic load effects of wings; Stability Derivatives; Aircraft Longitudinal Modes; Aircraft Longitudinal and Lateral-directional Modes.

Introduction to Automatic Flight Control System: Introduction to Aircraft Flight Control System (AFCS), Fundamentals of AFCS, Types of AFCS and Components of AFCS, Setup of the flight control system, System Performance Specification: - Requirements on flying and handling qualities and Parameters. Autopilot and its function, Types of Basic Autopilot Systems : Basic Longitudinal Autopilot and Lateral Autopilot Systems

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **understand** the basic concept of Stability and Equilibrium and **explain** contribution of various aircraft components to Longitudinal Stability	3											
CO2	Be able to **analyze** Parameters like variation of c.g, Power effects on Neutral Point and **demonstrate** understanding of Lateral-Directional Stability		2										

CO3	Be able to **analyze** the six-degree equations of motion of an aircraft based on body axis system		2										
CO4	Be able to **understand** the Dynamic Modes, AFCS and Principle function of Autopilot and its variants	2											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week	Topic	CT
Week-I	**Introduction to the Course**	CT-1
Class-1	Atmospheric Flight Mechanics and Earth Atmosphere	
Class-2	Aircraft Components and Aircraft Nomenclature	
Class-3	Basic Aerodynamics	
Week-2	**Equilibrium and Stability**	
Class-4	Equilibrium and Stability	
Class-5	Types of stability	
Class-6	Static Vs Dynamic Stability	
Week-3	**Longitudinal Static Stick Fixed Stability**	
Class-7	Criterion for Stability and Contribution of Wing	
Class-8	Horizontal Tail Contribution	
Class-9	Wing plus Tail Contribution	
Week-4	**Longitudinal Stability and Neutral Point**	CT-2
Class-10	Static Margin and CG Limits	
Class-11	Fuselage Contribution	
Class-12	Powerplant Contribution	
Week-5	**Longitudinal Stability and Neutral Point (contd)** **&** **Longitudinal Control**	
Class-13	Power Effects on Neutral Point	
Class-14	Elevator	
Class-15	Stick Free Stability, Most Forward CG Location	
Week-6	**Longitudinal Control** **&** **Longitudinal Maneuverability**	
Class-16	Longitudinal Stick Force per “g”, Ground Effect	
Class-17	Control requirement, Pull up Maneuver, Maneuver point	
Class-18	Elevator per “g”, Maneuver point	
Week-7	**Lateral-Directional Static Stability & Control**	
Class-19	Lateral-Directional Stability Derivates, Fuselage/Vertical Fin Contribution	
Class-20	Roll Stability, Wing Sweep Effect, Rudder	

Class-21	Dihedral Effect, Various Contribution,	
Week-8	**Equations of Rigid Aircraft Six Degree of Freedom of Motions**	
Class-22	Power Effect, Roll Control, Aileron and Tutorial	
Class-23	Derivation of Translational Motion Equations	CT-3
Class-24	Derivation of Angular Motion Equations	
Week-9	**Equations of Rigid Aircraft Six Degree of Freedom of Motions (contd) & Perturbed(Linear) Aircraft Model**	
Class-25	Derivation of Various Forces and Moments	
Class-26	Linearization of Equation	
Class-27	Small Perturbation Method, Linearization of Equation	
Week-10	**Perturbed(Linear) Aircraft Model**	
Class-28	Aerodynamic Force and Moment Derivates	
Class-29	Contribution of Aircraft Components to Aerodynamic Derivates	
Class-30	Linear Model and Aircraft Dynamic Modes	
Week-11	**Longitudinal Dynamic Modes**	
Class-31	Short period, Phugoid (Lanchester's Formulation)	
Class-32	Short Period Mode Approximation	
Class-33	Flying and handling Qualities, Cooper Harper Scale	
Week-12	**Lateral-Directional Dynamic Modes**	CT-4
Class-34	Pure Rolling Motion, Pure Yawing Motion, Spiral Approximation	
Class-35	Spiral Roll, Dutch Roll Mode Approximation	
Class-36	Lateral Flying Qualities, Routh's Stability Criterion	
Week-13	**Lateral-Directional Dynamic Modes (contd) & Aircraft Response to External Disturbances/Inputs**	
Class-37	Stability in Steady Roll Maneuver	
Class-38	Wind Effect on Aircraft Pure Plunging Motion	
Class-39	Wind Profiles, Longitudinal Mode, Response to Wind Shear	
Week-14	**Introduction to Aircraft Flight Control Systems**	

Class-40	Aircraft Flight Control System and Augmentation
Class-41	Fundamentals of AFCS and Components of AFCS
Class-42	Autopilot, Types of Autopilot

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C2, C4
			CO4	C2
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO3	C4
Final Examination (Section A & B)		60%	CO 1	C2
			CO 2	C4
			CO 3	C4
			CO 4	C2
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Flight Stability and Automatic Control – Robert C. Nelson
2. Automatic Flight Control – E. H. J. Pallett, Shawn Coyle
3. Fundamentals of Aerodynamics – John D. Anderson
4. Airplane Performance Stability and Control – Courtland D. Perkins and Robert E. Hage
5. Automatic Control of Aircraft and Missiles – John H. Blakelock
6. Dynamics of Flight: Stability and Control - Bernard Etkin, Lloyd Duff Reid

COURSE INFORMATION			
Course Code Course Title	AEAS 317 Mechanics of Structure, Structural Vibration and Aero Elasticity	Lecture Contact Hours Credit hours	4.00 4.00
PRE-REQUISITE			
Engineering Mechanics (Statics and Dynamics)			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To provide with the knowledge of relative motion between the various parts of a machine, forces which act on them and analysis of vibration. The knowledge of this subject is very essential for an engineer in designing the various parts of a machine			
OBJECTIVES			
1. To introduce the approaches and mathematical models used in kinematic and dynamic analysis of machinery. 2. To understand techniques for studying motion of machines and their components. 3. To give basic knowledge on kinematic and dynamic design of machinery. 4. To give basic knowledge on different types mechanical vibrations. 5. To be able to construct turning moment diagram. 6. To be able to calculate balancing mass and its position.			

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **apply** graphical and analytical methods to study the motion of a planar mechanism.	PO1	C3			K4	T, F, ASG
CO2	Be able to **analyze** simple mechanisms and gear trains.	PO2	C4			K4	T, F, ASG
CO3	Be able to **determine** the natural frequency and period of simple vibrating mechanical systems and obtain the analytical solution for system's time response.	PO2	C3			K4	T, F, Mid Term Exam
CO4	Be able to **develop** mathematical model of dynamic systems with single and multi-degrees of freedom.	PO2	C3	P1, P2		K4	T, F, ASG, Mid Term Exam
CO5	Be able to **explain** the concepts of vibration isolation, rotating imbalance and aero elasticity.	PO1	C2			K3	F, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Mechanics of Structure

Mechanisms; Displacement, velocity and acceleration; Turning moment: inertia and kinetic energy of reciprocating and rotating parts; Study of gears and gears trains; Static and dynamic balancing: reciprocating and rotating parts.

Structural Vibration

Free vibrations with one and two degrees of freedom; Longitudinal, transverse and torsional vibrations; Damped free and forced vibrations with single degrees of freedom; Whirling of shafts and rotors; Vibration absorption and isolation; Vibration measuring instruments; Methods of determining natural frequencies: matrix methods; Continuous systems: lateral vibrations of beams; Introduction to Lagrangian methods.

Aero Elasticity

Introduction to aero elasticity, load distribution, concepts of divergence, control effectiveness and reversal.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **apply** graphical and analytical methods to study the motion of a planar mechanism.	3											
CO2	Be able to **analyze** simple mechanisms and gear trains.		3										
CO3	Be able to **determine** the natural frequency and period of simple vibrating mechanical systems and obtain the analytical solution for system's time response.		3										
CO4	Be able to **develop** mathematical model of dynamic systems with single and multi-degrees of freedom.		3										
CO5	Be able to **explain** the concepts of vibration isolation, rotating imbalance and aero elasticity.	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 56 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 56 28 28
Formal Assessment Continuous Assessment Final Examination	 3 3
Total	174
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week	Topic	CT
Week-1	**Kinematics of motion**	
Class 1	Linear displacement, velocity and acceleration	
Class-2	Properties of fluid	
Class-3	Fluid Statics	
Class-4	Numerical	
Week-2	**Simple Mechanisms**	CT-1
Class-5	Kinematic link or element, types of link	
Class-6	Kinematic pair, classification of kinematic pairs	

	Class-7	Kinematic chain, types of joints in a chain	
	Class-8	Mechanism	
	Week-3	**Velocity in Mechanisms (Instantaneous Centre Method)**	
	Class-9	Methods for determining the velocity of a point on a link	
	Class-10	Properties and number of Instantaneous centers in a mechanism	
	Class-11	Types and location of instantaneous centers	
	Class-12	Method of locating instantaneous centers in a mechanism	
	Week 4	**Velocity in Mechanisms (Relative Velocity Method)**	
	Class 13	Relative velocity of two bodies moving in straight lines	
	Class 14	Velocity of a point on a link	
	Class 15	Velocities in a slider crank mechanism	Mid
	Class 16	Rubbing velocity at a pin joint	
	Week 5	**Gear Trains**	exam
	Class 17	Introduction and types of gear trains	
	Class 18	Simple and compound gear train	

	Class 19	Design of spur gears	CT-2
	Class 20	Epicyclic gear train	
	Week 6	**Turning Moment Diagram and Flywheel**	
	Class 21	Turning moment diagram for a single cylinder double acting steam Engine	
	Class 22	Turning moment diagram for a four stroke cycle IC engine.	
	Class 23	Fluctuation of energy, maximum fluctuation of energy and coefficient of fluctuation of energy	
	Class 24	Energy stored in a flywheel	CT-3
	Week 7	**Balancing of rotating and reciprocating masses**	
	Class 25	Balancing of rotating masses	
	Class 26	Balancing of rotating masses	
	Class 27	Balancing of reciprocating masses (cont'd)	
	Class 28	Balancing of reciprocating masses (cont'd)	
	Week-8	**Introduction to structural vibration**	
	Class 29	Definition and causes of vibration	
	Class 30	Modeling of vibration and important terminologies	
	Class 31	Types of vibration	

Class 32	Concepts of resonance, degrees of freedom		
Week 9	**Determination of natural frequency and equations of motion**	CT-4	
Class-33	Natural frequency of free longitudinal vibration		
Class 34	Natural frequency of free transverse vibration		
Class 35	Equations of motion of single degree of freedom systems		
Class 36	Equations of motion of multi degrees of freedom systems		
Week 10	**Damped Free Vibration and Forced Underdamped Vibration**		
Class 37	Damped Free Vibration		
Class 38	Related numerical		
Class 39	Forced Underdamped Vibration		
Class 40	Related numerical		
Week 11	**Vibration Isolation and Vibration Measuring Instruments**		
Class 41	Definition, types of vibration isolation and transmissibility ratio		
Class 42	Related numerical		
Class 43	Quantifying vibration level, considerations in choosing acceleration, velocity or displacement parameters		
Class 44	Piezoelectric transducer		

	Week 12	**Natural frequency of multi-degrees of freedom systems**	
	Class 45	Lagrange's method	
	Class 46	Numerical related to Lagrange's method and Dunkerly's formula.	
	Class 47	Determination of natural frequency and mode shapes using Matrix Method	
	Class 48	Numerical related to matrix method	
	Week 13	**Vibration of continuous media**	
	Class 49	Transverse vibration of a string	
	Class 50	Longitudinal vibration of a rod	
	Class 51	Torsional vibration of a shaft	
	Class 52	Lateral vibration of beams	
	Week 14	**Aeroelasticity**	
	Class 53	Introduction and types of aeroelasticity	
	Class 54	Static aeroelastic phenomenon	
	Class 55	Dynamic aeroelastic phenomenon	
	Class 56	Avoiding aeroelastic phenomena	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C3, C4
			CO 3 CO 4	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO 3, CO4	C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C3
			CO 4	C4
			CO 5	C5
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Theory of Machines (S. I. Units) – R. S. Khurmi, J. K. Gupta; Eurasia Publishing House (Pvt.) Ltd.

2. Mechanical Vibration-Theory and Applications (2nd Edition) - Frances S Tse, Ivan E Morse and R T Hinkle

3. Theory of Vibration with Application - William T Thomson

COURSE INFORMATION			
Course Code Course Title	AEAS 319 Machine Design	Lecture Contact Hours Credit hours	3.0 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To design, analysis and selection of commonly used mechanical components subject to static and dynamic loads.

OBJECTIVES

1. To calculate various loads as applied to shaft, and specify appropriate design stresses for shaft.
2. To specify suitable keys and couplings for shaft and other type of machine elements.
3. To analyze and design spur gear, helical gear and bevel gear.
4. To analyze and design of sliding bearings.
5. To analyze and design of clutches, brakes, power screws and springs.

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
1.	Be able to **define** the theories relating to power screws, shaft, keys, springs, bearings, gears, brakes and clutches.	PO1	C1			K3	T, F, ASG.
2.	Be able to **explain** the design requirements of various engineering machines.	PO2	C2			K3	T, F, ASG.
3.	Be able to **apply** the knowledge to design such machines like power screws, shaft, keys, springs, bearings, gears, brakes and clutches.	PO3	C3			K4	T, F, Mid Term Exam.
4.	Be able to **analyze** the design parameters of various engineering machines.	PO3	C4	P1, P2		K4	T, F, ASG, Mid Term Exam.

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Introduction to machine design. Design of basic machine elements like power screws, shaft and hole systems, keys and couplings, rivets, springs, bearings, gears, brakes and clutches. Design with composite materials.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **define** the theories relating to power screws, shaft, keys, springs, bearings, gears, brakes and clutches.	3											
CO2	Be able to **explain** the design requirements of various engineering machines.		3										
CO3	Be able to **apply** the knowledge to design such machines like power screws, shaft, keys, springs, bearings, gears, brakes and clutches.			3									
CO4	Be able to **analyze** the design parameters of various engineering machines.			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Topic	CT
Week-1	**Simple Stresses in Machine Parts**	
Class-1	Load, Stress, Strain, Tensile Stress and Strain, Compressive Stress and	CT-1
Class-2	Strain, Young's Modulus or Modulus of Elasticity, Shear Stress and Strain.	
Class-3	Stress-strain Diagram, Working Stress, Factor of Safety.	
Week-2	**Keys**	
Class-4	Types of Keys, Sunk Keys, Saddle Keys, Tangent Keys, Round Keys, Splines, Forces acting on a Sunk Key.	
Class-5	Strength of a Sunk Key, Effect of Keyways.	
Class-6	Mathematical Problems.	

Week-3	**Shafts**	Mid exam
Class-7	Material Used for Shafts, Manufacturing of Shafts, Types of shafts, Standard Sizes of Transmission Shafts.	
Class-8	Stresses in Shafts, Maximum Permissible Working Stresses for Transmission Shafts, Design of Shafts, Shafts Subjected to Twisting Moment Only.	
Class-9	Shafts Subjected to Bending Moment Only, Shafts Subjected to Combined	
Week-4	**Shafts**	
Class-10	Shafts Subjected to Fluctuating Loads, Shafts Subjected to Axial Load in addition to Combined Torsion and Bending Loads.	
Class-11	Design of Shafts on the Basis of Rigidity.	
Class-12	Mathematical Problems.	
Week-5	**Power Screws**	
Class-13	Types of Screw Threads used for Power Screws, Multiple Threads, Torque, Required to Raise Load by Square Threaded Screws.	
Class-14	Torque Required to Lower Load by Square Threaded Screws, Efficiency of Square Threaded Screws, Maximum Efficiency of Square Threaded Screws, Efficiency vs. Helix Angle.	
Class-15	Overhauling and Self-locking Screws, Efficiency of Self Locking Screws, Coefficient of Friction, Acme or Trapezoidal Threads.	
Week-6	**Power Screws**	
Class-16	Stresses in Power Screws.	
Class-17	Design of Screw Jack, Differential and Compound Screws.	
Class-18	Mathematical Problems.	
Week-7	**Springs**	

	Class-19	Types of Springs, Material for Helical Springs, Standard Size of Spring, Wire, Terms used in Compression Springs.	CT-2
	Class-20	End Connections for Compression Helical Springs, End Connections for Tension Helical Springs, Stresses in Helical Springs of Circular Wire.	
	Class-21	Deflection of Helical Springs of Circular Wire, Eccentric Loading of Springs.	
	Week-8	**Springs**	
	Class-22	Buckling of Compression Springs, Surge in Springs, Energy Stored in Helical Springs of Circular Wire.	
	Class-23	Stress and Deflection in Helical Springs of Non-circular Wire, Helical Springs Subjected to Fatigue Loading.	
	Class-24	Springs in Series, Springs in Parallel, Concentric or Composite Springs, Helical Torsion Springs, Flat Spiral Springs.	
	Week-9	**Clutchces**	CT-3
	Class-25	Types of Clutches, Positive Clutches, Friction Clutches.	
	Class-26	Material for Friction Surfaces, Considerations in Designing a Friction Clutch, Types of Friction Clutches.	
	Class-27	Single Disc or Plate Clutch, Design of a Disc or Plate Clutch, Multiple Disc Clutch and Cone Clutch.	
	Week-10	**Brakes**	
	Class-28	Energy Absorbed by a Brake, Heat to be Dissipated during Braking.	
	Class-29	Materials for Brake Lining, Types of Brakes.	
	Class-30	Single Block or Shoe Brake, Pivoted Block or Shoe Brake, Double Block or Shoe Brake, Simple Band Brake, Differential Band Brake.	
	Week 11	**Spur Gears**	
	Class-31	Friction Wheels, Advantages and Disadvantages of Gear Drives.	
	Class-32	Classification of Gears, Terms used in Gears, Condition for Constant Velocity Ratio of Gears–Law of Gearing.	
	Class-33	Forms of Teeth, Cycloidal Teeth, Involute Teeth, Comparison Between Involute and Cycloidal Gears.	

	Week 12	**Spur Gears**		
	Class-34	Systems of Gear Teeth, Standard Proportions of Gear Systems, Interference in Involute Gears.		
	Class-35	Minimum Number of Teeth on the Pinion in order to Avoid Interference, Gear Materials, Design Considerations for a Gear Drive.		
	Class-36	Beam Strength of Gear Teeth-Lewis Equation, Permissible Working Stress for Gear Teeth in Lewis Equation, Dynamic Tooth Load.		
	Week 13	**Bearings**		
	Class-37	Classification of Bearings, Types of Sliding Contact Bearings, Hydrodynamic Lubricated Bearings, Assumptions in Hydrodynamic, Lubricated Bearings.		
	Class-38	Important Factors for the Formation of Thick Oil Film in Hydrodynamic Lubricated Bearings.		
	Class-39	Wedge Film Journal Bearings, Squeeze Film Journal Bearings, Properties of Sliding Contact Bearing Materials, Materials used for Sliding Contact Bearings.		
	Week 14	**Bearings**		
	Class-40	Properties of Lubricants, Terms used in Hydrodynamic Journal Bearings, Bearing Characteristic Number and Bearing Modulus for Journal Bearings, Coefficient of Friction for Journal Bearings		
	Class-41	Mathematical Problems.		
	Class-42	Review.		

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO 4	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO 3, CO4	C3, C4
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C3
			CO 4	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. A Textbook of Machine Design - R. S. Khurmi, J. K. Gupta.
2. Fundamentals of Machine Component Design - Robert C Juvinall.
3. Design of Machine Elements (4th Ed) - Virgil Moring Faires.
4. Mechanical Engineering Design (7th Edition) - Joseph E Shigley, Charles R Mischke & Richard G Budynas

COURSE INFORMATION			
Course Code Course Title	AEAS 325 Computational Fluid Dynamics	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
Fundamentals of Aeronautical Engineering, Engineering Mechanics (Statics and Dynamics), Mechanics of Solids			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This course introduces the students with the fundamental principles of Computational Fluid Dynamics (CFD) for understanding fluid flow and fluid properties based on computational method.			
OBJECTIVES			
1. To explain the methods of fluid flow analysis i.e. theoretical, experimental and computational. 2. To describe the concept potential theory and its application to incompressible and inviscid flows. 3. To apply the numerical methods for solution of flow situations. 4. To describe implications errors and stability analysis of numerical methods.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **explain** the methods of fluid flow analysis i.e. theoretical, experimental and computational.	PO1	C2			K3	T, F, ASG.
CO2	Be able to **describe** the concept potential theory and its application to incompressible and inviscid flows.	PO1	C2			K3	T, F, ASG.
CO3	Be able to **apply** the numerical methods for solution of flow situations.	PO2	C3	P1, P2, P3		K4	F, Mid Term Exam.
CO4	Be able to **Analyze** implications errors and stability analysis of numerical methods.	PO2	C4	P1, P2, P3		K4	T, F, ASG.
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Introduction to computational fluid dynamics and its application. Review of governing equations, their forms (conservative and non-conservative formulations) and variants. Boundary conditions. Classification of Partial Differential Equations and their effects on CFD problem setup and solutions. Concept of equation discretization using finite difference methods, Explicit and implicit methods of formulations and solutions. Domain discretization. Algebraic grid generations, stretched grids, staggered grids, elliptic grid generation techniques. CFD techniques for Finite Difference Methods; Lax-Wendroff technique, MacCormack's Technique, under relaxation and over relaxation techniques. Errors, Consistency and stability analysis, numerical dispersion and artificial viscosity. Finite volume techniques for diffusion problems, convection-diffusion problems. Algorithms for pressure- velocity coupling in steady flows (SIMPLE, SIMPLER, SIMPLEC, PISO). Solution of discretized equations (TDMA, point iterative, line iterative and ADI techniques). Concept of turbulence models. Post processing techniques in CFD.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **explain** the methods of fluid flow analysis i.e. theoretical, experimental and computational.	3											
CO2	Be able to **describe** the concept potential theory and its application to incompressible and inviscid flows.	3											
CO3	Be able to **apply** the numerical methods for solution of flow situations.		3										

	CO4	Be able to **analyze** implications errors and stability analysis of numerical methods.		3											
(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)															

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week-1	**Topic**	**CT**
Class-1	Introduction to computational fluid dynamics	CT-1
Class-2	Review of governing equations, their forms (conservative and non-conservative)	
Class-3	Boundary Conditions	
Week-2		
Class-4	Classification of Partial Differential Equations and	
Class-5	Lift and drag, Flow over airfoils.	
Class-6	Effects of Partial Differential Equations on CFD problem setup and solutions.	
Week-3		Mid Term Exam
Class-7	Explicit methods of formulations and solutions	
Class-8	Domain discretization	
Class-9	Algebraic grid generations	
Week-4		
Class-10	Implicit methods of formulations and solutions	
Class-11	Domain discretization	
Class-12	Algebraic grid generations	
Week-5		
Class-13	stretched grids	
Class-14	staggered grids	
Class-15	elliptic grid	
Week-6		
Class-16	CFD techniques for Finite Difference Methods	
Class-17	Lax-Wendroff technique	
Class-18	MacCormack’s Technique,	
Week-7		CT-2

	Class-19	Consistency and stability analysis	
	Class-20	Numerical dispersion and artificial viscosity.	
	Class-21	Errors	
	Week-8		
	Class-22	Finite volume techniques	
	Class-23	Instrumentation, Introduction to the cockpit and its instruments.	
	Class-24	under relaxation techniques	
	Week-9		CT-3
	Class-25	Convection-diffusion problems	
	Class-26	Solved out examples	
	Class-27	Solved out examples	
	Week-10		
	Class-28	SIMPLE	
	Class-29	SIMPLER	
	Class-30	SIMPLEC, PISO	
	Week 11		
	Class-31	Discretization equations	
	Class-32	Black box and its functions.	
	Class-33	point iterative	
	Week 12		
	Class-34	Discretization techniques	
	Class-35	TDMA	
	Class-36	Stages of flight, Heading, drift angle, Math.	
	Week 13		
	Class-37	Turbulence flow	
	Class-38	Turbulence flow modeling	
	Class-39	Turbulence flow modeling using CFD techniques	
	Week 14		

Class-40	Post processing techniques in CFD.	
Class-41	Post processing techniques in CFD.	
Class-42	Revision class	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C2
			CO 4	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO3	C3
Final Examination (Section A & B)		60%	CO 1	C2
			CO 2	C2
			CO 3	C3
			CO 4	C3
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Computational Fluid Dynamics – John D. Anderson.
2. An Introduction to Computational Fluid Dynamics: The Finite Volume Method – H. Versteeg
3. Fundamentals of Aerodynamics - John D Anderson; McGrawhill.
4. Aerodynamics for Engineering Students –E.L Houghton, P.W. Carpenter, S.H. Collicot and D.T. Valentine; Elsevier.
5. Computational Fluid Mechanics and Heat Transfer - Pletcher.

COURSE INFORMATION			
Course Code Course Title	: AEAS 326 : Computational Fluid Dynamics Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE

Course Code: AEAS 325
Course Title: Computational Fluid Dynamics

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course introduces the students with the fundamental principles of Computational Fluid Dynamics (CFD) for understanding fluid flow and fluid properties based on computational method.

OBJECTIVE

1. To place CFD in the context of a useful design tool for industry and a vital research tool for fluid research.
2. To familiarize students with the basic steps and algorithms associated with CFD.
3. To develop practical expertise of solving CFD problems with MATLAB and a commercial CFD code, ANSYS CFX.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **demonstrate** practical physical problems in computational domain with ANSYS software.	5	Psychomotor/ Precision			K6	R, Q, T, ASG
CO2	Be able to **integrate** the solution and interpretation of the obtained result from CFD analysis using ANSYS and MATLAB.	5	Psychomotor / Articulation	P1,P2 ,P3		K6	R, Q, Pr, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	Introduction to CFD and ANSYS CFX
2.	Numerical solution of parabolic equation using FDM
3.	Defining a CFD problem and creating geometry and mesh
4.	Flow over a cylinder using ANSYS- FLUENT
5.	Flow over an aerofoil using ANSYS -FLUENT
6.	Post Processing – analysis of results; validation and verification

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **demonstrate** practical physical problems in computational domain with ANSYS software.					2							
CO2	Be able to **integrate the** solution and interpretation of the obtained result from CFD analysis using ANSYS and MATLAB.					2							

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	7
Practical	14
Total	21
Self-Directed Learning	
Preparation of Lab Reports	5
Preparation of Lab Test	5
Preparation of presentation	10
Preparation of Quiz	5
Engagement in Group Projects	10
Formal Assessment	
Continuous Assessment	6
Final Quiz	1
Total	63

TEACHING METHODOLOGY

Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Introduction to CFD and ANSYS CFX
Week 2	Numerical solution of parabolic equation using FDM
Week 3	- Defining a CFD problem and creating geometry and mesh - Flow over a cylinder using ANSYS- FLUENT
Week 4	Mid Term Evaluation
Week 5	Flow over an aerofoil using ANSYS -FLUENT
Week 6	Post Processing – analysis of results; validation and verification
Week 7	Lab Quiz + Viva

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P3/Precision
		CO 2	P4/Articulation
Report Writing/Programming	15%	CO 1	P3/Precision
		CO 2	P4/Articulation
Mid Term Evaluation (exam/project/assignment)	20%	CO1	P3/Precision
Final Evaluation (Exam/project/assignment)	30%	CO2	P4/Articulation
Viva Voce/ Presentation	10%	CO2	P4/Articulation
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. Computational Fluid Dynamics: A Practical Approach 3rd Edition by Jiyuan Tu
2. Computational Fluid Dynamics 1st Edition by John Anderson.

COURSE INFORMATION			
Course Code Course Title	AEAS 437 Aerospace Vehicle Design	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
Aeronautical Engineering Drawing-I, Aeronautical Engineering Drawing II, Applied Aerodynamics, Aerospace Propulsion, Aircraft Loading and Structure Analysis, Aerospace Vehicle Stability and Control.			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To teach students the methodology and decision making involved in the process of designing aircraft.			
OBJECTIVES			
1. To describe an aircraft design phase like conceptual, preliminary and detail. 2. To generate a first estimation of the new aircraft weight. 3. To analyze the critical performance parameters for the new aircraft. 4. To generate the configuration layout for the new aircraft. 5. To understand the detail design phase and analyzing the wing design, tail design, fuselage design, and propulsion system design.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1.	Be able to **understand** the concept of design of an aerospace system, mission, or vehicle.	PO1	C2			K3	T, F, ASG
CO2.	Be able to **apply** the conceptual design phase, design layout and design analysis for various types and categories of aircraft, requirement of teamwork and engineering projects.	PO2	C3	P1, P2, P3, P4, P6		K3	T, F, ASG
CO3.	Be able to **analyze** the preliminary design phase and find out the Max take-of weight (MTOW), wing area & engine sizing.	PO2	C4	P1, P2		K4	T, Mid Term Exam, F
CO4.	Be able to **evaluate** the different design parameters like wing, tail, fuselage, landing gear, and propulsion system.	PO3	C5	P1, P2		K4	T, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Introduction to conceptual design; Design layout and design analysis - various types and categories of aircraft, requirement of teamwork for complex engineering projects. Aircraft design methods; Techniques for selecting, sizing and stressing components; Regulatory requirements for certification; Off-design requirements; Construction tolerances.

Aircraft preliminary design; Configuration design - performance, propulsion, weight and balance; Aerodynamics design – lift, drag, stability and control, structures and loads; Structural design – payload considerations, center of gravity requirements and materials; Philosophies of design and analysis.

Aircraft detailed design; System design –System design procedures; Systems integration; Test procedures; Fatigue and damage tolerance; the art of design and trade studies. Investigation of a typical aircraft configuration; Component layout; Alternate configurations; weight penalties or gains; requirements for ancillary equipment. Engine and propeller selection.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **understand** the concept of design of an aerospace system, mission, or vehicle.	3											
CO2	Be able to **apply** the conceptual design phase, design layout and design analysis for various types and categories of aircraft, requirement of teamwork and engineering projects.		3										
CO3	Be able to **analyze** the preliminary design phase and find out the Max take-of weight (MTOW), wing area & engine sizing.		3										

CO4	Be able to **evaluate** the different design parameters like wing, tail, fuselage, landing gear, and propulsion system.			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Topic	CT
Week-1	**Introduction**	
Class-1	Introduction to Design	CT-1
Class-2	Engineering Design	
Class-3	Feasibility Analysis	
Week-2	**Systems Engineering Approach**	

	Class-4	Fundamentals of Systems Engineering	
	Class-5	Design Requirements	
	Class-6	Design Review, Evaluation, and Feedback	
	Week-3	**Aircraft Conceptual Design**	Mid Term exam
	Class-7	Primary Functions of Aircraft Components	
	Class-8	Aircraft Configuration Alternatives	
	Class-9	Aircraft Classification and Design Constraints	
	Week-4	**Preliminary Design**	
	Class-10	Maximum Take-Off Weight Estimation	
	Class-11	Wing Area and Engine Sizing	
	Class-12	Design Examples &Problems	
	Week-5	**Wing Design**	
	Class-13	Airfoil Section	
	Class-14	Airfoil Section	
	Class-14	High-Lift Device	
	Week-6	**Wing Design**	
	Class-16	High-Lift Device	
	Class-17	Wing Design Steps	
	Class-18	Wing Design Steps	

	Week-7	**Tail Design**	CT-2
	Class-19	Tail Configuration	
	Class-20	Tail Configuration	
	Class-21	Horizontal Tail Parameters	
	Week-8	**Tail Design**	
	Class-22	Horizontal Tail Parameters	
	Class-23	Vertical Tail Design	
	Class-24	Vertical Tail Design	
	Week-9	**Fuselage Design**	CT-3
	Class-25	Cockpit Design	
	Class-26	Optimum Length-to-Diameter Ratio	
	Class-27	Fuselage Design Steps	
	Week-10	**Propulsion System Design**	
	Class-28	Engine Type Selection	
	Class-29	Engine Installation	
	Class-30	Engine Performance	
	Week 11	**Landing Gear Design**	
	Class-31	Landing Gear Configuration	
	Class-32	Landing Gear Geometry	
	Class-33	Landing Gear and Aircraft Centre of Gravity	
	Week 12	**Weight of Components**	
	Class-34	Sensitivity of Weight Calculation	

Class-35	Aircraft Major Components	
Class-36	Weight Calculation Technique	
Week 13	**Aircraft Weight Distribution**	
Class-37	Aircraft Centre of Gravity Calculation	
Class-38	Centre of Gravity Range	
Class-39	Weight Distribution Technique	
Week 14	**Design of Control Surfaces**	
Class-40	Aileron Design	
Class-41	Elevator Design	
Class-42	Rudder Design	

ASSESSMENT STRATEGY

<table>
<tr><td colspan="2">Components</td><td>Grading</td><td>CO</td><td>Blooms Taxonomy</td></tr>
<tr><td rowspan="5">Continuous Assessment (40%)</td><td rowspan="2">Class Test/ Assignment 1-3</td><td rowspan="2">20%</td><td>CO 1, CO 2</td><td>C2, C3</td></tr>
<tr><td>CO 4</td><td>C4</td></tr>
<tr><td>Class Performance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Class Attendance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Mid-Term Assessment (Exam/Project)</td><td>10%</td><td>CO 2, CO 3</td><td>C3 C4</td></tr>
</table>

Final Examination (Section A & B)	60%	CO 1	C 2
		CO 2	C 3
		CO 3	C 4
		CO 4	C 5
Total Marks	100%		

TEXT AND REFERENCE BOOKS:

1. Aircraft Design: A systems of Engineering Approach- Mohammad H. Saddaey
2. Aircraft Design: A Conceptual Approach - Raymer, 3rd Ed; AIAA Virginia, 1999.
3. Airplane Design: John Roskam, Parts

COURSE INFORMATION			
Course Code Course Title	: AEAS 438 : Aerospace Vehicle Design Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE

Course Code: AEAS 437
Course Title: Aerospace Vehicle Design

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To apply all the design phases & structural layout for aircraft design.

OBJECTIVE

1. To describe an aircraft design phase like conceptual, preliminary and detail.
2. To generate a first estimation of the new aircraft weight.
3. To analyze the critical performance parameters for the new aircraft.
4. To generate the configuration layout for the new aircraft.
5. To understand the detail design phase and analyzing the wing design, tail design, fuselage design, and propulsion system design.

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **apply** the conceptual design phase, design layout and design analysis for various types and categories of aircraft, requirement of teamwork and engineering projects.	1	C3			K3	R, Q, T
CO2	Be able to **analyze** the preliminary design phase and find out the Max take-of weight (MTOW), wing area & engine sizing.	2	C4			K4	R, Q, T
CO3	Be able to **design** the various aircraft's components like wing, tail, fuselage, landing gear, and propulsion system.	3	Psychomotor /Neutralization	P1, P2, P3		K5	Pr
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

Exp No	Exp Name
1.	Conceptual design report, depending on the mission profile: • Development of system operational requirement, • Selection of configuration from different alternative using Figure of Merit.
2.	Preliminary design report: • Numerical problems on maximum take-off weight estimation, wing area &engine sizing.
3.	Detail design report: • Wing design: Selection of aero foil, determination of wing parameters using Geometric and Trigonometric method. • Tail design: determination of tail parameters. • Fuselage Design: determination of fuselage parameters • Propulsion System Design: determination of propulsion system parameters • Landing Gear Design: determination of landing gear parameters • Weight of Components & Weight Distribution: Estimation of component's weight and distribution of center if gravity
4.	Individual project on specified Aircraft Design.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **apply** the conceptual design phase, design layout and design analysis for various types and categories of aircraft, requirement of teamwork and engineering projects.	3											
CO2	Be able to **analyze** the preliminary design phase and find out the Max take-of weight (MTOW), wing area & engine sizing.		3										
CO3	Be able to **design** the various aircraft's components like wing, tail, fuselage, landing gear, and propulsion system.			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical Total	 14 28 42
Self-Directed Learning Preparation of Lab Reports Preparation of presentation Engagement in Individual Design	 30 05 30
Formal Assessment Continuous Assessment	 05
Total	112

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Introduction to design sessional and providing mission profiles
Week 2	Conceptual design phase
Week 3	Conceptual design phase
Week 4	Preliminary design phase
Week 5	Preliminary design phase
Week 6	Preliminary design phase
Week 7	Detail design phase
Week 8	Detail design phase
Week 9	Detail design phase
Week 10	Detail design phase
Week 11	Detail design phase
Week 12	Detail design phase
Week 13	Individual project on specified Aircraft Design.
Week 14	Individual project on specified Aircraft Design.

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	C3/Apply
		CO 2	C4/Analyse
Report Writing	25%	CO 1	C3/Apply
		CO 2	C4/Analyse
		CO 3	P5/ Neutralization
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	C3/Apply, C4/Analyse, P5/ Neutralization
Viva Voce/ Presentation	20%	CO1, CO2, C03	C3/Apply, C4/Analyse, P5/ Neutralization
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. Aircraft Design: A systems of Engineering Approach- Mohammad H. Sadraey
2. Aircraft Design: A Conceptual Approach - Raymer, 3rd Ed; AIAA Virginia, 1999.
3. Airplane Design: John Roskam, Parts

COURSE INFORMATION			
Course Code Course Title	AEAS 439 Rotordynamics and Aircraft Performance	Lecture Contact Hours Credit hours	3.0 3.0
PRE-REQUISITE			
Applied Aerodynamics			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn the Rotor dynamics and aircraft performance			
OBJECTIVES			
1. To explain the blade momentum and element theory for lift generation in helicopters. 2. To explain the performance of helicopter in different phases of flight. 3. To explain the performance of fixed wing aircraft.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **develop** the basic concepts of momentum theory as applied to rotary wing aircraft.	PO1	C3			K3	T, F
CO2	Be able to **understand** blade element theory and different performance parameters and factors influencing these performance.	PO2	C2			K3	T, F
CO3	Be able to **analyze** the components of drag for fixed wing aircraft and engine performance.	PO2	C4	P1, P2		K4	Mid Term Exam, F,
CO4	Be able to **analyze** performance of an fixed wing	PO2	C4			K4	T, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project
Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

a. Main Contents: Helicopter dynamics, Helicopter and Fixed Wing Aircraft performance

b. Detail Contents:

Performance of Fixed-Wing Aircraft: Introduction, the aircraft and its environment, weight performance, Aerodynamic performance, Engine performance. Flight envelopes, take-off and landing, climb and gliding, cruise performance; Maneuver performance.

Rotary-Wing Aircraft Performance: Introduction to rotor dynamics, momentum theory, Vertical climb and descent, Autorotation, Ground effect, Rotor mechanisms, Introduction to rotor aerodynamics and aerodynamic design, Rotorcraft performance, rotorcraft in vertical and forward flight, rotorcraft maneuver, Rotorcraft mission analysis, V/STOL performance; Noise performance.

SKILL MAPPING													
No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **develop** the basic concepts of momentum theory as applied to rotary wing aircraft.	3											
CO2	Be able to **understand** blade element theory and different performance parameters and factors influencing these performance in helicopter.		3										
CO3	Be able to **analyze** the components of drag for fixed wing aircraft and engine performance.		3										
CO4	Be able to **analyze** performance of an fixed wing		3										

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	42 21 21
Formal Assessment Continuous Assessment Final Examination	4 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE:

Week	Topic	CT
Week 1	**Introduction to Helicopter dynamics**	CT 1
Class 1	Helicopter History and advantages of helicopters over fixed wing aircraft	
Class 2	Helicopter configurations, their working principles	
Class 3	Basic control mechanisms of helicopter, degrees of freedom and pilot controls	
Week 2	**Momentum theory in Rotor dynamics**	
Class 4	Introduction to momentum theory as applied to rotor dynamics. Simplifying assumptions	
Class 5	Analysis of vertical flight: Hover using momentum theory	
Class 6	Dependence of parameters for hover flight	
Week 3	**Momentum theory application to Rotor dynamics: Vertical Flight**	
Class 7	Analysis of vertical flight: Climb using momentum theory	
Class 8	Analysis of vertical flight: Climb using momentum theory	
Class 9	Analysis of vertical flight: Descending flight using momentum theory	
Week 4	**Momentum theory application to Rotor dynamics: Vertical Flight**	CT 2
Class 10	Applicability of momentum theory and discussion turbulent wake state and windmill braking	
Class 11	Auto rotation and Ideal auto rotation	
Class 12	In ground effect and out of ground effect. Brown out and vortex structures of vertical flight	
Week 5	**Blade elementary theory and non-uniform flows**	
Class 13	Application of Blade elementary theory for vertical flight.	
Class 14	Correlation between pilot pitch input and variation in thrust coefficient, power coefficient	
Class 15	Introduction to non-uniform flows	
Week 6	**Forward flight concept and Helicopter performance**	
Class 16	Introduction to forward flight and its dynamics, construction of articulated blades. Practical exposure to	
Class 17	Analysis of forward flight using momentum theory blade elementary theory, induced power in forward flight	
Class 18	Performance of Helicopter in vertical flight: hover, climb and descend flights;	

Week 7	**Helicopter performance and stability analysis**	
Class 19	Helicopter performance in forward flight, limiting factors of forward speed.	
Class 20	Static stability analysis of helicopters	
Class 21	Longitudinal and lateral dynamic stability analysis for helicopters	
Week 8	**Introduction to Aircraft Performance**	CT-3
Class 22	Aviation history (Pre Wright era, Era of Strut & Wire Biplanes)	
Class 23	Aviation history (Era mature Propeller Driven Airplane, Era of Jet Propelled Airplane)	
Class 24	Unconventional Designs (Innovative Concepts)	
Week 9	**Aerodynamics of the Airplane**	
Class 25	Aerodynamic Centre	
Class 26	Lift and Drag Buildup	
Class 27	Drag Polar	
Week 10	**Engine Performance**	
Class 28	Thrust and Efficiency	
Class 29	Variation of power and specific fuel consumption with velocity and altitude.	
Class 30	Variation of thrust and specific fuel consumption with velocity and altitude.	
Week 11	**Airplane Performance: Steady Flight**	
Class 31	Equations of motion for steady and level flight.	
Class 32	Thrust required	
Class 33	Aerodynamic relations associated with Maximum C_L/C_D, $C_L^{3/2}/C_D$, $C_L^{1/2}/C_D$	
Week 12	**Airplane Performance: Steady Flight**	CT 4
Class 34	Thrust available and the maximum velocity of **propeller driven** aircraft.	
Class 35	Thrust available and the maximum velocity of **jet propelled** aircraft.	
Class 36	Power required and power available .	
Week 13	**Airplane Performance: Steady Flight**	
Class 37	Rate of climb, time to climb.	
Class 38	Service Ceiling & Absolute ceiling.	
Class 39	Range and Endurance.	
Week 14	**Airplane Performance: Accelerated Flight**	
Class 40	Level Turn, Pull up and pull down maneuver.	

Class 41	V-n Diagram and energy cocept.	
Class 42	Takeoff and landing performance.	

ASSESSMENT STRATEGY				
Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1	C3
			CO2, CO4	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO3	C4
Final Examination (Section A & B)		60%	CO 1	C3
			CO 2	C4
			CO 3	C4
			CO 4	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Performance of Fixed and Rotary Wing Aircraft - Antonio Filippone
2. Aerodynamics of the helicopter - Alfred Gessow/ Garry C. Myers Jr.
3. Basic Helicopter Aerodynamics - John Seddon/Simon Newman.
4. The Art of the Helicopter - John Watkinson.
5. Aircraft Performance and Design - John D. Anderson; WCB McGrawhill.

COURSE INFORMATION			
Course Code Course Title	AEAS 447 Space Engineering	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To prepare students with a better understanding concerning the motion of spacecraft.			
OBJECTIVES			
1. Inspect the basic concepts of Orbital Mechanics. 2. Explain Space Environment. 3. Explain Space Laws and Legislative Issues. 4. Apply basics of Orbital Mechanics to Satellite Operations & Rocket Launching			

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **inspect** the basic concepts of Orbital Mechanics.	PO2	C4			K4	T, F, ASG.
CO2	Be able to **explain** Space Environment.	PO1	C2			K3	T, F, ASG.
CO3	Be able to **explain** Space Laws and Legislative Issues.	PO1	C2			K3	F, Mid Term Exam.
CO4	Be able to **apply** basic of Orbital Mechanics to Satellite Operations & Rocket Launching	PO2	C3	P1, P2		K4	T, F, ASG.

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Introduction: Space environment, types of spacecraft, present-day satellites and launch vehicles.

Orbital mechanics: Two-body Problem, Kepler's laws, geometry of orbits, Kepler's equation, classical orbital elements, orbit determination from initial conditions, position and velocity prediction from orbital elements. Satellite operations: Geostationary orbit, Hohmann transfer, inclination change maneuvers, launch windows for rendezvous missions, perturbation effects due to earth oblateness, sun synchronous orbits.

Attitude dynamics and control: Rotation matrices, Euler angles, attitude kinematics, Euler's equations for rotational dynamics, torque free motion of asymmetric and axisymmetric rigid bodies, effect of energy dissipation on stability of rotational motion, attitude control of spinning and non-spinning satellites.

Basic properties of the electro-magnetic environment in space; Basic Space Law and legislative issues; The Outer Space Treaty; The Space Activities Act Standards.

Introduction to rocket launching: Rocket equation, multi-staging, parallel staging, optimal staging, sensitivity ratios, vertical ascent trajectories, gravity turn trajectories.

Introduction to satellite system: Types of satellite, Satellite components. Satellite link design; uplink & downlink. Satellite constellation. Dilution of precision, Satellite Receivers: characteristics, error. Receiver Autonomous Integrity Monitoring. Introduction to systems engineering approach.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **inspect** the basic concepts of Orbital Mechanics.		3										
CO2	Be able to **explain** Space Environment.	3											
CO3	Be able to **explain** Space Laws and Legislative Issues.	3											
CO4	Be able to **apply** basic of Orbital Mechanics to Satellite Operations & Rocket Launching		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week-1	**Topic**	**CT**
Class-1	Two-body Problem, Kepler's laws.	CT-1
Class-2	Geometry of orbits, Kepler's equation, classical orbital elements.	
Class-3	Orbit determination from initial conditions, position and velocity prediction from orbital elements.	
Week-2		
Class-4	The Outer Space Treaty.	
Class-5	The Outer Space Treaty.	
Class-6	The Space Activities Act Standards.	
Week-3		Mid Term Exam
Class-7	Different types of orbits.	
Class-8	International Space Station.	
Class-9	Hohmann transfer.	
Week-4		

	Class-10	Inclination change maneuvers, launch windows for rendezvous missions.		
	Class-11	Perturbation effects due to earth oblateness.		
	Class-12	Sun synchronous orbit and Molniya orbit.		
	Week-5			
	Class-13	Rotation matrices & Euler angles.		
	Class-14	Euler's equations for rotational dynamics.		
	Class-15	Torque free motion of asymmetric rigid bodies.		
	Week-6			
	Class-16	Torque free motion of axisymmetric rigid bodies.		
	Class-17	Attitude control of spinning satellites.		
	Class-18	Attitude control of non-spinning satellites.		
	Week-7			
	Class-19	Radiation Environment & Plasma Environment.		
	Class-20	Neutral Environment & Particulate Environment.		
	Class-21	Sunspot, solar wind, corona, Solar Prominences, Solar Flares.		
	Week-8		CT-2	
	Class-22	Structure of Sun and Earth.		
	Class-23	Magnetic field of Sun and Earth.		
	Class-24	Causes of Earth’s magnetic field.		
	Week-9			
	Class-25	Mechanical structure.		
	Class-26	Propulsion subsystem		
	Class-27	Propulsion subsystem	CT-3	
	Week-10			
	Class-28	Attitude and orbit control subsystem.		
	Class-29	Payload subsystem.		

	Class-30	Antenna subsystem.		
	Week 11			
	Class-31	Thermal control subsystem.		
	Class-32	Power supply subsystem.		
	Class-33	Telemetry, tracking and command (TT&C) subsystem.		
	Week 12			
	Class-34	Rocket equation.		
	Class-35	Multi-staging, parallel staging, optimal staging and sensitivity ratios.		
	Class-36	Vertical ascent trajectories, gravity turn trajectories.		
	Week 13			
	Class-37	Emergence of system engineering and history.		
	Class-38	Definition, Examples & Elements		
	Class-39	Motivation for system engineering, Function of system engineering		
	Week 14			
	Class-40	Life cycle of a system. Focus and principles of system engineering.		
	Class-41	Vee Model, contribution, system engineer's responsibility.		
	Class-42	System engineering processes & System managements.		

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1	C3
			CO2	C2
			CO3	C1
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO4	C3
Final Examination (Section A & B)		60%	CO 1	C3
			CO 2	C2
			CO 3	C1
			CO 4	C3
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Elements of Spacecraft Design - Charles D. Brown
2. Satellite Technology Principles and Applications - Anil K. Maini and Varshaagrawal
3. Space Mission Analysis and Design - Wiley J. Larson and James R. Wertz
4. Spacecraft Systems Engineering- Peter Fortescue, John Stark and Graham Swinerd
5. Digital Satellite Communications - Tri T. Ha; McGraw-Hill International.
6. Satellite Communications- Dennis Roddy; McGraw-Hill TELECOM.
7. Satellite Communications - T. Pratt, C. Bostian, J. Allnut; John Wiley & Sons Inc

COURSE INFORMATION			
Course Code Course Title	AEAS 407 Turbomachinery	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE

AEAS-207 (Thermodynamics), AEAS-301 (Heat Transfer), AEAS-337 (Aerospace propulsion)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn about the details of turbomachines and working principles

OBJECTIVES

1. To know the classification and applications of different turbo machines.
2. To develop the basic concepts of thermodynamic analysis of diffusers, nozzles.
3. To analyze the Thermodynamic and Aerodynamic of flow through Axial and Radial Flow Compressors and Turbines.
4. To demonstrate understanding of instabilities in compressor operations and methods to arrest instabilities.
5. To identify performance parameters influencing the operation of turbo machines

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **demonstrate** understanding of turbomachines and **analyze** aerothermodynamic process of Nozzle and Stator and its significance	PO1	C4			K3	T, F, ASG
CO2	Be able to **predict** of Performance of turbomachines by Dimensional Analysis techniques, **analyze** aerodynamic forces on blades by understanding flow through Cascades and **examine** Aerothermodynamic analysis of flow through Axial Flow Compressors	PO2	C6	P1, P2		K4	T, F, ASG
CO3	Be able to **examine** Aerothermodynamic analysis of flow through Axial Flow Turbines and Analyse parameters affecting performance of Axial Flow Compressors	PO2	C4	P1, P2		K4	T, F, Mid Term Exam
CO4	Be able to **examine** Aerothermodynamic analysis of flow through Centrifugal Compressors and Radial Turbines and also **Predict** design and Off design performance of Gas Turbines and **Demonstrate** understanding of Aerothermodynamic coupling of components	PO2	C6	P1, P2, P3		K4	T, F, Mid Term Exam
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Mechanics and thermodynamics of diffusers, nozzles, compressors and turbines; Dimensional Analysis, Energy Transfer in turbo-machines, Stage dynamics and performance of axial flow compressor and turbine, centrifugal compressors and radial turbines, stage velocity triangles. Theories of cascades. Axial compressor and turbine blade design considerations. Prediction of design and off design performance of Gas Turbines; Gas turbine component matching; Transient behavior of Gas turbines.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **demonstrate** understanding of turbomachines and **analyze** aerothermodynamic process of Nozzle and Stator and its significance	3											
CO2	Be able to **predict** of Performance of turbomachines by Dimensional Analysis techniques, **analyze** aerodynamic forces on blades by understanding flow through Cascades and **examine** Aerothermodynamic analysis of flow through Axial Flow Compressors		3										
CO3	Be able to **examine** Aerothermodynamic analysis of flow through Axial Flow Turbines and **Analyze** parameters affecting performance of Axial Flow Compressors		3										
CO4	Be able to **examine** Aerothermodynamic analysis of flow through Centrifugal Compressors and Radial Turbines and also **Predict** design and Off design performance of Gas Turbines and **Demonstrate** understanding of Aerothermodynamic coupling of components		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Topic	CT
Week-I	**Introduction to Turbo-machines**	CT-1
Class-1	Historical review of evolution of turbo-machines	
Class-2	Introduction to Turbo-machines, classification of turbo-machines	
Class-3	Essential Components and advantages of turbo-machines over positive displacement machines	
Week-2	**Thermodynamic laws**	
Class-4	Review of thermodynamic laws	
Class-5	Thermodynamic analysis of flow through nozzles for large pressure ratios and small pressure ratios	
Class-6	Thermodynamic analysis of flow through diffusers for large pressure ratios and small pressure ratios	
Week-3	**Introduction to aerodynamics analysis**	
Class-7	Work and efficiency definitions of turbines and compressors	

Class-8	Discussion on stage efficiencies, polytrophic efficiencies applied to turbine and compressors	
Class-9	Introduction to aerodynamics analysis of flow through the turbo-machines	
Week-4	**Dimensional analysis**	CT-2
Class-10	Introduction to Dimensional analysis, Buckingham's π -theorem	
Class-11	Dimensional analysis applied to incompressible and compressible turbo- machines	
Class-12	Performance characteristics of turbines, compressors, fans and blowers	
Week-5	**2D Flow Through Cascades**	
Class-13	Introduction to 2D flow through cascades	
Class-14	Aerodynamic analysis of compressor and turbine cascade and efficiency of cascades	
Class-15	Performance of cascades	
Week-6	**Axial flow compressor**	
Class-16	Thermodynamic analysis of axial flow compressor. Multi-staging effects and its analysis. Infinitesimal staging and its effects. Stage-wise performance analysis	
Class-17	Variation of thermodynamic properties of air in multistage compressors	
Class-18	Performance of axial flow compressors, Flow coefficient, degree of reaction, diffusion etc.	
Week-7	**Velocity Triangles**	
Class-19	Discussions on velocity triangles, work done by compressor, change in properties across the compressor stages	
Class-20	Efficiencies of axial flow compressors.	
Class-21	Performance of axial flow compressors, Flow coefficient, degree of reaction, diffusion etc.	
Week-8	**Surge**	
Class-22	Axial flow compressor losses and its effects	
Class-23	Unstable operations of axial flow compressor	
Class-24	Rotating stall and Surge. Detection of onset of rotating stall and surge	
Week-9	**Axial Flow Turbines**	
Class-25	Thermodynamic analysis of axial flow turbines	
Class-26	Aerodynamic analysis of axial flow turbines	
Class-27	Multi-staging and multi pooling requirements of turbines	

Week-10	**Stage velocity triangles**	CT-3
Class-28	Stage velocity triangles.	
Class-29	Effect of degree of reaction and velocity triangles for different values of degree of reactions	
Class-30	Losses and efficiencies of axial flow turbines	
Week-11	**Performance**	
Class-31	Performance of axial flow turbines	
Class-32	Introduction of centrifugal and radial machines	
Class-33	Enthalpy and conservation of Enthalpy across rotors	
Week-12	**Centrifugal compressors**	CT-4
Class-34	Comparison of centrifugal compressors with axial flow compressors, advantages and applications	
Class-35	Velocity triangles, analysis of work, efficiencies. Variation of fluid property in centrifugal compressors	
Class-36	Comparison of radial turbines with axial turbines, advantages and applications	
Week-13	**Radial Flow Turbines**	
Class-37	Velocity triangles, work done, efficiency of radial flow turbines. Various Configurations and constructions of radial flow turbines	
Class-38	Axial compressor and turbine blade design considerations	
Class-39	Blade cooling techniques in turbines	
Week-14	**Design Performance**	
Class-40	Prediction of design and off design performance of Gas Turbines	
Class-41	Gas turbine component matching	
Class-42	Transient behavior of Gas turbines	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C4, C6
			CO4	C6
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO2, CO3	C4, C6
Final Examination (Section A & B)		60%	CO1	C4
			CO2	C6
			CO3	C4
			CO4	C6
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Mechanics and Thermodynamics of Propulsion - Hill & Peterson.

2. Fluid Mechanics, Thermodynamics of Turbo-machinery - S L Dixon; Pergamon Press, 1966.
3. Fundamentals of Turbomachinery- BK Venkanna
4. Gas Turbine Theory-H Cohen, GFC Rogers, HIH Saravanamuttoo
5. Principles of Turbo-machinery - Seppo A. Korpela; WILEY Publications.
6. Turbines Compressors and Fans-S M Yahya.

COURSE INFORMATION			
Course Code Course Title	: AEAS 408 : Turbomachinery Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE

Course Code: AEAS 407
Course Title: Turbomachinery

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To apply the theoretical knowledge of different types of compressors and turbines in practical cases.

OBJECTIVE

1. To determine the thermodynamic properties of flow inside the diffusers, nozzles, compressors and turbines.
2. To compile and analyze the various properties of flow and check whether the laws of thermodynamics hold.
3. To determine the performance of different types of compressors and turbines.
4. To analyze the design considerations required for different types of working conditions.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **Demonstrate** understanding of Nomenclature of Blades, thermodynamics and aerothermodynamics of turbomachines.	5	Psychomotor/ Precision			K6	Pr., R, Q, T, F
CO2	Be able to **Analyze** Stage Velocity triangles of Compressor and Turbine, Predict performance of Turbomachines and able to demonstrate energy transfer in turbomachines	5	C4 & Psychomotor/ Precision	P1,P2 ,P3		K6	Pr., R,Q ,T, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	Determination of pressure and temperature of the flow inside compressors and turbines
2.	Determination of the performance of different types of compressors and turbines.
3.	Representation of stage velocity triangles calculated from different parameters
4.	Predict performance of turbomachines and Calculation of energy transfer in turbo-machines

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to Demonstrate understanding of Nomenclature of Blades, thermodynamics and aerothermodynamics of turbo machines.					2							
CO2	Be able to Analyze Stage Velocity triangles of Compressor and Turbine, Predict performance of Turbo machines and able to demonstrate energy transfer in turbo machines					3							

Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	07
Practical	14
	Total 21
Self-Directed Learning	
Preparation of Lab Reports	05
Preparation of Lab Test	10
Preparation of presentation	05
Preparation of Quiz	05
Engagement in Group Projects	10
Formal Assessment	
Continuous Assessment	07
Final Quiz	1
Total	66

TEACHING METHODOLOGY

Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Familiarization with types of turbomachines and Construction of turbomachines.
Week 2	Thermodynamic Cycle Analysis of Axial Flow Compressors and Turbines
Week 3	Aerothermodynamic Analysis of Axial Flow Compressors and Turbines.
Week 4	Familiarization with Wind Tunnel Set-up for Cascade flow Analyse the Stage Velocity triangles of Axial Flow Compressors and Turbines
Week 5	Perform experiment in 2D Wind Tunnel for Compressor Blade Rows. Perform experiment in 2D Wind Tunnel for Turbine Blade Rows
Week 6	Lab Quiz
Week 7	Presentation on Assigned Problems

ASSESSMENT STRATEGY

Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	35%	CO 1	C4, P3
		CO 2	C4, P3
Report Writing/Programming	15%	CO 1	C4, P3/Analyse & Precision
		CO 2	C4, P3/Precision & Analyse
Mid Term Evaluation (exam/project/assignment)	20%	CO1	P4/ Articulation
Final Evaluation (Exam/project/assignment)	20%	CO1, CO2	P3/Precision, C4/Analyse,
Viva Voce/ Presentation	10%	CO1, CO2	P3/Precision, C4/Analyse,
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. Mechanics and Thermodynamics of Propulsion - Hill & Peterson.
2. Fluid Mechanics, Thermodynamics of Turbo-machinery - S L Dixon; Pergamon Press, 1966.
3. Fundamentals of Turbomachinery- BK Venkanna
4. Gas Turbine Theory-H Cohen, GFC Rogers, HIH Saravanamuttoo
5. Principles of Turbo-machinery - Seppo A. Korpela; WILEY Publications.
6. Turbines Compressors and Fans-S M Yahya.

COURSE INFORMATION			
Course Code Course Title	AEAS 413 High Speed Aerodynamics	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE

Fundamentals of Aeronautical Engineering
Engineering Mechanics (Statics and Dynamics)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To introduce the theories of compressible flow involving subsonic and supersonic cases.

OBJECTIVES

1. To define the fundamental aspects of compressible flow.
2. To solve simple problems related to shock and expansion (Prandtl-Meyer) waves phenomena.
3. To solve simple problems related to adiabatic flow
4. To design and perform the experimental work related to water table experiments.
5. To evaluate and perform the CFD simulations works related to compressible

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **explain** the concept of compressible flow involving subsonic and supersonic cases.	PO2	C2			K3	T, F, ASG
CO2	Be able to **explain** the mechanism of formation of sound wave and shock wave and their effect on the compressible flow involving change of pressure, temperature, velocity, entropy etc.	PO1	C2	P1, P2		K3	Mid Term Exam, F
CO3	Be able to **analyze** the influence of normal shock, oblique shock and expansion wave on compressible flow.	PO2	C4	P1, P2		K4	Mid Term Exam, T, F
CO4	Be able to **evaluate** the change of properties of compressible flow due to stationary and moving shock waves.	PO2	C5	P1, P2		K4	T, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Basic equations of compressible flow, wave propagation in compressible media; velocity of sound, subsonic and supersonic flows, Mach number, isentropic flow, stagnation properties, flow through convergent-divergent nozzle.
Normal shock waves, oblique shock and expansion waves, Prandatl-Mayer expansion fans, shock expansion theory, linearized flow theory.
Flow with friction and heat transfer, moving shock wave, shock tube flow, transonic flow, and measurements in compressible flow.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **explain** the concept of compressible flow involving subsonic and supersonic cases.		3										
CO2	Be able to **explain** the mechanism of formation of sound wave and shock wave and their effect on the compressible flow involving change of pressure, temperature, velocity, entropy etc.	3											
CO3	Be able to **analyze** the influence of normal shock, oblique shock and expansion wave on compressible flow.		3										
CO4	Be able to **evaluate** the change of properties of compressible flow due to stationary and moving shock waves.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	
COURSE SCHEDULE	

Week	Topic	CT
Week-1	**Basic equations of compressible flow**	CT-1
Class-1	Bernoulli's Equation, Low-speed wind tunnel.	
Class-2	Pitot tube: measurement of airspeed, pressure coefficient.	
Class-3	Governing equation for Inviscid, Compressible flow.	
Week-2	**Subsonic and supersonic flows**	
Class-4	Aspects of subsonic flow,	
Class-5	Aspects of supersonic flow: shock wave	
Class-6	Types of flow: subsonic, supersonic and hypersonic.	
Week-3	**Compressibility**	

	Class-7	Definition of total (stagnation) condition.		
	Class-8	Speed of sound		
	Class-9	Sound formation and propagation in air.		
	Week-4	**Stagnation properties**		
	Class-10	Special forms of Energy equation		
	Class-11	Prandlt-Glauert compressibility correction		
	Class-12	Drag divergence mach number, critical mach number.	Mid exam	
	Week-5	**Flow through convergent-divergent nozzle**		
	Class-13	Governing Equation for Quasi-one-dimensional flow.		
	Class-14	Nozzle flows, diffusers, subsonic wind tunnel, CD nozzle.		
	Class-15	Supersonic wind tunnel and related math.		
	Week-6	**Normal shock waves**		
	Class-16	The basic normal shock equations.		
	Class-17	Calculation of normal shock waves.		
	Class-18	Related mathematics.		
	Week-7	**Oblique shock and expansion waves**		
	Class-19	Oblique shock relations		
	Class-20	Supersonic flow over wedges and cones.		

	Class-21	Detached shock wave in front of a blunt body	CT-2
	Week-8	**Prandatl-Mayer expansion waves**	
	Class-22	Prandatl-Mayer expansion waves	
	Class-23	Continue	
	Class-24	Mathematical problem.	
	Week-9	**Shock expansion theory**	CT-3
	Class-25	Shock expansion theory: application to supersonic airfoils	
	Class-26	Continue	
	Class-27	Mathematical problem	
	Week-10	**Linearized flow theory**	
	Class-28	Derivation of the Linearized Supersonic pressure coefficient formula	
	Class-29	Application to supersonic airfoils	
	Class-30	Super critical airfoils and related problems	
	Week 11	**Flow with friction and heat transfer**	
	Class-31	Explain basic equations and formulae	
	Class-32	Mathematical problem solve	
	Class-33	Mathematical problem solve	
	Week 12	**Moving shock wave**	
	Class-34	Introduction to moving shock wave	
	Class-35	Equations of moving shock wave	
	Class-36	Shock tube flow	
	Week 13	**Types of flow**	

Class-37	Transonic flow
Class-38	Subsonic flow
Class-39	Supersonic flow
Week 14	**Measurements in compressible flow**
Class-40	Equations of motion for compressible flow
Class-41	Energy equation for compressible flow
Class-42	Problem solving and review

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO3	C2, C4
			CO 4	C5
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO 2, CO3	C2, C4
Final Examination (Section A & B)		60%	CO 1	CO 1
			CO 2	CO 2

		CO 3	CO 3
		CO 4	CO 4
Total Marks	100%		

TEXT AND REFERENCE BOOKS:

1. Fundamentals of Aerodynamics- John D. Anderson; McGraw Hill.
2. Aerodynamics for Engineering Students, 5th Edition-E. L. Houghton & P. W. Carpenter
3. Gas Dynamics, 3rd Edition-James E. A. John and Theo G. Keith
4. Gas Dynamics- E. Rathakrishna

COURSE INFORMATION			
Course Code Course Title	: AE 300 : Industrial Training	Lecture Contact Hours Credit Hours	: 8 weeks : 1.00

PRE-REQUISITE
Student should complete all courses up to 3rd Year, 2nd Semester

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
To provide the experience for the students regarding industrial environment and organization as well as the functionality of the engineers in industries.

OBJECTIVE

1. To be able to practice the responsibility of becoming an engineer in the profession of engineering.
2. To be able to able to instill communication skill in engineering which include daily interaction with working environment and technical writing.
3. To be able to involve and experience the true working environment of the engineer.
4. To be able to work in a team.
5. To be able to manage a project within a given time frame.
6. To be able to effectively communicate solution to problems (oral, visual, written).

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Present** the practical experience. in the industrial sector of maintenance, planning, engineering service and aircraft inspection through written documents and oral presentation	10	Affective/ Valuing				Pr , R

CO2	**Recognize** the structure and management of an industry/organization to apply this knowledge in the individual's professional life.	9	Affective/ Receiving				Pr , R
CO3	**Internalize** the industrial training knowledge further in project or research work.	12	Affective/ Characterisa -tion by value		A1,A2, A3		Pr , R
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam; Bloom's Taxonomy: C-Cognitive, P- Psychomotor and A-Affective)							

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Present** the practical experience. in the industrial sector of maintenance, planning, engineering service and aircraft inspection through written documents and oral presentation										2		
CO2	**Recognize** the structure and management of an industry/organization to apply this knowledge in the individual's professional life.									3			
CO3	**Internalize** the industrial training knowledge further in project or research work.												3
(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)													

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Industrial Visit & Training
Week 2	Industrial Visit & Training
Week 3	Industrial Visit & Training
Week 4	Test for Industrial Performance, Presentation & Viva

ASSESSMENT STRATEGY

Components	**Grading**	**CO**	**Blooms Taxonomy**
Attendance	10%		
Industrial Performance, Observation and Presentation	90%	CO 1	Affective/Valuing
		CO 2	Affective/Receiving
		CO3	Affective/Characterization by value
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS
As per the type of core work of the assigned industry.

COURSE INFORMATION			
Course Code Course Title	: AEAS 400 : Final Year Design and Research Project	Lecture Contact Hours Credit Hours	: 12.00 : 6.00
PRE-REQUISITE			
Courses learned up to Level-3			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn and grow research capability by analysing previous research work related to area of interest. Theoretical Knowledge gained studying up to level three can be further enhanced by analytical as well as research work on the field of individual interest making a group of students of similar field of interest. Learn to develop hardware solution for a real time industry related problem through working in a team.			
OBJECTIVE			
1. To learn more in-depth knowledge of the major subject/field of study, including deeper insight into current research and development work. **2.** To contribute to research and development work. **3.** To use a holistic view to critically, independently and creatively identify, formulate and deal with complex issues. **4.** To plan and use adequate methods to conduct qualified tasks in given frameworks and to evaluate the work. **5.** To create, analyse and critically evaluate different technical/architectural solutions. **6.** To critically and systematically integrate knowledge. **7.** To provide design experience to the students through teamwork and familiarize them with the project management methodology **8.** To provide the ability to understand and redefine a given engineering problem, and the ability to develop a conceptual design **9.** To provide students the ability to communicate effectively			

	LEARNING OUTCOMES & GENERIC SKILLS						
No.	Course Outcomes	Corresponding PO No.	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Identify** a problem requiring an Aeronautical engineering based solution and develop ability to give solution.	PO3	Cognitive/ Analyze			K3	APW,R
CO2	**Analyze** a problem, and identify, formulate techniques and use the project management skill, appropriate computing and engineering tools for obtaining its solution.	PO5	Psychomotor/Articulation, & Cognitive/ Analyze	P1, P2, P4		K6	PW, APW
CO3	**Seek** professional, ethical, environmental and social impacts of the design project or thesis work along with cooperation of team members	PO9	Affective/ Valuing	P1, P6	A4, A5		PW, APW
CO4	Handle academic knowledge through independent studies of relevant literature, and to cultivate the ability to **evaluate** and briefly account for the central elements in a large literature base.	PO12	Psychomotor/Articulation, & Cognitive/ Evaluate	P1, P5, P7	A5	K8	T, Mid Term Exam
CO5	**Solve** a practical problem by a systematic use of an appropriate choice of theory and methodologies and **Present** the design project results or thesis results through written technical documents and oral presentations	PO10	Cognitive/ Create, Affective/ Characterization by Value	P1, P3	A1, A2		PR,R, ASG,F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, PW-Practical Work, APW-Analysis of Previous Work)							

COURSE CONTENT

Course Contents:

Students may choose to write alone or in groups of up to 4 students.

Types of thesis:

Students can choose topics containing theoretical, empirical and/or practical aspects. But irrespective of the topic chosen, the use of relevant theory and literature is fundamental to the thesis.

An empirical paper: The idea is to gather knowledge on a specific topic and to relate theory to empirical observations, e.g. by using existing data, by using questionnaires or experiments.

A case study: A case study approach involves an analysis of a specific occurrence or process in an actual company or another type of organization. The purpose of a case study is to provide descriptions, analyses and suggested solutions to problems in relation to the case in hand. Case studies will involve the use of quantitative and/or qualitative methods for data collection.

A theoretical paper: This type of thesis builds on a theoretical model or a generic problem. Often a theoretical thesis is based on existing literature studies in which a theoretical problem is analyzed. This type of thesis is the least common.

No type of thesis is superior to others and no topics guarantee a high grade. The grade is based solely on whether the topic is thoroughly analyzed, the results clearly presented and whether you are able to demonstrate your knowledge of current theories and analyses, competent application of methods as well as independent critical judgment.

CO-PO MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Identify** a problem requiring an Aeronautical engineering based solution and develop ability to give solution.				3								
CO2	**Analyze** a problem, and identify, formulate techniques and use the project management skill, appropriate computing and engineering tools for obtaining its solution.					3							
CO3	**Seek** professional, ethical, environmental and social impacts of the design project or thesis work along with cooperation of team members									3			

CO4	Handle academic knowledge through independent studies of relevant literature, and to cultivate the ability to **evaluate** and briefly account for the central elements in a large literature base.												2
CO5	**Solve** a practical problem by a systematic use of an appropriate choice of theory and methodologies and **Present** the design project results or thesis results through written technical documents and oral presentations										3		

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 - 42 42
Self-Directed Learning Research Work under the supervision of Supervisor Project work/Simulation practice at Lab Preparation of Thesis Paper	 84 42 42
Formal Assessment Continuous Assessment Final Presentation	 8 3
Total	221

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

ASSESSMENT STRATEGY

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Lab participation and Report	20%	CO 1	Cognitive/Analyze
			CO 2	Psychomotor/Articulation, & Cognitive/Analyze
			CO 3	Affective/Valuing
			CO4	Psychomotor/Articulation, & Cognitive/Evaluate
	Labtest-1, Labtest-2	30%	CO 1	Cognitive/Analyze
			CO 2	Psychomotor/Articulation, & Cognitive/Analyze
			CO 3	Affective/Valuing
	Project and Presentation	25%	CO5	Cognitive/Create, Affective/Characterization by Value
Lab Quiz		25%	CO 1	Cognitive/Analyze
			CO 2	Psychomotor/Articulation, & Cognitive/Analyze
			CO 3	Affective/Valuing
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

As reviewed by different students or group of students

*****Details of program outcome and grading policy are attached as Annex A and Annex B.**

5.1.2 Elective Courses (Aerospace Discipline)

COURSE INFORMATION			
Course Code Course Title	AEAS 337 Aerospace Propulsion	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
AEAS-207 (Thermodynamics), AEAS-301 (Heat Transfer)			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn about the fundamentals of air breathing and non-air breathing engines and their different components.			
OBJECTIVES			
1. To demonstrate understanding of contemporary propulsion systems used in both air breathing and non-air breathing aircrafts. Classify Engine, Heat Engines, Air Breathing and Non –Air Breathing Engines. 2. To apply and analyze thermodynamics to assess the thermodynamic process occurring in various components of a gas engine which include inlets, fans, compressors, combustion chambers, turbines, afterburners and nozzles and how they interact with each other. 3. To demonstrate understanding of design variables affecting the performance of each component of an aero engine. 4. To demonstrate understanding basic aspects of rocket propulsion, propellants, rocket staging and dynamics.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **demonstrate** understanding of Gas Turbine Engines and **analyze** Thermodynamic Process of Ideal and Real Cycle	PO1	C4			K3	T, F, ASG
CO2	Be able to **explain** function and construction of various components of Gas Turbine Engine and their Significance.	PO1	C2			K3	T, F, ASG
CO3	Be able to **demonstrate** Understanding of Variation types of Propelling Nozzles and basic aspects related to Rocket Propulsion and its Propellants	PO1	C2			K3	T, F, Mid Term Exam
CO4	Be able to **apply** Basic aspects of Rocket Propulsion and **understand** Rocket Staging and Impact of Drag on Staging.	PO2	C3			K4	T, F, Mid Term Exam

	Classification of IC engines, **understand** operation of Piston Engines, its construction and Performance parameters						

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project; Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Fundamentals of air breathing engines; Operating principles of piston engines, thermal efficiency calculations, classification of piston engines, illustration of working of gas turbine engine, the thrust equation, factors affecting thrust, effect of pressure, velocity and temperature changes of air entering compressor, Propeller theory.

Inlets, nozzles and combustion chambers for jet engines ; Internal flow and Stall in subsonic inlets – relation between minimum area ratio and eternal deceleration ratio, diffuser performance, supersonic inlets, shock swallowing by area variation, real flow in nozzles and nozzle efficiency, losses in nozzles, equilibrium flow and frozen flow in nozzles, two phase flow in nozzles, ejector and variable area nozzles, interaction of nozzle flow with adjacent surfaces, thrust reversal, classification of combustion chambers, combustion chamber performance, flame stabilization.

Propulsion unit requirements for subsonic and supersonic flight. Compressors, combustion systems, turbines and after burner. Gas turbine cycles for aircraft propulsion; turbojet, turbofan, turbo shaft engines. Efficiency of components; Off-design considerations; Selection of materials for aero-engine. Aero-thermochemistry of Fuels and Propellants. Methods of thrust augmentation, Aero engine control.

Rocket propulsion and rocket propellants; liquid and solid rocket propulsion systems, nozzle design, rocket performance; Dynamics of rocket flight, orbital velocity; Staging; Future developments; Minimization of noise and pollution; Sub-orbital propulsion systems; Ram jet; Scram-jets; Hybrid engines.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **demonstrate** understanding of Gas Turbine Engines and **analyze** Thermodynamic Process of Ideal and Real Cycle	3											
CO2	Be able to **explain** function and construction of various components of Gas Turbine Engine and their Significance	2											
CO3	Be able to **demonstrate** understanding of Variation types of Propelling Nozzles and basic aspects related to Rocket Propulsion and its Propellants	2											
CO4	Be able to **apply** Basic aspects of Rocket Propulsion and **understand** Rocket Staging and Impact of Drag on Staging. Classification of IC engines, **understand** operation of Piston Engines, its construction and Performance parameters		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week	Topic	CT
Week-I	**Introduction to Course**	CT-1
Class-1	Classification of Air Breathing and Non-Air Breathing Engines	
Class-2	Compare Air Breathing and Non-Air Breathing Engines	
Class-3	Performance Characteristics of Gas Turbine Engine	
Week-2	**Thermodynamic Analysis: Gas Turbine Engine (Ideal Cycle Performance)**	
Class-4	Ideal Cycle Performance Analysis for Aircraft Propulsion: Turbojet, Turbo shaft, Turbofan engines	
Class-5	Analysis of Thermodynamic Processes: Cycle Components and Component Performance	
Class-6	Tutorial-1	
Week-3	**Thermodynamic Analysis: Gas Turbine Engine (Real Cycle Performance)**	
Class-7	Real Cycle Performance Analysis for Aircraft Propulsion: Turbojet, Turbo shaft, Turbofan engines	
Class-8	Methods of Augmenting Efficiency of Gas Turbine Engine	
Class-9	Tutorial-2	

Week-4	**Intake and Intake System**	CT-2
Class-10	Purpose of Air Intake and Types of Air Intakes	
Class-11	Aerothermodynamic Analysis of Subsonic and Supersonic Intakes	
Class-12	Performance Analysis of Air Intake	
Week-5	**Compressors**	
Class-13	Classification of Compressors, Merit & Demerit of Each type	
Class-14	Compressor operation, Performance, Construction	
Class-15	Vector Analysis of Airflow through Axial Flow Compressors and Compressor Flow Instability	
Week-6	**Combustion Chamber**	
Class-16	Introduction to combustion chamber	
Class-17	Classification of combustion chambers	
Class-18	Combustion chamber performance and Flame stabilization	
Week-7	**Turbine**	
Class-19	Turbine operation and Types of Turbines	
Class-20	Turbine Construction and Performance	
Class-21	Thrust Equation and Factors Affecting Thrust	
Week-8	**Exhaust Ducts or Propelling Nozzle**	

Class-22	Real flow in nozzles and nozzle efficiency, losses in nozzles.	CT-3
Class-23	Equilibrium flow and frozen flow in nozzles, two phase flow in nozzles	
Class-24	Ejector and variable area nozzles and Thrust Reversal	
Week-9	**Ram jet, Scram-jets, Pulse jet and Rocket**	
Class-25	Ram jet engine	
Class-26	Scram-jet engine	
Class-27	Pulsejet engine	
Week-10	**Rocket**	
Class-28	Rocket propulsion and rocket propellants	
Class-29	Liquid and solid rocket propulsion systems	
Class-30	Nozzle design and Rocket Performance	
Week-11	**Rocket (contd)** **&** **Thrust Control Method**	
Class-31	Rocket Staging and Effect of Drag on Staging	
Class-32	Methods of thrust augmentation	
Class-33	Thrust Reverser	
Week-12	**Thrust Control Method (contd)** **&**	

	Component Design, Material and Fuel	CT-4
Class-34	Aeroengine Control	
Class-35	Efficiency of components and Off-design considerations	
Class-36	Selection of materials for aero-engine	
Week-13	**Component Design, Material and Fuel** **&** **Piston Engines**	
Class-37	Aero-thermochemistry of Fuels and Propellants	
Class-38	Classification of IC Engines	
Class-39	Operating Principles of Piston Engine and Construction of	
Week-14	**Piston Engines**	
Class-40	Classification of Piston Engines	
Class-41	Thermodynamic Analysis of Cycle, Performance Factors	
Class-42	Tutorial	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
	Class Test/ Assignment	20%	CO1, CO2	C4, C2

Continuous Assessment (40%)	1-3			
			CO4	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO2, CO3	C2, C2
Final Examination (Section A & B)		60%	CO1	C4
			CO2	C2
			CO3	C2
			CO4	C3
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Mechanics and thermodynamics of propulsion - Hill and Peterson, 2nd edition; Addison; Wesley, NY, 1992.

2. Gas Turbine Theory-H Cohen, GFC Rogers, HIH Saravanamuttoo

3. Rocket propulsion elements (6th edition) - George P Sutton, Oscar Biblarz, John; Wiley, NY, 1992.

4. Aero thermodynamics of Aircraft Engine Components- Oates, G.C.; AIAA Education Series

5. Aircraft Gas Turbine Engine Technology (3rd edition) - Treager.

6. The Jet Engine - Rolls Royce Limited.

COURSE INFORMATION			
Course Code Course Title	AEAS 419 Maintenance Management and Repair of Aircraft	Lecture Contact Hours Credit hours	3.0 3.0
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn the vocabulary, practice and technologies of Aircraft Maintenance Management.			
OBJECTIVES			
1. To understand the basic function of an organization/industry and associated role of an aircraft maintenance engineer. 2. To study the concept, benefits, policies, performance indicators, methods and techniques of different maintenance programs for proactive and cost-effective approaches of aircraft maintenance. 3. To apply aircraft maintenance principles, procedures and airworthiness regulations to aircraft maintenance management. 4. To develop decision-making methodologies for components, systems and/ or processes to meet specified requirements, including innovative approaches to synthesis alternative solutions, concepts and procedures.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **define** the basic function of Aviation Industry from an Aircraft Maintenance Engineers Perspective	PO1	C1			K3	T/ ASG, F
CO2	Be able to **illustrate** concepts, policies and practices of Aircraft Maintenance Programs.	PO1	C2			K3	T/Mid Term Exam, F
CO3	Be able to **apply** aircraft maintenance principles, procedures and airworthiness regulations to aircraft maintenance management.	PO1	C3			K3	T/Mid Term Exam, F
CO4	Be able to **develop** processes and frameworks for Aircraft Maintenance Management.	PO2	C4			K3	T/ ASG, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)
COURSE CONTENTS
Maintenance management principles and techniques maintenance strategies, repair/replacement decision making, condition monitoring, maintenance management information systems; damage assessment techniques; **Types of aircraft maintenance** Maintenance requirements for various aircraft components; Aero-engine maintenance; Engine overhaul, component life, lubrication, patches and repairs, serviceability of components. **Logistics concepts** Statistics of reliability, availability, maintainability, reparability, life-cycle costing, logistic support analysis and supply support factors. **Repair of Structures** Practical issues in maintenance and repair of structures and systems, details of maintenance scheduling activities; Advanced methods of maintenance and repair; **Non Destructive Testing in Aircraft Maintenance** Application of NDI for manufacture and maintenance of structural components in aircraft industry. Different structural failure modes and analysis the causes of failure; **Aircraft accident investigation and prevention.**

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **define** the basic function of Aviation Industry from an Aircraft Maintenance Engineers Perspective	2											
CO2	Be able to **illustrate** concepts, policies and practices of Aircraft Maintenance Programs.	2											
CO2	Be able to **apply** aircraft maintenance principles, procedures and airworthiness regulations to aircraft maintenance management.	2											
CO4	Be able to **develop** processes and frameworks for Aircraft Maintenance Management.		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	42
Lecture	-
Practical / Tutorial / Studio	-
Student-Centered Learning	
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

Lecture Schedule:		
Week 1	**Introduction of an organization**	CT 1/ AGS, F
Class 1	Organization Structure	
Class 2	Role of different directorates	
Class 3	Role of different directorates	
Week 2	**Introduction to aircraft maintenance**	
Class 4	Definition of aircraft maintenance and activities.	
Class 5	Aircraft maintenance history and objective	

Class 6	Aircraft maintenance history and objective	
Week 3	**Aircraft Maintenance Strategies**	
Class 7	Maintenance Strategies, working assumption and mathematical model	
Class 8	Conditional Maintenance Models	
Class 9	Conditional Maintenance Models	
Week 4	**Maintenance Management Information Systems**	Mid Term
Class 10	Functions of Maintenance Management Information Systems	
Class 11	MMIS Structure, MMIS module (Equipment management module, work order control module)	
Class 12	MMIS module (Crafts management module, material supply and control module, performance reporting module, maintenance reporting)	
Week 5	**Aircraft Maintenance Management**	
Class 13	Primary functions of aircraft maintenance.	
Class 14	Secondary functions of aircraft maintenance	
Class 15	Local Factors of aircraft maintenance (Geographical situation, size of plant)	
Week 6	**FMEA (Failure Mode and Effect Analysis)**	
Class 16	Definition, benefits and activities of FMEA	
Class 17	Factors affecting FMEA, Tasks and Process pf FMEA	
Class 18	Evaluation criteria of FMEA with necessary examples.	
Week 7	**FADEC (Full Authority Digital Engine Control System)**	
Class 19	Definition of FADEC, Digital electronic control, design requirement of	
Class 20	Requirement of FADEC, Location of FADEC.	
Class 21	Operation and advantages of FADEC	
Week 8	**Health Monitoring Paradigms**	CT 2
Class 22	Taxonomy of maintenance philosophies	

Class 23	Corrective and Emergency Maintenance	
Class 24	Preventive and Predictive maintenance (Condition based and reliability- based maintenance)	
Week 9	**Patches and Repair**	
Class 25	Lap or scab Patch, Flush Patch	
Class 26	Open and closed skin area repair	
Class 27	Design of a patch of different area (pressurized, unpressurized)	
Week 10	**Patches and Repair**	
Class 28	Installation procedure of Rivets	
Class 29	Stresses applied to Rivet, Rivet spacing, Edge Distance of Rivet	
Class 30	Rivet Pitch, Traverse Pitch, and Rivet Layout Example	
Week 11	**NDT (Nondestructive Testing)**	CT 3
Class 31	Definition of NDT, Different types of NDT	
Class 32	Visual Inspection, Borescope and Liquid Penetrant Inspection	
Class 33	Eddy Current Inspection, Ultrasonic Inspection	
Week 12	**NDT (Nondestructive Testing)**	
Class 34	Acoustic Emission Inspection, Magnetic Particle Inspection	
Class 35	Radiographic Inspection, Inspection of Composites	
Class 36	Advantages and disadvantages of NDT	
Week 13	**Aircraft Accident Investigation**	
Class 37	Aspects of the Investigation, Group Investigation, Onsite Investigation	
Class 38	Precautionary measures for Investigation, Initial survey of site	
Class 39	Evidence collection, Photographs, Wreckage Distribution, Examination of Aircraft Structure, Power plant, Systems and Maintenance Investigation	
Week 14	**Life Cycle Costing**	
Class 40	Definition, Objective of Maintenance and Maintenance Cost	
Class 41	Maintenance Efficiency, Availability Performance and Productivity	
Class 42	Procedures for reducing maintenance failures	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO3	C1, C3
			CO 4	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO 2, CO3	C2, C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C3
			CO4	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Aircraft Production Technology and Management - S C Keshu and KK Ganapathi; Interline Publishing.

2. Aircraft Maintenance and Repair – kroes; Watkins Delp, McGraw Hill.
3. Aircraft Construction, Repair and Inspection - JOE Christy; Sterling Book House.

COURSE INFORMATION			
Course Code Course Title	AEAS 421 Aviation Safety	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn about aviation safety procedures and necessary arrangements.

OBJECTIVES

1. To gain knowledge about various types of safety management programs;
2. To understand the human factors in aviation;
3. To learn about risk management and emergency planning;
4. To gain knowledge about accident prevention strategies;
5. To analyze aircraft incidents and accidents in flight for human error.

COURSE OUTCOMES & GENERIC SKILLS

NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **explain** safety management programs	PO1	C2			K3	T, F
CO2	Be able to **plan** for risk management and emergency situation.	PO1	C3			K3	T, F

CO3	Be able to **analyze** aircraft incidents and accidents in flight for human error.	PO2	C4			K3	T, F, ASG
CO4	Be able to **recommend** proactive safety systems for significant real-life aviation industry	PO6	C5			K7	T/ASG, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project , Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Safety in aviation including aircrew, aircraft, maintenance, management operations and airspace with an emphasis on human performance; Safety management programs.

Human factors in aviation, relationship between the safety and efficiency of an aviation system and the people, tasks, environment and technology - human behavior, information processing, time management and situational awareness; Judgment, decision making, the senses, human error, automation, risk management, and emergency planning.

Role of proactive safety systems – crew resource management, safety culture, operational reporting systems, safety audits, attitudinal and behavioral assessment and other metrics. Illustrate safety concepts, accident prevention strategies, safety culture and safety program evaluation methodology; Practical analysis of aircraft incidents and accidents in flight safety.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **explain** safety management programs	3											
CO2	Be able to **plan** for risk management and emergency situation.	2											
CO3	Be able to **analyze** aircraft incidents and accidents in flight for human error.		3										
CO4	Be able to **recommend** proactive safety systems for significant real-life aviation industry						2						

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week 1	**Safety in aviation**	**CT**
Class-1	Safety in aviation including aircrew, aircraft	CT-1
Class-2	Safety in aviation including maintenance	
Class 3	Safety in aviation including management operations and airspace	
Week 2	**Human performance**	
Class-4	emphasis on human performance	
Class-5	Safety issues	
Class-6	Safety management programs	
Week-3	**Human factors in aviation**	
Class-7	Human factors in aviation	
Class-8	Relationship between the safety and efficiency of an aviation system	
Class-9	relationship between the safety and efficiency of the people	
Week-4		
Class-10	environment and technology - human behavior	

	Class-11	Continue	Mid exam
	Class-12	Information processing	
	Week 5	**STIMULI**	
	Class 13	time management and situational awareness	
	Class 14	Human limitations	
	Class 15	Human senses	
	Week 6	**Decision Making**	
	Class 16	Judgment	
	Class 17	Decision making	
	Class 18	Continue	
	Week-7		CT-2
	Class-19	Human error	
	Class-20	Continue	
	Class-21	Error due to the senses	
	Week 8	**Risk management**	
	Class 22	automation	
	Class 23	classification of risk	
	Class 24	risk management	
	Week 9	**Emergency planning**	CT-3
	Class 25	Introduction	
	Class 26	classification of emergency situation	
	Class 27	Emergency planning	
	Week 10	**Role of proactive safety systems**	

	Class 28	Details about Protective safety system		
	Class 29	crew resource management		
	Class 30	safety culture		
	Week 11	**Role of proactive safety systems**		
	Class 31	operational reporting systems		
	Class 32	safety audits		
	Class 33	Attitudinal and behavioral assessment and other metrics.		
	Week 12	**Safety concepts**		
	Class 34	Safety concepts		
	Class 35	Continue		
	Class 36	Analogy of safety concept.		
	Week 13	**Accident prevention strategies**		
	Class 37	Case study of different accidents		
	Class 38	TCAS system		
	Class 39	safety culture and safety program evaluation methodology		
	Week 14	**Practical analysis**		
	Class 40	Practical analysis of aircraft incidents and accidents in flight safety.		
	Class 41	Continue		
	Class 42	Review		

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C2, C3
			CO2	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO2, CO3	C3, C4
Final Examination (Section A & B)		60%	CO1	C2
			CO2	C3
			CO3	C4
			CO4	C5
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Hand notes provided - the teacher / instructor.
2. Flight safety Journal/ manuals from BAF.

COURSE INFORMATION			
Course Code Course Title	AEAS 423 Aerospace Management	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn about how the aviation sector and related areas are coordinated and organized.			
OBJECTIVES			
1. To learn the basic knowledge about the airline management incorporating flight mechanics and aircraft handling. 2. To analyze the various human factors involving the aircraft flight operations. 3. To ensure the flight safety by actively considering the effect of contemporary flight regulations. 4. To analyze the associated risk and reliability in relation to airworthiness standards. 5. To incorporate emergency procedure management and risk management, accident investigation and dispatch reliability management			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **understand** the fundamental technical aspects of flight mechanics and safety management for aviation	PO1	C2			K3	T, F
CO2	Be able to **explain** flight separation for military and civil aircrafts	PO1	C2			K3	T, F
CO3	Be able to **plan** for technical crew, scheduling as well as military and civil operations	PO2	C3			K4	T, F, ASG
CO4	Be able to **recommend** proactive safety systems for significant real-life aviation industry	PO6	C5			K7	T/ASG, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Introduction to aerospace management; Principles and practice of aviation, air traffic services and airline management incorporating flight mechanics and aircraft handling; Analysis of airline operations; Basic human factors and systematic safety issues involving aircraft accident case; Classification and use of civil and military airspace; Aspects of flight separation, aircraft performance and basic meteorology.

Civil aviation activities include engineering and maintenance, technical crew planning and scheduling; Airport and airfield planning for military and civil operations, operations control issues; Aviation regulations and safety; Flight safety and airworthiness standards; Risk and reliability management; Certification procedures and standards; Emergency procedure management and risk management, accident investigation and dispatch reliability management.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **understand** the fundamental technical aspects of flight mechanics and safety management for aviation	3											
CO2	Be able to **explain** flight separation for military and civil aircrafts	3											
CO3	Be able to **plan** for technical crew, scheduling as well as military and civil operations		3										
CO4	Be able to **recommend** proactive safety systems for significant real-life aviation industry						2						

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week 1	**Introduction to aerospace management**	CT-1
Class 1	Aerospace management	
Class 2	Principles and practice of aviation	
Class 3	Air traffic services	
Week 2	**Airline management**	
Class 4	Airline management incorporating flight mechanics	
Class 5	Continue	
Class 6	Airline management incorporating aircraft handling	
Week 3	**Human factors in aviation**	
Class 7	Human factors in aviation	Mid Exam
Class 8	Relationship between the safety and efficiency of an aviation system	
Class 9	Relationship between the safety and efficiency of the people	
Week 4	**Airline operations**	
Class 10	Airline operations	
Class 11	Continue	
Class 12	Basic human factors and systematic safety issues involving aircraft accident case	
Week 5	**Flight separation**	
Class 13	Classification and use of civil and military airspace	
Class 14	Aspects of flight separation	
Class 15	Continue	

Week 6	**Aircraft performance**	
Class 16	Aircraft performance regarding flight mechanics	
Class 17	Continue	
Class 18	Continue	
Week 7	**Basic meteorology**	
Class 19	Weather condition	
Class 20	Different meteorology	
Class 21	Continue	
Week 8	**Civil aviation activities**	
Class 22	Civil aviation activities	
Class 23	Civil aviation activities including engineering	
Class 24	Risk management	CT-2
Week 9	**Civil aviation maintenance**	
Class 25	Introduction	
Class 26	Maintenance of aircraft components	
Class 27	Emergency planning	
Week 10	**Technical crew planning**	
Class 28	Technical crew planning and scheduling	
Class 29	Crew resource management	
Class 30	Safety culture	
Week 11	**Airport and airfield planning for military and civil operations**	

Class 31	Airport planning for military operations	CT-3
Class 32	Airfield planning for military operations	
Class 33	Airport planning for civil operations	
Week 12	**Airport and airfield planning for military and civil operations**	
Class 34	Airfield planning for civil operations	
Class 35	Continue	
Class 36	Operations control issues	
Week 13	**Aviation regulations and safety**	
Class 37	Aviation regulations and safety	
Class 38	Flight safety and airworthiness standards	
Class 39	Risk and reliability management	
Week 14	**Management**	
Class 40	Emergency procedure management and risk management,	
Class 41	Accident investigation and dispatch reliability management.	
Class 42	Review	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C2, C2
			CO2	C2
	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO2, CO3	C2, C3
Final Examination (Section A & B)		60%	CO 1	C2
			CO 2	C2
			CO 3	C3
			CO4	C5
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Hand notes provided - the teacher / instructor.
2. Flight safety Journal/ manuals from BAF.

COURSE INFORMATION			
Course Code Course Title	AEAS 443 Pressurization and Air Conditioning Systems	Lecture Contact Hours Credit hours	3.0 3.0
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn about the pressurization and air conditioning system in an aircraft.			
OBJECTIVES			
1. To learn the fundamental principles of pressurization and air conditioning. 2. To understand basic pressurization and air conditioning systems and their equipment. 3. To familiarize with Aerospace applications of pressurization and air conditioning systems. 4. To understand load calculations and perform basic design of pressurization and air conditioning systems.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **define** the working principles of pressurization and air conditioning.	PO1	C1			K3	T/ ASG, F
CO2	Be able to **explain** the components of pressurization and air conditioning systems.	PO2	C2			K3	T/Mid Term Exam, F
CO3	Be able to **solve** the critical problems of pressurization and air conditioning systems.	PO2	C3	P1, P2		K4	T/Mid Term Exam, F
CO4	Be able to **analyze** the critical components of pressurization and air conditioning systems.	PO2	C4			K4	T/ ASG, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

a) **Main Contents:** Pressurization and air conditioning system
b) **Detail Contents:**

Pressurization

Concept of pressurization and its applications in the cockpit; Study of pressurization system and different components related to cockpit pressurization.

Refrigeration

Concept of refrigeration and its applications; Different refrigeration methods; Analysis of vapor compression refrigeration, absorption refrigeration and air-cycle refrigeration systems; Refrigerants; Refrigeration equipment: compressors, condensers, evaporators, expansion devices, other control and safety devices; Multi-evaporator, multi-compressor systems; Low temperature refrigeration.

Air conditioning

Concept of air conditioning and its uses; Cooling load calculation; Psychometric analysis; Air conditioning systems; Air distribution systems; Duct design methods; Air conditioning equipment; Application criteria; Control systems.

Fire Hazard

Fire hazard and firefighting equipment.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **define** the working principles of pressurization and air conditioning.	2											
CO2	Be able to **explain** the components of pressurization and air conditioning systems.		3										

	CO3	Be able to **solve** the critical problems of pressurization and air conditioning systems.		3										
	CO4	Be able to **analyze** the critical components of pressurization and air conditioning systems.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	42
Lecture	-
Practical / Tutorial / Studio	-
Student-Centered Learning	
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	2
Continuous Assessment	3
Final Examination	
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week-1	**Topic**	**CT**
Class-1	Concept of pressurization	CT 1
Class-2	Pressurization applications in the cockpit	
Class-3	Pressurization applications in the cabin	
Week-2	**Study of pressurization system**	
Class-4	Study of pressurization system	
Class-5	Different components	
Class-6	Cockpit pressurization	
Week-3	**Refrigeration**	Mid Exam
Class-7	Concept of refrigeration and its applications	
Class-8	Different refrigeration methods	
Class-9	Continue	
Week-4	**Vapor compression refrigeration**	
Class-10	Analysis of vapor compression refrigeration	
Class-11	Continue	
Class-12	Absorption refrigeration and air-cycle refrigeration systems	
Week-5	**Refrigerants**	
Class-13	Classification and use of Refrigerants	
Class-14	Refrigeration equipment	

	Class-15	Continue	
	Week-6	**Refrigeration equipment**	
	Class-16	Compressors	
	Class-17	Condensers	
	Class-18	Evaporators	
	Week-7	**Refrigeration equipment**	CT 2
	Class-19	Expansion devices	
	Class-20	Other control and safety devices	
	Class-21	Continue	
	Week-8	**Refrigeration equipment**	
	Class-22	Multi-evaporator	
	Class-23	Multi-compressor systems	
	Class-24	Low temperature refrigeration	
	Week-9	**Air conditioning**	CT 3
	Class-25	Introduction	
	Class-26	Concept of air conditioning and its uses	
	Class-27	Continue	
	Week-10	**Cooling load calculation**	
	Class-28	Mathematical problem	

Class-29	Cooling load calculation of different air conditioning cycle	
Class-30	Continue	
Week 11	**Psychometric analysis**	
Class-31	Psychometric analysis	
Class-32	Psychometric chart interpolation	
Class-33	Mathematical problem related Psychometric analysis	
Week 12	**Air conditioning systems**	
Class-34	Air conditioning systems	
Class-35	Continue	
Class-36	Air distribution	
Week 13	**Air distribution systems**	
Class-37	Duct design methods	
Class-38	Air conditioning equipment	
Class-39	Application criteria	
Week 14	**Fire hazard Management**	
Class-40	Fire hazard and firefighting equipment	
Class-41	Continue.	
Class-42	Review	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment	Class Test/ Assignment 1-3	20%	CO1, CO3	C1, C3
			CO 4	C4

(40%)	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO 2, CO3	C2, C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C3
			CO 4	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. 1.Modern Refrigeration and Air-conditioning – A D. Althause, C. H. Turnquist, A.F. Bracciano; The Goodheant Wilcox Company, Inc. 1982.

2. Heating cooling of Building, Design for Efficiency – J. F. Kreidev, A. Raldl; McGraw-Hill International Edition, 1994.

COURSE INFORMATION			
Course Code Course Title	AEAS 427 Noise Control and Vibration	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn about aviation safety procedures and necessary arrangements.			
OBJECTIVES			
1. To gain knowledge about sound transmission, its level and effect on human health. **2.** To understand the mathematical perspective of sound/vibration propagation. **3.** To evaluate various properties in relation to controlling noise. **4.** To understand about how vibration from vibrating machinery affects the surrounding environment.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **understand** the mathematical perspective of sound/vibration propagation	PO1	C2			K3	T, F
CO2	Be able to **evaluate** various properties in relation to controlling noise.	PO2	C5			K3	T, F
CO3	Be able to **list** different preventive measures to cancel out harmful vibrations in aircraft and helicopters.	PO1	C1			K4	T/ASG, F
CO4	Be able to **assess** the effects of vibrating machinery to surrounding environment.	PO2	C5			K4	T, F, ASG
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Sound waves; Sound sources; Sound transmission through walls and structures; sound pressure level; psychological response to sound; threshold of hearing and threshold of pain, maximum permissible levels of sound exposure; Sound transmission inside the aircraft; Mechanism of sound absorption; Sound control inside the aircraft.

Physical acoustics: The wave equation, solution of the wave equation, comparison with vibration having finite degrees of freedom; Acoustics of large and small rooms; Mechanism of sound absorption; Design of silencers.

Noise attenuation and control; Statistical properties of noise; response of systems to noise, correlation functions and transfer; Frequency response functions.

Vibration isolation, machine foundation design; Generation of vibration in machines, acceptable levels and methods of control; Vibration absorption; Random vibration; Beam and plate vibrations; Radiation of sound from vibrating machinery

Importance of vibration in aircraft and helicopters; Vibration identification and preventive measures in aircraft and helicopters

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Understand** the mathematical perspective of sound/vibration propagation	3											
CO2	**Evaluate** various properties in relation to controlling noise.		2										
CO3	**List** different preventive measures to cancel out harmful vibrations in aircraft and helicopters.	3											
CO4	**Assess** the effects of vibrating machinery to surrounding environment.		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week 1	**Sound waves**	
Class 1	Sound sources	
Class 2	Sound transmission through walls and structure	
Class 3	sound pressure level	
Week 2	**psychological response to sound**	
Class 4	threshold of hearing	
Class 5	threshold of pain	
Class 6	maximum permissible levels of sound exposure	CT 1
Week 3	**Sound transmission inside the aircraft**	
Class 7	Mechanism of sound absorption	
Class 8	Sound control inside the aircraft	
Class 9	Continue	
Week 4	**Physical acoustics**	
Class 10	The wave equation	
Class 11	solution of the wave equation	
Class 12	Continue	
Week 5	**Vibration and degrees of freedom**	
Class 13	comparison with vibration having finite degrees of freedom	Mid

		Exam
Class 14	Acoustics of large and small rooms	
Class 15	Continue	
Week 6	Sound absorption	
Class 16	Mechanism of sound absorption	
Class 17	Design of silencers	
Class 18	Continue	
Week 7	**Noise**	
Class 19	Noise attenuation and control	
Class 20	Statistical properties of noise	
Class 21	Continue	
Week 8	**Systems to noise**	
Class 22	response of systems to noise	CT 2
Class 23	Continue	
Class 24	correlation functions and transfer	
Week 9	**Frequency response**	
Class 25	Frequency response functions.	
Class 26	Continue	
Class 27	Continue	
Week 10	**Vibration isolation**	

Class 28	Introduction to vibration isolation	CT 3
Class 29	machine foundation design	
Class 30	Generation of vibration in machines	
Week 11	**Vibration levels and methods of control**	
Class 31	acceptable levels and methods of control	
Class 32	Vibration absorption	
Class 33	Random vibration control	
Week 12	**Vibrations on Bodies**	
Class 34	Beam and plate vibrations	
Class 35	Radiation of sound from vibrating machinery.	
Class 36	Continue	
Week 13	**Vibration in aircraft and helicopters**	
Class 37	Importance of vibration in helicopters	
Class 38	Importance of vibration in aircraft	
Class 39	Continue	
Week 14	**Vibration identification and prevention**	
Class 40	Vibration identification systems	
Class 41	Preventive measures in aircraft and helicopters.	
Class 42	Review of whole Syllabus	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C2, C5
			CO2	C5
	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO2, CO3	C5, C1
Final Examination (Section A & B)		60%	CO1	C2
			CO2	C5
			CO3	C1
			CO4	C5
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Fundamentals of Noise and Vibration – F. J. Fahy, J. G. Walker; Spon Press; 1998.
2. Active control of Noise and Vibration – Colin Snyder Hansen – C. H. Hansen, Scott Snyder; Spon Press, 1st edition, 1996.
3. Mechanical Vibrations (3rd edition) - Singiresu S Rao; Addison-Wesley, Massachusetts, 1995

COURSE INFORMATION			
Course Code Course Title	AEAS 429 Rotorcraft Performance	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
Thermodynamics Aerospace Propulsion			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn the various factors in designing the different components of the aircraft.			
OBJECTIVES			
1. To Gain knowledge about various types rotorcraft flight conditions. 2. To Understand the performance of rotors and engines in the presence of a helicopter fuselage and other rotors 3. To Evaluate various control settings and actuator forces for trim in hover, forward and climbing flight. 4. To Gain knowledge about various types of flight tests in relation to rotorcrafts.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **understand** various types of rotorcraft flight conditions.	PO1	C2			K3	T, F
CO2	Be able to **understand** the performance of rotors and engines in the presence of a helicopter fuselage and other rotors.	PO1	C2			K3	T, F
CO3	Be able to **evaluate** various control settings and actuator forces for trim in hover, forward and climbing flight.	PO2	C5			K3	T, F, ASG
CO4	Be able to **analyze** various types of flight tests in relation to rotorcrafts and know about design components of rotorcrafts considering fail safe and safe life concepts.	PO1	C4			K7	T/ASG, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Examine the performance of rotorcraft in hover, forward and climbing flight; Methods for estimating the performance of rotors and engines in the presence of a helicopter fuselage and other rotors; Calculate the control settings and actuator forces for trim in hover, forward and climbing flight at various centre of gravity locations for a real helicopter.

Helicopter dynamics and proceeds to derive stability augmentation and flight control system design; Rotorcraft flight test engineering including the use of dimensional analysis; Design

regulations and considerations relating to rotor induced vibration, ground resonance and fatigue; Emphasis on design for crash worthiness; Fail safe and safe life concepts.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **understand** various types of rotorcraft flight conditions. .	2											
CO2	Be able to **understand** the performance of rotors and engines in the presence of a helicopter fuselage and other rotors.	2											
CO3	Be able to **evaluate** various control settings and actuator forces for trim in hover, forward and climbing flight.		3										
CO4	Be able to **analyze** various types of flight tests in relation to rotorcrafts and know about design components of rotorcrafts considering fail safe and safe life concepts.	2											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE		
Week 1	**Performance of rotorcraft in hover**	CT 1
Class 1	Examine the performance of rotorcraft in hover	
Class 2	Continue	
Class 3	Continue	
Week 2	**Forward and climbing flight**	
Class 4	Forward flight	
Class 5	Climbing flight	
Class 6	Continue	
Week 3	**Methods for estimating the performance of rotors in the presence of a helicopter fuselage and other rotors**	
Class 7	Methods for estimating the performance of rotors in the presence of a helicopter fuselage	
Class 8	Continue	
Class 9	Methods for estimating the performance of rotors in the presence of other rotors	
Week 4	**Methods for estimating the performance of engines in the presence of a helicopter fuselage and other rotors**	
Class 10	Methods for estimating the performance of engines in the presence of a helicopter fuselage	
Class 11	Continue	
Class 12	Methods for estimating the performance of engines in the presence other rotors	

Week 5	**Control settings and actuator forces for trim in hover**	Mid term
Class 13	Calculate the control settings and actuator forces for trim in hover	
Class 14	Continue	
Class 15	Continue	
Week 6	**Control settings and actuator forces for trim inforward flight**	
Class 16	Calculate the control settings and actuator forces for trim in forward flight	
Class 17	Continue	
Class 18	Continue	
Week 7	**Control settings and actuator forces for trim in climbing flight**	CT 2
Class 19	Calculate the Control settings and actuator forces for trim in climbing flight	
Class 20	Continue	
Class 21	Continue	
Week 8	**Helicopter dynamics**	
Class 22	Introduction to Helicopter dynamics	
Class 23	Continue	
Class 24	Continue	
Week 9	**Stability augmentation and flight control system design**	
Class 25	Derivation of stability augmentation and flight control system design	

Class 26	Continue	
Class 27	Continue	
Week 10	**Rotorcraft flight test**	
Class 28	Rotorcraft flight test engineering	
Class 29	Continue	
Class 30	Use of dimensional analysis	CT 3
Week 11	**Design regulations and considerations relating to rotor induced vibration**	
Class 31	Introduction	
Class 32	Design regulations and considerations	
Class 33	Continue	
Week 12	**Design regulations and considerations relating to ground resonance**	
Class 34	Introduction	
Class 35	Design regulations and considerations	
Class 36	Continue	
Week 13	**Design regulations and considerations relating to rotor induced fatigue**	
Class 37	Introduction	
Class 38	Design regulations and considerations	
Class 39	Continue	
Week 14	**Emphasis on design for crash worthiness**	
Class 40	Emphasis on design for crash worthiness	
Class 41	Continue	
Class 42	Fail safe and safe life concepts	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C2
			CO 4	C2,C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO 3, CO4	C4,C5
Final Examination (Section A & B)		60%	CO 1	C 2
			CO 2	C 2
			CO 3	C 5
			CO 4	C 4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Rotary Wing aerodynamics - W.Z. Stepniewski and C.N. Keys; Dover Publications.
2. Theory of Flight (AP 3456A) - Royal Air Force Manual.
3. Helicopter Flight Dynamics - Gareth D. Padfield.

COURSE INFORMATION			
Course Code	AEAS 431	Lecture Contact Hours	3.00
Course Title	Weapon Engineering	Credit hours	3.00

PRE-REQUISITE

AEAS 103 (Fundamentals of Aeronautical Engineering), AEAV 203 (Electronics-I),

AEAS 337 (Aerospace Propulsion)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course is an Elective course but mandatory for the military student officers. This course is offered to impart knowledge on Properties, performance of explosives & explosive train used in weapon system, Warhead technologies, features of Fuses/Safety/arming devices, Theory of propulsion, Principles of missile flight & guidance, Precision guided munitions etc.

OBJECTIVES

1. To understand properties, performance, features of explosives used in weapon system.

2. To understand and analyze anatomy of high explosive & warhead technology

3. To understand working principle of arming devices and analyze theory of propulsion applicable in weapon engineering.

4. To analyze missile flight dynamics and missile guidance techniques.

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **understand** development, properties, performance, features of explosives used in weapon system.	PO1	C2			K3	T, ASG, F
CO2	Be able to **understand** and **analyze** anatomy of high explosive, Warhead technology, structural design & modeling of warhead & its classification to be applied in weapon engineering.	PO2	C2, C4			K3	Mid Term Exam, T, F
CO3	Be able to **understand** Mechanical/ Electrical fuses used in land service, aerial weapons; also to **analyze** theory of propulsion applicable in weapon engineering.	PO1	C2, C4			K4	Mid Term Exam, T, F
CO4	Be able to **analyze** aerodynamics of slender bodies, wings, principles of missile flight, missile guidance phases/ techniques,	PO2	C4			K4	ASG, T, F

	Electronic warfare techniques.						

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project

Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Properties & Performance of explosives: Heat & temperature of explosion, oxygen balance, Pressure of explosion, Power Index, brisance, related tests, detonation velocity, Explosive train.

Features of explosives : Compatibility, stability and their measuring tests, Sensitivity and sensitiveness of explosives.

Classification of Explosives : Initiator, Booster, Main filling, compound explosives, UN Hazard division and hazard classification.

Safe Storage of Explosives : Concept of Quantity distances, Traverses in explosive storage area.

Warhead technology : Anatomy of high explosive blast, warhead geometry, structural design & modeling.

Classification of warheads : Blast warhead, Shaped charged warhead, Kinetic Energy Rod and fragmentation warheads.

Fuzes, Safety/arming devices : Impact, Delay, Air burst, Proximity, Hydrostatic Fuses, Construction and working of different Fuses.

Theory of propulsion : Specific impulse, Classification of propellants, Gun/Rocket propellants, Solid, Liquid and hybrid propellants, Cryogenic propellants, Additives used in propellant.

Principles of missile flight & guidance : Components of a guided missile, Types of guided missile, Missile guidance phases, techniques. Homing guidance, Command guidance, Inertial Guidance, Terrain Correlation Matching (TERCOM), INS aided with GPS guidance technique.

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	Be able to **understand** development, properties, performance, features of explosives used in weapon system.	3											
CO2	Be able to **understand** and **analyze** anatomy of high explosive, Warhead technology, structural design & modeling along with its classification to be applied in weapon engineering.		3										
CO3	Be able to **understand** Mechanical/ Electrical fuzes used in land service, aerial weapons; also to **analyze** theory of propulsion applicable in weapon engineering.	2											
CO4	Be able to **analyze** aerodynamics of slender bodies, wings, principles of missile flight, missile guidance phases/techniques, Precision Guided Munitions, Electronic warfare techniques.		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	42
Lecture	-
Practical / Tutorial / Studio	-
Student-Centered Learning	
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	2
Continuous Assessment	3
Final Examination	
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

WEEK-1	**TOPIC**	**CT/MID**
Class 1	History & development of military explosives, Chemistry of explosives, nature of explosions.	
Class 2	Factors affecting explosion process, related definitions, application of explosives (military & industrial engineering).	
Class 3	Properties of explosives, Classification of explosives used in weapon system.	
WEEK-2		
Class 4	Performance of explosives, heat & temperature of explosion, oxygen	

	balance, Pressure of explosion.	CT-1
Class 5	Power Index, brisance, related tests, rate of burning, detonation velocity & pressure.	
Class 6	Explosion process, Explosive train.	
WEEK-3		
Class 7	Features of explosives – compatibility, stability and their measuring tests.	
Class 8	Sensitivity and sensitiveness of explosives, factors affecting sensitivity of explosives.	
Class 9	Video demonstration on explosive science, generation of shock wave etc.	
WEEK-4		MID Term
Class 10	Initiator, Booster explosives; properties, relative comparison & examples.	
Class 11	Bursting, mixed, plastic explosives; properties, relative comparison & examples.	
Class 12	UN International classification of dangerous goods, Hazard division and hazard classification.	
WEEK-5		
Class 13	UN International Explosive Storage Compatibility groups and compatibility of explosives	
Class 14	Concept of Quantity distances for safe storage and operation,	
Class 15	Traverses in explosive storage area for safe storage of explosives; Types of traverses.	
WEEK-6		
Class 16	Warhead technology, anatomy of high explosive blast.	
Class 17	Weapon shape considerations; warhead geometry.	
Class 18	Blast analysis, structural design & modeling.	
WEEK-7		

Class 19	Classification of warheads, Blast warhead	
Class 20	Shaped charged warhead, Monroe Effect, Hollow charge principles.	
Class 21	Kinetic Energy Rod and fragmentation warheads.	
WEEK-8		CT-2
Class 22	Fuzes, initiators, safety/arming devices used in weapon engineering.	
Class 23	Impact, Delay, Air burst, Proximity, Hydrostatic Fuzes.	
Class 24	Construction and working of Pistol with single safety.	
WEEK-9		
Class 25	Construction and working of typical Fuze with more than one safety.	
Class 26	Construction and working of M-6 Mechanical nose fuze used in Mortar weapon.	
Class 27	Construction and working of Fuze AMV-AE-2 Mechanical impact Fuze with electrical initiating device used in Aircraft bomb.	
WEEK-10		
Class 28	Theory of propulsion, Specific impulse, Parts & Types of propulsion system.	
Class 29	Classification of propellants, Gun/Rocket propellants, Solid, Homogeneous, Heterogeneous propellants	
Class 30	Liquid and hybrid propellants, Cryogenic propellants.	
WEEK-11		
Class 31	Additives added in the solid propellants, Stabilisers, Plasticisers, Moderants, lubricants etc.	
Class 32	Aerodynamics and dynamics of slender bodies and wings; Construction & functioning of typical rocket, Spin and fin stabilization.	
Class 33	Principles of missile flight & guidance; Components of a guided missile,	
WEEK-12		

Class 34	Types of guided missile on the basis of Target, launching method, guidance, trajectory, aerodynamics etc.	CT-3
Class 35	Missile guidance phases, Command guidance techniques.	
Class 36	Missile guidance-Homing guidance techniques; Active Homing Guidance system.	
WEEK-13		
Class 37	Semi-active Homing Guidance, Passive Homing Guidance system.	
Class 38	Inertial Guidance techniques, Inertial Navigation System (INS), Advantages, disadvantages.	
Class 39	Advanced guidance and sensor systems, Terrain Correlation Matching (TERCOM) technique, INS aided with GPS technique.	
WEEK-14		
Class 40	Precision Guided Munitions (PGM), Electro-Optical/TV Guided system, Laser guided system etc.	
Class 41	Basics of Electronic warfare techniques.	
Class 42	Revisions of the course contents.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1	C2
			CO3	C2, C4
			CO4	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO2	C2, C4
Final Examination (Section A & B)		60%	CO 1	C2

		CO 2	C2, C4
		CO3	C2, C4
		CO4	C4
Total Marks	100%		

TEXT AND REFERENCE BOOKS:

1. Brassey's Series Book on Explosives, Propellants and Pyrotechnics–A Bailey, S.G. Murray
2. Explosive Engineering–P. W Cooper.
3. Conventional Warhead Systems Physics and Engineering Design – R. M. Lloyd
4. Guided missiles – T.V. Karthikeyan and A.K. Kapoor
5. Missile Guidance and Control systems–George M Siouris.
6. Recommendations on Transport of Dangerous Goods – United Nations Orange Book

COURSE INFORMATION			
Course Code Course Title	AEAS 435 Aircraft Structural Design	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE

Aerospace Vehicle Stability and Control

Mechanics of Structure, Structural Vibrations and Aero Elasticity

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn the various factors in designing the different components of the aircraft.

OBJECTIVES

1.To learn what an engineer should consider as a responsibility during the design phase of an aircraft.

2.To be able to explain the contemporary requirements and trends for designing various components of an aircraft.

3.To be able to evaluate the different types of loads acting on the aircraft and their possible effect in its structural integrity.

4.To evaluate the advantages and disadvantages of basic contemporary configurations of different aircraft components.

5.To be able to ensure the safety of designed components based on structural integrity.

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **understand** an engineer's responsibility in relation to designing various components of an aircraft.	PO1	C2			K3	T, F
CO2	Be able to **understand** the basic contemporary factors for designing various components of an aircraft.	PO1	C2			K3	T, F
CO3	Be able to **evaluate** various types of loads acting on the aircraft.	PO2	C5	P1, P2		K3	T, F, ASG
CO4	Be able to **analyze** about various contemporary configurations of different aircraft components.	PO2	C4			K4	T/ASG, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project

Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS
Introduction to Aircraft Structural Design; Design for Manufacturing: Engineer's Responsibility, Producibility, Maintainability, Tooling, Other Considerations Aircraft Loads: Review of Aero-elasticity, Flight Maneuvers, Wing Design Loads, Empennage Loads, Fuselage Loads, Propulsion Loads, Landing Gear Loads, Miscellaneous Loads, and Example of an Airplane Load Calculation Buckling and Stability of Structures: Columns and Beam Columns, Crippling Stress, Buckling of Thin Sheets, Thin Skin-Stringer Panel – Compression, Skin-Stringer Panel – General, Integrally Stiffened Panel, Wing Design: Wing Box Structure, Wing Box Design, Wing Covers, Spars, Ribs and Bulkheads, Wing Root Joints, Variable Swept Wings, Wing Fuel Tank Design, Wing Leading and Trailing Edges, Wing Control Surfaces, Fixed Leading and Trailing Edges, Design Considerations Empennage Design: Horizontal Stabilizer, Vertical Stabilizer (Fin), Elevator and Rudder Fuselage Design: Introduction, Fuselage Configuration, Fuselage Detail Design, Forward Fuselage, Wing and Fuselage Intersection, Stabilizer and Aft Fuselage Intersection, Fuselage Opening Landing Gear: Introduction, Development and Arrangements, Stowage and Retraction, Selection of Shock Absorbers, Wheels and Brakes Engine Mounts: Propeller-Driven Engine Mounts, Inlet of Jet Engine (Fighter), Wing-Pod (Pylon) Mounts, Rear Fuselage Mount and Tail Mount, Fuselage Mount (for Fighters)

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to understand an engineer's responsibility in relation to designing various components of an aircraft.	3											
CO2	Be able to understand the basic contemporary factors for designing various components of an aircraft.	2											
CO3	Be able to evaluate various types of loads acting on the aircraft.		3										
CO4	Be able to analyze about various contemporary configurations of different aircraft components.		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2 3

Final Examination	
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE		
Week 1	**Introduction to Aircraft Structural Design**	CT 1
Class 1	Design for Manufacturing	
Class 2	Engineer's Responsibility,	
Class 3	Producibility, Maintainability, Tooling, Other Considerations	
Week 2	**Aircraft Loads**	
Class 4	Review of Aero-elasticity	
Class 5	Flight Maneuvers	
Class 6	Continue	
Week 3	**Aircraft Loads (Continued)**	
Class 7	Wing Design Loads, Empennage Loads	
Class 8	Continue	
Class 9	Fuselage Loads, Propulsion Loads	

Week 4	**Aircraft Loads (Continued)**	
Class 10	Landing Gear Loads, Miscellaneous Loads	
Class 11	Continue	
Class 12	Example of an Airplane Load Calculation	
Week 5	**Buckling and Stability of Structures**	
Class 13	Columns and Beam Columns	Mid term
Class 14	Crippling Stress	
Class 15	Buckling of Thin Sheets	
Week 6	**Buckling and Stability of Structures (Continued)**	
Class 16	Thin Skin-Stringer Panel – Compression	
Class 17	Continue	
Class 18	Continue	
Week 7	**Buckling and Stability of Structures (Continued)**	
Class 19	Skin-Stringer Panel – General	
Class 20	Integrally Stiffened Panel	
Class 21	Continue	
Week 8	**Wing Design**	CT2

Class 22	Wing Box Structure, Wing Box Design	
Class 23	Wing Covers, Spars, Ribs and Bulkheads	
Class 24	Wing Root Joints, Variable Swept Wings	
Week 9	**Wing Design (Continued)**	
Class 25	Wing Fuel Tank Design	
Class 26	Continue	
Class 27	Wing Leading and Trailing Edges	
Week 10	**Wing Design (Continued)**	
Class 28	Wing Control Surfaces	
Class 29	Fixed Leading and Trailing Edges	
Class 30	Design Considerations	
Week 11	**Empennage Design**	
Class 31	Horizontal Stabilizer	
Class 32	Vertical Stabilizer (Fin)	
Class 33	Elevator and Rudder	
Week 12	**Fuselage Design**	
Class 34	Introduction, Fuselage Configuration	
Class 35	Fuselage Detail Design, Forward Fuselage, Wing and Fuselage Intersection	CT 3
Class 36	Stabilizer and Aft Fuselage Intersection, Fuselage Opening	
Week 13	**Landing Gear**	
Class 37	Introduction, Development and Arrangements	
Class 38	Stowage and Retraction, Selection of Shock Absorbers	

Class 39	Wheels and Brakes	
Week 14	**Engine Mounts**	
Class 40	Propeller-Driven Engine Mounts, Inlet of Jet Engine (Fighter)	
Class 41	Wing-Pod (Pylon) Mounts, Rear Fuselage Mount and Tail Mount	
Class 42	Fuselage Mount (for Fighters)	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3 `	20%	CO1, CO2	C2
			CO 4	C2,C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO 3, CO4	C4,C5

Final Examination (Section A & B)	60%	CO 1	C 2
		CO 2	C 2
		CO 3	C 5
		CO 4	C 4
Total Marks	100%		

TEXT AND REFERENCE BOOKS:

1. Hand notes provided - the teacher / instructor.
2. Flight safety Journal/ manuals from BAF.

COURSE INFORMATION			
Course Code Course Title	AEAS 455 Human Performance and Limitations	Lecture Contact Hours Credit hours	3.0 3.0
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn about Human Performance and Limitations in order to improve Safety Standards.			
OBJECTIVES			
1. To learn about some historic aircraft accidents and associated Human Factors 2. To understand the factors affecting Human Performance. 3. Understanding how Engineers work as a Part of the technical and Social Ecosystem. 4. To identify potential risks and hazards and improve Safety Standards.			

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **define** the limitations of human performance and the associated factors	PO1	C1			K3	T/ ASG, F
CO2	Be able to **relate** human factors with errors in the workplace.	PO2	C2			K3	T/MidTerm Exam, F

CO3	Be able to **organize** work environment and scenarios to identify hazards and safety risks.	PO1	C3			K3	T/Mid Term Exam, F
CO4	Be able to **analyze** work processes for mitigation of Hazards and Improve Safety.	PO2	C4			K3	T/ ASG, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project

Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Fundamental Human Factors Concept: Understand the term human factor, the need take human factors into account, incidents attributable to human factors/human error, human factors applications in aviation operations.

Human performance and limitation: Vision, Hearing, Information and protection, memory, claustrophobia and physical access.

Social Psychology & Responsibilities: Individual and group, motivation and de-motivation, peer pressure, culture issues, team working, management, supervision and leadership.

Factors affecting performance: Fitness/health, Stress: domestic and works related, time pressure and deadline, workload, overload, sleep and fatigue, shift work, alcohol, medication, drug use, use of psychoactive, substances, restriction on exercising privileges of license/ authorization under influence psychoactive substance(reference ANO D.3)

Physical Environment, Management and Organization: Noise and fumes, illumination, climate and temperature, motion and vibration, working environment, management‘s contribution to safety, allocation of resources, safe and unsafe organization.

Takes: physical work, repetitive tasks, visual inspection, and complex systems.

Communication: Within and between teams, work logging and recording, keeping up to date currency, dissemination of information, terms and organizational issues in aircraft maintenance.

Human Error: Error models including the SHEL and Reason models, and theories, Murphy's law, human error in aircraft maintenance inspection including selected case studies, implications of error, error prevention considerations and strategies, avoiding and managing errors.

Hazards in workplace: Recognizing and avoiding hazards, dealing with emergencies.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **define** the limitations of human performance and the associated factors		1										
CO2	Be able to **relate** human factors with errors in the workplace.	2											
CO2	Be able to **organize** work environment and scenarios to identify hazards and safety risks.		1										
CO4	Be able to **analyze** work processes for mitigation of Hazards and Improve Safety.	2											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	42
Lecture	-
Practical / Tutorial / Studio	-
Student-Centered Learning	
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	2
Continuous Assessment	3
Final Examination	
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE		
Week 1	**Chapter 01-FUNDAMENTALS OF HUMAN FACTORS**	CT 1/ASG, F
Class 1	1.1 MEANING OF HUMAN FACTORS 1.2 SCOPE OF HUMAN FACTORS AND ERROR MANAGEMENT 1.3 HUMAN FACTORS MODELS	
Class 2	1.4 HUMAN FACTORS IN AVIATION 1.5 ORIGINS OF HUMAN FACTORS IN AVIATION 1.6 THE RELATIONSHIP BETWEEN HUMAN FACTORS AND ERGONOMICS.	
Class 3	1.7 THE IMPORTANCE OF HUMAN INPUT INTO AIRCRAFT	

	MAINTENANCE ACTIVITIES 1.8 THE IMPORTANCE OF AN EFFECTIVE HUMAN FACTORS PROGRAM IN A MAINTENANCE ORGANISATION. 1.9 AN INTEGRATED APPROACH TO HUMAN FACTORS AND SAFETY	
Week 2	**Chapter 1 and Chapter 2** **INCIDENTS ATTRIBUTABLE TO HUMAN FACTORS/ ERRORS**	
Class 4	1.10 THE COST EFFECTIVENESS OF IMPLEMENTING HF ROGRAMS IN ORGANISATIONS. 1.11 REGULATORY ASPECTS OF HUMAN FACTORS IN AVIATION ENGINEERING 1.12 THE IMPORTANCE OF TRAINING IN REDUCING MAINTENANCE ERRORS	
Class 5	2.0 INTRODUCTION 2.1 HUMAN FACTORS BEHIND ACCIDENTS/INCIDENTS: SOME STATISTICS	
Class 6	2.2 AN OUTLINE OF INCIDENTS/ACCIDENTS ATTRIBUTABLE TO HUMAN FACTORS / HUMAN ERRORS 2.3 APPRECIATION OF HUMAN FACTORS BEHIND ACCIDENTS AND INCIDENTS	
Week 3	**Chapter-3** **HUMAN PERFORMANCE & LIMITATIONS**	
Class 7	3.0 INTRODUCTION 3.1 HUMAN IN THE HF MODEL 3.2 HUMAN PERFORMANCE AS PART OF THE MAINTENANCE ENGINEERING SYSTEM	
Class 8	3.3 VISION 3.4 HEARING 3.3 LISTENING PROCESS	
Class 9	3.6 INFORMATION PROCESSING 3.7 CLAUSTROPHOBIA, PHYSICAL ACCESS AND FEAR OF HEIGHTS 3.8 PERFORMANCE SHAPING FACTORS	

Week 4	**Chapter 4** **SOCIAL PSYCHOLOGY**	Mid Exam, F
Class 10	4.1 INTRODUCTION 4.2 THE SOCIAL ENVIRONMENT 4.3 RESPONSIBILITY: INDIVIDUAL AND GROUP	
Class 11	4.4 MOTIVATION AND DE MOTIVATION 4.5 PEER PRESSURE	
Class 12	4.6 CULTURE ISSUES 4.7 TEAM WORKING	
Week 5	**Chapter 4 and Chapter 5** **FACTORS AFFECTING PERFORMANCE**	
Class 13	4.8 MANAGEMENT, SUPERVISION AND LEADERSHIP 4.9 MAINTENANCE RESOURCE MANAGEMENT (MRM)	
Class 14	5.0 INTRODUCTION 5.1 FITNESS AND HEALTH	
Class 15	5.2 STRESS: DOMESTIC AND WORK RELATED 5.3 TIME PRESSURE AND DEADLINES	
Week 6	**Chapter 5 and Chapter 6** **PHYSICAL ENVIRONMENT**	
Class 16	5.4 WORKLOAD-OVERLOAD AND UNDERLOAD 5.5 SLEEP, FATIGUE AND SHIFT WORK 5.6 ALCOHOL, MEDICATION AND DRUG ABUSE	
Class 17	6.0 INTRODUCTION 6.1 NOISE	
Class 18	6.2 FUMES 6.3 ILLUMINASION	
Week 7	**Chapter 6** **PHYSICAL ENVIRONMENT**	
Class 19	6.4 CLIMATES AND TEMPERATURE	
Class 20	6.5 MOTION AND VIBRATION	
Class 21	6.6 WORKING ENVIRONMENT	
Week 8	**Chapter 7** **TASKS**	CT 2/ ASG, F
Class 22	7.0 INTRODUCTION 7.1 PHYSICAL WORK	
Class 23	7.2 REPETITIVE TASKS	

	7.3 VISUAL INSPECTION	
Class 24	7.4 COMPLEX SYSTEMS	
Week 9	**Chapter 8** **COMMUNICATION**	
Class 25	8.0 INTRODUCTION 8.1 PROCESS OF COMMUNICATION	
Class 26	8.2 MODES OF COMMUNICATION	
Class 27	8.3 COMMUNICATION WITHIN AND BETWEEN TEAMS	
Week 10	**Chapter 8** **COMMUNICATION**	
Class 28	8.4 COMMUNICATION PROBLEMS	
Class 29	8.5 WORK LOGGING AND RECORDING	
Class 30	8.6 KEEPING UP-TO-DATE	
Week 11	**Chapter 8 and Chapter 9** **HUMAN ERROR**	CT 3/ ASG, F
Class 31	8.7 DISSEMINATION OF INFORMATION	
Class 32	9.0 INTRODUCTION 9.1 ERROR MODELS AND THEORIES	
Class 33	9.2 TYPES OF ERROR IN MAINTENANCE TASKS 9.4 AVOIDING AND MANAGING ERRORS	
Week 12	**Chapter 9** **HUMAN ERROR**	
Class 34	9.3 IMPLICATIONS OF ERRORS (i. e. ACCIDENTS)	
Class 35	9.4 AVOIDING AND MANAGING ERRORS	
Class 36	Continue.	
Week 13	**Chapter 10** **HAZARDS IN WORKPLACE**	
Class 37	10.0 INTRODUCTIONS 10.1 POTENTIAL HAZARDS IN AIRCRAFT MAINTENANCE ENGINEERING	
Class 38	10.2 RELEVANT LEGISLATION AND THE MAINTENANCE ORGANISATION'S RESPONSIBILITIES	

Class 39	10.3 ENGINEER'S INDIVIDUAL RESPONSIBILITIES 10.4 DEALING WITH EMERGENCIES	
Week 14	**Chapter 11** **SITUATION AWARENESS**	
Class 40	11.0 INTRODUCTION	
Class 41	11.1 SITUATION AWARENESS IN WORKPLACE	
Class 42	Review of whole Syllabus	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO3	C1, C3
			CO 4	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO 2, CO3	C2, C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2

		CO 3	C3
		CO4	C4
Total Marks	100%		

TEXT AND REFERENCE BOOKS:

1. Human Factors for Aviation Maintenance - An EASA Part 66/147 approved manual on Human Factors; Aircraft Technical Book Co.
2. Human Performance and Limitations - Trevor Thom
3. Human Performance and Limitations in Aviation – R. D. Campbell, Michael Bagshaw

COURSE INFORMATION			
Course Code Course Title	AEAS 457 Airworthiness Legislation	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn about whole aircraft licensing and certifications.			
OBJECTIVES			
1. To Know about the legislative and regulatory framework of national and international aviation authorities and the relationship between them. 2. To Understand the role of Part-66 and Part-145 guidance material and their use in complying with the airworthiness requirements and maintenance regulations of EASA. 3. To Understand aircraft operation and certification requirements and the associated documentation. 4. To Analyze the applicable National and International requirements and the EASA Part-M regulation for the continued airworthiness and maintenance of aircraft.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **define** the legislative and regulatory framework of national and international aviation authorities and the relationship between them.	PO1	C1			K3	T, F
CO2	Be able to **explain** the role of Part-66 and Part-145 guidance material and their use in complying with the airworthiness requirements and maintenance regulations of EASA	PO1	C2			K3	T, F, Mid Term Exam
CO3	Be able to **explain** aircraft operation, certification requirements and the associated documentation.	PO1	C2			K3	Mid Term Exam, F
CO4	Be able to **analyze** the applicable National and International requirements and the EASA Part-M regulation for the continued airworthiness and maintenance of aircraft.	PO2	C4			K3	T, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Aircraft Maintenance Engineers License: Civil Aviation Rules 1984 PART I, Air Navigation Orders & Sections, Responsibilities: by the need to fly aircraft in a satisfactory condition i. e. Common, civil, constitutional law, Penalties under statutory law and resulting from civil law suits, Categories - which parts of the aircraft, Area and extent of limitations and privileges within Categories, Overlap of Category applicability, Relevant Airworthiness Notices (e.g.5,11and 36) .

Certifications: Civil Aviation Rules 1984 PART VIM, Certificate of Compliance: Maintenance Release; Fitness for Fight; Duplicate inspections, Contributory certifications and reliance on.

Aircraft Log Books: Civil Aviation Rules 1984 PART Vlll, CAAB Approval: Light Aircraft, large aircraft,

Worksheets: Aircraft Maintenance Log, Data to be entered in log books, Condition reports; e.g., investigations, NDT and other inspections, Maintenance checks and inspections, Cross-reference to other files, records of other documentation and persons.

Aircraft Maintenance Log: Aircraft Maintenance Log - Air Operator's Certificate requirements.

Aircraft Maintenance: Type Certification, Weight Schedule, External and Internal Markings and Signs, National and Registration, Cabin Warning Placards, Doors and Exits. Certificate of Airworthiness Categories, Purposes of Flight, Flight Manual, Certificate of Registration, Air Operators Certificates, Radio Station License and Approval, Change of ownership, Maintenance Organization, Maintenance Schedule, General Engineering Manual, Stores Systems, Release of Parts.

Civil Aviation Rules: 1984 part VIII, Reportable Defects, Reportable Accidents,

Air Navigation Orders: Maintenance Requirements, Airworthiness Notice,

Airworthiness Directives: Bangladesh and Foreign.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **define** the legislative and regulatory framework of national and international aviation authorities and the relationship between them.	3											
CO2	Be able to **explain** the role of Part-66 and Part-145 guidance material and their use in complying with the airworthiness requirements and maintenance regulations of EASA	3											
CO3	Be able to **explain** aircraft operation, certification requirements and the associated documentation.	3											
CO4	Be able to **analyze** the applicable National and International requirements and the EASA Part-M regulation for the continued airworthiness and maintenance of aircraft.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21

Formal Assessment Continuous Assessment Final Examination	2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	
COURSE SCHEDULE	

Week	Topic	CT
Week-1	**Part A- AIRWORTHINESS CERTIFICATION**	CT-1
Class-1	Chapter-A.1, A.2, A.3, A.4	
Class-2	Chapter-A.5, A.6, A.7, A.8	
Class-3	Chapter-A.9, A.10, A.11	
Week-2	**PART B - MAINTENANCE DIRECTIONS**	
Class-4	Chapter- B.1 to B.8	
Class-5	Chapter- B.9 to B.16	
Class-6	Chapter- B.17 to B.22	
Week-3	**PART C - CERTIFICATE OF APPROVAL- ORGANISATIONS AND INDIVIDUALS**	
Class-7	Chapter- C.1, C.2, C.3	
Class-8	Chapter- C.4, C.5	

	Class-9	Chapter- C.6, C.7, C.8	
	Week-4	**PART D - LICENSING AIRCRAFT MAINTENANCE ENGINEERS CHAPTER**	
	Class-10	Chapter- D.1, D.2	
	Class-11	Chapter- D.3, D.4	
	Class-12	Chapter- D.5, D.6, D.7	Mid exam
	Week-5	**PART E - AIRCRAFT EQUIPMENT**	
	Class-13	Chapter- E.1, E.2, E.3	
	Class-14	Chapter- E.4, E.5	
	Class-15	Chapter- E.6, E.7	
	Week-6	**PART F- AIRWORTHINESS AND OPERATIONS DIRECTIONS**	
	Class-16	Chapter- E.8, E.9	
	Class-17	Chapter- E.10, E.11, E.12	
	Class-18	Chapter- F.1	
	Week-7	**PART M- Continuing Airworthiness Requirements**	
	Class-19	Chapter 1: Regulations & Acceptable Means of Compliance (Section A)	
	Class-20	Chapter 2: Procedures for Competent Authority & Acceptable Means of Compliance (Section B)	

Class-21	Chapter 3: Appendices to the Regulation	CT-2
Week-8	**PART M- Continuing Airworthiness Requirements**	
Class-22	Chapter 4: Appendices to AMCs	
Class-23	Chapter 5: Opt-Outs	
Class-24	Part 66- Chapter 1: Regulations& Acceptable Means of Compliance (Section A)	
Week-9	**PART 66- Aircraft Maintenance Licence** **PART 145- Approved Maintenance Organization**	CT-3
Class-25	Chapter 2: Procedures for Competent Authority & Acceptable Means of Compliance (Section B)	
Class-26	Part 145-Chapter 1: Regulations & Acceptable Means of Compliance (Section A)	
Class-27	Chapter 2: Procedures for Competent Authority & Acceptable Means of Compliance (Section B)	
Week-10	**PART 147- Approved Maintenance Training Organisations**	
Class-28	Chapter 1: Regulations	
Class-29	Chapter 2: Acceptable Means of Compliance to Part-147	
Class-30	Chapter 3: Guidance Material to Part-147 Chapter 4: National Variants	
Week 11	**CAR 84**	
Class-31	PART I- PERSONNEL LICENSING.	
Class-32	PART I- PERSONNEL LICENSING.	
Class-33	PART I- PERSONNEL LICENSING.	
Week 12	**CAR 84**	
Class-34	PART II- RULES OF THE AIR	
Class-35	PART III- AVIATION METEORLOGY PART IV- AERONAUTICAL CHARTS PART V- UNITS OF MEASUREMENT	

	PART VI- OPERATION OF AIRCRAFT	
Class-36	PART VII- REGISTRATION AND MARKING OF AIRCRAFT PART VIII- AIRWORTHINESS REQUIREMENTS	
Week 13	**CAR 84**	
Class-37	PART IX- FACILITATION PART X- AERONAUTICAL TELECOMMUNICATIONS PART XI- AIR TRAFFIC SERVICES	
Class-38	PART XII- SEARCH AND RESCUE PART XIV- AERODROMES AND AIRPORTS	
Class-39	PART XV- AERONAUTICAL INFORMATION SERVICES PART XVI- AIRCRAFT NOISE PART XVII- SAFEGUARD AGAINST ACTS OF UNLAWFUL INTERFERENCE	
Week 14	**CAR 84**	
Class-40	Part XVIIIA- SAFE TRANSPORTATION OF DANGEROUS GOODS BY AIR PART XVIII- AIR TRANSPORT SERVICES	
Class-41	PRELIMINARY	
Class-42	Review of whole syllabus	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO 4	C4
	Class Performance	5%		

	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO 2, CO3	C2
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C2
			CO 4	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. ANO (Air Navigation Order)
2. CAR (Civil Aviation Rules) 1984

COURSE INFORMATION			
Course Code Course Title	AEAS 459 Entrepreneurship Development	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn how to Start, Organize and successfully Manage a new Business Venture.

OBJECTIVES

1. To be able to learn and apply skills and managerial quality needed for entrepreneurship.
2. To use the knowledge of market research to investigate the opportunities to nurture a new business idea.
3. To be able to plan effectively for financial and human resource development in order to solidify the newly started business.
4. To be able to analyze Business Performance.

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **demonstrate** understanding of Entrepreneurial Concepts and its roles in Business	PO1	C2			K3	T/ ASG, F
CO2	Be able to **apply** Market research knowledge to investigate new opportunities of Business.	PO2	C3			K3	T/Mid Term Exam, F
CO3	Be able to **plan** Financial and Operational framework of business	PO2	C3			K3	T/ Mid Term Exam, F

CO4	Be able to **analyze** business performance by using managerial skills.	PO2	C4			K3	T/ ASG, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Entrepreneurship: definition and importance and its role; Characteristics and skills of entrepreneurs; Entrepreneurial process; Self-assessment; Managers, leader, innovators and entrepreneurs.

Small Business: nature and importance, methods for generating ideas, creativity process, product planning and development process; Merger, acquisition & joint venture; Business plan; Marketing plan; Market research; Financial plan; Organizational and human resource plan; Production plan; Financing the business, Managing early operations and growth.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **demonstrate** understanding of Entrepreneurial Concepts and its roles in Business.	1											
CO2	Be able to **apply** Market research knowledge to investigate new opportunities of Business.		2										
CO3	Be able to **plan** Financial and Operational framework of business		2										
CO4	Be able to **analyze** business performance by using managerial skills.		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

Lecture Schedule		
Week 1	**Entrepreneurship**	CT 1/ASG, F
Class 1	definition and importance and its role; Characteristics and skills of entrepreneurs; Entrepreneurial process; Self-assessment; Managers, leader, innovators and entrepreneurs.	
Class 2	importance	
Class 3	importance	
Week 2	**Entrepreneurship**	
Class 4	importance	
Class 5	roles	
Class 6	roles	
Week 3	**Entrepreneurship**	
Class 7	entrepreneurs	
Class 8	Characteristics	
Class 9	Characteristics	
Week 4	**Entrepreneurship**	Mid Term, F
Class 10	Skills	
Class 11	Skills	
Class 12	Entrepreneurial process	
Week 5	**Entrepreneurship**	
Class 13	Entrepreneurial process	
Class 14	Entrepreneurial process	
Class 15	Self-assessment	
Week 6	**Entrepreneurship**	
Class 16	Self-assessment	
Class 17	Managers, leader, innovators and entrepreneurs.	
Class 18	Managers, leader, innovators and entrepreneurs.	
Week 7	**Small Business**	CT 2/ASG, F
Class 19	nature and importance	
Class 20	methods for generating ideas	
Class 21	creativity process	
Week 8	**Small Business**	
Class 22	product planning and development process	
Class 23	product planning and development process	
Class 24	Merger	

Week 9	Small Business	
Class 25	acquisition & joint venture	
Class 26	Business plan	
Class 27	Business plan	
Week 10	**Market research**	CT 3, F
Class 28	Market research	
Class 29	Market research	
Class 30	Financial plan	
Week 11	**Financial plan**	
Class 31	Financial plan	
Class 32	Organizational and human resource plan	
Class 33	Organizational and human resource plan	
Week 12	**Financing the business**	
Class 34	Production plan	
Class 35	Production plan	
Class 36	Production plan	
Week 13	**Financing the business**	
Class 37	Financing the business	
Class 38	Financing the business	
Class 39	Financing the business	
Week 14	**Managing early operations and growth.**	
Class 40	Managing early operations and growth.	
Class 41	Managing early operations and growth.	
Class 42	Managing early operations and growth.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment	Class Test/ Assignment 1-3	20%	CO1, CO3	C1, C3
			CO 4	C4

(40%)	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO 2, CO3	C2, C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C3
			CO4	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Entrepreneurship 6th Edition; Robert D. Hisrich, Michael P Peters, Dean AShepherd.

2. Entrepreneurship Strategies and Resources 3rd Edition; Marc J. Dollinger –Pearson Education.

3. New Venture Creation: Entrepreneurship for the 21st Century 5th Edition;Jeffrey A. Timmons – McGraw Hill.

COURSE INFORMATION			
Course Code Course Title	AEAS 461 Advanced Materials Processing Technologies	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn about Advanced Materials Processing Technologies.

OBJECTIVES

1. To understand the common failure mechanisms of engineering materials.
2. To Study the internal structure of each major class of engineering material.
3. To understand the principal concerns of common materials processing techniques.
4. To Analyze and identify machining requirements.

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **explain** the common mechanisms by which engineering materials fail	PO1	C2			K3	T, F, ASG
CO2	Be able to **explain** the general internal structure of each major class of engineering material	PO1	C2			K3	T, F
CO3	Be able to **identify** the principal concerns of common materials processing techniques	PO1	C3			K3	T, F, ASG

CO4	Be able to **analyze** and identify machining requirements.	PO2	C4			K4	T, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Overview of Advanced Materials Processing Technologies: Outline of advanced materials processing techniques: Precision Materials Removal Processes; Precision Forming; Microwave Technology; Advanced Surface Engineering Processes; Joining Technologies.

Precision Removal Processes: Ultra-precision machining, theories, principles and applications. Micro Electro-discharge machining. Physio-chemical machining, Surface Metrology of machined components.

Laser Materials Processing: Fundamentals of industrial lasers. Laser materials interaction theories. Laser processing for various industries such as metals, non-metals, photovoltaic, bio-medical applications.

Nontraditional Machining: Principles, equipment, process variables and applications – surface engineering – concept of CIM and FMS – additive manufacturing – advanced manufacturing techniques.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **explain** the common mechanisms by which engineering materials fail	2											

CO2	Be able to **explain** the general internal structure of each major class of engineering material	2											
CO3	Be able to **identify** the principal concerns of common materials processing techniques	2											
CO4	Be able to **analyze** common mechanisms and identify machining requirements.		2										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

Lecture Schedule		
Week 1	**Overview of Advanced Materials Processing Technologies**	CT 1/ ASG, F
Class 1	Advanced Materials	
Class 2	Materials Processing	
Class 3	Materials Processing	
Week 2	**Advanced Materials Processing Technologies**	
Class 4	Materials Processing Technologies	
Class 5	Outline	
Class 6	Precision Materials Removal Processes	
Week 3	**Materials Processing Technologies**	
Class 7	Precision Materials Removal Processes	
Class 8	Precision Forming	
Class 9	Precision Forming	
Week 4	**Microwave Technology**	Mid Term, F
Class 10	Microwave Technology	
Class 11	Microwave Technology	
Class 12	Microwave Technology	
Week 5	**Advanced Surface Engineering Processes**	
Class 13	Advanced Surface Engineering Processes	
Class 14	Advanced Surface Engineering Processes	
Class 15	Advanced Surface Engineering Processes	
Week 6	**Joining Technologies**	
Class 16	Precision Removal Processes	
Class 17	Ultra-precision machining	
Class 18	Ultra-precision machining	
Week 7	**Laser Materials Processing**	
Class 19	Fundamentals of industrial lasers.	
Class 20	Fundamentals of industrial lasers	
Class 21	Fundamentals of industrial lasers	

Week 8	Laser Materials Processing	CT 2/ASG, F
Class 22	Laser materials interaction theories.	
Class 23	Laser materials interaction theories.	
Class 24	Laser materials interaction theories.	
Week 9	**Laser Materials Processing**	
Class 25	Laser processing for various industries -metal	
Class 26	Laser processing for various industries- non metal	
Class 27	Laser processing for various industries-photovolatic	
Week 10	**Laser Materials Processing**	
Class 28	Laser processing for various industries	
Class 29	bio-medical applications.	
Class 30	bio-medical applications.	
Week 11	**Nontraditional Machining**	CT 3, F
Class 31	: Principles, equipment, process variables and applications – surface	
	engineering – concept of CIM and FMS – additive manufacturing – advanced	
	manufacturing techniques.	
Class 32	Continue	
Class 33	Continue	
Week 12	**Nontraditional Machining**	
Class 34	Principles, equipment	
Class 35	process variables and applications –	
Class 36	surface engineering	
Week 13	**Nontraditional Machining**	
Class 37	concept of CIM and FMS	
Class 38	additive manufacturing	
Class 39	additive manufacturing	
Week 14	**Nontraditional Machining**	
Class 40	Advanced manufacturing techniques.	
Class 41	Advanced manufacturing techniques.	
Class 42	Advanced manufacturing techniques.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO3	C1, C3
			CO 4	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO 2, CO3	C2, C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C3
			CO4	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Aerospace Materials Handbook- Editors: Sam Zhang, Dongliang Zhao

2. Manufacturing Technology for Aerospace Structural Materials- F.C. Campbell; Elsevier

COURSE INFORMATION			
Course Code	AEAS 463	Lecture Contact Hours	3.0
Course Title	Fluid Power and Control	Credit hours	3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn and familiarize the details of fluid power and control.

OBJECTIVES

1. To understand the role of hydraulic and pneumatic system.
2. To analyze hydraulic and pneumatic system and identify basic components.
3. To trace and describe the flow of energy in a fluidic system.
4. To be able to use and analyze technical documentation such as datasheets, function diagrams and pneumatic and hydraulic circuit diagrams.
5. To perform and be familiar with troubleshooting techniques of pneumatic and hydraulic systems.
6. To understand and perform work in accordance with fluid power safety rules and procedures

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **define** hydraulic and pneumatic system	PO1	C1			K3	T/ ASG, F
CO2	Be able to **explain** the basic components of hydraulic and pneumatic system	PO2	C2			K3	T/Mid Term Exam, F
CO3	Be able to **apply** the concepts of hydraulic and pneumatic systems to commercial and industrial aspects.	PO2	C3	P1, P2		K4	T/Mid Term Exam, F
CO4	Be able to **analyze** how to troubleshoot the hydraulic and pneumatic systems	PO2	C4			K4	T/ ASG, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project

Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

a. **Main Contents:** Fluid Power and Control

b. **Detail Contents:**

Hydraulic Systems

Introduction to Fluid Power, properties of Hydraulic Fluids, Energy, Power and Frictional losses in Hydraulic Systems, Pumps, Valves, Hydraulic Conductors and Fittings, Auxiliary Hydraulic Devices, Hydraulic Circuit Design and Analysis.

Pneumatic Systems

Introduction to pneumatics, Pneumatic logic control, Pneumatic Circuits and Applications, Basic Electrical Controls for Fluid Power Circuits. Compressors, Air preparation, Valves and actuators.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **define** hydraulic and pneumatic system	2											
CO2	Be able to **explain** the basic components of hydraulic and pneumatic system		3										

CO2	Be able to **apply** the concepts of hydraulic and pneumatic systems to commercial and industrial aspects.		3										
CO4	Be able to **analyze** how to troubleshoot the hydraulic and pneumatic systems		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week 1	**Introduction to Fluid Power**	
Class 1	Fluid Power	
Class 2	Types of fluid	
Class 3	Application	
Week 2	**Hydraulic Fluid**	
Class 4	Introduction	
Class 5	Application	
Class 6	Properties	
Week 3	**Hydraulic Fluid**	
Class 7	losses in Hydraulic Systems	
Class 8	Energy loss	
Class 9	Continue	CT-1
Week 4	**Hydraulic Fluid**	
Class 10	Power loss	
Class 11	Continue	
Class 12	Continue	
Week 5	**Hydraulic system**	
Class 13	Introduction	
Class 14	Working Principles	Mid
Class 15	Applications	Term Exam
Week 6	**Hydraulic Components**	
Class 16	Hydraulic Pump	
Class 17	Continue	
Class 18	Hydraulic valves	

Week 7	**Hydraulic Components**	CT-2
Class 19	Hydraulic Conductors and fittings	
Class 20	Continue	
Class 21	Numerical	
Week 8	**Hydraulic Devices**	
Class 22	Auxiliary Hydraulic Devices	
Class 23	Continue	
Class 24	Continue	
Week 9	**Hydraulic Circuit**	
Class 25	Design	
Class 26	Continue	
Class 27	Analysis	
Week 10	**Hydraulic Circuit**	CT-3
Class 28	Numerical problems	
Class 29	Continue	
Class 30	Continue	
Week 11	**Introduction to pneumatics**	
Class 31	Pneumatic logic control	
Class 32	Pneumatic logic control	
Class 33	Numerical	
Week 12	**Pneumatic Circuits**	
Class 34	Introduction	
Class 35	Applications	
Class 36	Continue	
Week 13	**Basic Electrical Controls for Fluid Power Circuit**	
Class 37	Description	
Class 38	Analysis	
Class 39	Continue	
Week 14	**Applications**	
Class 40	Compressors	
Class 41	Air preparation	
Class 42	Valves and actuators	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO3	C1, C3
			CO 4	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO 2, CO3	C2, C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C3
			CO4	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Mechanics and thermodynamics of propulsion - Hill and Peterson, 2nd edition; Addison; Wesley, NY, 1992.

2. Gas Turbine Theory-H Cohen, GFC Rogers, HIH Saravanamuttoo

3. Rocket propulsion elements (6th edition) - George P Sutton, Oscar Biblarz, John; Wiley, NY, 1992.

4. Aero thermodynamics of Aircraft Engine Components- Oates, G.C.; AIAA Education Series

5. Aircraft Gas Turbine Engine Technology (3rd edition) - Treager.
6. The Jet Engine - Rolls Royce Limited.

COURSE INFORMATION			
Course Code Course Title	AEAS 449 Space Engineering II	Lecture Contact Hours Credit hours	3.0 3.0
PRE-REQUISITE			
Space Engineering			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To formulate engineering views about space missions, architecture of spacecraft and evaluation and cost estimation of space mission.			
OBJECTIVES			
1. To identify the critical aspects of the objectives of space mission. 2. To acquire skills for designing space mission architecture. 3. To develop consciousness of launch and space environments. 4. To carry out systematic and analytic mission evaluation and cost estimation.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **describe** theories and tools about the space missions and systems.	PO1	C2			K3	T, F, ASG.
CO2	Be able to **identify** how the elements of a space mission work and the key trades that lead to a successful mission.	PO1	C2			K3	T, F, ASG.
CO3	Be able to **apply** systems engineering processes to develop conceptual designs for space missions and systems.	PO2	C3	P1, P2		K4	F, Mid Term Exam.
CO4	Be able to **select** appropriate spacecraft architecture and understand their effect on spacecraft and payload design and performance.	PO1	C2			K4	T, F, ASG.

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project

Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Basic mission objectives, principles and practical methods for mission design and operations in depth, initial requirements definition, operations concept development, architecture trade-offs, payload design, bus sizing, subsystem definition, system manufacturing, verification and operations, launch & space environments, ascent/entry, launch system services, derived requirements and critical interfaces, induced environments, spacecraft architecture definition, payload design, derived & allocated requirements, functional architecture, current technologies subsystem design (power, adcs/gnc, comm, propulsion, cdh, thermal, structures/configuration), system realization, mission evaluation, technical risk assessment and cost estimation.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **describe** theories and tools about the space missions and systems.	3											
CO2	Be able to **identify** how the elements of a space mission work and the key trades that lead to a successful mission.	3											
CO2	Be able to **apply** systems engineering processes to develop conceptual designs for space missions and systems.		3										
CO4	Be able to **select** appropriate spacecraft architecture and understand their effect on spacecraft and payload design and performance.	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week-1	**Topic**	**CT**
Class-1	Basic mission objectives.	
Class-2	Principles and practical methods for mission design.	
Class-3	Operations in depth.	
Week-2		CT-1
Class-4	Initial requirements definition.	
Class-5	Operations concept development.	
Class-6	Architecture trade-offs.	
Week-3		
Class-7	Payload design.	
Class-8	Bus sizing.	
Class-9	Subsystem definition.	
Week-4		
Class-10	System manufacturing.	
Class-11	Verification and operations.	
Class-12	Launch & space environments.	
Week-5		Mid Term Exam
Class-13	Ascent/entry, launch system services.	
Class-14	Ascent/entry, launch system services.	
Class-15	Ascent/entry, launch system services.	
Week-6		
Class-16	Derived requirements and critical interfaces.	
Class-17	Derived requirements and critical interfaces.	
Class-18	Derived requirements and critical interfaces.	
Week-7		CT-2

Class-19	Radiation environment & plasma environment.	
Class-20	Induced environments	
Class-21	Induced environments	
Week-8		
Class-22	Induced environments.	
Class-23	Spacecraft architecture definition.	
Class-24	Spacecraft architecture definition.	
Week-9		CT-3
Class-25	Payload design, derived & allocated requirements.	
Class-26	Payload design, derived & allocated requirements.	
Class-27	Payload design, derived & allocated requirements.	
Week-10		
Class-28	Functional architecture.	
Class-29	Functional architecture.	
Class-30	Functional architecture.	
Week 11		
Class-31	Current technologies subsystem design (power, adcs/gnc, comm).	
Class-32	Current technologies subsystem design (power, adcs/gnc, comm).	
Class-33	Current technologies subsystem design (power, adcs/gnc, comm).	
Week 12		
Class-34	Propulsion, cdh.	
Class-35	Thermal structures/configuration.	
Class-36	System realization.	
Week 13		
Class-37	Mission evaluation.	
Class-38	Technical risk assessment.	
Class-39	Cost estimation.	

Week 14	
Class-40	Review
Class-41	Review
Class-42	Review

ASSESSMENT STRATEGY

Components		Grading		Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1 CO2	C2 C2
			CO3	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid Term Assessment (Exam/Project)	10%	CO4 CO3	C2, C3
Final Examination (Section A & B)		60%	CO 1	C2
			CO 2	C2
			CO 3	C3
			CO 4	C2
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Elements of Spacecraft Design - Charles D. Brown
2. Satellite Technology Principles and Applications - Anil K. Maini and Varshaagrawal
3. Space Mission Analysis and Design - Wiley J. Larson and James R. Wertz
4. Spacecraft Systems Engineering- Peter Fortescue, John Stark and Graham Swinerd

5.1.3 Core and Specialized Courses Offered by Avionics Discipline

COURSE INFORMATION			
Course Code Course Title	AEAV 203 Electronics-I	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
Electrical Circuit Analysis-I Electrical Circuit Analysis-II			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This subject is classified under the Applied Technology group and intended to teach the students the concepts, principles and working of basic electronic circuits. It is targeted to provide a basic foundation for technology areas like communication systems, industrial electronics as well as instrumentation, control systems and electronic circuit design.			
OBJECTIVES			
1.To provide an introduction to modern electronic circuit design and to introduce students to the concepts and simple principles of active semiconducting devices (diodes, bipolar and FET transistors, and display devices) 2. To discuss their implementation in a number of basic electronic circuits, i.e. amplifiers (single device, differential and op-amp), voltage regulators and power supplies.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to explain the operation of semiconductor diodes, transistors and operational amplifiers in order to design basic circuits	PO1	C2			K3	T, F, ASG
CO2	Be able to compare and analyze the characteristics of different types of diodes, transistors and operational amplifiers	PO1	C4			K3	T, F, Mid Term Exam
CO3	Be able to apply semiconductor diodes, BJT, JFET, MOSFET and operational amplifiers to solve real world problems.	PO1	C3			K3	T, F, ASG
CO4	Be able to identify, analyze and solve mathematical and practical problems of electronic circuits	PO2	C4	P1, P2		K4	T, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Semiconductor diode, equivalent circuits; P-N junction as a circuit element: Intrinsic and extrinsic semiconductors, operational principle of p-n junction diode, contact potential, current-voltage characteristics of a diode; Diode circuits: Half wave and full wave rectifiers, rectifiers with filter capacitor, characteristics of a zener diode, zener shunt regulator, clamping and clipping circuits. Bipolar junction transistor (BJT): BJT characteristics and regions of operation, BJT as an amplifier. Single stage mid-band frequency BJT amplifier circuits: Voltage and current gain, input and output impedance of a common base, common emitter and common collector amplifier circuits.

Introduction to Metal-oxide-semiconductor field-effect-transistor (MOSFET) and Junction field-effect-transistor (JFET)

Operational amplifiers (Op-Amp): Properties of ideal Op-Amps, non-inverting and inverting amplifiers, inverting integrators, differentiator, weighted summer and other applications of Op-Amp circuits, effects of finite open loop gain and bandwidth on circuit performance, logic signal operation of Op-Amp, dc imperfections.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to explain the operation of semiconductor diodes, transistors and operational amplifiers in order to design basic circuits	3											
CO2	Be able to compare and analyze the characteristics of different types of diodes, transistors and operational amplifiers	3											
CO3	Be able to apply semiconductor diodes, BJT, JFET, MOSFET and operational amplifiers to solve real world problems.	3											
CO4	Be able to identify, analyze and solve mathematical and practical problems of electronic circuits		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE		
Week-1	**Topic**	**CT**
Class-1	The Bohr Model of Atom, Electrons and Shells, Valence Electrons, Insulators, Conductors, Semiconductors	**CT-1**
Class-2	Construction of semiconductors, current in semiconductors, electron and hole current	
Class-3	**Continued**	
Week-2		
Class-4	Intrinsic and Extrinsic materials, p-type and n-type semiconductor, Majority and Minority Carriers	
Class-5	p-n junction, Formation of Depletion Region, Barrier Potential	
Class-6	Energy Diagram of P-N Junction and Depletion Region	
Week-3		**Mid exam**
Class-7	Forward bias and Reverse Bias Diode	
Class-8	**Reverse Current and Reverse Breakdown Voltage, V-I Characteristic for Forward Bias and Reverse Bias Diode**	
Class-9	Solving Numerical Problems, Temperature Effect on Diode, Ideal vs Practical Diode, DC and AC Resistance of Diode, Diode Equivalent Circuit	
Week-4		

	Class-10	**Load Line Analysis**	
	Class-11	**Diode in series and parallel circuits and related numerical problems**	
	Class-12	**Half wave and Full wave Rectifier,**	
	Week-5		
	Class-13	**Clipper and Clapper Circuit**	
	Class-14	**Clipper and Clapper Circuit(Cont.)**	
	Class-15	**Clipper and Clapper Circuit(Cont.)**	
	Week-6		
	Class-16	Construction and operation of Transistor	
	Class-17	**Common-base Transistor, Transistor Amplifying Action, Common Emitter Configuration**	
	Class-18	**Common Emitter Operation, Limits of Operation, Solving Numerical Problems**	
	Week-7		
	Class-19	**Operating Point of a Transistor, Fixed bias Configuration, Forward Bias of Base-Emitter, Collector-Emitter Loop**	
	Class-20	**Transistor Saturation, Load-line Analysis, Emitter bias Configuration, Base-emitter Loop, Collector-emitter Loop, Saturation Level, Load line**	

		Analysis	
	Class-21	Collector Feedback Configuration, Emitter follower Configuration	
	Week-8		
	Class-22	Field effect transistor (FETs), Classification	
	Class-23	Construction and operating principle of MOSFETs	CT-2
	Class-24	Current-Voltage Characteristics of MOSFETs	
	Week-9		
	Class-25	Current-Voltage Characteristics of MOSFETs(Continued)	
	Class-26	ID VS VDS equation derivation	
	Class-27	MOSFET Symbol, analysis of electronic circuit to determine RS and RD	
	Week-10		CT-3
	Class-28	Analysis of electronic circuit to determine RS and RD (Continued)	
	Class-29	Analysis of electronic circuit to determine RS and RD (Continued)	
	Class-30	Maths to determine RD	
	Week 11		
	Class-31	Maths to determine RD, Current mirror	

	Class-32	**CMOS construction, operation**	
	Class-33	**Maths related to CMOS**	
	Week 12		
	Class-34	**Small signal operation and Models (hybrid-π, hybrid-T)**	
	Class-35	**Common-source(CS) amplifier (Circuit, Small signal equivalent Circuit, advantage, disadvantage, Comparison)**	
	Class-36	**Common drain(CD) amplifier (Circuit, Small signal equivalent Circuit, advantage, disadvantage, Comparison), Source follower/Buffer**	
	Week 13		
	Class-37	**Small signal equivalent circuit of MOSFETs**	
	Class-38	**Derivation of gain, Impedance**	
	Class-39	**Math related to gain, Impedance**	
	Week 14		
	Class-40	**Transistor biasing**	
	Class-41	**Construction and Operation of JFET**	
	Class-42	**Construction and Operation of JFET (Continuation)**	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO3	C1, C2
			CO4	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/project)	10%	CO 3	C2
			CO2	C4
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C4
			CO 3	C2
			CO 4	C3
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. **Microelectronic Circuits – Adel S. Sedra&Keneth C. Smith; Oxford University Press.**
2. **Electronic Devices and Circuit Theory - R.L Boylsted; Prentice Hall of India Private Ltd.**
3. **Semi Conductor Circuit Approximation - Albert P Malvino; Tata McGraw- Hill.**
4. **Electronic Devices and Circuits – Jacob Millman& Christos C. Halkias; Tata McGraw-Hill.**
5. **Micro-Electronic Circuit Analysis and Design- Donald A. Neamen; McGraw-Hill**

COURSE INFORMATION			
Course Code **Course Title**	**AEAV 201** **Electrical Circuit Analysis-II**	**Lecture Contact** Hours **Credit hours**	**3.00** **3.00**
PRE-REQUISITE			
Electrical Circuit Analysis(DC Circuits)**-I**			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This course is provided to impart knowledge on concepts and application of different types of 1-Phase, 3-Phase AC Circuit, Passive Filters, Magnetically coupled circuits etc.			

OBJECTIVES
1. To learn phase and amplitude information of RLC Circuits, to be adept in to solve problems involving series and parallel AC circuits. **2. To understand and analyze different types of passive filters and features of magnetically coupled circuits.** **3. To understand the basics of 3-phase circuits and apply the acquired knowledge of for calculating voltage, current, power in 3-phase circuits.**

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to understand the basic definitions, phase and amplitude information of RLC Circuits and ability to solve series and parallel AC circuits.	PO1	C2	P1, P2		3	T, F, ASG
CO2	Be able to apply the knowledge of AC circuits to solve various engineering problems.	PO1	C3			3	T, F, Mid Term Exam
CO3	Be able to understand and analyze different types of passive	PO2	C2, C4	P1, P2		3	T, F, ASG

	filters and features of magnetically coupled circuits.						
CO4	Be able to apply the knowledge of 3-phase circuits for calculating voltage, current, power (P, Q and S).	PO2	C3	P1, P2		3	T, F, ASG
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
<u>Sinusoidal functions</u> Instantaneous current, voltage, power, Effective current and voltage, average power, Phases and complex quantities, impedance, real and reactive power, power factor. <u>Single-phase AC circuits</u> Series and parallel RL, RC and RLC circuits, nodal and mesh analysis, application of network theorems in AC circuits, circuits with non-sinusoidal excitations, transients in ac circuits. <u>Resonance in AC circuits, Passive Filters</u> Series and parallel resonance, Low pass filter, High pass filter, Band pass filter, Band stop filter. <u>Magnetically coupled circuits</u> Mutual Inductance, Energy in a Coupled Circuit & its Numerical analysis, Linear Transformers. <u>Three phase circuits</u> Impedance, Voltage, Current of three phase circuit, Y-Y Connection, Y-Δ Connection, Δ-Y Connection, Δ-Δ Connection & their Numerical Analysis, Power Calculation (P, Q,S etc) of three phase circuit.

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	Be able to understand the basic definitions, phase and amplitude information of RLC Circuits and ability to solve series and parallel AC circuits	3											
CO2	Be able to apply the knowledge of AC circuits to solve various engineering problems	3											
CO3	Be able to understand and analyze different types of passive filters and features of magnetically coupled circuits.		3										
CO4	Be able to apply the knowledge of 3-phase circuits for calculating voltage, current, power (P, Q and S).		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	2 3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

WEEK-1	TOPIC	CT/MTD
Class 1	Faraday's law of electromagnetic induction; Lenz's law	CT-1
Class 2	Alternating voltage generation	
Class 3	Application of AC voltage in aircraft	
WEEK-2		
Class 4	Details of Sinusoidal functions & its different terminology	
Class 5	Effective voltage & current	
Class 6	Average value	
WEEK-3		
Class 7	Phase relation and complex quantities	
Class 8	Phase relation and complex quantities	
Class 9	Impedance function	
WEEK-4		MID TERM
Class 10	Impedance & phase calculation	
Class 11	Impedance & phase calculation	
Class 12	Impedance & phase calculation	

WEEK-5		
Class 13	**Impedance, phase, power, average power & energy calculation**	
Class 14	**Impedance, phase, power, average power & energy calculation**	
Class 15	**Impedance, phase, power, average power & energy calculation**	
WEEK-6		
Class 16	**Analysis of single-phase AC circuits**	
Class 17	**Superposition theorem, Nodal and mesh analysis**	
Class 18	**Application of network theorems in AC circuits**	
WEEK-7		
Class 19	**Introduction to Resonant circuits**	
Class 20	**Series Resonance in AC circuits**	
Class 21	**Application of resonance**	
WEEK-8		**CT-2**
Class 22	**Basics of Passive filter**	
Class 23	**Low pass filter**	
Class 24	**High pass filter**	
WEEK-9		
Class 25	**Band pass filter**	
Class 26	**Band stop filter**	
Class 27	**Continue with Mathematical practice**	
WEEK-10		
Class 28	**Self & Mutual Inductance**	
Class 29	**Dot Convention in mutually coupled circuit**	
Class 30	**Numerical analysis**	
WEEK-11		**CT-3**
Class 31	**Energy in a Coupled Circuit**	
Class 32	**Linear Transformer**	
Class 33	**Continue with Mathematical practice**	
WEEK-12		
Class 34	**Impedance, Voltage, Current of three phase circuit**	
Class 35	**Y-Y Connection of three phase circuit**	
Class 36	**Y-Δ Connection of three phase circuit,**	
WEEK-13		
Class 37	**Δ-Y Connection of three phase circuit**	
Class 38	**Δ-Δ Connection of three phase circuit**	
Class 39	**Numerical Analysis & Mathematical practice**	
WEEK-14		
Class 40	**Power Calculation of three phase circuit**	
Class 41	**Continue with Mathematical practice**	
Class 42	**Review of the Syllabus**	

ASSESMENT STRATEGY				
Components		**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (40%)	**Class Test/ Assignment 1-3**	**20%**	**CO1**	**C2**
			CO3	**C2, C4**
			CO4	**C3**
	Class Performance	**5%**		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/project)	10%	**CO2**	**C3**
Final Examination (Section A & B)		**60%**	**CO1**	**C2**
			CO2	**C3**
			CO3	**C2, C4**
			CO4	**C3**
Total Marks		**100%**		

TEXT AND REFERENCE BOOKS:

1. **Alternating Current Circuits – Russell & George F. Corcoran; John Wiley and Sons.**
2. **Fundamentals of Electric circuits- Charles K. Alexander & Matthew N. O. Sadiku 3. Introductory Circuits for Electrical & Computer Engineering - James. W. Nilson; Prentice Hall of India Private Ltd.**
4. **A Text Book of Electrical Technology- B L Theraja and A K Theraja; S.Chand & Company Ltd.**

COURSE INFORMATION			
Course Code Course Title	AEAV 205 Numerical Analysis and Applications	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
Math-1(Differential and Integral Calculus)			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
The course will develop numerical methods aided by technology to solve algebraic, transcendental, and differential equations, and to calculate derivatives and integrals also understanding of the elements of error analysis for numerical methods.			
OBJECTIVES			

1. To analyze appropriate numerical methods to solve algebraic and transcendental equations as well as generating approximate function
2. To develop appropriate numerical methods to solve a differential equation and to evaluate a derivative at a value
3. To learn about numerical methods to solve a linear system of equations so that students able to perform an error analysis for various numerical methods
4. To prepare for various numerical root finding methods and to derive appropriate numerical methods to calculate a definite integral
5. To compose various numerical methods in a modern computer language

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	**Be able to demonstrate understanding of common numerical methods, number representation and errors and how they are used to obtain approximate solutions to otherwise intractable mathematical problems**	**PO1**	**C2**	**P1, P2, P3**		**K3**	**T, F, ASG**
CO2	**Be able to apply numerical methods to obtain approximate solutions to mathematical problems related to various topics such as interpolation , differentiation, integration etc.**	**PO1**	**C3**	**P1, P2, P3**		**K3**	**T, F**
CO3	**Be able to understand numerical methods for various mathematical operations and tasks, such as the solution of linear and nonlinear equations, and the solution of differential equations.**	**PO1**	**C2**	**P1, P2**		**K3**	**T, F, ASG**
CO4	**Be able to perform an error analysis for various numerical methods and prove results for various numerical root finding methods**	**PO2**	**C4**			**K4**	**T, F**
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Roots of polynomials and transcendental equations; Determinants and matrices; Eigen values and Eigen vectors; Solution of simultaneous linear equations; Solution of linear and non-linear algebraic equations; Solution of ordinary differential equations; Solution of partial differential equation; Introduction to the use of scalar, vector and matrix variables; The manipulation of matrix variables in arithmetic functions.

Interpolation methods; Numerical differentiation and integration; Solving equations by finite differences; Graph plotting and curve fitting; Applications in structural mechanics.

Iterative solutions for non-linear problems; Use fundamental programming concepts to solve mathematical problems; Develop computer programs to solve simple engineering and mathematical problems.

Engineering analysis by using graphical tools in MATLAB and MS Excel; Use of spreadsheet; Data structures; Graphing; Recursion; Packages for data manipulation.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to demonstrate understanding of common numerical methods, number representation and errors and how they are used to obtain approximate solutions to otherwise intractable mathematical problems	2											
CO2	Be able to apply numerical methods to obtain approximate solutions to mathematical problems related to various topics such as interpolation , differentiation, integration etc.	2											

	CO3	**Be able to understand numerical methods for various mathematical operations and tasks, such as the solution of linear and nonlinear equations, and the solution of differential equations.**	**2**											
	CO4	**Be able to perform an error analysis for various numerical methods and prove results for various numerical root finding methods**		**3**										
(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)														

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	**42**
Practical / Tutorial / Studio	**-**
Student-Centered Learning	**-**
Self-Directed Learning	
Non-face-to-face learning	**42**
Revision of the previous lecture at home	**21**
Preparation for final examination	**21**
Formal Assessment	
Continuous Assessment	**2**
Final Examination	**3**
Total	**131**

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week 1	**Errors in numerical calculation**	**CT 1**
Class 1	**Errors and their computations**	
Class 2	**A general Error formula**	
Class 3	**Error in a series of approximation**	
Week 2	**Roots of polynomials and transcendental equations**	
Class 4	**Bisection**	
Class 5	**False position and Iteration method**	
Class 6	**Newton Raphson**	
Week 3	**Interpolation methods (Finite difference interpolation method)**	
Class 7	**Forward difference**	
Class 8	**Continue**	
Class 9	**Backward difference**	
Week 4	**Interpolation methods (Finite difference interpolation method)**	**Mid term**
Class 10	**Central difference**	
Class 11	**Continue**	
Class 12	**Symbolic relations and Separation of symbols**	
Week 5	**Interpolation methods (Central & Divided difference interpolation method)**	
Class 13	**Gauss Central Difference Formula**	
Class 14	**Continue**	
Class 15	Sterling's Formula and Bessel's Formula	
Week 6	**Interpolation methods (Central & Divided difference interpolation method)**	
Class 16	**Continue**	
Class 17	Newton's General Interpolation Formula	
Class 18	**Interpolation by Iteration**	
Week 7	**Graph plotting and curve fitting**	**CT 2**
Class 19	**Fitting a Straight Line**	
Class 20	**Nonlinear Curve Fitting**	
Class 21	**Continue**	
Week 8	**Numerical Differentiation**	
Class 22	**Errors in Numerical Differentiation**	**CT 3**
Class 23	**Continue**	
Class 24	**General Idea about Numerical Integration Method**	

Week 9	**Numerical Integration**
Class 25	**Trapizoidal Rule**
Class 26	**Simpsons 1/3 rule**
Class 27	**Simpsons 3/8 rule**
Week 10	**Numerical solution of ordinary differential equations**
Class 28	**Solution by Taylor series**
Class 29	Pieard's Method and Euler's Method
Class 30	**Runge-Kutta Method**
Week 11	**Numerical solution of partial differential equation**
Class 31	**Jacobi;s Method**
Class 32	**Gauss-Seidal Method**
Class 33	**Continue**
Week 12	**Numerical solution of linear systems of algebraic equations**
Class 34	**Direct Method**
Class 35	**Continue**
Class 36	**Continue**
Week 13	**Determinants and matrices**
Class 37	**Transpose Matrix**
Class 38	**Inversion Matrix**
Class 39	**Continue**
Week 14	**Eigen values and Eigen vectors**
Class 40	**Eigenvalues of a Symmetric Tridiagonal Matrix**
Class 41	**Continue**
Class 42	**Review of whole Syllabus**

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	**Class Test/ Assignment 1-3**	**20%**	**CO1, CO3 CO4**	**C2 C4**

	Class Performnace	**5%**		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/project)	**10%**	**CO2**, **CO3**	**C3**
Final Examination (Section A & B)		**60%**	**CO1**	**C2**
			CO2	**C3**
			CO3	**C2**
			CO4	**C4**
Total Marks		**100%**		

TEXT AND REFERENCE BOOKS:

1. **Numerical Methods – S. Balachandra Rao and C.K. Shantha; Stosius Inc.**
2. **Numerical Methods for Engineers – Steven C. Chopra, Raymond P. Carale; Tata McGraw-Hill Publishing Company Ltd.**
3. **Applied Numerical Analysis– Curtis F. Gerald, Patrick O. Wheatley; Addison-Wesley Publishing** Company User's Guide for Student Edition of MATLAB – **Duane Hanselman& Bruce Littlefield, Prentice Hall, NJ, 1997.**

COURSE INFORMATION			
Course Code Course Title	AEAV 202 Electrical Circuits Analysis – II Sessional	Lecture Contact Hours Credit hours	3.00 1.50

PRE-REQUISITE
Course Code: AEAV 201 Course Title: Electrical Circuit Analysis-II

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
Students will be able to compare the performance of ac circuits and knowledge will help to build a strong foundation for further development of their project work in the next levels.

OBJECTIVE
1. To prepare the students to have a basic knowledge in the analysis of Electric Networks. 2. To solve the given circuit with various theorems and methods. 3. To analyses the various three phase circuit's star and delta connections. 4. To distinguish between tie set and cut set methods for solving various circuits.

COURSE OUTCOMES & GENERIC SKILLS

	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to understand about measurement of voltage, current, power and phase shift in AC power circuits	PO1	C2			K3	R,Q,T
CO2	Be able to analyze single phase RLC circuits for impedances, voltages, currents, powers and phase shift	PO2	C4			K4	R,Q,T

CO3	Be able to design different types of passive filters and analyze their response and demonstrate the performance of a resonant circuit with the variation in frequency.	PO3	Psychomotor/ Neutralization			K5	R,Q,T
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ;PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

Exp No	Experiments Name
1.	Familiarization with alternating current (ac) waves.
2.	Study of R-L-C series circuit.
3.	Study of Low and High pass filters and their characteristics with different input frequency
4.	Study of Band Pass and Band Stop filters and their characteristics with different input frequency
5.	Study of Series Resonance
6.	Study of Parallel Resonance
7.	Analysis of AC Circuits, Observing Variables as functions of time using Mutual Inductance
8.	Sub Circuits using Net listing and Schematics and Three Phase Circuits.
9.	AC Transient Analysis

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to understand about measurement of voltage, current, power and phase shift in AC power circuits	3											
CO2	Be able to analyze single phase RLC circuits for impedances, voltages, currents, powers and phase shift		3										
CO3	Be able to design different types of passive filters and analyze their response and demonstrate the performance of a resonant circuit with the variation in frequency.			2									

	(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical Total	 14 28 42
Self-Directed Learning Preparation of Lab Reports Preparation of Lab Test Preparation of presentation Preparation of Quiz Engagement in Group Projects	 10 10 5 10 20
Formal Assessment Continuous Assessment Final Quiz	 14 1
Total	112

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Introduction
Week 2	Familiarization with alternating current (ac) waves.
Week 3	Study of R-L-C circuit
Week 4	Study of Low and High pass filters and their characteristics with different input frequency
Week 5	Study of Band Pass and Band Stop filters and their characteristics with different input frequency.
Week 6	Study of Series Resonance.
Week 7	Study of Parallel Resonance.
Week 8	Analysis of AC circuits, Observing Variables as functions of time using Mutual Inductance.
Week 9	Sub Circuits using Net listing and Schematics and Three Phase Circuits.
Week 10	AC Transient Analysis.
Week 11	Lab Practice.
Week 12	Lab Test
Week 13	Lab Quiz

Week 14	**Viva Voce**

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Conduct Lab Test/ Class Performance	**25%**	**CO 1**	**C2/Understand**
		CO 2	**C4/Analyse**
		CO3	**P5 / Neutralization**
Report Writing/Programming	**15%**	**CO 1**	**C2/Understand**
		CO 2	**C4/Analyse**
		CO3	**P5 /Neutralization**
Mid Term Evaluation (exam/project/assignment)	**20%**	**CO1,CO2**	**C2/Understand**
			C4/Analyse
Final Evaluation (Exam/project/assignment)	**30%**	**CO1, CO2, C03**	**C2/Understand, C4/Analyse, P5/Neutralization**
Viva Voce/ Presentation	**10%**	**CO1, CO2, C03**	**C2/Understand, C4/Analyse, P5 /Neutralization**
Total Marks	**100%**		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. **Alternating Current Circuits – Russell & George F. Corcoran; John Wiley and Sons.**
2. **Fundamentals of Electric circuits- Charles K. Alexander & Matthew N. O. Sadiku**
3. **Introductory Circuits for Electrical & Computer Engineering - James. W. Nilson; Prentice Hall of India Private Ltd.**
4. **A Text Book of Electrical Technology- B L Theraja and A K Theraja; S.Chand & Company Ltd.**

COURSE INFORMATION			
Course Code Course Title	AEAV 204 Electronics-I Sessional	Contact Hours Credit hours	1.50 0.75

PRE-REQUISITE
Electronics I (Theory)

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
Students will be able to see the practical implementation of the circuit and electronic device theories that were taught to them previously. Practical means that the circuits that the students study are made up of actual electronic components. Students will also learn the practical skills required to design and troubleshoot actual electronic circuitries.

OBJECTIVE

1. To prepare and use the appropriate basic laboratory equipment for conducting circuit analysis according to common engineering practice.
2. To identify, demonstrate and measure the various types of electronic circuit with correct practice for valid outcome.
3. To measure, define and describe the characteristics of several passive and active components using standard circuit analysis.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Perform experiments with the basic electronic components like diode, Bipolar Junction Transistor(BJT), Op-Amp, digital and analog measuring equipment etc and Apply the knowledge of basic electronic components and	PO1, PO5	P2,C3			K3, K6	R,Q,T

	networks practically						
CO2	**Analyze the characteristics of different electronic devices such as diodes, Transistors etc., and simple circuits like rectifiers, amplifier set While Show the percentage and causes of differences between theoretical knowledge with the practical observations.**	**PO2, PO4**	**C4, P3**			**K3, K8**	**R,Q,T**
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

Exp No	Experiments Name
1.	Study of diode i-v characteristics.
2.	Study of diode rectifier circuits
3.	Study of n-p- n cb (common base) transistor characteristics.
4.	Study of n-p-n ce (common emitter) transistor characteristics.
5.	Mathematical operations using op-amp adder and differentiator.
6.	Mathematical operations using op-amp integrator circuit.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Perform experiments with the basic electronic components like diode, Bipolar Junction Transistor(BJT), Op-Amp, digital and analog measuring equipment etc and Apply the knowledge of basic electronic components and networks practically	3				3							
CO2	Analyze the characteristics of different electronic devices such as diodes, Transistors etc., and simple circuits like rectifiers, amplifier set While Show the percentage and causes of differences between theoretical knowledge with the practical observations.		3		3								

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	07
Practical	14
Total	21
Self-Directed Learning	
Preparation of Lab Reports	05
Preparation of Lab Test	05
Preparation of presentation	2.5
Preparation of Quiz	05
Engagement in Group Projects	10
Formal Assessment	
Continuous Assessment	07
Final Quiz	1
Total	57

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Introduction
Week 2	
Week 3	Study of diode i-v characteristics.
Week 4	
Week 5	Study of diode rectifier circuits.
Week 6	Lab Quiz-1.
Week 7	Study of n-p- n cb (common base) transistor characteristics.
Week 8	Study of n-p-n ce (common emitter) transistor characteristics
Week 9	
Week 10	Mathematical operations using op-amp adder and differentiator
Week 11	
Week 12	Mathematical operations using op-amp integrator circuit
Week 13	Lab Quiz-2.
Week 14	Lab Test

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Conduct Lab Test/ Class Performance	25%	CO 1	P2/Perform,C3/Apply
		CO 2	C4/ Analyze, P3/Show
Report Writing/Programming	15%	CO 1	P2/Perform,C3/Apply
		CO 2	C4/ Analyze, P3/Show
Mid Term Evaluation (exam/project/assignment)	20%	CO1,CO2	P2/Perform,C3/Apply
			C4/ Analyze, P3/Show
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	P2/Perform,C3/Apply
Viva Voce/ Presentation	10%	CO1, CO2, C03	C4/ Analyze, P3/Show
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. Microelectronic Circuits – Adel S. Sedra &Keneth C. Smith; Oxford University Press.
2. Electronic Devices and Circuit Theory - R.L Boylsted; Prentice Hall of India Private Ltd. Private Ltd.

COURSE INFORMATION			
Course Code Course Title	: AEAV 206 : Numerical Analysis and Applications Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE

Course Code: AEAV 205
Course Title: Numerical Analysis and Applications

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn and familiarize the basics of common numerical methods as well as the analysis and implementation and application of numerical methods.

OBJECTIVE

1. **To demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.**
2. **To apply numerical methods to obtain approximate solutions to mathematical problems.**
3. **To analyze and evaluate the accuracy of common numerical methods.**

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to execute simple programs to get familiarize with MATLAB software.	5	Psychomotor/Manipulation			K6	R, Q, T

CO2	Be able to demonstrate practical physical problems in numerical domain using MATLAB	5	Psychomotor /Precision	P1,P2		K6	R, Q, T
CO3	Be able to solve engineering problems by applying numerical methods using MATLAB.	5	Psychomo tor/Articu lation			K6	ASG, F, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ;PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam;)

COURSE CONTENT

Exp No	Exp Name
1.	Introduction to MATLAB
2.	Creating Matrix
3.	Matrix operations and Matrix Applications
4.	Plotting and Graphing
5.	Using Statements
6.	Loops
7.	Bracketing Methods of Numerical Analysis
8.	Open Methods of Numerical Analysis
9.	Basic Simulink
10.	Solving Engineering Problems Using MATLAB and Simulink

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to execute simple programs to get familiarize with MATLAB software.					2							

CO2	Be able to demonstrate practical physical problems in numerical domains using MATLAB.					2							
CO3	Be able to solve engineering problems by applying numerical methods using MATLAB.					2							
(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)													

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	14
Practical	28
Total	42
Self-Directed Learning	
Preparation of Lab Reports	10
Preparation of Lab Test	10
Preparation of presentation	5
Preparation of Quiz	10
Engagement in Group Projects	20
Formal Assessment	
Continuous Assessment	14
Final Quiz	1
Total	112

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Introduction to MATLAB
Week 2	Creating Matrix
Week 3	Matrix operations and Matrix Applications
Week 4	Plotting and Graphing
Week 5	Using Statements
Week 6	Loops

Week 7	**Bracketing Methods of Numerical Analysis**
Week 8	**Open Methods of Numerical Analysis**
Week 9	**Basic Simulink**
Week 10	**Solving Engineering Problems Using MATLAB and Simulink**
Week 11	**Lab Test**
Week 12	**Lab Quiz**
Week 13	**Presentation on Assigned Problems**
Week 14	**Project Demonstration**

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P2/Manipulation
		CO 2	P3/Precision
Report Writing/Programming	15%	CO 1	P2/Manipulation
		CO 2	P3/Precision
Mid Term Evaluation (exam/project/assignment)	20%	CO3	P4/ Articulation
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	P2/Manipulation P3/Precision, P4/ Articulation
Viva Voce/ Presentation	10%	CO1, CO2, C03	P2/Manipulation P3/Precision, P4/ Articulation
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1) Numerical Methods Using MATLAB 4th Edition by John Mathews, Kurtis Fink.
2) Numerical Methods with MATLAB: Implementations and Applications 2nd Edition by Gerald Recktenwald.

COURSE INFORMATION			
Course Code **Course Title**	**: AEAV 226** **: Numerical Analysis** and Applications **Sessional**	**Lecture Contact Hours** **Credit Hours**	**: 1.50** **: 0.75**

PRE-REQUISITE

Course Code: AEAV 205
Course Title: Numerical Analysis and Applications

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn and familiarize the basics of common numerical methods as well as the analysis and implementation and application of numerical methods.

OBJECTIVE

4. **To demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.**
5. **To apply numerical methods to obtain approximate solutions to mathematical problems.**
6. **To analyze and evaluate the accuracy of common numerical methods.**

COURSE OUTCOMES & GENERIC SKILLS							
No.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to execute simple programs to get familiarize with MATLAB software.	5	Psychomotor/Manipulation			K6	R, Q, T , ASG
CO2	Be able to demonstrate practical physical problems in numerical domain using MATLAB	5	Psychomotor /Precision	P1,P2		K6	R, Q, Pr, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

Exp No	Exp Name
1.	Introduction to MATLAB
2.	Creating Matrix
3.	Matrix operations and Matrix Applications
4.	Bracketing Methods of Numerical Analysis
5.	Open Methods of Numerical Analysis
6.	Basic Simulink

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12

CO1	**Be able to execute simple programs to get familiarize with MATLAB software.**					**2**							
CO2	**Be able to demonstrate practical physical problems in numerical domain using MATLAB**					**2**							
(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)													

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	**7**
Practical	**14**
Total	**21**
Self-Directed Learning	
Preparation of Lab Reports	**5**
Preparation of Lab Test	**5**
Preparation of presentation	**10**
Preparation of Quiz	**5**
Engagement in Group Projects	**10**
Formal Assessment	
Continuous Assessment	**6**
Final Quiz	**1**
Total	**63**

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	**Introduction to MATLAB**
Week 2	**Creating Matrix**
Week 3	**Matrix operations and Matrix Applications**
Week 4	**Bracketing Methods of Numerical Analysis**
Week 5	**Open Methods of Numerical Analysis**

Week 6	**Basic Simulink**
Week 7	**Lab Quiz, Presentation.**

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P2/Manipulation
		CO 2	P3/Precision
Report Writing/Programming	15%	CO 1	P2/Manipulation
		CO 2	P3/Precision
Mid Term Evaluation (exam/project/assignment)	20%	CO1	P2/Manipulation
Final Evaluation (Exam/project/assignment)	30%	CO2	P3/Precision
Viva Voce/ Presentation	10%	CO2	P3/Precision
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

5. **Numerical Methods Using MATLAB 4th Edition by John Mathews, Kurtis Fink.**
6. **Numerical Methods with MATLAB: Implementations and Applications 2nd Edition by Gerald Recktenwald.**

COURSE INFORMATION

Course Code **Course Title**	**AEAV 215** **Electronics-II**	**Lecture Contact Hours** **Credit hours**	**3.00** **3.00**

PRE-REQUISITE

Electrical Circuit Analysis(DC Circuits)**-I**
Electrical Circuit Analysis(AC Circuits)**-II**
Electronics-I (Basic Electronic Circuits)

CURRICULUM STRUCTURE

Outcome Based Education
(OBE)

SYNOPSIS/RATIONALE

This subject focuses on how to create electronic systems with 'building block' circuits using biplolar transistors and FETs, and looks at the use and operation of amplifiers. It also looks at how to design feedbacks to systems, and interface with sensors.

OBJECTIVES

1. **To classify different types of FETs and demonstrate feedback amplifiers, OP-AMPs, and oscillator circuits.**
2. **To compute and characterization of feedback amplifiers, OP-AMPs, and oscillator circuits.**
3. **To understand familiarity with basic electronic components and use them to design simple electronic circuits**
4. **To analyze basic forms of power supply filters and determine their filtering performance and performance of basic class-A and class-B power amplifiers.**

COURSE OUTCOMES & GENERIC SKILLS							
NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to analyze analog and digital electronic circuits from a circuit and monolithic (integrated circuit) implementation point of view	PO2	C4			K3	T, F, ASG
CO2	Be able to explain the design of elements in bipolar- and CMOS-based op amps, feedback, power supplies, linear and non-linear applications circuits with the op amp as the basic building block, and transistor circuits for realizing basic digital circuits	PO1	C2			K3	T, F, Mid Term Exam
CO3	Be able to apply the concepts of basic electronic devices to design, fabricate and test small electronic circuit	PO2	C3	P1, P3		K3	T, F, ASG
CO4	Be able to analyze the design, operation, and troubleshooting of electronic systems.	PO2	C4			K4	T, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Frequency response of amplifiers: Poles, zeros and Bode plots, amplifier transfer function, techniques of determining 3 dB frequencies of amplifier circuits, frequency response of single-stage and cascade amplifiers, frequency response of differential amplifiers.

MOSFET: Structure and physical operation of an enhancement MOSFET, threshold voltage, Body effect, current- voltage characteristics of an enhancement MOSFET, biasing discrete and integrated MOS amplifier circuits, single-stage MOS amplifiers, MOSFET as a switch, CMOS inverter

JFET: Structure and physical operation of JFET, transistor characteristics, and pinch-off voltage.

Differential and multistage amplifiers: Description of differential amplifiers, smallsignal operation, differential and common mode gains, RC coupled mid-band frequency amplifier.

Op-Amp: General purpose Op-Amp: DC analysis, small-signal analysis of different stages, gain and frequency response of 741 Op-Amp.
Negative feedback: properties, basic topologies, feedback amplifiers with different topologies, stability, frequency compensation. Active filters: Different types of filters and specifications, transfer functions, realization of first and second order low, high and bandpass filters using Op-Amps.

Signal generators: Basic principle of sinusoidal oscillation, Op-Amp RC oscillators, and LC and crystal oscillators. Power Amplifiers: Classification of output stages, class A, B and AB output stages.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Be able to analyze analog and digital electronic circuits from a circuit and monolithic (integrated circuit) implementation point of view**		3										
CO2	**Be able to explain the design of elements in** bipolar- and CMOS-based op amps, feedback, power supplies, linear and non-linear	3											

		applications circuits with the op amp as the basic building block, and transistor circuits for realizing basic digital circuits												
	CO3	**Be able to apply the concepts of basic electronic devices to design, fabricate and test small electronic circuit**		**3**										
	CO4	**Be able to analyze the design, operation, and troubleshooting of electronic systems.**		**3**										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	**42**
Practical / Tutorial / Studio	**-**
Student-Centered Learning	**-**
Self-Directed Learning	
Non-face-to-face learning	**42**
Revision of the previous lecture at home	**21**
Preparation for final examination	**21**
Formal Assessment	
Continuous Assessment	**2**
Final Examination	**3**
Total	**131**

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE		
Week-1	Topic	CT-1
Class-1	Basic of Op-Amp and Circuit Symbol, Classification, Ideal Op-Amp Characteristics	
Class-2	Buffer/ Source Follower, Non Ideal Effects	
Class-3	Integrator(Non-inverting), Differentiator	
Week-2		
Class-4	Inverting Integrator, Inverting Differentiator, Weighted Summer, Subtractor	
Class-5	Zero Crossing Detector, Voltage level Detector(Comparator), Smoke Detector	
Class-6	Schmitt Trigger, Practical Op-Amp Amplifiers	
Week-3		Mid exam
Class-7	AC performance (Frequency Response/ Slew rate), Current Compensation	
Class-8	Input Resistance of feedback Op-Amp, Frequency Response Analysis, Semi-Logarithmic Graph Paper Scaling	
Class-9	Output Resistance Feedback Op-Amp, Bode Plot (Magnitude Plotting)	
Week-4		
Class-10	Bode Plotting (Phase plotting, magnitude plotting)	

	Class-11	Stability from Bode Plot	
	Class-12	Bode Plot Practice Examples, Phase Margin and Gain Margin	
	Week-5		
	Class-13	Stability	
	Class-14	Pole-Zero Plot	
	Class-15	Stability from Pole-Zero Plot	
	Week-6		
	Class-16	Frequency Band, Gain Bandwidth Product, Cut-off frequency	
	Class-17	Low Frequency Response, High Frequency Response	
	Class-18	Active Filter, Classification of Active Filter	
	Week-7		
	Class-19	LPF, HPF, BPF, BRF/ Notch	
	Class-20	LPF, HPF, BPF, BRF/ Notch -Continued	

	Class-21	Cut-Off Frequency of LPF, HPF, BPF, BRF/Notch	CT-2
	Week-8		
	Class-22	Filter Design	
	Class-23	Filter Design -Continued	
	Class-24	Oscillator	
	Week-9		CT-3
	Class-25	Phase-Shift Oscillator, Oscillator Design	
	Class-26	The Colpitts Oscillator, Wein bridge Oscillator	
	Class-27	Feedback Amplifier, Classification of Amplifier	
	Week-10		
	Class-28	Gain with feedback	
	Class-29	Advantages of feedback	
	Class-30	Advantages of feedback -Continued	
	Week 11		
	Class-31	Voltage series feedback	

	Class-32	Current series feedback	
	Class-33	Voltage shunt feedback	
	Week 12		
	Class-34	Related Math problems of feedback	
	Class-35	Current-Shunt feedback	
	Class-36	Method of Analysis of Current-shunt Amplifier	
	Week 13		
	Class-37	Power Amplifier	
	Class-38	Classification of Power Amplifier	
	Class-39	Advantages of Power Amplifier	
	Week 14		
	Class-40	Crossover distortion of Power Amplifier	
	Class-41	Efficiency of Power Amplifiers	
	Class-42	Efficiency of Power Amplifiers -Continued	

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy

Continuous Assessment (40%)	**Class Test/ Assignment 1-3**	**20%**	**CO1, CO3**	**C1, C2**
			CO 4	**C3**
	Class Performance	**5%**		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/project)	10%	**CO2**,**CO3**	C2, **C4**
Final Examination (Section A & B)		**60%**	**CO 1**	**C1**
			CO 2	**C4**
			CO 3	**C2**
			CO 4	**C3**
Total Marks		**100%**		

TEXT AND REFERENCE BOOKS:

1. **Semi-Conductor Circuit Approximation - Albert P Malvino; Tata McGraw- Hill.**
2. **Electronic Devices and circuit – Jacob Millman& Christos C. Halkias; Tata McGrawHill.**
3. **Micro-Electronic Circuit Analysis and Design- Donald A. Neamen; McGraw-Hill.**
4. **Operational Amplifier and Linear Integrated Circuit –RamakantGayakwad; Prentice Hall College Div.**

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COURSE INFORMATION			
Course Code Course Title	AEAV-217 Aircraft Electrical System	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This course is provided to impart knowledge on basics and application of different electro-mechanical systems including DC/AC motor, Generators; basics of Aircraft Electrical system including AC/DC Power generation in aircraft, Power distribution system in aircraft, wiring, Bus-bar system, starting system, electrical loads in aircraft etc.

OBJECTIVES

1. **To learn the basics of Electro-Mechanical system including Ideal transformer, transformation ratio, losses of transformer etc.**

2. **To understand the construction and operation of DC motor, DC generator, AC motor and Alternator.**

3. **To learn the basics of AC and DC power generations, Power supply system, electrical wiring in aircraft.**

4. **To understand the functioning of Power distribution system in aircraft, Bus-bar system, electrical starting system of aircraft engine, electrical loads etc.**

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to understand the Transformers, DC Generators, Alternators, DC/AC motors etc.	PO1	C2			K3	T, Q, F, ASG
CO2	Be able to analyze the working principles of any electrical machine under loaded and unloaded conditions.	PO1	C4			K3	T, Mid Term Exam, F
CO3	Be able to understand the basics of AC and DC power generations, Power supply systems, Electrical Wiring in aircraft.	PO2	C2			K3	T, Q, F, ASG
CO4	Be able to understand & analyze the	PO2	C2, C4			K4	T, Q, F, ASG

	functioning of aircraft Power distribution system, Bus-bar system, Starting system, Electrical loads.						

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS
Electro-Mechanical System: Transformer: Ideal transformer, transformation ratio, no-load and load vector diagrams, transformer test, tosses of transformer, eddy current loss, hysteresis loss. **Generator: Excitation systems, equivalent circuit, vector diagrams at different loads, factor.** **DC generator: Types, no load voltage characteristic, effect of speed on no-load and load characteristics and voltage regulation.** **Three Phase Alternator: Overview, Principle of operation.** **DC motor: Torque, counter emf, speed, torque-speed characteristics, starting and speed regulation.** **AC and DC Power Generation System in aircraft: AC/DC Electrical Power generation system, Aircraft batteries used in different types of aircraft,, Frequency wild & Constant frequency system, Voltage regulation, Paralleling & Load sharing etc.** **Aircraft Power Distribution System: Aircraft Power distribution system, Bus-bar system used in different aircraft, Electrical wiring system, Electrical starting system of aircraft, Auxiliary Power Unit (APU), Ground Power Unit (GPU), Electrical loads in aircraft, Aircraft lighting system.**

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	Be able to Define the Transformer, Ideal Transformer, Generator, DC generator, Three phase alternator, DC motor, AC motor etc.	3											
CO2	Ability to formulate and then analyze the working of any electrical machine under loaded and unloaded conditions	3											
CO3	Be able to understand the basics of AC and DC power generations, Power supply systems, Electrical Wiring in aircraft.		1										
CO4	Be able to understand and analyze the functioning of aircraft Power distribution system, Bus-bar system, Starting system, Electrical loads.		1										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**

Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

WEEK-1	TOPIC	CT/MID
Class 1	What is Transformer, construction, application.	CT-1
Class 2	Ideal transformer & its working principle.	
Class 3	Transformer test and losses of transformer.	
WEEK-2		
Class 4	Transformation ratio, no-load and load vector diagrams.	
Class 5	Eddy current loss, hysteresis loss.	
Class 6	Continue	
WEEK-3		
Class 7	Excitation systems, Equivalent circuit.	
Class 8	Vector diagrams at different loads.	
Class 9	Generator Factors.	
WEEK-4		MID Term
Class 10	Continue with generator.	
Class 11	Introduction to DC motor, Torque.	
Class 12	Counter EMF , Speed.	
WEEK-5		
Class 13	Torque-speed characteristics.	
Class 14	Starting and speed regulation.	
Class 15	Mathematical problems.	
WEEK-6		
Class 16	Introduction to Three phase alternator & construction.	
Class 17	Working Principle of Three Phase alternator.	
Class 18	Principle of operation of Three Phase alternator.	

WEEK-7		
Class 19	Principle of operation of Three Phase alternator.	
Class 20	Mathematical problems.	
Class 21	Overview of syllabus of Section A.	
WEEK-8		CT-2
Class 22	Introduction to Aircraft Electrical System; Syllabus, CO-PO.	
Class 23	Power sources, Power distribution systems.	
Class 24	AC Power Supply systems.	
WEEK-9		
Class 25	Frequency wild & Constant frequency system.	
Class 26	DC Power Supply systems.	
Class 27	Voltage regulation, Paralleling & Load sharing.	
WEEK-10		
Class 28	Lead Acid Batteries.	
Class 29	Nickel-Cadmium Batteries.	
Class 30	Typical Battery system in a Turbo-prop ac; Lithium Batteries.	
WEEK-11		CT-3
Class 31	Characteristics of Aircraft Electrical Wire, Wire Size.	
Class 32	Electric Conduit, Terminals, Bonding, Grounding.	
Class 33	Identification of Wire & Cable.	
WEEK-12		
Class 34	Busbar, Bus-ties, typical & Simplified Aircraft Bus-bar System.	
Class 35	Electrical power distribution systems of typical transport aircraft, helicopter etc.	
Class 36	Static & Rotary Converting Unit, Transformer Rectifier Unit.	
WEEK-13		
Class 37	Auxiliary Power Unit for starting of aircraft engines.	
Class 38	Ground Power System : DC System.	
Class 39	Ground Power System : AC System.	
WEEK-14		
Class 40	Electrical Loads, Exterior Lighting : Navigation, Anti-collision, Landing & Taxing Lighting system.	
Class 41	Interior Lighting : Cockpit, Cabin & Emergency Lighting system.	
Class 42	Overview of syllabus of Section B.	

ASSESMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment	Class Test/ Assignment	20%	CO1	C2

(40%)	1-3		CO3	C2
			CO4	C2, C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/project)	10%	CO2	C4
Final Examination (Section A & B)		60%	CO 1	C2
			CO 2	C4
			CO3	C2
			CO4	C2, C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. **Electric Machine and Transformers – Irving L. Kosow; Prentice Hall of India.**

2. **Aircraft Electrical and Electronic Systems - Mike Tooley and David Wyatt; Routledge.**

3. **A Text Book of Electrical Technology (Volume-II)- B L Theraja and A K Theraja; S.Chand& Company Ltd.**

4. **Aircraft Electrical Systems- EHJ Pallet; Pearson Education**

5. **Aircraft Electricity & Electronics- Thomas K Eismin, Tata McGraw-Hill**

6. **Electric Machinery Fundamental - Stephan J. Chapman; McGraw-Hill.**

COURSE INFORMATION

Course Code Course Title	: AEAV 216 : Electronics-II Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE

Course Code: EECE 162
Course Title: Electrical Circuit Analysis-I Sessional
Course Code: AEAV 202
Course Title: Electrical Circuit Analysis-II Sessional

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

The aim of this course is to introduce the students to the basic concepts of electronics. The primary objective of this course is to understand and implement the basic electronic circuits such as amplifiers, filters, oscillators etc with the help of theoretical and practical problem solving. It is required from the students to understand the analog electronic circuit which in turn are used as the building blocks of the larger and more complex systems.

OBJECTIVE

To correlate the theoretical concepts of various analog electronics circuits with practical feasibility; thereby students can learn different electronics circuits and its electrical characteristics in a better way.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to demonstrate engineering skills by way of breadboard circuit design with electronic devices and components.	5	Psychomotor/Precision			K6	R,Q,T

CO2	Be able to understand the practical aspects of basic electronics theory.	1	C2			K3	R, Q,T
CO3	Be able to build various Electronic circuits such as power amplifier, applications of operational amplifiers, RC coupled amplifiers, oscillators, digital circuits etc.	3	Psychomotor/Manipulation	P1, P2		K5	Pr, PR

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ;PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	Study of I-V characteristics of pn-junction diode
2.	Study of diode rectifier circuits
3.	STUDY OF N-P-N CB (Common Base) TRANSISTOR CHARACTERISTICS.
4.	STUDY OF N-P-N CE (Common Emitter) TRANSISTOR CHARACTERISTICS.
5.	Study the Characteristics of JFET
6.	Mathematical operations using op-amp adder & differentiator
7.	Mathematical operations using op-amp integrator circuit
8.	Determining the Frequency response curve of Low pass & High Pass filter using OP-Amp.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to demonstrate engineering skills by way of breadboard circuit design with electronic devices and components.					1							

CO2	Be able to understand the practical aspects of basic electronics theory.	2											
CO3	Be able to build various Electronic circuits such as power amplifier, applications of operational amplifiers, RC coupled amplifiers, oscillators, digital circuits etc.			3									
(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)													

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	14
Practical	28
Total	42
Self-Directed Learning	
Preparation of Lab Reports	10
Preparation of Lab Test	10
Preparation of presentation	5
Preparation of Quiz	10
Engagement in Group Projects	20
Formal Assessment	
Continuous Assessment	14
Final Quiz	1
Total	112

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Study of I-V characteristics of pn-junction diode
Week 2	Study of diode rectifier circuits
Week 3	STUDY OF N-P-N CB (Common Base) TRANSISTOR CHARACTERISTICS.
Week 4	STUDY OF N-P-N CE (Common Emitter) TRANSISTOR CHARACTERISTICS.

Week 5	Practice/Review
Week 6	Lab Test-1
Week 7	Study the Characteristics of JFET
Week 8	Mathematical operations using op-amp adder & differentiator
Week 9	Mathematical operations using op-amp integrator circuit
Week 10	Determining the Frequency response curve of Low pass & High Pass filter using OP-Amp.
Week 11	Practice/Review
Week 12	Lab Test-2
Week 13	Lab Quiz
Week 14	Viva

ASSESSMENT STRATEGY

Components	Grading		Bloom's Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P3/Precision
		CO 2	C2/Understand
Report Writing/Programming	15%	CO 1	P3/Precision
		CO 2	C2/Understand
Mid Term Evaluation (exam/project/assignment)	20%	CO3	P2/Manipulation
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	P3/Precision, C2/Understand, P2/ Manipulation
Viva Voce/ Presentation	10%	CO1, CO2, C03	P3/Precision, C2/Understand, P2/ Manipulation
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. Microelectronic Circuits – Adel S. Sedra & Keneth C. Smith; Oxford University Press.
2. Electronic Devices and Circuit Theory - R.L Boylsted; Prentice Hall of India Private Ltd. Private Ltd.

COURSE INFORMATION			
Course Code Course Title	: AEAV 218 : Aircraft Electrical System Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE
Course Code: AEAV 217 Course Title: Aircraft Electrical System

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This sessional is intended to familiarize the basics of electro-mechanical components like transformer, DC generator, DC motor, alternator and their operations.

OBJECTIVE
1. To have a basic knowledge of transformers. 2. To study basic knowledge of induction motor and the principles of DC motors in various practical fields. 3. To understand the basic working principle of various generators and motors. 4. To be able to understand the basics of DC Self-Excited Shunt Generator

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to analyze the knowledge about fundamental laws of electromagnetic circuits and transformer by applying basic electromagnetic laws.	5	C4			K6	R, Q, T

CO2	Be able to perform the working of linear machine as generator, motor and properties of three phase alternators by applying basic electromagnetic laws.	5	Psychomotor/ Manipulation			K6	R, Q,T, Pr, PR

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	Regulation of the Transformer in Various Loads
2.	Study the properties of DC Separately Excited Shunt Generator
3.	Study the properties of DC Self-Excited Shunt Generator
4.	Study the properties of DC Shunt Motor
5.	Study the properties of Three-Phase Alternator in various loads

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to analyze the knowledge about fundamental laws governing working of electromagnetic circuits and the working of transformer by applying basic electromagnetic laws on them.					3							
CO2	Be able to perform the working of linear machine as generator, motor and properties of three phase alternators by applying basic electromagnetic laws on them.					3							

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	07
Practical	14
Total	21
Self-Directed Learning	
Preparation of Lab Reports	05
Preparation of Lab Test	05
Preparation of presentation	05
Preparation of Quiz	05
Engagement in Group Projects	10
Formal Assessment	
Continuous Assessment	07
Final Quiz	1
Total	59

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Regulation of the Transformer in Various Loads
Week 2	Study the properties of DC Separately Excited Shunt Generator
Week 3	Study the properties of DC Self-Excited Shunt Generator
Week 4	Study the properties of DC Shunt Motor
Week 5	Study the properties of Three-Phase Alternator in various loads
Week 6	Lab Test
Week 7	Lab Quiz

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Conduct Lab Test/ Class Performance	25%	CO 1	C4/Analyze
		CO 2	P2/Manipulation
Report Writing/Programming	15%	CO 1	C4/Analyze
		CO 2	P2/Manipulation
Mid Term Evaluation (exam/project/assignment)	20%	CO2	P2/Manipulation
Final Evaluation	30%	CO1,	C4/Analyze, P2/Manipulation

(Exam/project/assignment)		CO2	
Viva Voce/ Presentation	10%	CO1, CO2	C4/Analyze, P2/Manipulation
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. Electric Machine and Transformers – Irving L. Kosow; Prentice Hall of India.
2. A Text Book of Electrical Technology (Volume-II)- B L Theraja and A K Theraja; S.Chand& Company Ltd.
3. Electric Machinery Fundamental - Stephan J. Chapman; McGraw-Hill.

COURSE INFORMATION			
Course Code Course Title	AEAV 301 Digital Systems	Lecture Contact Hours Credit hours	3.00 Hrs 3.00 Hrs
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This course will allow the students to gain all important fundamentals of digital system before they get into more advanced or optional topics. Digital technology is applied in almost everything in our daily lives. A strong fundamental of digital technology will prepare the students for further study in the related field.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1.	**Be able to explain** the structure of various number systems, combinational and sequential circuits and its applications in digital circuit design.	PO1	C2, C3			K3	T/ ASG, F
CO2.	**Be able to design complete logic circuits that can contribute positively in real life**	PO3	C6			K3	T/ ASG, F

	conditions.						
CO3.	**Be able to analyze and report on a project working in a group both as a member and as a leader.**	**PO2**	**C4**	**P1, P2, P3**		**K3**	**Mid Term Exam**
CO4.	**Be able to explain the architecture of 8086 microprocessor, addressing modes, instruction set** and its application.	**PO1**	**C2**			**K4**	**F**
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Digital System: Introduction to number systems and codes. Analysis and synthesis of digital logic circuits: Basic logic functions, Boolean algebra, combinational logic circuits, minimization of combinational logic. Modular combinational circuit, Multiplexer, demultiplexer and their implementation in CMOS, decoder, encoder, comparators, Introduction to programmable logic devices. Sequential circuits: Different types of latches, flip-flops. Shift registers, counters and their applications. Introduction to memory devices and their structure. Microprocessor: Introduction to microprocessors. Intel 8086 microprocessor: Architecture, addressing modes, instruction sets

SKILL MAPPING													
No.	**Course Outcome**	**PROGRAM OUTCOMES (PO)**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
CO1	**Be able to** explain the structure of various number systems, combinational and sequential circuits and its applications in digital circuit design.	**2**											
CO2	**Be able to design complete logic circuits that can contribute positively in real life conditions.**			**2**									
CO3	**Be able to analyze and report on a project working in a group both as a member and as a leader.**		**2**										
CO4	**Be able to explain the architecture of 8086 microprocessor, addressing modes, instruction set** and its application.	**1**											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	**42**
Practical / Tutorial / Studio	**-**
Student-Centered Learning	**-**

Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	**131**
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE			
Week	**Lecture**	**Topics**	**Remarks**
1	**Lec 1**	Concept of digital and analog systems, advantages and disadvantages of digital system.	**CT1/ASG, F**
	Lec 2	**Decimal, Binary, Octal & Hexadecimal number system**	
	Lec 3	**Signed number, Gray Code, Parity method of error detection, ASCII, Binary addition, division, subtraction, multiplication**	
2	**Lec 4**	**Operations, truth table and logic symbol of AND, OR, NAND, NOR, exclusive-OR, exclusive-NOR gate**	
	Lec 5	**Pulsed operation of different logic gates**	
	Lec 6	**Practical problem-solving using logic gates**	
3	**Lec 7**	**Laws of Boolean Algebra**	
	Lec 8	DeMorgan’s Theorem	

	Lec 9	Simplify expression by using laws and rules of Boolean algebra	
4	Lec 10	Sum of Product and Product of Sum	
	Lec 11	Karnaugh Map to simplify Boolean expression	
	Lec 12	Application of Boolean algebra and the Karnaugh map method to a system operation	
5	Lec 13	Basic combinational logic circuits	CT-2/ Mid Term, F
	Lec 14	Design a combinational logic circuit for a truth table and vice versa	
	Lec 15	Practical problem solving using combinational logic circuits	
6	Lec 16	The half adder, the full adder, parallel binary adders	
	Lec 17	Continue	
	Lec 18	Comparators (magnitude and cascaded comparators)	
7	Lec 19	Operation, truth table and logic symbol of basic decoders	
	Lec 20	Application example of decoder (BCD to decimal and BCD to 7 segment decoder)	
	Lec 21	Operation, truth table and logic symbol of basic encoders	
8	Lec 22	Code Converters (BCD to Binary, Binary to Gray and Gray to Binary)	CT-3/ Mid Term, F
	Lec 23	Operation of multiplexers (74LS151 and 74HC157A multiplexers)	
	Lec 24	Operation of demultiplexers (74HC154 multiplexers)	
9	Lec 25	Operation of S-R, D and J-K flip-flop, truth table, logic symbols	

	Lec 26	Continue	
	Lec 27	Application examples of different fip-flops.	
10	Lec 28	Asynchronous Counter operation	
	Lec 29	Application of Asynchronous Counter	
	Lec 30	Synchronous Counter operation	
11	Lec 31	Application of Synchronous Counter	CT-4/ASG, F
	Lec 32	Up/ down Synchronous Counter	
	Lec 33	Design of a Synchronous Counter	
12	Lec 34	Operation of shift registers, serial in/ serial out shift registers	
	Lec 35	Mathematical problems	
	Lec 36	Serial in- parallel out shift registers, parallel in-serial out shift registers, parallel in-parallel out shift registers	
13	Lec 37	Mathematical problems	
	Lec 38	Bidirectional shift registers, shift register counters	
	Lec 39	Continue	
14	Lec 40	Introduction to Microprocessor	
	Lec 41	The architecture of 8086 microprocessor, addressing modes, instruction set. .	

	Lec 42	Continue	

ASSESSMENT STRATEGY

Components		Grading		Blooms Taxonomy
(40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C2, C3,C6
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/project)	10%	CO3	C4
Final Examination (Section A & B)		60%	CO1	C2,C3
			CO2	C6
			CO3	C4
			CO4	C2
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. **Digital Logic and Computer Design- M Morris Mano; Prentice Hall of India Private Ltd.**
2. **Digital Fundamentals - Floyd; Prentice Hall International, Inc.**
3. **Pulse, Digital and Switching waveforms - Jacob Millman & Herbert Taub; Tata McGraw-Hill.**
4. **Microprocessor and Interfacing - Douglas V. Hall; Tata McGraw-Hill.**
5. **Microprocessor and Microprocessor Based System Design - Dr M. Rafiquzzaman; Universal Book Stall New Del**

COURSE INFORMATION			
Course Code Course Title	AEAV 303 Signal and System	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To understand the basics of electrical signals as well as the analysis and design of systems			
OBJECTIVES			

1. To describe signals mathematically and understand how to perform mathematical operations on signals. The operations should include operations on the dependent as well as independent variables.
2. To be familiar with commonly used signals such as the unit step, ramp, impulse function, sinusoidal signals and complex exponentials.
3. To be able to describe systems using linear constant coefficient differential equations and using their impulse response.
4. To be familiar with system properties - linearity, time invariance, presence or absence of memory, causality, bounded-input bounded-output stability and inevitability. Be able to identify whether a given system exhibits these properties and its implication for practical systems.

COURSE OUTCOMES & GENERIC SKILLS							
NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to understand the classification of signals and characteristics of systems	PO1	C2			K3	T, F, ASG
CO2	Be able to analyze the time domain LTI systems using convolution, impulse response, state variable representation and simulation diagrams	PO2	C4			K3	T, F, ASG
CO3	Be able to analyze the use of Fourier series and transforms and state-variables in order to solve electrical engineering problems.	PO2	C4	P1, P2		K3	T, F, ASG
CO4	Be able to analyze the use of Laplace Transform in order to solve engineering problems	PO2	C4	P1, P2		K4	T, F, ASG
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

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COURSE CONTENTS
Classification of signals and systems: signals - classification, basic operation on signals, elementary signals, representation of signals using impulse function; systems – classification. **Properties of Linear Time Invariant (LTI) systems:** Linearity, causality, time invariance, memory, stability, inevitability. **Time domain analysis of LTI systems:** Differential equations - system representation, order of the system, solution techniques, zero state and zero input response, system properties; impulse response - convolution integral, determination of system properties; state variable - basic concept, state equation and time domain solution. **Frequency domain analysis of LTI systems:** Fourier series- properties, harmonic representation, system response, frequency response of LTI systems. **Fourier transformation-** properties, system transfer function, system response and distortion-less systems. Applications of time and frequency domain analyses: solution of analog electrical and mechanical systems, amplitude modulation and demodulation, time-division and frequency-division multiplexing. **Laplace transformation:** properties, inverse transform, solution of system equations, system transfer function, system stability and frequency response and application.

SKILL MAPPIIG

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to understand the classification of signals and characteristics of systems	2											
CO2	Be able to analyze the time domain LTI systems using convolution, impulse response, state variable representation and simulation diagrams		3										
CO3	Be able to analyze the use of Fourier series and transforms and state-variables in order to solve electrical engineering problems.		3										
CO4	Be able to analyze the use of Laplace Transform in order to solve engineering problems		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE		
Week 1	**Introduction to signal and system**	CT 1
Class 1	Signals - classification	
Class 2	Elementary signals	
Class 3	Periodic vs aperiodic signals, Continuous vs discrete signals	
Week 2	**Transformation of independent variable**	
Class 4	Basic operation on signals: types	
Class 5	The shifting operation	
Class 6	Reflection operation, Time scaling operation	
Week 3	**Properties of Linear Time Invariant (LTI) systems**	
Class 7	Linear and nonlinear systems	
Class 8	Time varying and time invariant systems	
Class 9	System with and without memory	
Week 4	**Properties of Linear Time Invariant (LTI) systems**	CT 2
Class 10	Causal and non-causal systems	
Class 11	Convolution integral	
Class 12	Graphical interpretation of Convolution	

Week 5	Time domain analysis of LTI systems	
Class 13	Differential equations - system representation, system properties	
Class 14	Zero state and zero input response	
Class 15	impulse response - convolution integral	
Week 6	State variable - basic concept	
Class 16	Determination of system properties	
Class 17	State equation	
Class 18	Time domain solution	
Week 7	Frequency domain analysis of LTI systems: system response, frequency response of LTI systems.	CT 3
Class 19	Introduction to Fourier series	
Class 20	Dirichlet Condition and orthogonality	
Class 21	Properties of Fourier series	
Week 8	Types of Fourier Series	
Class 22	Basic concept of trigonometric Fourier series	
Class 23	Problem solving techniques	
Class 24	Effect of Symmetry	
Week 9	Fourier Series	
Class 25	Exponential Fourier Series	
Class 26	Convolution of two signals	
Class 27	Systems with periodic inputs	
Week 10	Fourier transformation	CT 4
Class 28	Properties	
Class 29	system transfer function	
Class 30	Problem solving on basic properties	
Week 11	Fourier transformation	
Class 31	Convolution of signals	
Class 32	Energy of aperiodic signals	
Class 33	Problem solving	
Week 12	Applications of Fourier transformation	
Class 34	Amplitude modulation	
Class 35	Demodulation	
Class 36	time-division and frequency-division multiplexing	
Week 13	Laplace transformation	
Class 37	Properties	
Class 38	Inverse transform	
Class 39	Problem solving	
Week 14	system equations	

Class 40	**System stability**	
Class 41	**System transfer function**	
Class 42	**Frequency response and application.**	

ASSESSMENT STRATEGY

<table>
<tr><th colspan="2">Components</th><th>Grading</th><th>CO</th><th>Blooms Taxonomy</th></tr>
<tr><td rowspan="5">Continuous Assessment (40%)</td><td rowspan="2">Class Test/ Assignment 1-3</td><td rowspan="2">20%</td><td>CO1, CO2</td><td>C1, C2</td></tr>
<tr><td>CO 2</td><td>C3</td></tr>
<tr><td>Class Performance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Class Attendance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Mid-Term Assessment (Exam/project)</td><td>10%</td><td>CO 2, CO3</td><td>C3</td></tr>
<tr><td colspan="2" rowspan="4">Final Examination (Section A & B)</td><td rowspan="4">60%</td><td>CO 1</td><td>CO 1</td></tr>
<tr><td>CO 2</td><td>CO 2</td></tr>
<tr><td>CO 3</td><td>CO 3</td></tr>
<tr><td>CO4</td><td>CO4</td></tr>
</table>

	Total Marks	**100%**		

TEXT AND REFERENCE BOOKS:

1. **Signals and Systems, 2nd Edition- Simon Haykin, Barry Van Veen; Pearson Education Asia**
2. **Signal Processing and Linear Systems, 1st Edition- B.P. Lathi; Oxford University Press**
3. **Continuous and Discrete Signals & Systems - S.S. Soliman & M. D. Srinath; Prentice Hall of India Private Ltd.**
4. **Signal and System (Continuous & Discrete) - R.E. Ziemer; Pearson Education Asia.**
5. **Feedback Control System - Phillips & Horbour; Prentice Hall.**
6. **Signals and Systems- Alan V. Oppenheim and Alan S. Willsky; Prentice Hall.**

COURSE INFORMATION			
Course Code Course Title	: AEAV 302 : Digital Systems Sessional	Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE
Course Code: AEAV 301 Course Title: Digital Systems

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This sessional is intended to teach the students basics, concepts, principles and working of digital circuits putting forth the use of a transistor as a switch, number systems, Boolean Algebra, logic gates, counters, timers and so on.

OBJECTIVE
1. To learn about combinational digital circuits. 2. To learn about sequential digital circuits. 3. To solve complex design problems regarding digital electronics based on realistic aspects. 4. To develop communication and project management skills among the students through presentation and mini projects.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **demonstrate** the use of standard electronic test equipment such as logic gates, digital multi-meters, power supplies and other digital equipment to test, andimplement digital circuits.	5	C4			K7	R, Q,T
CO2	**Be able to analyze a circuit correctly and compare its theoretical performance to actual performance**.	2	C4			K3	R, Q,T

CO3	Be able to develop a project by digital circuits to solve real life problems working in a group as a member or as a leader.	5	Psycho motor/ Articu lation	P1,P2 ,P3		K6	Pr, PR

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ;PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	**Familiarization and use of truth table of basic logic Gates.**
2.	De Morgan's Laws using the Logic Gates
3.	**Truth tables and simplification using Boolean algebra**
4.	**Design of Adder & Subtraction circuits using basic gates**
5.	**Design and implement of encoder and decoder circuits**
6.	**Design and implement of BCD to seven-segment decoder circuit using logic gates.**
7.	**Design and implement of Multiplexer & De-multiplexer circuit using logic gates**
8.	**Design and implement of various types of clocked flip-flop circuits using logic gates.**
9.	**Design and implement of up and down counters**
10.	**Project**

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to demonstrate the use of standard electronic test equipment such as logic gates, digital multi-meters, power supplies and other digital equipment to test, and					1							

	implement digital circuits.												
CO2	Be able to analyze a circuit correctly and compare its theoretical performance to actual performance. .		2										
CO3	Be able to develop a project by digital circuits to solve real life problems working in a group as a member or as a leader					2							
(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)													

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	14
Practical	28
Total	42
Self-Directed Learning	
Preparation of Lab Reports	10
Preparation of Lab Test	10
Preparation of presentation	5
Preparation of Quiz	10
Engagement in Group Projects	20
Formal Assessment	
Continuous Assessment	14
Final Quiz	1
Total	112

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Familiarization and use of truth table of basic logic Gates.

Week 2	De Morgan's Laws using the Logic Gates
Week 3	**Truth tables and simplification using Boolean algebra**
Week 4	**Design of Adder & Subtraction circuits using basic gates**
Week 5	**Design and implement of encoder and decoder circuits**
Week 6	**Design and implement of BCD to seven-segment decoder circuit using logic gates.**
Week 7	**Design and implement of Multiplexer & De-multiplexer circuit using logic gates**
Week 8	**Design and implement of various types of clocked flip-flop circuits using logic gates.**
Week 9	**Design and implement of up and down counters**
Week 10	**Review**
Week 11	**Lab Test-1**
Week 12	**Lab Quiz**
Week 13	**Presentation on Assigned Problems**
Week 14	**Project Demonstration**

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P3/Precision
		CO 2	C4/Analyse
Report Writing/Programming	15%	CO 1	P3/Precision
		CO 2	C4/Analyse
Mid Term Evaluation (exam/project/assignment)	20%	CO3	P4/ Articulation
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	P3/Precision, C4/Analyse, P4/ Articulation
Viva Voce/ Presentation	10%	CO1, CO2, C03	P3/Precision, C4/Analyse, P4/ Articulation
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

7. **Digital Logic and Computer Design- M Morris Mano; Prentice Hall of India Private Ltd.**
8. **Digital Fundamentals - Floyd; Prentice Hall International, Inc.**
9. **Pulse, Digital and Switching waveforms - Jacob Millman & Herbert Taub; Tata McGraw-Hill.**
10. **Microprocessor and Interfacing - Douglas V. Hall; Tata McGraw-Hill.**
11. **Microprocessor and Microprocessor Based System Design - Dr M. Rafiquzzaman; Universal Book Stall New Delhi.**

COURSE INFORMATION			
Course Code Course Title	AEAV 305 Communication Engineering	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
Signals and Systems			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
The course objective is to cover the principles of analog and digital communication systems involving different modulation and demodulation technique. The course relies heavily on deterministic analytical tools such as Fourier series, Fourier transforms and the sampling theorem.			
OBJECTIVES			
1. To develop and compare the functional blocks of coding/modulation and demodulation/decoding for analog and digital communication systems. 2. To analyze the analog-to-digital conversion process with emphasis on Nyquist Sampling Criteria, line coding, pulse shaping and optimum detection functions. 3. To analyze different parameters of analog and digital communication techniques.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
1.	Be able to explain the fundamental principles of communication systems, noises, information theory and application of	PO1	C2, C3			K3	T/ ASG, F

	modulations in aircraft communication system						
2.	**Be able to describe and compare different types of amplitude modulations, demodulations, applications, advantages and limitations.**	**PO1**	**C2**			K3	**T/ Mid Term Exam, F**
3.	**Be able to explain the fundamentals of angle modulation, demodulation and its application in communication system.**	**PO1**	**C2**			K3	**T/Mid Term Exam, F,**
4.	**Be able to describe the basic concepts of analog to digital signal conversion, digital modulation and demodulation techniques.**	**PO1**	**C2**			K3	**T/ ASG, F**
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
<u>Overview of communication systems</u>: Basic principles & fundamental elements; Noise: Sources & characteristics. <u>Information theory</u>: Measure of information, channel capacity of a continuous system and channel capacity; <u>Communication systems</u>: Analog and digital. <u>Continuous wave modulation</u>: Transmission types, Amplitude modulation: Introduction, double side band, single side band, vestigial side band, quadrature, spectral analysis of each type, envelope and synchronous detection. <u>Angle modulation</u>: Instantaneous frequency, frequency modulation (FM) and phase modulation (PM), spectral analysis, demodulation of FM and PM. Pulse modulation: Sampling theorem, Nyquist criterion, aliasing, instantaneous and natural sampling. Pulse amplitude modulation: Principle, bandwidth requirements. <u>Pulse code modulation (PCM):</u> Quantization principle, quantization noise, non-uniform quantization, signal to quantization error ratio, differential PCM, demodulation of PCM. <u>Delta modulation (DM):</u> Principle, adaptive DM, line coding – formats and bandwidths. <u>Digital modulation:</u> Amplitude-shift keying - Phase-shift keying (PSK): Frequency-shift Keying (FSK) <u>Multiplexing:</u> Time division multiplexing (TDM) - principle, receiver synchronization, frame synchronization, TDM of multiple bit rate systems, frequency division multiplexing - principle, de-multiplexing, wavelength-division multiplexing. <u>Aircraft Communication System:</u> Intercommunication System, VHF/UHF Communication, HF Communication, Satellite Communication, Emergency Locator Transmitter.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO) 1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to explain the fundamental principles of communication systems, noises, information theory and application of modulations in aircraft communication system.	2											
CO2	Be able to describe and compare different types of amplitude modulations, demodulations, applications, advantages and limitations.	2											

	CO3	Be able to explain the fundamentals of angle modulation, demodulation and its application in communication system	2											
	CO4	Describe the basic concepts of analog to digital signal conversion, digital modulation and demodulation techniques.	2											
(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)														

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE			
Week	**Lecture**	**Topics**	**Remaks**
1	**Lec 1**	**Information Theory**	**CT1**
	Lec 2	Shanon's information capacity theorem	
	Lec 3	**Basic communication block diagram**	
2	**Lec 4**	**DSB-SC modulation**	
	Lec 5	**Tone Modulation**	
	Lec 6	**Multiplier Modulator, Non-Linear Modulator, Switch Modulator, Ring Modulator**	
3	**Lec 7**	**Coherent and Non-coherent Demodulation**	
	Lec 8	**Sigle Sideband Modulation**	
	Lec 9	**Numerical Problem**	
4	**Lec 10**	**Vestigial Sideband Modulation and Demodulation**	
	Lec 11	**Quadrature Amplitude Modulation and Demodulation**	
	Lec 12	**Applications of Modulations**	
5	**Lec 13**	**Angle Modulation**	**CT-2**
	Lec 14	**Relationship between phase and frequency modulation**	
	Lec 15	**Generation of Frequency Modulation**	
6	**Lec 16**	**Pulse modulation: Sampling theorem** **Definition, Principle**	

	Lec 17	Nyquist criterion Aliasing	
	Lec 18	Bandwidth requirements and application	
7	Lec 19	Definition of Pulse code Modulation, quantization & quantization principle	
	Lec 20	Quantization noise, non-uniform quantization	
	Lec 21	Signal to quantization error ratio and math	
8	Lec 22	Time Division Multiplexing	CT-3
	Lec 23	TDM: Receiver synchronization, frame synchronization	
	Lec 24	Frequency Division Multiplexing	
9	Lec 25	DPCM (transmitter, receiver)	
	Lec 26	Continue	
	Lec 27	ADPCM &Demodulation of PCM	
10	Lec 28	Continue	
	Lec 29	TDM of multiple bit rate systems	
	Lec 30	Delta modulation (DM): Principle, transmitter & receiver	
11	Lec 31	Continue	CT-4
	Lec 32	Adaptive DM: (transmitter and receiver)	
12	Lec 34	DM: Threshold of coding and overloading	
	Lec 35	Digital modulation: Amplitude-shift keying	

	Lec 36	**Phase-shift keying (PSK):**	
13	**Lec 37**	**BPSK & QPSK**	
	Lec 38	Frequency-shift Keying (FSK)	
	Lec 39	Line coding and its properties	
14	Lec 40	Aircraft Communication	
	Lec 41	**HF Communication**	
	Lec 42	**VHF Communication**	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment	20%	CO1, CO3 CO4	C2, C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid- Term Assessment (Exam /Project)	10%	CO1, CO2	C2
Final Examination (Section A & B)		60%	CO1	C2 , C3
			CO2	C2
			CO3	C2
			CO4	C2
Total		100%		

TEXT AND REFERENCE BOOKS:

1. Digital and Analog Communication System - Leon W. Couch; Pearson Education.
2. Communication System - Somon Haykin; John Wiley & Sons, Inc.
3. Modern Digital & Analog Communication System - B. P. Lathi; Oxford University Press.
4. Telecommunication Switching Systems and Networks - Thiagarajan Viswanathan; Prentice Hall of India Private Ltd.
5. Electronic Communication Systems-Kennedy & Davis; Tata McGraw Hill

COURSE INFORMATION			
Course Code **Course Title**	**AEAV 307** **Electromagnetic Field Theory**	**Lecture Contact Hours** **Credit hours**	**3.00** **3.00**

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
To learn and familiarize with the basics of electro- magnetic field theories and implement that knowledge in the field of aircraft communication and navigation.

OBJECTIVES
1. **To learn the basic of Static electric field** 2. **To study the different boundary conditions** 3. **To use the principles** Poisson‘s and Laplace‘s equations in different co**-ordinate systems.** 4. **To understand the basic of** Maxwell‘s equations: Faraday‘s law of **electromagnetic induction,**

COURSE OUTCOMES & GENERIC SKILLS							
NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1.	Be able to apply vector calculus to static electric-magnetic fields in different engineering situations.	PO1	C3	-		K3	T/ ASG, F
CO2.	Be able to analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.	PO2	C4	P1, P2		K3	T/ Mid Term Exam, F
CO3.	Be able to examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.	PO1	C4			K3	T/Mid Term Exam, F,
CO4.	Be able to compare the nature of electromagnetic wave propagation in guided medium which are used in microwave applications.	PO1	C2			K4	T/ ASG, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Static electric field: Postulates of electrostatics, Coulomb‘s law for discrete and continuously distributed charges, Gauss‘s law and its application, electric potential due to charge distribution, conductors and dielectrics in static electric field, flux density - boundary conditions, capacitance - electrostatic energy and forces, energy in terms of field equations, capacitance calculation of different geometries, boundary value problems – Poisson‘s and Laplace‘s equations in different co-ordinate systems. **Steady electric current:** Ohm‘s law, continuity equation, Joule‘s law, resistance calculation. **Static Magnetic field:** Postulates of magneto statics, Biot-Savart‘s law, Ampere‘s law and applications, vector magnetic potential, magnetic dipole, magnetization, magnetic field intensity and relative permeability, boundary conditions for magnetic field, magnetic energy, magnetic forces, torque and inductance of different geometries. Time varying fields and Maxwell‘s equations: Faraday‘s law of electromagnetic induction, Maxwell‘s equations - differential and integral forms, boundary conditions, potential functions, time harmonic fields and Poynting theorem. Plane electromagnetic wave: Plane wave in loss less media - Doppler effect, transverse electromagnetic wave, polarization of plane wave, plane wave in lossy media – low-loss dielectrics, good conductors, group velocity, instantaneous and average power densities.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to apply vector calculus to static electric-magnetic fields in different engineering situations.	1											
CO2	Be able to analyze Maxwell's equation in different forms (differential and integral) and apply them to diverse engineering problems.		1										
CO3	Be able to examine the phenomena of wave propagation in different media and its interfaces and in applications of microwave engineering.	1											
CO4	Be able to compare the nature of	1											

		electromagnetic wave propagation in guided medium which are used in microwave applications.													
(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)															

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	42
Lecture	-
Practical / Tutorial / Studio	-
Student-Centered Learning	
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week 1	Introduction to Electromagnetics
Class 1	Fundamentals Quantities of Electromagnetics
Class 2	Co-ordinate Transformation
Class 3	Fundamentals postulates of Electrostatics

Week 2	Law's of Electrical Field
Class 4	Coulomb's law of Electric Field, Guass Law
Class 5	**Ring Charge, Surface Charge and related problems**
Class 6	**Surface Charge using Guass Law**
Week 3	**Electric Field and related terms**
Class 7	**Electric Scalar Potential and related problems**

Class 8	**Electric Dipole, Material in a static Electric Field**	
Class 9	**Electric Field Intensity and relative permittivity and related problems**	
Week 4	**Capacitance and Energy**	**CT 1**
Class 10	**Capacitance of a capacitor, Capacitance of Cylinder**	
Class 11	Electric Store Energy, Poisson's and Laplace Equation with **boundary conditions**	
Class 12	**Image Theory/ Method of Image**	
Week 5	**Energy and Power related terms**	
Class 13	**Image Theory Method of Image**	
Class 14	**Line Charge, Steady Current, Convection/Conduction Current Density**	
Class 15	**Resistance calculation, Power Dissipation**	
Week 6	**Magneto statics**	
Class 16	**Governing and boundary equations for current density and related problems**	
Class 17	**Equivalent RC circuits, Magneto statics**	

Class 18	**Fundamental postulates of Magneto statics**	
Week 7	**Magnetic Characteristics**	**CT 2**
Class 19	**Biot-Savart Law, Magnetic Dipole**	
Class 20	**Boundary Conditions and Related Problems**	
Class 21	**Classification of Magnetic material**	
Week 8	**Magnetic Properties**	
Class 22	**Inductance of an Inductor, Inductance of a co-axial cable**	
Class 23	**Magnetic Store Energy, Magnetic Store energy for a co-axial cable**	
Class 24	**Magnetic Force and related problems**	
Week 9	**Time Varying Electromagnetics and Wave equation**	**Mid term**
Class 25	**Time Varying Electro magnetics, Fundamental Postulates and related problems**	
Class 26	Time Varying Potentials and Maxwell's equations	
Class 27	**Time Harmonic Electro magnetics, Wave equation fro electric and magnetic field**	
Week 10	**Plane Wave Polarization**	
Class 28	**Plane Wave, Polarization. Uniform Plane Wave**	

Class 29	Doppler Effect and problems	
Class 30	Plane Wave in a Lossy media	
Week 11	**Plane wave propagation and power flow**	
Class 31	Plane wave propagating through a good conductor	
Class 32	Skin Depth/ Depth of Penetration	
Class 33	Electromagnetics Power Flow	
Week 12	**Pointing vector and Average power density**	CT-3
Class 34	Continued and related math problems	
Class 35	Pointing vector and Average Power density	
Class 36	Instantaneous expression of pointing vector and average power density	
Week 13	**Plane wave and co-efficient**	
Class 37	Group Velocity and Phase Velocity	
Class 38	Nominal incidence of a plane wave at plane boundary	
Class 39	Refection Coefficient, Transmission co-efficient, Standing wave ratio	
Week 14	**Problems Analysis**	
Class 40	Continued and Related Mathematical Problems	
Class 41	Normal Incidence of plane wave on a good conductor	
Class 42	Problem analysis and solving method	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1	C3
			CO2/CO 3	C4
			CO 4	C2
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam /Project)	10%	CO 2	C4
			CO3	
Final Examination (Section A & B) (60%)		60%	CO 1	C3
			CO 2	C4
			CO3	C4
			CO4	C2
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. **Engineering Electromagnetics – W. H. HaytJr& John A. Buck; Tata McGraw-Hill Publishing Company Ltd**
2. **Fields and Waves in Communication Electronics - Simon Ramo; John Wiley & Sons.**

3. **Fundamentals of Engineering Electromagnetic - D.K. Cheng; Prentice Hall of India Private Ltd.**

COURSE INFORMATION			
Course Code **Course Title**	**AEAV 309** **Aircraft Avionics systems**	**Lecture Contact Hours** **Credit hours**	**3.00** **3.00**
PRE-REQUISITE			
Electromechanical Systems			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn and familiarize with the basics of electro- magnetic field theories and implement that knowledge in the field of communication.			
OBJECTIVES			
1. To learn the basic of Static electric field **2. To study the different boundary conditions** **3.** To use the principles Poisson‘s and Laplace‘s equations in different co**-ordinate systems** **4.** To understand the basic of Maxwell‘s equations: Faraday‘s law of **electromagnetic induction**			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	**Be able to define the generation of AC and DC power and supply in aircraft, bus bar, generator, alternator, fuses and circuit breakers in aircraft power supply.**	**PO1**	**C1**			K3	**T,F,ASG**
CO2	**Be able to explain the concept of emergency power supply, aircraft batteries and Illustrate various safety requirements, aircraft electrical wiring and lighting.**	**PO2**	**C2**			K3	**T,Q,F**
CO3	**Be able to apply the knowledge to understand the performance of Full Authority Digital Engine Control (FADEC) System.**	**PO1**	**C3**			K3	**T,F**
CO4	**Be able to analyze the basic aspects of Hydraulic systems, Pneumatic systems, brake system**	**PO2**	**C4**			K3	**F,ASG**
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Aircraft Electrical Systems: AC and DC power generations and supply in aircraft, bus bar, generator, alternator, fuses and circuit breakers in aircraft power supply, Concept of emergency power supply, aircraft batteries, types, capacity etc. external power supplies, Auxiliary Power Unit (APU), Components of power distribution, safety requirements, aircraft electrical wiring and lighting. **Aircraft Electronic Systems** Integrated Cockpit Display System: Introduction, Cockpit Display System, Glass Cockpit, Display Unit, HUD, HDD, HMD, IEEE smart sensors. **Engine Control and Monitoring System:** Principles of Operation, Engine Indications and Monitoring, Full Authority Digital Engine Control (FADEC) System. **Emergency Systems:** Warning Systems, Fire Detection and Suppression, Emergency Oxygen, Passenger Evacuation, Cockpit Voice Recorder & Flight Data Recording System, Ice & Rain Protection System, Emergency power sources, Emergency landing. **Airplane control systems:** Push pull rod system, operating principles, Cable and pulley system, Power assisted and fully powered flight controls, digital fly by wire systems. Introduction to Hydraulic systems, Pneumatic systems, brake system, anti-skidding, landing gear systems, Engine Fuel systems, Air conditioning and pressurizing system, deicing and anti- icing system.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to define the generation of AC and DC power and supply in aircraft, bus bar, generator, alternator, fuses and circuit breakers in aircraft power supply.	3											

CO2	Be able to explain the concept of emergency power supply, aircraft batteries and Illustrate various safety requirements, aircraft electrical wiring and lighting.		3										
CO3	Be able to apply the knowledge to understand the performance of Full Authority Digital Engine Control (FADEC) System.	3											
CO4	Be able to analyze the basic aspects of Hydraulic systems, Pneumatic systems, brake system		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE		
Week 1	Aircraft Electrical Systems	CT 1
Class 1	AC And DC Power Generations And Supply In Aircraft	
Class 2	Bus Bar,	
Class 3	Generator	
Week 2	Aircraft Electrical Systems	
Class 4	Alternator	
Class 5	Fuses And Circuit Breakers in Aircraft Power Supply	
Class 6	Concept of Emergency Power Supply	
Week 3	Aircraft Power Supply	
Class 7	Aircraft Batteries, Types, Capacity etc	
Class 8	Auxiliary Power Unit (APU)	
Class 9	Power Supplies, Components of Power Distribution	
Week 4		MID Term
Class 10	External Power Supply	
Class 11	Safety Requirements	
Class 12	Aircraft Electrical Wiring and Lighting	
Week 5	Aircraft Electronic Systems	
Class 13	Integrated Cockpit Display System	
Class 14	Introduction, Cockpit Display System	
Class 15	Glass Cockpit, Display Unit	
Week 6	Engine Control and Monitoring System	
Class 16	HUD, HDD	
Class 17	HMD	
Class 18	IEEE Smart Sensors	
Week 7	Emergency Systems	CT 2
Class 19	Principles of Operation	
Class 20	Engine Indications and Monitoring	

Class 21	Full Authority Digital Engine Control (FADEC) System.	
Week 8		
Class 22	Warning Systems	
Class 23	Fire Detection and Suppression	
Class 24	Emergency Oxygen	
Week 9		
Class 25	Passenger Evacuation	
Class 26	Continue	
Class 27	Continue	
Week 10		CT 3
Class 28	Ice & Rain Protection System	
Class 29	Emergency power sources	
Class 30	Emergency landing	
Week 11	Airplane control systems	
Class 31	Push pull rod system	
Class 32	Operating Principles	
Class 33	Cable and pulley system	
Week 12		
Class 34	Power assisted and fully powered flight controls	
Class 35	Digital fly by wire systems	
Class 36	Continue	
Week 13	Introduction to Aircraft Aerospace	
Class 37	Hydraulic systems	
Class 38	Pneumatic systems	
Class 39	Brake system, anti-skidding, landing gear systems	
Week 14		
Class 40	Engine Fuel systems	

Class 41	**Air conditioning and pressurizing system**	
Class 42	**Deicing and anti- icing system.**	

ASSESEMENT STRATEGY

<table>
<tr><td colspan="3"></td><td rowspan="2">CO</td><td rowspan="2">Blooms Taxonomy</td></tr>
<tr><td colspan="2">Components</td><td>Grading</td></tr>
<tr><td rowspan="5">Continuous Assessment (40%)</td><td rowspan="2">Class Test/ Assignment 1-3</td><td rowspan="2">20%</td><td>CO1
CO3</td><td>C1, C3</td></tr>
<tr><td>CO4</td><td>C4</td></tr>
<tr><td>Class Performance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Class Attendance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Mid-Term Assessment (Exam /Project)</td><td>10%</td><td>CO 2</td><td>C2</td></tr>
<tr><td colspan="2" rowspan="4">Final Examination (Section A & B)</td><td rowspan="3">60%</td><td>CO 1</td><td>C1</td></tr>
<tr><td>CO2</td><td>C2</td></tr>
<tr><td>CO3</td><td>C3</td></tr>
<tr><td></td><td>CO4</td><td>C4</td></tr>
<tr><td colspan="2">Total Marks</td><td>100%</td><td colspan="2"></td></tr>
</table>

TEXT AND REFERENCE BOOKS:

1. Aircraft Systems (3rd edition) -- Ian Moir, Allan Seabridge; WILEY Publications.

2. Handbooks of Airframe and Power plant Mechanics; US dept. of Transportation, Federal, Aviation Administration, The English Book Store, New Delhi, 1995
3. Aircraft Electrical Systems- EHJ Pallette, 3rd edition, Pearson Education.
4. Aircraft Electronics- F Terry White, White Publications.
5. Fundamentals of Aircraft Electronics- Scott Kenney, Avotek Information Resources.

6. Aircraft Communications and Navigation Systems - David Wyatt, Mike Tooley: Routledge

COURSE INFORMATION			
Course Code Course Title	AEAV 313 Digital Signal Processing	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
Signal and Systems			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn and familiarize the discrete signals and systems and also designing various filters			
OBJECTIVES			
1. To study about discrete time systems. 2. To study the design techniques for FIR and IIR digital filters 3. To study the conversion for analogue signal to digital signal in signal processing 4. To study the properties of random signal, digital signal processing			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	Course Outcome	Correspon ding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to understand the basic concepts of signals, signal processing and digital signals, signals and systems in discrete time, analog to digital conversion, impulse response.	PO1	C2	1		K3	T, F, ASG
CO2	Be able to explain the Fourier transform and convolution to filter signals and explain the properties of the discrete-time Fourier transform (DTFT), discrete Fourier transform (DFT) and properties, fast Fourier transform (FFT)	PO2	C3	2		K4	T, F, ASG
CO3	Be able to analyze signals and systems in discrete time, including use of the z-transform, Correlation: Circular convolution, auto-correlation and cross correlation.	PO2	C4	2		K3	T, Mid Term Exam, F
CO4	Be able to design infinite impulse response (IIR) filters using impulse invariance method and bilinear transformation method, , design using impulse invariant, bi-linear Z transformation, least-square methods and finite precision effects.	PO3	C5	3		K4	Mid Term Exam, F, ASG
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Introduction to digital signal processing (DSP): Discrete-time signals and systems, analog to digital conversion, impulse response, finite impulse response (FIR) and infinite impulse response (IIR) of discrete-time systems, difference equation, convolution, transient and steady state response. **Discrete transformations:** Discrete Fourier series, discrete-time Fourier series, discrete Fourier transform (DFT) and properties, fast Fourier transform (FFT), inverse fast Fourier transform. Z transformation - properties, transfer function, poles and zeros and inverse Z transform. Correlation: Circular convolution, auto-correlation and cross correlation. **Digital Filters:** FIR filters - linear phase filters, specifications, design using window, optimal and frequency sampling methods. IIR filters – specifications, design using impulse invariant, bi-linear Z transformation, least-square methods and finite precision effects. Introduction to MATLAB Simulink application in DSP. Implementation of DSP in RADAR Engineering.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to understand the basic concepts of signals, signal processing and digital signals, signals and systems in discrete time, analog to digital conversion, impulse response.	3											

	CO2	Be able to explain the Fourier transform and convolution to filter signals and explain the properties of the discrete-time Fourier transform (DTFT), discrete Fourier transform (DFT) and properties, fast Fourier transform (FFT)		3										
	CO3	Be able to analyze signals and systems in discrete time, including use of the *z*-transform, Correlation: Circular convolution, auto-correlation and cross correlation.		3										
	CO4	Be able to design infinite impulse response (IIR) filters using impulse invariance method and bilinear transformation method, design using impulse invariant, bi-linear Z transformation, least-square methods and finite precision effects.			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131
TEACHING METHODOLOGY	

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week 1	**Introduction to digital signal processing (DSP)**	**CT 1**
Class 1	**Discrete-time signals and systems**	
Class 2	**Types of signals**	
Class 3	**Analog and digital systems**	
Week 2	**Conversion of signals**	
Class 4	**Basic sampling theorem**	
Class 5	**Quantization and digitization**	
Class 6	**Problem solving techniques**	
Week 3	**Properties of digital signals**	
Class 7	**Linearity & time variant properties**	
Class 8	**Static, dynamic and system stability**	
Class 9	**Causal, non-causal and basic theory of convolution**	
Week 4	**Impulse response**	**CT 2**
Class 10	**Significance**	
Class 11	**Finite impulse response (FIR)**	
Class 12	**Infinite impulse response (IIR)**	
Week 5	**Discrete time system**	
Class 13	**Recursive DTS**	
Class 14	**Non-recursive DTS**	
Class 15	**Problem solving**	
Week 6	**Difference equation**	
Class 16	**Solution technique of difference equation**	
Class 17	**Homogenous solution: theory & problem solving**	
Class 18	**Particular solution: theory & problem solving**	
Week 7	**Structures of LTI systems**	**Mid Term**
Class 19	**Direct form 1: theory & problem solving**	
Class 20	**Direct form 2: theory & problem solving**	
Class 21	**Problem solving**	

	Week 8	**Discrete transformations**		
	Class 22	**Discrete-time Fourier series**		
	Class 23	**Properties of discrete-time Fourier series**		
	Class 24	**Analytical problems on DTFS**		
	Week 9	**Fourier transform (DFT)**		
	Class 25	**Properties**		
	Class 26	**Convolution of two signals using DFT**		
	Class 27	**Frequency shifting & modulation**		
	Week 10	**Inverse fast Fourier transform**		
	Class 28	**Properties**		
	Class 29	**Finding the real signal**		
	Class 30	**Demodulation & circular convolution**		
	Week 11	**Filter design**	CT 3	
	Class 31	**Theory of filter design**		
	Class 32	**Design technique of FIR filters**		
	Class 33	**Filter design using window method**		
	Week 12	**Z transform**		
	Class 34	**Significance & advantages**		
	Class 35	**Properties of Z transform**		
	Class 36	**Problem solving on various properties**		
	Week 13	**Inverse Z transform**		
	Class 37	**Problem solving using properties**		
	Class 38	**One sided Z transform**		
	Class 39	**IIR filters**		
	Week 14	**Design of IIR filters**		
	Class 40	**Theory of IIR filter design**		
	Class 41	**Impulse invariance method**		
	Class 42	**Bilinear transformation method**		
		Extra Classes		
	Class 43	**Problem solving notch and low pass filters**		
	Class 44	**Review of the course outline**		

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy

Continuous Assessment (40%)	**Class Test/ Assignment 1-3**	**20%**	**CO1, CO2**	**C2, C3**
			CO 3	**C4**
	Class Performance	**5%**		
	Class Attendance	**5%**		
	Mid-Term Assessmen (Exam / Project)	**10%**	**CO 3 CO4**	**C4, C5**
Final Examination (Section A & B)		**60%**	**CO 1**	**C2**
			CO 2	**C3**
			CO 3	**C4**
			CO4	**C5**
Total Marks		**100%**		

TEXT AND REFERENCE BOOKS:

1. **Signals and Systems, 2nd Edition 2nd Edition by Simon Haykin**
2. **Digital Signal Processing: A Practical Approach (2nd Edition) 2nd Edition by Emmanuel Ifeachor , Barrie Jervis**
3. **Essentials of Digital Signal Processing 1st Edition by B. P. Lathi**
4. **Signal Processing and Linear Systems 1st Edition by B. P. Lathi**

COURSE INFORMATION			
Course Code Course Title	: AEAV 306 : Communication Engineering Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE
Course Code: AEAV-305 Course Title: Communication Engineering
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
This sessional is intended to teach the students the basics of communication as well as the analysis and implementation of various communication methods.
OBJECTIVE
1. To explain the basic theory of different types modulation techniques of communication 2. To apply the basic theory of modulation using different engineering equipment 3. To compare the numerical results with software results to design a communication system as per requirement 4. To analyze the effect of noise by analyzing different communication techniques

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods

CO1	Be able to demonstrate the use of appropriate tools and construct the circuit for implementing basic processes of different types of AM modulation	3	Psychomotor/Precision			K5	R,Q,T, F
CO2	Be able to construct the circuit for implementing basic processes of FM modulation and Delta Modulation and Demodulation	3	Psychomotor /Articulation			K5	R,Q,T, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ;PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

Exp No	Exp Name
1.	AM Modulation by Transistor
2.	AM Demodulation by Diode detector
3.	FM Modulation.
4.	FM Demodulation
5.	DSB-SC and SSB Modulator
6.	DSB-SC and SSB Demodulators
7.	Delta Modulation and Demodulation

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to demonstrate the use of appropriate tools and construct the circuit for implementing basic processes of different types of AM modulation			3									
CO2	Be able to construct the circuit for implementing basic processes of FM modulation and Delta Modulation and Demodulation			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning Lecture Practical Total	 07 14 21
Self-Directed Learning Preparation of Lab Reports Preparation of Lab Test Preparation of presentation Preparation of Quiz Engagement in Group Projects	 5 5 5 5 10
Formal Assessment Continuous Assessment Final Quiz	 7 1
Total	**59**

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	AM Modulation by Transistor AM Demodulation by Diode detector
Week 2	FM Modulation. FM Demodulation
Week 3	DSB-SC and SSB Modulator
Week 4	DSB-SC and SSB Demodulators
Week 5	Delta Modulation and Demodulation
Week 6	Lab Quiz
Week 7	Viva

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	15%	CO 1	P3/Precision
		CO 2	P4/ Articulation
Report Writing/Programming	35%	CO 1	P3/Precision
		CO 2	P4/ Articulation
Final Evaluation (Exam/project/assignment)	40%	CO1, CO2	P3/Precision, P4/ Articulation
Viva Voce/ Presentation	10%	CO1, CO2	P3/Precision, P4/ Articulation
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. Digital and Analog Communication System - Leon W. Couch; Pearson Education.
2. Communication System –Somon Haykin; John Wiley & Sons, Inc.
3. Modern Digital & Analog Communication System - B. P. Lathi; Oxford University Press.
4. Telecommunication Switching Systems and Networks – ThiagarajanViswanathan; Prentice Hall of India Private Ltd.
5. Electronic Communication Systems-Kennedy & Davis; Tata McGraw Hill

COURSE INFORMATION			
Course Code Course Title	: AEAV 324 : Digital Signal Processing Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE
Course Code: AEAV 313 Course Title: Digital Signal Processing

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This sessional is intended to learn and familiarize the basics of digital signals as well as the analysis and design of different analog and digital filters.

OBJECTIVE
1.To design FIR and IIR filters by MATLAB to meet specific magnitude and phase requirements. 2.To perform Z and inverse Z transforms using the definitions, Tables of Standard Transforms and Properties, and Partial Fraction Expansion 3.To determine if a DT system is linear, time-invariant, causal, and memoryless, determine asymptotic, marginal and BIBO stability of systems given in frequency domain. 4.To use computers and MATLAB to create, analyze and process signals, and to simulate and analyze systems sound and image synthesis and analysis, to plot and interpret magnitude and phase of LTI system frequency response.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods

CO1	Be able to analyze the basic sampling process, quantization, z-transform using MATLAB and also analytically	5	C4			K6	R, Q, T
CO2	Be able to execute the basic theory of Fourier Transform, Discrete Fourier Transform (DFT), Inverse Discrete Fourier Transform (IDFT), FIR Digital Filter Design Using Window Method MATLAB	5	Psychomotor/Manipulation			K6	R, Q,T, Pr, PR

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	Discrete-Time Signals in Time-domain.
2.	Discrete -Time System and System response.
3.	Study of DFT, FFT, IDFT and IFFT
4.	Z-transform and Its Application
5.	FIR Digital Filter Design Using Kaiser Window Method

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to analyze the basic sampling process, quantization to convert the analog signal into digital signal, z-transform using software and also analytically		2										
CO2	Be able to execute the basic theory of Fourier Transform, Discrete Fourier Transform (DFT), Inverse Discrete Fourier Transform (IDFT), FIR Digital Filter Design Using Kaiser Window Method					2							

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	**07**
Practical	**14**
Total	**21**
Self-Directed Learning	
Preparation of Lab Reports	**05**
Preparation of Lab Test	**05**
Preparation of presentation	**05**
Preparation of Quiz	**05**
Engagement in Group Projects	**10**
Formal Assessment	
Continuous Assessment	**07**
Final Quiz	**01**
Total	**59**

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	**Discrete-Time Signals in Time-domain.**
Week 2	**Discrete -Time System and System response.**
Week 3	**Study of DFT, FFT, IDFT and IFFT**
Week 4	**Z-transform and Its Application**
Week 5	**FIR Digital Filter Design Using Kaiser Window Method**
Week 6	**Lab Test-1**
Week 7	**Lab Quiz**

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Conduct Lab Test/ Class Performance	25%	CO 1	C4/Analyze
		CO 2	P2/Manipulation
Report Writing/Programming	15%	CO 1	C4/Analyze
		CO 2	P2/Manipulation
Mid Term Evaluation (exam/project/assignment)	20%	CO1, CO2	C4/Analyze, P2/Manipulation
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2	C4/Analyze, P2/Manipulation
Viva Voce/ Presentation	10%	CO1, CO2	C4/Analyze, P2/Manipulation
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. Digital Signal Processing – John G.Proakis & Dimitris Manolakis; Prentice Hall.
2. Digital Signal Processing Using MATLAB - Vinay K. Langle& John G. Proakis; CL-Engineering.
3. Digital Signal Processing - Thomas J. Cavicchi; John Wiley & Sons.
4. Digital Signal Processing-A practical approach– Emmanuel C. Ifeachor& Barrie W. Jervis; Prentice Hall.
5. Signal and System (Continuous & Discrete) - Rodger E. Ziemer, W. H. Tranter & D. R. Fannin; Pearson Education.

COURSE INFORMATION			
Course Code Course Title	AEAV 330 Measurement and Aircraft Instruments Sessional	Contact Hours Credit Hours	: 3.00 : 1.50
PRE-REQUISITE			
Measurement and Aircraft Instruments			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This sessional is intended to teach the students the basic concepts of measurement and analyze different functions of aircraft instruments.			
OBJECTIVE			
Upon completion of the course, the students will be able to: 1. Conduct experiments, and then analyze and interpret results successfully. 2. Demonstrate that water level and flow rate can be controlled by using feedback transducer. 3. Analyze the principle of operations of the pitot static system. 4. Demonstrate that the functions of various aircraft instruments are based on the pitot static system 5. Analyze the properties, operation and construction of directional gyro. 6. Know the basic working principle of instruments using in aircraft's operation and maintenance.			

COURSE OUTCOMES & GENERIC SKILLS							
No.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	**Be able to demonstrate the use of transducer to control water level and flow rate.**	**5**	**Psychomotor/Precision**			**K6**	**R, Q, T**
CO2	**Be able to analyze the principle of operations of the pitot static system and directional gyro.**	**2**	**C4**			**K3**	**R, Q,T**
CO3	**Be able to develop a lab module of aircraft basic instruments working in a group as a member or as a leader.**	**5**	**Psychomotor/Articulation**			**K6**	**Pr, PR**

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ;PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	Familiarization with Pressure Transducer (Strain Gauge)
2.	Flow Rate Control of Water by Feedback Transducer.
3.	Study of the pitot static system
4.	Study of the airspeed indicator (ASI)
5.	Study of the vertical speed indicator (VSI)
6.	Study of the altimeter
7.	Study of the gyroscopic equipment

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to demonstrate the use of transducer to control water level and flow rate.					1							
CO2	Be able to analyze the principle of operations of the pitot static system and directional gyro.		2										
CO3	Be able to develop a lab module of aircraft basic instruments working in a group as a member or as a leader.					2							

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	

Lecture Practical	14 28 Total 42
Self-Directed Learning Preparation of Lab Reports Preparation of Lab Test Preparation of presentation Preparation of Quiz Engagement in Group Projects	 10 10 5 10 20
Formal Assessment Continuous Assessment Final Quiz	 14 1
Total	**112**

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Introduction and familiarization with the equipment.
Week 2	Familiarization with Pressure Transducer (Strain Gauge)
Week 3	Flow Rate Control of Water by Feedback Transducer.
Week 4	Study of the pitot static system
Week 5	Study of the airspeed indicator (ASI)
Week 6	Study of the vertical speed indicator (VSI)
Week 7	Study of the altimeter
Week 8	Study of the gyroscopic equipment
Week 9	Review
Week 10	Lab Test-Group 1
Week 11	Lab Test- Group 2
Week 12	Lab Quiz
Week 13	Presentation on Assigned Problems
Week 14	Project Demonstration

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Conduct Lab Test/ Class Performance	25%	CO 1	P3/Precision
		CO 2	C4/Analyse
Report Writing/Programming	15%	CO 1	P3/Precision
		CO 2	C4/Analyse
Mid Term Evaluation (exam/project/assignment)	20%	CO3	P4/ Articulation
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	P3/Precision, C4/Analyse, P4/ Articulation
Viva Voce/ Presentation	10%	CO1, CO2, C03	P3/Precision, C4/Analyse, P4/ Articulation
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. Aircraft Instruments And Integration Systems- EHJ Pallet
2. Aircraft Electricity And Electronics- Thomas Eismin

COURSE INFORMATION			
Course Code Course Title	AEAV 411 Control System Engineering	Lecture Contact Hours Credit hours	3.0 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

The course is to provide insight into basics of open and closed loop systems in classical and modern control and associated tools in time and frequency domain to analyze them.

OBJECTIVES

1. To introduce to the modeling of systems in formats to be used for analysis.
2. To introduce to Single Input Single Output system characteristics
3. To analyze systems in time and frequency domain
4. To introduce to digital control system and their characteristics

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to model the systems for analysis and reduce complex block diagram	PO1	C4	P1, P2		K3	T, F
CO2	Be able to introduce state variables and Time Response analysis	PO2	C4			K3	T, F
CO3	Be able to assess stability of systems in S- domain	PO2	C5			K3	Mid Term Exam, F,
CO4	Be able to get exposure to design and digital control systems	PO3	C6	P1, P2		K5	T, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

a. Main Contents: Modeling, Time and frequency based analysis for open & closed loop system

b. Detail Contents:

Introduction to control systems. Linear system models: Transfer function, block diagram and SignalFlow Graph (SFG). State variables: SFG to state variables, transfer function to state variable and state variable to transfer function. Feedback control system: Closed loop systems, parameter sensitivity, transient characteristics of control systems, effect of additional pole and zero on the system

response and system types and steady state error. Routh stability criterion. Analysis of feedback control system: Root locus method and frequency response method. Design of feedbackcontrol system: Controllability and observability, root locus, frequency response and state variable methods. Digital control systems: introduction, sampled data systems, stability analysis in Z-domain.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to model the systems for analysis and reduce complex block diagram	3											
CO2	Be able to introduce state variables and Time Response analysis		3										
CO3	Be able to assess stability of systems in S-domain		3										
CO4	Be able to get exposure to design and digital control systems			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	42 21 21

Formal Assessment Continuous Assessment Final Examination	4 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

Assessment Strategy

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment	Class Test/ Assignment 1-3	20%	CO1,CO2 CO4	C4 C6

(40%)	**Class P**erformance	5%		
	Class Attendance	5%		
	Mid-Te**rm** Assessment (Exam / Project)	10%	**CO3**	**C3**
Final Examination (Section A & B)		60%	CO1	**C4**
			CO 2	**C4**
			CO 3	**C3**
			CO 4	**C6**
Total Marks		**100%**		

Lecture Schedule:

Week	Topic	CT
Week 1	**Introduction and Mathematical Models of Physical Systems**	
Class 1	**Introduction to control systems**	
Class 2	**Differential equations of Physical Systems**	
Class 3	**Differential equations of Physical Systems**	
Week 2	**Introduction and Mathematical Models of Physical Systems**	
Class 4	**Transfer Functions**	**CT 1**

Class 5	Block Diagram Reduction Methods	
Class 6	Block Diagram Reduction Methods	
Week 3	Introduction and Mathematical Models of Physical Systems	
Class 7	Signal Flow Graphs	
Class 8	Signal Flow Graphs	

Class 9	Application of Mason's Gain Formula	
Week 4	State Variables	CT 2
Class 10	Basics of State Space Modeling	
Class 11	SFG to State Variables, Transfer Function to State Variable	
Class 12	State Variable to Transfer Function	
Week 5	Time Response Analysis	
Class 13	Introduction	
Class 14	Standard Test Signals	
Class 15	Time Response of First Order Systems	
Week 6	Time Response Analysis	
Class 16	Time Response of Second Order Systems	

Class 17	Time Response of Second Order Systems	
Class 18	Effect of adding Pole and Zero to a system	
Week 7	Concept of Stability	CT 03
Class 19	Concept Of Stability And Necessary Conditions For Stability	
Class 20	Routh Stability Criterion	
Class 21	Relative Stability Analysis	
Week 8	Root Locus Technique	
Class 22	Introduction	
Class 23	Construction Of Root Locus	
Class 24	Stability Analysis	
Week 9	Root Locus Technique	
		CT3
Class 25	Stability Analysis	
Class 26	Stability Analysis	

Class 27	Stability Analysis	
Week 10	Frequency Response Analysis	
Class 28	Bode Plot	
Class 29	Bode Plot	
Class 30	Stability In Frequency Domain: Nyquist Plot	

Week 11	Introduction To Design	
Class 31	Preliminary Considerations Of Classical Design	
Class 32	Design Of Basic Compensators	
Class 33	Design Of Basic Compensators	
Week 12	Introduction To Design	
Class 34	Design Of Basic Compensators	
Class 35	Design Of Controllers	
Class 35	Design Of Controllers	CT 4
Class 36	Design Of Controllers	

Week 13	State Variable Analysis And Design	
Class 37	Concepts And Introduction	
Class 38	State Variable Methods	
Class 39	Controllability And Observability	
Week 14	Digital Control Systems	
Class 40	Introduction	
Class 41	Sampled Data Systems	
Class 42	Stability Analysis In Z-Domain	

TEXT AND REFERENCE BOOKS: **Modern Control Systems – Richard C. Dorf and Robort H Bishop; Pearson Education Private Ltd.**

1. **Control System Engineering- Norman S. Nise; Wiley**

2. **Linear Control System Analysis and Design. - John J.D. Azzo& Constantine H. Houpis; McGraw-Hill International.**

3. **Modern Control Engineering - Ktsuhiko Ogata; Prentice Hall**

COURSE INFORMATION			
Course Code Course Title	AEAV 412 Control Systems Engineering Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE
Control System Engineering

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
The goal of this course is to provide an outlook to students to see perceive most real life system as a control system problem and use tools of Control System to analyze for finding solutions.

OBJECTIVE

1. To introduce to the modeling of real life systems
2. To evaluate the effects of different controllers

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to analyze the modeling of systems in various forms of working.	2	C4			K3	R,Q,T,V
CO2	Be able to evaluate the effects of various types of controllers on the systems performance.	5	Psychomotor/Precision			K6	R,Q,T,V

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ;PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	Apply modeling principles in real life applications
2.	Analyzing and evaluating the affects of different kinds of controllers on system performance
3.	Experiment on water level control setup using Proportional, Integrator and Derivative Control
4.	Experiment on speed control of motor using proportional, integrator and derivative
5.	Experiment on temperature sensing setup using proportional, integrator and derivative

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to analyze the modeling of systems in various forms of working.		3										
CO2	Be able to evaluate the affects of various types of controllers on the systems performance.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical Total	 7 14 21
Self-Directed Learning Preparation of Lab Reports Preparation of Lab Test Preparation of presentation Preparation of Quiz Engagement in Group Projects	 7 7 7 5 10
Formal Assessment Continuous Assessment Presentation Final Quiz	 7 1 1
Total	66

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Experiment on water level control setup using Proportional Control
Week 2	Experiment on water level control setup using Proportional and Integrator Control
Week 3	Experiment on water level control setup using Proportional, Integrator and Derivative Control
Week 4	Experiment on speed control of motor using proportional, integrator and derivative
Week 5	Experiment on temperature sensing setup using proportional, integrator and derivative
Week 6	Lab Test & viva
Week 7	Presentation on a Assigned Problems

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Conduct Lab Test/ Class Performance/Report Writing	60%	CO1	C4
		CO2	C5
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2	C4,C5
Viva Voce/ Presentation	10%	CO1, CO2	C4,C5
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. Modern Control Engineering- Katsuhiko Ogata
2. Control Systems Engineering – Norman S Nise

COURSE INFORMATION			
Course Code Course Title	AEAV 401 Microwave Engineering	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
Electro- magnetic field theory			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
Microwave Engineering introduces the student to RF/microwave analysis methods and design techniques. Scattering parameters are defined and used to characterize devices and system behavior. Passive and active devices commonly utilized in microwave subsystems are analyzed and studied. Design procedures are presented along with methods to evaluate device performance.			

OBJECTIVES

1. To understand important and unique engineering issues at microwave and millimeter wave frequencies
2. To learn microwave network theory and the use of scattering matrix
3. To know the design criteria for waveguide and coaxial microwave components
4. To explain microwave fundamentals to design, fabricate and test a useful microwave component or device, which may be designed using micro-strip line technology
5. To apply these components in the design of useful systems such as radars transmitters and receivers etc.

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to apply electromagnetic theory to calculation of parameters involved in waveguides and transmission lines	PO1	C3	P1, P2		K3	T,ASG,Q,F
CO2	Be able to explain simple microwave circuits and devices including matching circuits, couplers, antennas and amplifiers.	PO4	C2			K8	T,ASG,Q,F
CO3	Be able to describe and design common system such as radar and microwave transmission links	PO2	C4	P1, P3		K3	T,ASG,Q,F
CO4	Be able to identify various microwave equipment and learn to use those	PO1	C3			K4	T,ASG,Q,F

	equipment.						

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Transmission lines: Voltage and current in ideal transmission lines, reflection, transmission, standing wave, impedance transformation, Smith chart, impedance matching and lossy transmission lines.

Waveguides: General formulation, modes of propagation and losses in parallel plate, rectangular and circular waveguides. Micro strips: Structures and characteristics.

Rectangular resonant cavities: Energy storage, losses and Q.

Radiation: Small current element, radiation resistance, radiation pattern and properties, Hertzian and half wave dipoles.

Antennas: Mono pole, horn, rhombic and parabolic reflector, array, and Yagi- Udaantenna.

Microwave devices: Klystron, Magnerton, TWT and Twystron are used as microwave oscillators and amplifiers.

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	Be able to apply electromagnetic theory to calculations regarding waveguides and transmission lines.	1											
CO2	Be able to explain simple microwave circuits and devices including matching circuits, couplers, antennas and amplifiers.				2								
CO3	Be able to describe and design common system such as radar and microwave transmission links		1										
CO4	Be able to identify various microwave equipment and learn to use those equipment.	1											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE		
WEEK-1	**Introduction to Microwave Engineering**	**CT/MID**
Class 1	EM Spectrum	CT-1
Class 2	Mode of Propagation, Transmission Line	
Class 3	Telegrapher's Equation, Travelling Wave Equation	
WEEK-2	**Transmission Line**	
Class 4	Loss-less Transmission line theory	
Class 5	Distortion less transmission line and related mathematical problems.	
Class 6	Termination of Transmission Line	
WEEK-3	**Transmission Line**	
Class 7	Termination of Transmission Line	
Class 8	Time Average Power Flow on TL's	

Class 9	Voltage standing Wave Ratio, Input Impedance of Transmission Line	
WEEK-4	Insertion Loss and Transmission Co efficient	Mid Term
Class 10	VSWR, ISWR, Insertion Loss	
Class 11	Related mathematical problems regarding last topic	
Class 12	Introduction to Smith Chart	
WEEK-5	Smith Chart	
Class 13	Introduction to Smith Chart and related Problems	
Class 14	Location Determination of Voltage Maximum and Minimum from Load	
Class 15	Problem Analysis and Solving	
WEEK-6	Waveguides	
Class 16	Introduction to Waveguides	
Class 17	Mode of Propagation	
Class 18	General solutions to Maxwell's Equations for different modes	
WEEK-7	Rectangular Waveguide	
Class 19	Introduction to Rectangular Waveguide	
Class 20	Equations for rectangular waveguide, Dominant Mode	
Class 21	Boundary Condition of Rectangular waveguide and mathematical Problems	
WEEK-8	Resonant Cavity	CT 02
Class 22	Introduction to Resonant Cavity, Advantages, Disadvantages and Uses	
Class 23	Characteristics of Cavity Resonator	
Class 24	Cavity Resonator for different modes	
WEEK-9	Quality factor of a resonator	
Class 25	Determination of Quality Factor	
Class 26	Time Average Magnetic Stored Energy	
Class 27	Power Loss	
WEEK-10	Micro strip Line and Antenna	
Class 28	Micro strip Structure and Modes of Micro strip Line	
Class 29	Introduction to Antenna	
Class 30	Basic Equation, Antenna region, Antenna Parameter	
WEEK-11	Antenna	CT 03
Class 31	Radiation Pattern, Power Pattern, Beam Area	
Class 32	Radiation intensity, Directive gain and related mathematical Problems	
Class 33	FRIIS Transmission Formula, Radar Equation and related problems	
WEEK-12	Different Types of Antenna	
Class 34	Half-Wave Dipole Antenna Equation	
Class 35	Hertizian Dipole Antenna	
Class 36	Half Wave Dipole Antenna and Hertizian Dipole Antenna related	

	Problems	
WEEK-13	**Magnetic Dipole Antenna**	
Class 37	**Magnetic Dipole Antenna and radiation and power intensity**	
Class 38	Klystron's Amplifier and their mechanism	
Class 39	**S-Parameter and related mathematical problems**	
WEEK-14	**Problems Analysis**	
Class 40	**Continued and Related Mathematical Problems**	
Class 41	**Revision**	
Class 42	**Revision**	

ASSESSMENT STRATEGY

Components		**Grading**	**CO**	Bloom's Taxonomy
Continuous Assessment (40%)	**Class Test/ Assignment 1-3**	**20%**	**CO1**	**C3**
			CO2	**C2**
	Class Performance	**5%**		
	Class Attendance	**5%**		
	Mid-Term Assessment (Exam / Project)	**10%**	**CO2, CO3**	**C2, C4**
Final Examination (Section A & B)		**60%**	**CO1**	**C2**
			CO2	**C3**
			CO3	**C4**
			CO4	**C3**
Total Marks		**100%**		

TEXT AND REFERENCE BOOKS:

1. **Microwave Devices and Circuits - Samuel Y. Liao; Prentice Hall of India.**
2. **Foundations for Microwave Engineering - E. Colliong; McGraw-Hill International.**
3. **Microwave Engineering - M.Pozar; Addision Wesley Publishing Company.**
4. **Antenna Theory Analysis and Design - C.A. Balanis; John Wile**

COURSE INFORMATION			
Course Code Course Title	AEAV 407 Radar Engineering	Lecture Contact Hours Credit hours	3.00 Hrs 3.00 Hrs

PRE-REQUISITE

Electromagnetic Field Theory

CURRICULUM STRUCTURE

Outcome Based Education
(OBE)

SYNOPSIS/RATIONALE

This course is an introduction to radar. It is designed to develop the primary knowledge and techniques necessary to analyze the performance of radar systems so that the student are able to specify the subsystem performance requirements in a radar system design.

OBJECTIVES

1. To explain the principle involved in radar system
2. To know the various types of radar and areas of applications
3. To determine various radar parameters
4. To learn about radar transmitter, receiver and antennas.

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1.	Be able to **describe** theoretical principles of radar system.	PO1	C2	1			T/ ASG, F
CO2.	Be able to **apply** basic radar knowledge in handling different radar system in aircraft communication and Navigation.	PO1	C3	-			T/ Mid Term Exam, F
CO3.	Be able to **describe** and compare between different radar transmitters and antennas.	PO1	C2	-			T/Mid Term Exam, F,
CO4.	Be able to **explain** the role of radar in electronic warfare including different jamming techniques and working principles of airborne radar.	PO1	C2	1			T/ ASG, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Introduction to Radar: Radar Principle, Functional block diagrams, Radar range equation, Radar frequencies, Pulse repetition frequency and Range ambiguity, Minimum detectable signal. **Radar cross-section of targets:** Detection and tracking, jamming techniques.
Doppler Effect: Continuous wave and frequency modulation radars, moving target indicator and phase-Doppler radars.
Radar transmitter: Magnetron oscillator, klystron amplifier and traveling wave tube amplifier.
Radar antenna: Antenna parameters, radiation pattern and aperture distribution.
Radar receivers: Displays and duplexers.
Electronic Warfare: Electronic counter measures, Electronic counter measures.
Introduction to Airborne Radar.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **describe** theoretical principles of radar system.	1											
CO2	Be able to **apply** basic radar knowledge in handling different radar system in aircraft communication and Navigation.	2											
CO3	Be able to **describe** and compare between different radar transmitters and antennas	1											
CO4	Be able to **explain** the role of radar in electronic warfare including different jamming techniques and working principles of airborne radar.	1											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	42
Lecture	-
Practical / Tutorial / Studio	-
Student-Centered Learning	
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21

Formal Assessment **Continuous Assessment** **Final Examination**	 **2** **3**
Total	**131**
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week	Lecture	Topics	Remarks
1	Lec 1	Introduction to Radar and application in aviation sector and course objectives.	CT-1
	Lec 2	Radar basic working principle, radar functional block diagram	
	Lec 3	Radar range equation, mathematical problems.	
2	Lec 4	Radar frequencies, Pulse repetition frequency and Range ambiguity, Minimum detectable signal.	
	Lec 5	Radar cross-section of targets: What is radar cross section, types of radar cross section (3 types with descriptions).	
	Lec 6	RCS regions, examples and mathematical problems.	
3	Lec 7	Radar Resolution: What is Radar resolution, range resolution.	
	Lec 8	Angle resolution, Doppler resolution, mathematical problems.	
	Lec 9	Probability density function: types of pdf, probability of detection, false alarm.	
4	Lec 10	Integration of radar pulses: integration of radar pulses types and mathematical problems.	

	Lec 11	Moving target Indicator (MTI): MTI block diagram,.	
	Lec 12	MTI limitations, delay line cancellers, staggered prf techniques.	
5	Lec 13	Continuous wave radar, CW radar block diagram, frequency modulated radar and their differences.	Mid Term
	Lec 14	Doppler effect: What is Doppler effect, derivation of Doppler radar frequency equation	
	Lec 15	Phased Doppler radar , mathematical problems.	
6	Lec 16	Detection and tracking: Tracking radar, tracking types, radar tracking techniques.	
	Lec 17	Angle tracking and range tracking techniques and advantages, disadvantages,	
	Lec 18	Monopulse tracking, conical scan, sequential lobing, tracking radar limitations, low angle tracking.	
7	Lec 19	Clutter: what is clutter, airborne clutter and ground clutter	
	Lec 20	cutter attenuation factor, clutter RCS, mathematical problems	
	Lec 21	Receiver noise, noise figure, detection of radar signals in noise	
8	Lec 22	Radar transmitter: Introduction, Radar transmitter functional block, transmitter functions and types.	CT-2
	Lec 23	Solid state amplifier, magnetron,	
	Lec 24	klystron amplifier and traveling wave tube amplifier.	
9	Lec 25	Radar Receivers and duplxers:.	
	Lec 26	Radar receiver, superheterodyne receiver and duplexers	
	Lec 27	Automatic detection, mathematical problems	

10	Lec 28	Radar jamming: radar jamming, jamming fundamentals and jamming techniques.	
	Lec 29	Noise jamming and its types.	
	Lec 30	Radar antenna: functions of radar antenna, antenna parameters,	
11	Lec 31	Antenna radiation pattern and aperture, mathematical problems.	CT- 3
	Lec 32	Parabolic Antenna: Working Principle, Numerical Problem	
	Lec 33	Parabolic Antenna: Working Principle	
12	Lec 34	Array antenna: types of array antenna	
	Lec 35	Electronic Warfare, ESM, ECM, ECCM	
	Lec 36	Radar Jamming, Fundamentals of radar noise jamming	
13	Lec 37	Different types of radar noise jamming	
	Lec 38	Different types of radar deception jamming	
	Lec 39	Introduction to airborne radar	
14	Lec 40	Airborne Weather radar	
	Lec 41	Synthetic Aperture Radar	
	Lec 42	Side Looking Airborne Radar	

ASSESSMENT STRATEGY

	CO	Blooms

<table>
<tr><td colspan="2">Components</td><td>Grading</td><td></td><td>Taxonomy</td></tr>
<tr><td rowspan="7">Continuous Assessment

(40%)</td><td rowspan="2">Class Test/ Assignment

1-3</td><td></td><td>CO1</td><td rowspan="2">C2, C3</td></tr>
<tr><td rowspan="2">20%</td><td>CO2/CO 3</td></tr>
<tr><td></td><td>CO 4</td><td>C2</td></tr>
<tr><td>Class Performance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Class Attendance</td><td>5%</td><td></td><td></td></tr>
<tr><td rowspan="2">Mid-Term Assessment
(Exam /Project)</td><td rowspan="2">10%</td><td>CO 2</td><td rowspan="2">C3, C2</td></tr>
<tr><td>CO3</td></tr>
<tr><td colspan="2" rowspan="4">Final Examination (Section A & B)</td><td rowspan="4">60%</td><td>CO 1</td><td>C2</td></tr>
<tr><td>CO 2</td><td>C3</td></tr>
<tr><td>CO3</td><td>C2</td></tr>
<tr><td>CO4</td><td>C2</td></tr>
<tr><td colspan="2">Total Marks</td><td>100%</td><td colspan="2"></td></tr>
</table>

TEXT AND REFERENCE BOOKS:

1. **Introduction to RADAR systems - M. Skolnik; McGraw-Hill International.**
2. **Principle of Radar - Tomay; Prentice Hall of India.**
3. **Radar design, principles, signal processing and the environment - Fred E Nathanson, Prentice Hall of India Private Ltd.**
4. **Introduction to Electronic Defense System- FlippoNeri; Artech House Publishers**

COURSE INFORMATION			
Course Code Course Title	AEAV 408 Radar Engineering Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE

Course Code: AEAV 407
Course Title: Radar Engineering (Theory)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

The aim of this course is to provide the students with an understanding of the fundamental principles, design of radar system and analysis of radar signals by the means of practical demonstration of different radars.

OBJECTIVE

1. To become familiar with fundamentals of Radar and gain in depth knowledge about the different types of Radar and their operation.
2. To learn about signal detection in Radar and various Radar signal detection techniques and become familiar with Radar surveillance

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to demonstrate the use of Radar antenna, signal processing unit and Radar scope for the detection of various stationary and moving objects.	5	Psychomotor/Precision			K6	R, Q, T, F
CO2	Be able to analyze Radar signal such as its patterns, intensity, directionality and basic concept of Radar surveillance.	2	C4			K3	R, Q,T, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ;PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Exp No	Exp Name
1.	Detection of stationary targets using parabolic antenna and study the influence of Sensitivity Time Control (STC) on display.
2.	Detection of moving targets using parabolic antenna and estimation of beam- width.
3.	Detection of moving targets using patch antenna.
4.	Study of the effect of short pulses on range.
5.	Study of the effect of short pulses on range.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to demonstrate the use of Radar antenna, signal processing unit and Radar scope for the detection of various stationary and moving objects.					2							
CO2	Be able to analyze Radar signal such as its patterns, intensity, directionality and basic concept of Radar surveillance.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	7
Practical	14
Total	21
Self-Directed Learning	
Preparation of Lab Reports	10
Preparation of Lab Test	10
Preparation of presentation	10
Preparation of Quiz	6

Formal Assessment Continuous Assessment Presentation Final Quiz	 7 1 1
Total	**66**

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Detection of stationary targets using parabolic antenna and study the influence of Sensitivity Time Control (STC) on display.
Week 2	Detection of moving targets using parabolic antenna and estimation of beam-width.
Week 3	Detection of moving targets using patch antenna.
Week 4	Lab Quiz & Presentation
Week 5	Study of the effect of short pulses on range.
Week 6	Detection of moving targets using patch antenna.
Week 7	Lab Test & viva

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO1, CO2	P3/Precision, C4/Analyse
Report Writing/Programming	15%	CO1, CO2	P3/Precision, C4/Analyse
Mid Term Evaluation (exam/project/assignment)	20%	CO1, CO2	P3/Precision, C4/Analyse
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2	P3/Precision, C4/Analyse
Viva Voce/ Presentation	10%	CO1, CO2	P3/Precision, C4/Analyse
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. **Introduction to RADAR systems - M. Skolnik; McGraw-Hill International.**
2. **Principle of Radar - Tomay; Prentice Hall of India.**
3. **Radar design, principles, signal processing and the environment - Fred E Nathanson, Prentice Hall of India Private Ltd.**

COURSE INFORMATION			
Course Code Course Title	AEAV 442 Microwave Engineering Sessional	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE
Digital Signal Processing, Communication Engineering Sessional

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
The goal of this sessional is to introduce students with microwave components, circuits, circuit criteria so that student is able to design any microwave circuits and understand microwave working principles.

OBJECTIVE

3. To get familiar with microwave components
4. Analyzing circuits in terms of scattering parameters, electrical characteristics of waveguides and transmission lines through electromagnetic field analysis
5. To learn about applications of microwaves
6. Determine the wavelengths and wave impedances using different waveguide

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to demonstrate the practical hands-on use of various microwave sources & devices and digital modulation and communication schemes.	5	Psychomotor/ Precision			K6	R, Q, T

CO2	**Be able to analyze Microwave signal such as its patterns, beam width, directionality and basic concept of polarization and its properties.**	**2**	**C4**			**K3**	**R, Q,T**
CO3	**Be able to develop a project based on microwave properties on different materials to solve real life problems working in a group as a member or as a leader.**	**5**	**Psychomotor/Articulation**	**P1,P2**		**K6**	**Pr, PR**
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ;PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

Exp No	**Exp Name**
1.	**Familiarization with Microwave Training System**
2.	**Study of Microwave Signal: Radiation pattern, Beam width and Directionality**
3.	**Study of polarization of microwave signal**
4.	**Measurement of wavelength (λ), VSWR, reflection coefficient and transmission coefficient (T) using a slotted coaxial transmission line and a microwave generator.**
5.	**Study of reflection of microwaves & application of reflection of microwave**
6.	**Measurement of wavelengths and wave impedance by a slotted waveguide section**

SKILL MAPPING

No.	**Course Learning Outcome**	**PROGRAM OUTCOMES (PO)**											
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**

CO1	**Be able to demonstrate the practical hands-on use of various microwave sources & devices and digital modulation and communication schemes.**					**1**							
CO2	**Be able to analyze Microwave signal such as its patterns, beam width, directionality and basic concept of polarization and its properties.**		**2**										
CO3	**Be able to develop a project based on microwave properties on different materials to solve real life problems working in a group as a member or as a leader.**					**2**							
(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)													

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	**07**
Practical	**14**
Total	**21**
Self-Directed Learning	
Preparation of Lab Reports	**05**
Preparation of Lab Test	**05**
Preparation of presentation	**2.5**
Preparation of Quiz	**05**
Engagement in Group Projects	**10**
Formal Assessment	
Continuous Assessment	**07**
Final Quiz	**1**
	57

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Exp:1 Familiarization with Microwave Training System; Exp2: Study of Microwave Signal: Radiation pattern, Beam width and Directionality
Week 2	Study of polarization of microwave signal
Week 3	Measurement of wavelength (λ), VSWR, reflection coefficient and transmission coefficient (T) using a slotted coaxial transmission line and a microwave generator.
Week 4	Study of reflection of microwaves & application of reflection of microwave
Week 5	Measurement of wavelengths and wave impedance by a slotted waveguide section
Week 6	Lab Test & viva
Week 7	Presentation on Assigned Problems

ASSESSMENT STRATEGY

Components	Grading	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P3/Precision
		CO 2	C4/Analyse
Report Writing/Programming	15%	CO 1	P3/Precision
		CO 2	C4/Analyse
Mid Term Evaluation (exam/project/assignment)	20%	CO3	P4/ Articulation
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	P3/Precision, C4/Analyse, P4/ Articulation
Viva Voce/ Presentation	10%	CO1, CO2, C03	P3/Precision, C4/Analyse, P4/ Articulation
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

3. Microwave Devices and Circuits - Samuel Y. Liao; Prentice Hall of India.
4. Foundations for Microwave Engineering - E. Colliong; McGraw-Hill International.
5. Microwave Engineering - M.Pozar; Addision Wesley Publishing Company.
6. Antenna Theory Analysis and Design - C.A. Balanis; John Wiley & Sons

COURSE INFORMATION			
Course Code Course Title	AEAV 443 Aircraft Navigation and Communication	Lecture Contact Hours Credit hours	4.00 4.00
PRE-REQUISITE: None			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This course is provided to gather knowledge about navigation systems of an aircraft.			
OBJECTIVES			
1. To Understand and analyze the working principles of different navigation systems being used in modern aircrafts. 2. To characterize and compare the performance parameters in Navigation System			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to understand basics of aircraft navigation, phases of flight terminologies, geometry of earth, coordinate frames, concepts of SEP and CEP, NDB and Direction Finding.	PO1	C2			K3	T, F

CO2	**Be able to understand VOR, Distance Measuring Equipment Radio Altimeter, Concept of Secondary Radar & MODEs, Basic operating principle of Traffic Alert Collision Avoidance System, ADS-B**	**PO1**	**C2**			**K3**	**T, F**
CO3	**Be able to analyze the basic operating principle and function of Instrument Landing System, Microwave landing system, Flight Management System.**	**PO2**	**C4**			**K3**	**T, F**
CO4	**Be able to understand the basics Global Navigation Satellite System (GNSS) integration & SBAS.**	**PO1**	**C2**	**P1, P2**		**K3**	**T, F**
CO5	**Be able to understand and analyze basic working principle of Gyroscopes and Inertial navigation system, Doppler navigation system, Multi-sensor navigation system and AHRS.**	**PO2**	**C2, C4**	**P1, P2**		**K4**	**T, F**
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
a. Main Contents: Aircraft Navigation Systems **b. Detail Contents:** **<u>Introduction to Air Navigation:</u> Methods of navigation, Phases of flight, navigation terminologies including bearing, heading etc. Geometry of earth, coordinate frames. Navigation errors including concepts of SEP & CEP (excluding DOP). (4 Hrs)** **<u>Radio Navigation:</u> Non-Directional Beacon and Radio Direction Finding, Loop Antenna, Sense Aerial, Ambiguity Resolve. Radio Altimeter, VOR, Light House Principle, Frequency Spectrum, Wave Equation, Errors and limitations, DME operation, Mathematical Relations, Mode of operation. (10Hrs)** **<u>Secondary Radar</u>: Concept of Secondary Radar, MODE-A,C,S,4,5 Signal Format and types of transmission, ATC-RBS Interrogation-Reply Pulse, Technical features of IFF Mk XIIA, TACAN, ADS-B (3 Hrs)** **<u>Traffic Alert Collision Avoidance System</u>: Introduction, Basic operating principle, Block diagram and system description, Controls and display. (2 Hrs)** **<u>Flight Management System</u>: Introduction, basic operating principle, block diagram and system description, controls and display. (1 Hr)** **<u>Instrument Landing System (ILS)</u>: Principle of operation, Antenna Array Arrangement, Beam pattern Geometry of LOC and GS, cockpit indications and interpretation, Development and concepts of Microwave Landing System with introduction to Time Referencing Scanning Beam (TRSB). (6 Hrs)** **<u>Global Navigation and Satellite System (GNSS) and Satellite Based Augmentation System (SBAS):</u> History of Navstar, Development of generations of satellite and their types, Control station, monitoring and receiver components. C/A, P code and Y Code. Almanac and Ephemeris data, determination of time of arrival. Trilateration derivation. Dilution errors including GDOP, HDOP, VDOP and TDOP. Prediction of GPS Accuacy. Discuss RNSS. Introduction to SBAS including WAAS and Differential GPS (DGPS). Concept of Receiver Autonomous Integrity Monitoring (RAIM). (10 hrs)** **<u>Gyroscopes:</u> Construction, properties of Gyro – Rigidity and Precession with mathematical treatment. Drift and Tilt errors, earth rate and transport rate compensation. (3 Hrs)** **<u>Inertial Navigation System:</u> Basic principle, gyro compassing, alignment, gyro corrections, centripetal & coriolis acceleration, schuler oscillation and IN Mechanization. Ring Laser Gyro and Fibre optic gyro working. Strapdown Inertial Navigation System. Errors and simulation study (optional). Kalman Filtering and hybrid navigation system (IN/GPS) (10 Hrs)** **<u>Attitude and Heading Reference System (AHRS):</u> Vertical and Directional Gyro, working principle, Time constant for AHRS, errors in AHRS (3 hrs)**

Doppler Navigation System (DNS): Principle of working, beam configuration, frequency equations, spectrum, track and heading DNS. Doppler/GPS hybrid navigation system. (4 hrs)

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to understand basics of aircraft navigation, phases of flight terminologies, geometry of earth, coordinate frames, concepts of SEP and CEP, NDB and Direction Finding.	3											
CO2	Be able to understand VOR, Distance Measuring Equipment Radio Altimeter, Concept of Secondary Radar & MODEs, Basic operating principle of Traffic Alert Collision Avoidance System, ADS-B	3											
CO3	Be able to analyze the basic operating principle and function of Instrument Landing System, Microwave landing system, Flight Management System.		3										

CO4	**Be able to understand the basics Global Navigation Satellite System (GNSS) integration & SBAS.**	**3**											
CO5	**Be able to understand and analyze basic working principle of Gyroscopes and Inertial navigation system, Doppler navigation system, Multi-sensor navigation system and AHRS.**		**3**										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning **Lecture** **Practical / Tutorial / Studio** **Student-Centered Learning**	**56** **-** **-**
Self-Directed Learning **Non-face-to-face learning** **Revision of the previous lecture at home** **Preparation for final examination**	 **56** **28** **28**
Formal Assessment **Continuous Assessment** **Final Examination**	**3** **3**
Total	**174**

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE		
Week	**Topic**	**CT**

Week 1	Introduction	
Class 1	Methods of Navigation & Phases of flight	CT 1
Class 2	Navigation Terminologies	
Class 3	Geometry of Earth and coordinate frames	
Class 4	Navigation errors (SEP & CEP)	
Week 2	Radio Navigation	
Class 5	Non Directional Beacon	
Class 6	Radio Direction Finding (DF)	
Class 7	Radio Altimeter	
Class 8	Radio Altimeter	
Week 3	Radio Navigation	CT 2
Class 9	VOR	
Class 10	VOR	
Class 11	VOR	
Class 12	DME	
Week 4	Radio Navigation	
Class 13	DME	
Class 14	DME Modes of operation	
Class 15	Concept of secondary radar principle	
Class 16	ATCRBS & IFF	
Week 5	Secondary Radar & FMS	
Class 17	ATCRBS & IFF	
Class 18	Traffic Alert Collision Avoidance System (TCAS)	
Class 19	ADSB	
		CT 3
Class 20	Flight Management System (FMS)	
Week 6	Landing Systems	
Class 21	Instrument Landing System (ILS), Principle of operation	
Class 22	ILS Components	
Class 23	ILS Indications and Limitations	
Class 24	Microwave Landing System (MLS), Principle of operation	
Week 7	Landing Systems & GNSS	
Class 25	MLS TRSB	
Class 26	MLS Numerical	
Class 27	History of Navstar	CT4
Class 28	Types of satellites and their generations	

Week 8	GNSS & SBAS	
Class 29	Components of GNSS	
Class 30	C/A, P and P(Y) Code	
Class 31	Almanac and Ephemeris	
Class 32	Determination of time of arrival, Trilateration	
Week 9	Instrument Landing System	
Class 33	Sagnac effect in GPS	
Class 34	Dilution of Position (GDOP, HDOP, VDOP & TDOP)	
Class 35	User Equipment Range Error (UERE) and Accuracy of GPS	
Class 36	Concept of SBAS, Differential GPS and Receiver Autonomous Integrity Monitoring (RAIM)	
Week 10	Gyroscopes	CT5
Class 37	Introduction to Gyroscopes	
Class 38	Properties of Gyroscopes and its mathematical treatment	
Class 39	Errors and compensations related to gyroscopes	
Class 40	Basic principle of Inertial Navigation System (INS)	
Week 11	Inertial Navigation System	
Class 41	Gyro compassing	
Class 42	Alignment of INS	
Class 43	Mechanization equations	
Class 44	Mechanization equations	
Week 12	Inertial Navigation System	
Class 45	Gyro corrections, coriolis and centripetal acceleration	
Class 46	Schuler oscillation and errors in INS	
Class 47	Ring Laser Gyro and Fibre Optic Gyro, Strapdown Inertial Navigation System	
Class 48	Kalman filter	
Week 13	Attitude and Heading Reference System	
Class 49	Hybrid Navigation System	
Class 50	Vertical and Directional Gyro, working principle	
Class 51	Derivation of Time Constant for AHRS	
Class 52	Errors in AHRS	
Week 14	Doppler Navigation System	
Class 53	Principle of working	
Class 54	Beam configuration and frequency spectrum	
Class 55	Mathematical treatment to derive velocities	
Class 56	Doppler/GPS navigation system	

COURSE SCHEDULE				
ASSESSMENT STRATEGY				
Components		**Grading**	**CO**	**Blooms Taxonomy**
Continuous Assessment (40%)	**Class Test/ Assignment 1-4**	**20%**	**CO1 CO2**	**C2**
			CO4 CO5	**C2, C4**
	Class Performance	**5%**		
	Class Attendance	**5%**		
	Mid-Term Assessment (Exam / Project)	10%	**CO3**	**C4**
Final Examination (Section A & B)		**60%**	**CO 1**	**C2**
			CO 2	**C2**
			CO 3	**C4**
			CO 4	**C**

		CO 5	C2,C4
Total Marks	100%		

TEXT AND REFERENCE BOOKS:

1. Avionics Fundamentals- Jeppesen; Highflyn.
2. Principles of Avionics - Albert Helfrick; Avionics Communication.
3. Digital Avionics Systems Principles and Practice - R. Spitzer; The Blackburn Press.
4. Antennas and Wave propagation- 4th Edition, John D Kraus, Ronald J Marhefka; McGraw-Hill
5. Avionics Navigation Systems – Myron Kayton; Wiley-Interscience
6. Elements of Electronic Navigation- N S Nagaraja; McGraw-Hill.
7. Strapdown Inertial Navigation Techonology- David Titterton and John Weston; Pub: The Institution of Engineering and Technology
8. Understanding GPS – Elliot Kaplan & Christopher Hegarty; Artech House

COURSE INFORMATION			
Course Code Course Title	AEAV 444 Aircraft Communication and Navigation Sessional	Contact Hours Credit Hours	1.50 0.75

PRE-REQUISITE
Aircraft Communication and Navigation (Theory)

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This subject aims at providing a basic understanding of navigation guidance and communication, with special attention to the signal processing aspect and overall system integration for further workplace.

OBJECTIVE
1. To demonstrate knowledge and understanding of: 2. Fundamentals of the various guidance techniques and their properties. 3. Position and attitude estimation. 4. Examples of current and planned implementations and applications of navigation instruments and their working mechanism.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods

CO1	Be able to demonstrate the use of aircraft communication equipment (RADAR), navigation equipment (DME, ILS, VOR, Radio Altimeter) and controlling equipment (Autopilot).	5	Psychomotor/ Precision			K6	R, Q, T
CO2	Be able to develop a model of aircraft navigational equipment and demonstrate that model for further lab use working in a group as a member or as a leader.	5	Psychomotor/Articulation	P1,P2		K6	Pr, PR
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ;PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

Exp No	Exp Name
1.	Familiarization with DME operation and its terminologies using a DME trainer set.
2.	Familiarization with ILS operation and terminologies and ILS
3.	Familiarization with Radio Altimeter and simulating a return signal through a test set.
4.	Familiarization with autopilot operation and its terminologies and autopilot Testing using a Trainer set.
5.	Familiarization with GPS operation and terminologies and GPS Receiver Testing using a GPS Simulator test set.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to demonstrate the use of aircraft communication equipment (RADAR), navigation equipment (DME, ILS, VOR, Radio Altimeter) and controlling equipment (Autopilot).					1							

CO2	Be able to develop a model of aircraft navigational equipment and demonstrate that model for further lab use working in a group as a member or as a leader.					2							
(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)													

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	7
Practical	14
Total	**21**
Self-Directed Learning	
Preparation of Lab Reports	5
Preparation of Lab Test	7
Preparation of presentation	5
Preparation of Quiz	5
Engagement in Group Projects	10
Formal Assessment	
Continuous Assessment	7
Final Quiz	1
Total	**61**

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Familiarization with DME operation and its terminologies using a DME trainer set.
Week 2	Familiarization with ILS operation and terminologies and ILS
Week 3	Familiarization with Radio Altimeter and simulating a return signal through a test set.
Week 4	Familiarization with autopilot operation and its terminologies and autopilot Testing using a Trainer set.
Week 5	Familiarization with GPS operation and terminologies and GPS Receiver Testing using a GPS Simulator test set.

Week 6	**Lab quiz & viva**
Week 7	**Project Demonstration**

ASSESSMENT STRATEGY			
Components	**Grading**	**CO**	**Blooms Taxonomy**
Conduct Lab Test/ Class Performance	**25%**	**CO 1**	**P3/Precision**
Report Writing/Programming	**15%**	**CO 1**	**P3/Precision**
Mid Term Evaluation (exam/project/assignment)	**20%**	**CO2**	**P4/ Articulation**
Final Evaluation (Exam/project/assignment)	**30%**	**CO1, CO2**	**P3/Precision, P4/ Articulation**
Viva Voce/ Presentation	**10%**	**CO1, CO2**	**P3/Precision, P4/ Articulation**
Total Marks	**100%**		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. **Avionics Fundamentals- Jeppesen; Highflyn.**
2. **Principles of Avionics - Albert Helfrick; Avionics Communication.**
3. **Digital Avionics Systems Principles and Practice - R. Spitzer; The Blackburn Press.**
4. **Antennas and Wave propagation- 4th Edition, John D Kraus, Ronald J Marhefka; McGraw-Hill**
5. **Avionics Navigation Systems – Myron Kayton; Wiley-Interscience.**
6. **Elements of Electronic Navigation- N S Nagaraja; McGraw-Hill.**

COURSE INFORMATION			
Course Code **Course Title**	**: AEAV 400** **: Final Year** Design and **Research Project**	Contact Hours **Credit Hours**	**: 12.00** : 6.00

PRE-REQUISITE
Courses learned up to Level-3
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
To learn and grow research capability by analysing previous research work related to area of interest. Theoretical Knowledge gained studying up to level three can be further enhanced by analytical as well as research work on the field of individual interest making a group of students of similar field of interest. Learn to develop hardware solution for a real time industry related problem through working in a team.
OBJECTIVE
1. To learn more in-depth knowledge of the major subject/field of study, including deeper insight into current research and development work. **2. To contribute to research and development work.** **3. To use a holistic view to critically, independently and creatively identify, formulate and deal with complex issues.** **4. To plan and use adequate methods to conduct qualified tasks in given frameworks and to evaluate the work.** **5. To create, analyse and critically evaluate different technical/architectural solutions.** **6. To critically and systematically integrate knowledge.** **7. To provide design experience to the students through teamwork and familiarize them with the project management methodology** **8. To provide the ability to understand and redefine a given engineering problem, and the ability to develop a conceptual design** **9. To provide students the ability to communicate effectively**

LEARNING OUTCOMES & GENERIC SKILLS							

No	Course Outcomes	Corresponding PO No.	Bloom's Taxonomy	KP	CP	CA	Assessment Methods
CO1	Be able to Identify a problem requiring an Aeronautical engineering based solution and develop ability to give solution.	PO3	Cognitive/ Analyze	K3			APW,R
CO2	Analyze a problem, and identify, formulate techniques and use the project management skill, appropriate computing and engineering tools for obtaining its solution	PO5	Psychomotor/Articulation, & Cognitive/ Analyze	K6	P1, P2, P4		PW, APW
CO3	Be able to Seek professional, ethical, environmental, and social impacts of the design project or thesis work along with cooperation.	PO9	Affective/ Valuing		P1, P6	A4, A5	PW, APW
CO4	Be able to Handle academic knowledge through independent studies of relevant literature, and to cultivate the ability to evaluate and briefly account for the central elements in a large literature base.	PO12	Psychomotor/Articulation, & Cognitive/ Evaluate	K8	P1, P5, P7	A5	T, Mid Term Exam
CO5	Solve a practical problem by a systematic use of an appropriate choice of theory and methodologies and Present the design project results or thesis results through written technical documents and oral presentations	PO10	Cognitive/ Create, Affective/ Characterization by Value		P1, P3	A1, A2	PR,R, ASG,F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, PW-Practical Work, APW-Analysis of Previous Work)

COURSE CONTENT

Course Contents:

Students may choose to write alone or in groups of up to 4 students.

Types of thesis:

Students can choose topics containing theoretical, empirical and/or practical aspects. But irrespective of the topic chosen, the use of relevant theory and literature is fundamental to the thesis.

An empirical paper: The idea is to gather knowledge on a specific topic and to relate theory to empirical observations, e.g. by using existing data, by using questionnaires or experiments.

A case study: A case study approach involves an analysis of a specific occurrence or process in an actual company or another type of organization. The purpose of a case study is to provide descriptions, analyses and suggested solutions to problems in relation to the case in hand. Case studies will involve the use of quantitative and/or qualitative methods for data collection.

A theoretical paper: This type of thesis builds on a theoretical model or a generic problem. Often a theoretical thesis is based on existing literature studies in which a theoretical problem is analyzed. This type of thesis is the least common.

No type of thesis is superior to others and no topics guarantee a high grade. The grade is based solely on whether the topic is thoroughly analyzed, the results clearly presented and whether you are able to demonstrate your knowledge of current theories and analyses, competent application of methods as well as independent critical judgment.

CO-PO MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Identify a problem requiring an Aeronautical engineering based solution and develop ability to give solution.				3								

CO2	**Analyze a problem, and identify, formulate techniques and use the project management skill, appropriate computing and engineering tools for obtaining its solution.**					**3**							
CO3	**Seek professional, ethical, environmental, social impacts and responsibilities of the design project or thesis work**										3		
CO4	**Handle academic knowledge through independent studies of relevant literature, and to cultivate the ability to evaluate and briefly account for the central elements in a large literature base.**												2
CO5	**Solve a practical problem by a systematic use of an appropriate choice of theory and methodologies and Present the design project results or thesis results through written technical documents and oral presentations**										**3**		

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	**-**
Practical / Tutorial / Studio	**42**
Student-Centred Learning	**42**
Self-Directed Learning	
Research Work under the supervision of Supervisor	**84**
Project work/Simulation practice at Lab	**42**
Preparation of Thesis Paper	**42**
Formal Assessment	
Continuous Assessment	**8**
Final Presentation	**3**
Total	**221**
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Lab participation and Report	20%	CO 1	Cognitive/Analyze
			CO 2	Psychomotor/Articulation, & Cognitive/Analyze
			CO 3	Affective/Valuing
			CO4	Psychomotor/Articulation, & Cognitive/Evaluate
	Labtest-1, Labtest-2	30%	CO 1	Cognitive/Analyze
			CO 2	Psychomotor/Articulation, & Cognitive/Analyze
			CO 3	Affective/Valuing
	Project and Presentation	25%	CO5	Cognitive/Create, Affective/Characterization by Value
Lab Quiz		25%	CO 1	Cognitive/Analyze
			CO 2	Psychomotor/Articulation, & Cognitive/Analyze
			CO 3	Affective/Valuing
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

As reviewed by different students or group of students

***Details of program outcome and grading policy are attached as Annex A and Annex B.

5.1.4 Optional / Elective Courses (Avionics Discipline)

COURSE INFORMATION			
Course Code Course Title	AEAV 329 Measurement and Aircraft Instruments	Lecture Contact Hours Credit hours	3.0 3.0

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To introduce students to fundamentals of instrumentation and digital data communication

OBJECTIVES

1. To introduce working principles of basic aircraft instruments
2. Introduce to various types of transducer and signal conditioning
3. Introduce the signal flow through various medium including digital data bus

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **define** to fundamentals of measurement and basic instruments in aircraft	PO1	C1			K3	T, F,
CO2	Be able to **explain** transducers and Pitot Static instruments working	PO1	C2			K3	T, F
CO3	Be able to **develop** understanding of gyro, RPM and temperature based system	PO2	C3			K4	Mid Term Exam, F,
CO4	Be able to **analyze** methods of signal conditioning and digital data transmission and fuel measurement	PO2	C4			K4	T, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project

Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

a. Main Contents:

b. Detail Contents:

Fundamentals: Generalized measurements systems, dimensions and units of measurements, causes and types of experimental errors, error and uncertainty analysis.

Air pollution sampling and measurements; Data acquisition and processing.

Introduction: Introduction to Basic-6 and Basic-T aircraft instruments, applications of instruments in aircraft, functional elements of a measurement system and classification of instruments.

Instrument display and layout: Qualitative, quantitative display, scale range, operating range, type of scales- linear, non-linear, circular, straight, dual displays and digital display; instrument grouping in cockpit.

Transducers: Primary, secondary, mechanical, electrical and optical.

Measurement of non-electrical quantities: Temperature, pressure, flow, level, force and torque.

Pitot-static group of Instruments: ASI, Altimeter, VSI, Mach meter: Construction, operating principle, square law compensation, introduction to Air Data Computer, TAS, CAS, IAS

Aircraft Attitude & Indication system: Gyroscope & properties- Precession & rigidity, Gyro Horizon Indicator, Turn & Bank Indicator, construction and operating principle.

Measurement of Engine RPM: Torque measurement, Tacho probe.

Temperature Measurement: Thermocouple, Radiation pyrometer, PRTD, air temperature sensors-Principle application in aviation.

Fuel flow and quantity measurement: Resistive & Capacitive transducer, aircraft fuel measurement system, compensation for aircraft attitude and non-uniform tank contour.

Basic elements of signal conditioning: Instrumentation amplifier, noise and source of noise, noise elimination compensation, A/D and D/A converters, sample and hold circuits. Data acquisition system.

Digital Data Transmission Lines: Data buses, MIL STD 1553, ARINC 429, Optical data buses.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **define** to fundamentals of measurement and basic instruments in aircraft	3											
CO2	Be able to **explain** transducers and Pitot Static instruments working	3											
CO3	Be able to **develop** understanding of gyro, RPM and temperature based system		3										
CO4	Be able to **analyze** methods of signal conditioning and digital data transmission and fuel measurement		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

COURSE SCHEDULE		
Week	**Topic**	**CT**
Week 1	**Fundamentals of Measurement**	CT1
Class 1	Generalized measurements systems	
Class 2	Dimensions and Units of Measurements	
Class 3	Causes and types of errors and uncertainty analysis	
Week 2	**Fundamentals of Measurement**	
Class 4	Data acquisition and processing	
Class 5	Introduction to Basic-6 and Basic-T aircraft instruments	
Class 6	Applications of instruments in aircraft	
Week 3	**Fundamentals of Measurement and Instrument Display and Layout**	
Class 7	Functional elements of a measurement system and classification of instruments	
Class 8	Quantitative and Qualitative displays. Scale Range and Operating range	
Class 9	Types of scales (Linear, Nonlinear, Circular, Straight, Dual and Digital displays)	
Week 4	**Transducers**	CT 2
Class 10	Introduction	
Class 11	Classification of Transducers	
Class 12	Classification of Transducers	
Week 5	**Measurement of Non Electrical Quantities**	
Class 13	Measurement of temperature	
Class 14	Measurement of pressure, flow and level	
Class 15	Measurement of force and torque	
Week 6	**Pitot Static Group of Instruments**	
Class 16	Construction and operating principle of Air Speed Indicator	
Class 17	Construction and operating principle of Altimeter and Vertical Speed Indicator	
Class 18	Construction and operating principle of Machmeter	

Week	Topic	CT
Week 7	**Pitot Static Group of Instruments**	CT2
Class 19	Square Law Compensation	
Class 20	Introduction to Air Data Computer	
Class 21	QFE, QNE, TAS, CAS and IAS	
Week 8	**Aircraft Attitude and Indication System**	CT3
Class 22	Gyroscope & Properties of Gyroscope (Rigidity & Precession)	
Class 23	Construction and working principle of Gyro Horizon Indicator	
Class 24	Construction and working principle of Turn and Bank Indicator	
Week 9	**Measurement of Engine RPM and Temperature**	
Class 25	Torque measurement	
Class 26	Tacho Probe	
Class 27	Principle application in aviation of Thermocouple	
Week 10	**Temperature Measurement**	CT 4
Class 28	Principle application in aviation of Radiation Pyrometer	
Class 29	Principle application in aviation of PRTD	
Class 30	Air Temperature Sensors	
Week 11	**Fuel Flow and Quantity Measurement**	
Class 31	Resistive & Capacitive Transducer,	
Class 32	Aircraft Fuel Measurement	
Class 33	Compensation for aircraft attitude and non-uniform tank contour	
Week 12	**Basic Elements of Signal Conditioning**	
Class 34	Instrumentation amplifier, noise and source of noise, noise elimination compensation	
Class 35	A/D Converters	
Class 36	A/D Converters	
Week 13	**Basic Elements of Signal Conditioning**	
Class 37	D/A Converters	
Class 38	Sample and Hold Circuits	
Class 39	Data Acquisition System	

Week	Topic	CT
Week 14	**Digital Data Transmission Lines**	CT 4
Class 40	Introduction to Data Buses.	
Class 41	MIL STD 1553 and 1773 data buses	
Class 42	ARINC 429, Optical data buses	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO4	C4
	Class Performance	5%		
	Class Attendacne	5%		
	Mid-Term Assessment (Exam /Project)	10%	CO3	C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C3
			CO 4	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Aircraft Instruments and integrated Systems- EHJ Pallet; Pearson Education Publishers.
2. Aircraft Electricity and Electronics- Thomas Eismin; Glencoe.
3. Modern Electronic Instrumentation and Measurement Techniques - Albert D Helfrick; Prentice Hall of India private Ltd.
4. Federal Aviation Agency (FAA) Hand Book of Flying: Flight Instruments.
5. Electrical Electronics Measurement and Instrumentation - A.K. Sawheney; Dhanpat Rai

COURSE INFORMATION			
Course Code Course Title	AEAV 413 Mobile Cellular Communications	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE
Communication Engineering

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
By the end of the course, the student will be able to analyze and design wireless and mobile cellular systems and work in advanced research wireless and mobile cellular programs

OBJECTIVES
1. To understand the basic cellular system concepts. 2. To have an insight into the various propagation models and the speech coders used in mobile communication. 3. To understand the multiple access techniques and interference education techniques in mobile communication. 4. To enable the student to synthesis and analyze wireless and mobile cellular communication systems over a stochastic fading channel 5. To provide the student with an understanding of diversity reception techniques

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **define** cellular radio concepts and **identify** various propagation effects	PO1	C1			K3	T, Q, ASG, F
CO2	Be able to **relate** to the mobile system specifications.	PO2	C2			K3	T, Q, ASG, F
CO3	Be able to **classify** multiple access techniques in mobile communication.	PO2	C2			K3	T, Q, ASG, F
CO4	Be able to **analyze** various methodologies to improve the cellular capacity	PO1	C4	P1, P2		K3	T, Q, ASG, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project

Q – Quiz; ASG – Assignment; F – Final Exam

COURSE CONTENTS

Introduction: Concept, evolution and fundamentals. Analog and digital cellular systems.

Cellular Radio System: Frequency reuse, co-channel interference, cell splitting and components.

Mobile radio propagation: Propagation characteristics, models for radio propagation, antenna at cell site and mobile antenna. Frequency Management and Channel Assignment: Fundamentals, spectrum utilization, fundamentals of channel assignment, fixed channel assignment, non-fixed channel assignment, traffic and channel assignment. Handoffs and Dropped Calls: Reasons and types, forced handoffs, mobile assisted handoffs and dropped call rate. Diversity Techniques: Concept of diversity branch and signal paths, carrier to noise and carrier to interference ratio performance. Digital cellular systems: Global system for mobile, time division multiple access and code division multiple access.

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	Be able to **discuss** cellular radio concepts and **identify** various propagation effects	3											
CO2	Be able to **relate** to the mobile system specifications.		3										
CO3	Be able to **classify** multiple access techniques in mobile communication.		3										
CO4	Be able to **analyze** various methodologies to improve the cellular capacity	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Topic**	**CT/MID**
Week-1	**Introduction**	CT-1
Class 1	Concept evolution and fundamentals	
Class 2	Analog and digital cellular systems	
Class 3	Analog and digital cellular systems	

Week	Topic	CT/MID
Week-2	**Cellular Radio System**	CT-1
Class 4	Syst Frequency reuse em Technologies principles	
Class 5	co-channel interference	
Class 6	cell splitting and components	
Week-3	**Mobile Radio Propagation**	
Class 7	Propagation characteristics	
Class 8	models for radio propagation	
Class 9	Continue	
Week-4	**Antenna cell**	MID
Class 10	antenna at cell site	
Class 11	Mobile antenna	
Class 12	mobile antenna types	
Week-5	**Frequency Management**	
Class 13	Fundamentals	
Class 14	spectrum utilization	
Class 15	Continue	
Week-6	**Airborne EW**	
Class 16	Airbrone EW familiarization	
Class 17	Technology evolution	
Class 18	Advanced EW technical approaches	
Week-7	**Radar Bands**	
Class 19	EW and radar bands	
Class 20	Anti-radiation missiles	
Class 21	Advanced threat radars and missile systems	

Week	Topic	CT/MID
Week-8	**Missile System**	CT-2
Class 22	Countering missile systems	
Class 23	Countering missile systems	
Class 24	Maneuverability and speed	
Week-9	**RF and IR seekers**	
Class 25	dropped call rate	
Class 26	Dropped Calls	
Class 27	Continue	
Week-10	**Diversity Techniques**	
Class 28	Concept of diversity branch	
Class 29	signal paths	
Class 30	carrier to noise	
Week-11	**Directed energy weapons**	CT-3
Class 31	carrier to interference ratio	
Class 32	Performance	
Class 33	Continue	
Week-12	**Digital cellular systems**	
Class 34	Global system for mobile	
Class 35	time division multiple access	
Class 36	Continue	
Week-13	**Code division multiple access.**	
Class 37	Phase and amplitude modulation	
Class 38	Continue	
Class 39	Continue	

Week	Topic	CT/MID
Week-14	**Revision**	CT-3
Class 40	Revision	
Class 41	Revision	
Class 42	Revision	

ASSESMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1	C1,C2,C4
			CO3	
			CO4	
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam / Project)	10%	CO1, CO2	C1,C2
Final Examination (Section A & B)		60%	CO1	C1
			CO2	C2
			CO3	C2
			CO4	C4
Total		100%		

TEXT AND REFERENCE BOOKS:

1. Mobile Cellular Telecommunication (Analog Digital Systems) - William C.Y Lee; McGraw-Hill.
2. Mobile & Personal Communication System & Series - Raj Pandya; IEEE Press, Prentice Hall of India.
3. Wireless Digital Communications - Dr. KamiloFeher; Prentice Hall of India.Mobile Communication satellites theory and application - Ton Logadon; McGraw-Hill International

COURSE INFORMATION			
Course Code	AEAV 415	Lecture Contact Hours	3.00
Course Title	Satellite Communications	Credit hours	3.00

PRE-REQUISITE

Aircraft electrical Systems,

Aircraft Communication and Navigation.

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

Satellite communication systems carry much of the world's communications traffic, particularly over oceans and are widely used for television distribution and navigation. Increasingly, satellites are also being used for data relay and personal communication systems. This course gives students a broad treatment of the diverse subsystems that make up a complete satellite communication system.

OBJECTIVES

1. To enable the student to become familiar with satellites and satellite services.
2. To study of satellite orbits and launching.
3. To study of earth segment and space segment components
4. To study of satellite access by various users.

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **understand** the fundamentals of satellite communication system	PO1	C2			K3	T, ASG, F
CO2	Be able to critically **analyze** the design requirements and the performance of satellite communication systems	PO2	C4	P1, P3		K4	T, F
CO3	Be able to **analyze** satellite subsystems	PO2	C4			K3	T, ASG, F
CO4	Be able to **understand** how a satellite communication system successfully transfers information from one earth station to another	PO1	C2	P1, P2		K4	T, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project

Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Introduction, satellite classification, solution of the space segment, evolution of the ground segment, very large aperture terminal, large and medium size antennas, small antennas, international telecommunication satellite, business service or equivalent VSATs, extra small aperture terminals, non-parabolic satellite antennas, voice-data-video applications, characteristics of satellite networks, VSAT technologies, elements of VSAT networks, regulatory issues, benefits of VSATs, overview of a VSAT network, applications of VSATs, VSAT network configurations, protocols and interfaces, assuring system compatibility requirements, economics of VSAT networks, advanced concepts.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **understand** the fundamentals of satellite communication system	3											
CO2	Be able to critically **analyze** the design requirements and the performance of satellite communication systems		3										
CO2	Be able to **analyze** satellite subsystems		3										
CO4	Be able to **understand** of how a satellite communication system successfully transfers information from one earth station to another	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-

Teaching and Learning Activities	Engagement (hours)
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Topic	CT
Week-1		
Class-1	What is Satellite and What is communication	CT-1
Class-2	Development of Satellite communication	
Class-3	Satellite Classification and familiarization with each class	
Week-2		
Class-4	What is space segment	
Class-5	Requirements of space segment	
Class-6	Problems and solutions of Space segment	

Week	Topic	CT
Week-3		Mid exam
Class-7	What is ground segment	
Class-8	History and evolution of ground segment	
Class-9	Working principles of ground segment	
Week-4		
Class-10	Requirements of aperture terminal	
Class-11	Equations of apertures	
Class-12	Familiarization of antennas and their size requirements	
Week-5		
Class-13	Antenna classification	
Class-14	Equation development according to requirements	
Class-15	Equation development according to requirements	
Week-6		
Class-16	International Telecommunication satellite familiarization	
Class-17	Working principles	
Class-18	VSATs	
Week-7		CT-2
Class-19	Extra small aperture terminals familiarization and use	
Class-20	Non parabolic antenna use, application and working principle	
Class-21	Voice data principles	
Week-8		
Class-22	Satellite network classification	
Class-23	Familiarization with every class	
Class-24	VSAT technologies	

Week	Topic	CT
Week-9		CT-2
Class-25	VSAT network coverage	
Class-26	Equipment used	
Class-27	Descriptions of elements	
Week-10		
Class-28	Regulatory issues	
Class-29	Benefits of VSATs	
Class-30	Overview of networks	
Week 11		CT-3
Class-31	Applications of VSATs	
Class-32	Network configuration	
Class-33	Network configuration	
Week 12		
Class-34	VSAT protocols	
Class-35	Interfaces require	
Class-36	Interface familiarization	
Week 13		
Class-37	System compatibility requirements	
Class-38	Requirement descriptions	
Class-39	Requirement descriptions	
Week 14		
Class-40	Economic advantages of VSAT	
Class-41	Advanced concepts	
Class-42	Review of whole syllabus	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO 1, CO 3	C2, C4
			CO 4	
	Class Performance	5%		
	Class Attendance	5%		
	Mid -Term Assessment (Exam/ Project)	10%	CO 2	C4
Final Examination (Section A & B)		60%	CO 1	C2
			CO 2	C4
			CO 3	C4
			CO 4	C2
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Digital Satellite Communications - Tri T. Ha; McGraw-Hill International.
2. Satellite Communication Mobile & Fixed Services - Michael J. Miler; Kluwer Academic Publisher.
3. Satellite Communications - T. Pratt, C. Bostian, J. Allnut; John Wiley & Sons Inc.
4. Mobile Communication satellites theory and application – Ton Logadon; McGraw-Hill International.

COURSE INFORMATION			
Course Code Course Title	AEAV 417 Optoelectronics	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
Electronics- I, Electronics- II			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
The aim of this course is to provide the students' knowledge of Optoelectronics and apply those in various project design.			
OBJECTIVES			
1. To provide knowledge of Optical properties in semiconductor. 2. To learn Properties of light: Particle and wave nature of light, polarization, interference, diffraction and blackbody radiation. 3. To be able to design and interrupt different systems. 4. To understand Modulation of light: Phase and amplitude modulation, electro-optic effect, acousto-optic effect and magneto optic devices.			

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to Gain **knowledge** about optical properties of semiconductor; direct and indirect band-gap materials, luminescence and quantum efficiency in radiation.	PO1	C1			K3	T, F, ASG
CO2	Be able to **describe** the properties of light, particle and wave nature of light, polarization, interference, diffraction and blackbody radiation	PO1	C2			K3	T, F, ASG
CO3	Be able to **evaluate** various light emitting diode, materials for visible and infrared LED, structure and coupling to optical fibers.	PO2	C5	2		K3	T, Mid Term Exam, F
CO4	Be able to **design** variables for stimulated emission and light amplification, understand the basic aspects of semiconductor lasers.	PO3	C6	P1, P3		K4	T, Mid Term Exam, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Optical properties in semiconductor: Direct and indirect band-gap materials, radiate and nonradioactive recombination, optical absorption, photo-generated excess carriers, minority carrier life time, luminescence and quantum efficiency in radiation. **Properties of light**: Particle and wave nature of light, polarization, interference, diffraction and blackbody radiation. **Light emitting diode (LED)**: Principles, materials for visible and infrared LED, internal and external efficiency, loss mechanism, structure and coupling to optical fibers. **Stimulated emission and light amplification**: Spontaneous and stimulated emission, Einstein relations, population inversion, absorption of radiation, optical feedback and threshold conditions. **Semiconductor Lasers**: Population inversion in degenerate semiconductors, laser cavity, operating wavelength, threshold current density, power output, hetero-junction lasers, optical and electrical confinement. Introduction to quantum well lasers. **Photo-detectors**: Photoconductors, junction photo-detectors, PIN detectors, avalanche photodiodes and phototransistors. **Solar cells**: Solar energy and spectrum, silicon and Schottkey solar cells. **Modulation of light**: Phase and amplitude modulation, electro-optic effect, acousto-optic effect and magneto optic devices. Introduction to integrated optics.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to Gain **knowledge** about optical properties of semiconductor; direct and indirect band-gap materials, luminescence and quantum efficiency in radiation.	3											
CO2	Be able to **describe** the properties of light, particle and wave nature of light, polarization, interference, diffraction and blackbody radiation	3											
CO3	Be able to **evaluate** various light emitting diode, materials for visible and infrared LED, structure and coupling to optical fibers.		3										
CO4	Be able to **design** variables for stimulated emission and light amplification, understand the basic aspects of semiconductor lasers.			3									

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-

Teaching and Learning Activities	Engagement (hours)
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Topic	CT
Week-1	**Optical Properties In Semiconductor**	CT-1
Class 1	Direct And Indirect Band-Gap Materials	
Class 2	Direct And Indirect Band-Gap Materials	
Class 3	Radiative And Non-Radiative Recombination	
Week-2	**Optical Properties In Semiconductor**	
Class 4	Radiative And Non-Radiative Recombination	
Class 5	Optical Absorption	
Class 6	Optical Absorption	
Week 3	**Optical Properties In Semiconductor**	
Class 7	Photo-Generated Excess Carriers	
Class 8	Photo-Generated Excess Carriers	
Class 9	Minority Carrier Life Time	

Week	Topic	CT
Week-4	**Optical Properties In Semiconductor**	
Class 10	Minority Carrier Life Time	CT2
Class 11	Luminescence And Quantum Efficiency In Radiation	
Class 12	Luminescence And Quantum Efficiency In Radiation	
Week 5	**Properties Of Light**	
Class 13	Particle And Wave Nature Of Light	
Class 14	Particle And Wave Nature Of Light	
Class 15	Polarization, Interference, Diffraction And Blackbody Radiation	
Week 6	**Properties Of Light**	
Class 16	Polarization, Interference,	
Class 17	Diffraction And Blackbody Radiation	
Class 18	Continue	
Week 7	**Light Emitting Diode (LED)**	Mid Term
Class 19	Principles, Materials For Visible And Infrared LED	
Class 20	Internal And External Efficiency, Loss Mechanism	
Class 21	Structure And Coupling To Optical Fibers	
Week 8	**Stimulated Emission And Light Amplification**	
Class 22	Spontaneous And Stimulated Emission	
Class 23	Einstein Relations	
Class 24	Population Inversion	
Week 9	**Stimulated Emission And Light Amplification**	
Class 25	Absorption Of Radiation	
Class 26	Optical Feedback	
Class 27	Threshold Conditions	

Week	Topic	CT
Week 10	**Semiconductor Lasers**	Mid Term
Class 28	Population Inversion In Degenerate Semiconductors, Laser Cavity	
Class 29	Operating Wavelength, Threshold Current Density, Power Output	
Class 30	Hetero-Junction Lasers, Optical And Electrical Confinement	
Week 11	**Photo-Detectors**	
Class 31	Photoconductors, Junction Photo-Detectors	
Class 32	PIN Detectors	
Class 33	Avalanche Photodiodes And Phototransistors.	
Week 12	**Solar Cells**	CT3
Class 34	Solar Energy And Spectrum	
Class 35	Silicon	
Class 36	Schottkey Solar Cells	
Week 13	**Modulation Of Light**	
Class 37	Phase And Amplitude Modulation	
Class 38	Electro-Optic Effect	
Class 39	Acousto-Optic Effect And Magneto Optic Devices	
Week 14	**Introduction To Integrated Optics**	
Class 40	Introduction To Integrated Optics.	
Class 41	Review	
Class 42	Review	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO 1, CO 2	C1, C2
			CO 3	C5
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/ Project)	10%	CO 2, CO 3	C2
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C5
			CO 4	C6
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Optoelectronics – an Introduction - J. Wilson, J.F.B. Hawkes; Prentice Hall of India Private Ltd.
2. Optical Electronics in Modern Communications - AmnonYariv; Oxford University Press.
3. Optical Fiber Communications: Principles & Practice - John M. Senior; Prentice Hall.
4. Introduction to optical Electronics – A. Jones; Harper & Row.
5. Electro-optical System Design for Information Process – L. Wyatt; McGraw-Hill.
6. Modern optical engineering the design of optical sys – J. Smith; SPIE Press McGrawHill.

COURSE INFORMATION			
Course Code Course Title	AEAV 419 Electronic Warfare	Lecture Contact Hours Credit hours	3.0 3.0

PRE-REQUISITE

Electronics-I, Radar Engineering

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

The purpose of electronic warfare is to deny the opponent the advantage of and ensure friendly unimpeded access to, the EM spectrum. EW can be applied from air, sea, land, and/or space by manned and unmanned systems, and can target humans, communication, radar, or other assets (military and civilian).

OBJECTIVES

1. To understand about joint electromagnetic spectrum operations.
2. To know about the electromagnetic operational environment.
3. To learn about electromagnetic battle management.
4. To understand about joint electromagnetic spectrum management operations.
5. To be able to electronic warfare's (EW's) relationship to irregular warfare, EW's relationship to space operations, EW's relationship to cyberspace operations, and EW's relationship to navigation warfare.

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Correspon ding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessme nt Methods**
CO1	Be able to **understand** Modern electronic warfare systems, architecture, types and technology, EW signal processing, modern EW operation, software control of EW sets.	PO1	C1			K3	T, F, ASG
CO2	Be able to **describe** various Role of expendables, chaff and decoys, comparing EW receiver capabilities. airborne EW, advanced EW technical approaches	PO1	C2			K3	T, F, ASG
CO3	Be able to **demonstrate** EW and radar bands, anti-radiation missiles, advanced threat radars and missile systems, countering missile systems, maneuverability and speed considerations.	PO2	C3			K3	T, Mid Term Exam, F
CO4	Be able to **Analyze** digital RF memory, camouflage jamming, search radar jamming, high ERP generation, directed energy weapons and stealth technology, countering stealth technology, high power microwave weapons, propagation limitations, high energy lasers and charged particle beam weapons	PO2	C4	P1, P2		K4	Mid Term Exam, F, ASG
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Modern electronic warfare (EW) systems: Architecture, types and technology.

EW signal processing: Modern EW operation, software control of EW sets.

Role of expendables: Chaff and decoys. Comparing EW receiver capabilities.

Airborne EW: Technology evolution. Advanced EW technical approaches, EW and radar bands, anti-radiation missiles, advanced threat radars and missile systems, countering missile systems, maneuverability and speed considerations.

RF and IR seekers: digital RF memory, camouflage jamming, search radar jamming, high ERP generation, directed energy weapons and stealth technology, countering stealth technology, high power microwave weapons, propagation limitations, high energy lasers and charged particle beam weapons

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **understand** Modern electronic warfare systems, architecture, types and technology, EW signal processing, modern EW operation, software control of EW sets.	3											
CO2	Be able to **describe** various Role of expendables: Chaff and decoys. Comparing EW receiver capabilities. Airborne EW, Technology evolution. Advanced EW technical approaches	3											
CO3	Be able to **demonstrate** EW and radar bands, anti-radiation missiles, advanced threat radars and missile systems, countering missile systems, maneuverability and speed considerations.		3										
CO4	Be able to **analyze** digital RF memory, camouflage jamming, search radar jamming, high ERP generation, directed energy weapons and stealth technology, countering stealth technology, high power microwave weapons, propagation limitations, high energy lasers and charged particle beam weapons		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centred Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Topic	CT
Week-1	**Modern electronic warfare (EW) systems**	CT-1
Class 1	warfare (EW) systems: Architecture	
Class 2	System types	
Class 3	System Technologies Familiarization	
Week-2	**Modern electronic warfare (EW) systems**	
Class 4	System Technologies principles	
Class 5	System Technologies use	
Class 6	Warfare architecture total connectivity	

Week	Topic	CT
Week-3	**EW signal processing**	CT-1
Class 7	Luminescence and quantum efficiency in radiation.	
Class 8	Modern EW operation	
Class 9	software control of EW sets	
Week-4	**Role of expendables**	CT 2
Class 10	Polarization and interference,	
Class 11	Chaff	
Class 12	Decoys	
Week-5	**Role of expendables**	
Class 13	Comparing EW receiver capabilities	
Class 14	Internal and external efficiency	
Class 15	Loss mechanism	
Week-6	**Airborne EW**	
Class 16	Airbrone EW familiarization	
Class 17	Technology evolution	
Class 18	Advanced EW technical approaches	
Week-7	**Radar Bands**	Mid Term
Class 19	EW and radar bands	
Class 20	Anti-radiation missiles	
Class 21	Advanced threat radars and missile systems	
Week-8	**Missile System**	
Class 22	Countering missile systems	
Class 23	Countering missile systems	
Class 24	Maneuverability and speed	
Week-9	**RF and IR seekers**	
Class 25	Digital RF memory	
Class 26	Camouflage jamming	
Class 27	Search radar jamming	

Week	Topic	CT
Week-10	**High ERP generation**	Mid Term
Class 28	Photo-detectors	
Class29	Photoconductors	
Class30	Junction photo-detectors	
Week-11	**Directed energy weapons**	
Class 31	Stealth technology	
Class 32	Interfaces require	
Class 33	Interface familiarization	
Week-12	**High power microwave weapons**	CT3
Class 34	Avalanche photodiodes and phototransistors	
Class 35	Interfaces require	
Class 36	Interface familiarization	
Week-13	**Propagation limitations**	
Class 37	Phase and amplitude modulation	
Class 38	Electro effect	
Class 39	Requirement descriptions	
Week- 14	**High energy lasers and charged particle beam weapons.**	
Class 40	Acousto-optic effect and magneto devices.	
Class 41	Introduction to integrated	
Class 42	Review of whole syllabus	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO 3	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Examination (Exam/ Project)	10%	CO 2, CO3	C2, C3
Final Examination (Section A & B)		60%	CO 1	C 1
			CO 2	C 2
			CO 3	C 3
			CO 4	C 4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Electronic Defense Systems - FilippoNeri; Artech House Publishers.
2. Electronic warfare in Information Age - D. Curtis Schleher; Artech House Publishers.
3. Electronic Warfare - JPR Browne; Brassey's London

COURSE INFORMATION			
Course Code Course Title	AEAV 421 Optical Fiber Communications	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This course discussed component and system concepts in optical communications and its application and to give students and understanding of the theory of optical devices and systems and their application in optical communication networks.

OBJECTIVES
1. To discuss the importance of optical fiber communication 2. To introduce optical fiber communication system 3. To describe the principle of LED 4. To describe the principle of laser 5. To illustrate light propagation in optical fiber.

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **distinguish** Step Index, Graded index fibers and compute mode volume construction and characteristics of optical sources and detectors	PO1	C2			K3	T, F, ASG
CO2	Be able to **explain** characteristics transmission characteristics, fiber joints and fiber couplers, light emitting diodes and laser diodes.	PO1	C3			K3	T, F, ASG
CO3	Be able to **explain** PIN photo-detector and avalanche photo-detectors, direct detection and coherent detection, noise and limitations, chromatic dispersion, nonlinear refraction, four wave mixing and laser phase noises.	PO2	C3			K4	T, Mid Term Exam, F
CO4	Be able to **analyze** Laser and fiber amplifiers, applications and limitations, multi-channel optical system, frequency division multiplexing, wavelength division multiplexing and optical CDMA. Radio on fiber technology, Fiber optic access networks	PO1	C4	P1, P2		K4	T, Mid Term Exam, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Introduction to Optical Fiber Communication. Light propagation through optical fiber: Ray optics theory and modern theory. Optical fiber: Types and characteristics transmission characteristics, fiber joints and fiber couplers. Light sources: Light emitting diodes and laser diodes. Detectors: PIN photo-detector and avalanche photo-detectors. Receiver analysis: Direct detection and coherent detection, noise and limitations. Transmission limitations: Chromatic dispersion, nonlinear refraction, four wave mixing and laser phase noises. Optical amplifier: Laser and fiber amplifiers, applications and limitations. Multi-channel optical system: Frequency division multiplexing, wavelength division multiplexing and optical CDMA. Radio on fiber technology, Fiber optic access networks.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **distinguish** Step Index, Graded index fibers and compute mode volume construction and characteristics of optical sources and detectors	3											
CO2	Be able to **explain** characteristics transmission characteristics, fiber joints and fiber couplers, light emitting diodes and laser diodes.	3											
CO3	Be able to **explain** PIN photo-detector and avalanche photo-detectors, direct detection and coherent detection, noise and limitations, chromatic dispersion, nonlinear refraction, four wave mixing and laser phase noises.		3										
CO4	Be able to **analyze** Laser and fiber amplifiers, applications and limitations, multi-channel optical system, frequency division multiplexing, wavelength division multiplexing and optical CDMA. Radio on fiber technology, Fiber optic access networks	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	**Topic**	**CT**
Week 1	**Introduction**	CT1
Class 1	Introduction to Optical Fiber Communication.	
Class 2	Light propagation	
Class 3	Continue	
Week 2	**Optical Fiber Theory**	
Class 4	Optical fiber	
Class 5	Ray optics theory	
Class 6	Mode theory	

Week	Topic	CT
Week 3	**Characteristics**	CT1
Class 7	Types	
Class 8	transmission characteristics	
Class 9	Continue	
Week 4	**Optical Fiber**	
Class 10	fiber couplers	CT2
Class 11	fiber joints	
Class 12	Continue	
Week 5	**Light sources**	
Class 13	Fundamentals	
Class 14	Light emitting diodes	
Class 15	laser diodes	
Week 6	**Detectors**	
Class 16	Fundamentals	
Class 17	PIN photo-detector	
Class 18	avalanche photo-detectors	
Week 7	**Receiver Analysis**	Mid Term
Class 19	Direct detection	
Class 20	Coherent detection	
Class 21	Noise and limitations	
Week 8	**Dispersion**	
Class 22	Transmission limitations	
Class 23	Chromatic dispersion	
Class 24	Nonlinear refraction	

Week	Topic	CT
Week 9	**Routing**	Mid Term
Class 25	Four wave mixing	
Class 26	Laser phase noises	
Class 27	Control	
Week 10	**Optical Amplifier**	
Class 28	Laser	
Class 29	Fiber amplifiers	
Class 30	Applications	
Week 11	**Multi-channel Optical System**	
Class 31	Frequency division multiplexing imitations	
Class 32	wavelength division multiplexing	
Class 33	Continue	
Week 12	**Optical CDMA**	CT3
Class 34	Fiber optic access networks	
Class 35	CDMA	
Class 36	Application	
Week 13	**Radio on Fiber Technology**	
Class 37	Fiber technology	
Class 38	Continue	
Class 39	Continue	
Week 14	**Revision**	
Class 40	Revision	
Class 41	Review	
Class 42	Review	

ASSESSMENT STRATEGY

<table>
<tr><th colspan="2">Components</th><th>Grading</th><th>CO</th><th>Blooms Taxonomy</th></tr>
<tr><td rowspan="5">Continuous Assessment (40%)</td><td rowspan="2">Class Test/ Assignment 1-3</td><td rowspan="2">20%</td><td>CO1, CO2</td><td>C2, C3</td></tr>
<tr><td>CO 2</td><td>C3</td></tr>
<tr><td>Class Performance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Class Attendance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Mid-Term Assessment (Exam/ Project)</td><td>10%</td><td>CO 2, CO3</td><td>C3</td></tr>
<tr><td colspan="2" rowspan="4">Final Examination (Section A & B)</td><td rowspan="4">60%</td><td>CO 1</td><td>C2</td></tr>
<tr><td>CO 2</td><td>C3</td></tr>
<tr><td>CO 3</td><td>C3</td></tr>
<tr><td>CO4</td><td>C4</td></tr>
<tr><td colspan="2">Total Marks</td><td>100%</td><td colspan="2"></td></tr>
</table>

TEXT AND REFERENCE BOOKS:

1. Optical Fiber Communications: Principles & Practice - John M. Senior; Prentice Hall of India.
2. Fiber Optic Communications - D C Agrawal; Wheeler Publishing.
3. Fiber Optic Communication System - Gerd Keiser; McGraw-Hill International.
4. Optical Communication System - John Gower; Prentice Hall of India.

COURSE INFORMATION			
Course Code Course Title	AEAV 435 Computer Networks	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
Resource sharing is the main objective of the computer network. The goal is to provide all the program, date and hardware is available to everyone on the network without regard to the physical location of the resource and the users.

OBJECTIVES

1. To provide the high Reliability. It is achieved by replicating the files on two or more machines, so in case of unavailability (due to fail of hardware) the other copies can be used.
2. To install interconnected microcomputer connected to the mainframe computer.
3. To increase system performance as the work load increases (load balancing).
4. To increase security as only authorized user can access resource in a computer network.

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to have a good **understanding** of the OSI Reference Model and in particular have a good knowledge of Layers 1-3.	PO1	C2			K3	T, ASG, F
CO2	Be able to **analyze** the requirements for a given organizational structure and select the most appropriate networking architecture and technologies	PO2	C4	P1, P3		K4	Mid Term Exam, F
CO3	Be able to **specify** and **identify** deficiencies in existing protocols, and then go onto formulate new and better protocols	PO1	C3			K3	Mid Term Exam, T,ASG, F
CO4	Be able to have an **understanding** of the issues surrounding Mobile and Wireless Networks	PO1	C2			K3	T, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Switching and multiplexing: ISO, TCP-IP and ATM reference models. Different data communication services: Physical layer wired and wireless transmission media. Cellular radio: Communication satellites; data link layer: Elementary protocols. Sliding window protocols. Error detection and corrections. HDLC.DLLL of Internet. DLLL of ATM: Multiple Access protocols. IEECE.802 Protocols for LANs and MANs. Switches. Hubs and bridges. High speed LAN Network Layer: Routing, congestion control, internetworking. Network layer in internet: IP protocol, IP addresses. ARP; NI in ATM transport layer, transmission control protocol. UDP.ATM adaptation layer, application layer, network security, email, domain name system. Simple network management protocol, HTTP and World Wide Web.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to have a good **understanding** of the OSI Reference Model and in particular have a good knowledge of Layers 1-3.	3											
CO2	Be able to **analyze** the requirements for a given organizational structure and select the most appropriate networking architecture and technologies		3										
CO3	Be able to **specify** and **identify** deficiencies in existing protocols, and then go onto formulate new and better protocols	2											
CO4	Be able to have an **understanding** of the issues surrounding Mobile and Wireless Networks	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Topic	CT
Week-1	**Introduction**	CT-1
Class-1	Switching	
Class-2	Multiplexing	
Class-3	Continue	
Week-2	**Reference Models**	
Class-4	Iso	
Class-5	Tcp-Ip	
Class-6	Atm	
Week-3	**Different Data Communication Services**	Mid exam
Class-7	Physical Layer Wired	
Class-8	Wireless Transmission Media	
Class-9	Continue	
Week-4	Cellular Radio	
Class-10	Transmission	
Class-11	Communication Satellites	
Class-12	Continue	
Week-5	**Data Link Layer**	
Class-13	Elementary Protocols	
Class-14	Sliding Window Protocols	
Class-15	Error Detection And Corrections	
Week-6	**Detectors**	
Class-16	Fundamentals	
Class-17	PIN Photo-Detector	
Class-18	Avalanche Photo-Detectors	

Week	Topic	CT
Week-7	**Corrections**	CT-2
Class-19	Hdlc	
Class-20	DLLL Of Internet	
Class-21	DLLL Of ATM	
Week-8	**Access**	
Class-22	Ieece.802	
Class-23	Protocols For Lans	
Class-24	Protocols For Mans	
Week-9	**Routing**	CT-3
Class-25	Switches. Hubs And Bridges.	
Class-26	High Speed LAN Network Layer	
Class-27	Congestion Control	
Week-10	**Internetworking**	
Class-28	Network Layer In Internet	
Class-29	IP Protocol	
Class-30	IP Addresses	
Week 11	**Control Protocol**	
Class-31	Arp	
Class-32	NI In ATM Transport Layer	
Class-33	Transmission Control Protocol	

Week	Topic	CT
Week 12	**Adaptation Layer**	CT-3
Class-34	Udp	
Class-35	ATM Adaptation Layer	
Class-36	Application	
Week 13	**Network Security**	
Class-37	Network Security	
Class-38	Email	
Class-39	Domain Name System	
Week 14	**Revision**	
Class-40	Simple Network Management Protocol	
Class-41	HTTP And World Wide Web.	
Class-42	Revision	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C2, C4
			CO 2	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam / Project)	10%	CO 2, CO3	C4, C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C3
			CO4	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Computer Network- Andrew S. Tanenbaum; Prentice Hall of India Private Ltd.
2. Data and Computer Communications – William Stallings; Prentice Hall of India.
3. Computer Network and Distributed Processing – James Martin; Prentice Hall of India Private Ltd.
4. Data Communication and Distributed Network – Uyless D. Black; Prentice Hall of India Private Ltd.

COURSE INFORMATION			
Course Code Course Title	AEAV 409 Microprocessor and Interfacing	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE
Digital Systems

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
The aim of this course is to provide the students' knowledge of microprocessor circuit and interface networks in various project design.

OBJECTIVES
1. To provide knowledge of Intel 8086 microprocessor 2. To learn architecture, addressing modes, instruction sets, assembly language programming 3. To be able to design and interrupt different systems 4. To understand peripheral interface, programmable timer, serial communication interface

COURSE OUTCOMES AND GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **gain knowledge** about operation of microprocessors	PO1	C1			K3	T, F, ASG
CO2	Be able to **understand** the architecture and system design of a microprocessor	PO1	C2			K3	Mid Term Exam, F
CO3	Be able to **evaluate** various interfaces of microprocessor	PO2	C5	P1, P2		K4	Mid Term Exam, F, ASG
CO4	Be able to **analyze** the performance &design variables for each component of a microprocessor	PO1	C4	P1, P3		K4	T, F, ASG

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **gain knowledge** about operation of microprocessors;	1											
CO2	Be able to **understand** the architecture and system design of a microprocessor;	2											
CO3	Be able to **evaluate** various interfaces of microprocessor;		2										
CO4	Be able to **analyze** the performance &design variables for each component of a microprocessor;	1											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home **Preparation for final examination**	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE		
Week	**Topic**	**CT**
Week 1	**Fundamental concept of microprocessor**	CT 1
Class 1	Introduction to microprocessors	
Class 2	Properties of microprocessor,	
Class 3	Continue	
Week 2	**Intel 8086 microprocessor**	
Class 4	Architecture	
Class 5	Architecture	
Class 6	Architecture	
Week 3	**Intel 8086 Microprocessor**	Mid Exam
Class 7	Addressing Modes,	
Class 8	Addressing Modes,	
Class 9	Instruction Sets,	
Week 4	**Intel 8086 Microprocessor**	
Class 10	Instruction Sets,	
Class 11	Instruction Sets,	
Class 12	Assembly Language Programming	

Week	Topic	CT
Week 5	**Intel 8086 Microprocessor**	Mid Exam
Class 13	Assembly Language Programming	
Class 14	System Design And Interrupt.	
Class 15	System Design And Interrupt.	
Week 6	**Interfacing**	
Class 16	Programmable Peripheral Interface	
Class 17	Programmable Peripheral Interface	
Class 18	Programmable Peripheral Interface	
Week 7	**Interfacing**	CT2
Class 19	Programmable Timer	
Class 20	Programmable Timer	
Class 21	Programmable Timer	
Week 8	**Interfacing**	
Class 22	Serial Communication Interface	
Class 23	Serial Communication Interface	
Class 24	Serial Communication Interface	
Week 9	**Interfacing**	
Class 25	Programmable Interrupt Controller	
Class 26	Programmable Interrupt Controller	
Class 27	Programmable Interrupt Controller	

Week	Topic	CT
Week 10	**Interfacing**	CT3
Class 28	Direct Memory Access	
Class 29	Direct Memory Access	
Class 30	Direct Memory Access	
Week 11	**Interfacing**	
Class 31	Keyboard And Display Interface	
Class 32	Keyboard And Display Interface	
Class 33	Keyboard And Display Interface	
Week 12	**Microcontroller**	
Class 34	Introduction	
Class 35	Introduction	
Class 36	Introduction	
Week 13	**Microcontroller**	
Class 37	Introduction	
Class 38	Introduction	
Class 39	Introduction	
Week 14	**Review**	
Class 40	Review	
Class 41	Review	
Class 42	Review	

ASSESSMENT STRATEGY

<table>
<tr><td colspan="3" rowspan="1"></td><td rowspan="2">CO</td><td rowspan="2">Blooms
Taxonomy</td></tr>
<tr><td colspan="2">Components</td><td>Grading</td></tr>
<tr><td rowspan="5">Continuous Assessment
(40%)</td><td rowspan="2">Class Test/ Assignment
1-3</td><td rowspan="2">20%</td><td>CO1,
CO2</td><td>C1, C2</td></tr>
<tr><td>CO 2</td><td>C2</td></tr>
<tr><td>Class Performance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Class Attendance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Mid-Term Assessment
(Exam / Project)</td><td>10%</td><td>CO 2,
CO3</td><td>C2, C3</td></tr>
<tr><td colspan="2" rowspan="4">Final Examination(Section A & B)</td><td rowspan="4">60%</td><td>CO 1</td><td>C1</td></tr>
<tr><td>CO 2</td><td>C2</td></tr>
<tr><td>CO 3</td><td>C3</td></tr>
<tr><td>CO4</td><td>C4</td></tr>
<tr><td colspan="2">Total Marks</td><td>100%</td><td colspan="2"></td></tr>
</table>

TEXT AND REFERENCE BOOKS:

1. Microprocessor and Interfacing - Douglas V. Hall; Tata McGraw-Hill.
2. Microprocessor and Microprocessor Based System Design - Dr M. Rafiquzzaman; Universal Book Stall New Delhi

COURSE INFORMATION			
Course Code Course Title	AEAV 403 Electric and Magnetic Properties of Materials	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course discussed component and system concepts in optical communications and its application and to give students and understanding of the theory of optical devices and systems and their application in optical communication networks.

OBJECTIVES

1. To discuss the importance of optical fiber communication
2. To introduce optical fiber communication system
3. To describe the principle of LED
4. To describe the principle of laser
5. To illustrate light propagation in optical fiber.
6. To explain total internal reflection

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **know** the basic electrical and magnetic properties of various materials and theories related to those properties.	PO1	C1			K3	T, F, ASG
CO2	Be able to **understand** the electrical behavior and characteristics of various materials, used in the electrical appliances, devices, instruments.	PO1	C2			K3	Mid Term Exam, F
CO3	Be able to **apply** the knowledge of electrical engineering material science to work in different industries.	PO1	C3			K4	Mid Term Exam, F, ASG
CO4	Be able to **analyze** of the physics behind the electrical engineering materials.	PO2	C4			K4	T, F, ASG

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **know** the basic electrical and magnetic properties of various materials and theories related to those properties.	1											
CO2	Be able to **understand** the electrical behaviour and characteristics of various materials, used in the electrical appliances, devices , instruments.	2											
CO3	Be able to **apply** the knowledge of electrical engineering material science to work in different industries.	1											
CO4	Be able to **analyze** of the physics behind the electrical engineering materials.		1										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	**Engagement (hours)**
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE		
Week	**Topic**	**CT**
Week 1	**Crystal Structures**	CT1
Class 1	Crystals, Types Of Crystals, Lattice And Basis	
Class 2	Lattice And Basis	
Class 3	Bravais Lattice And Miller Indices	
Week 2	**Classical Theory Of Electrical And Thermal Conduction**	
Class 4	Scattering, Mobility And Resistivity	
Class 5	Temperature Dependence Of Metal Resistivity, Mathiessen's Rule	
Class 6	Hall Effect And Thermal Conductivity	
Week 3	**Introduction To Quantum Mechanics**	
Class 7	Wave Nature Of Electrons, Schrodinger's Equation	
Class 8	One-Dimensional Quantum Problems- Infinite Quantum Well	
Class 9	Potential Step And Potential Barrier	
Week 4	**Uncertainty Principle**	
Class 10	Heisenbergs's Uncertainty Principle And Quantum Box,	
Class 11	Electron In A 3D Box	
Class 12	Hydrogen Atom	
Week 5	**Band Theory Of Solids**	
Class 13	Band Theory From Molecular Orbital, Bloch Theorem	
Class 14	Kronig-Penny Model, Brillouin Zone	
Class 15	Effective Mass, Density-Of-States. Carrier Statistic	
Week 6	**Band Theory Of Solids**	CT2
Class 16	Maxwell-Boltzmann And Fermi- Dirac Distributions	
Class 17	Fermi Energy	
Class 18	Fermi- Dirac Distributions	

Week	Topic	CT
Week 7	**Modern Theory Of Metals**	CT2
Class 19	Determination Of Fermi Energy And Average Energy Of Electrons	
Class 20	Average Energy Of Electrons	
Class 21	Classical And Quantum Mechanical Calculation Of Specific Heat	
Week 8	**Dielectric Properties Of Materials**	
Class 22	Dielectric Constant, Polarization Electronic	
Class 23	Ionic, Orientational And Interfacial	
Class 24	Internal Field, Clausius-Mosotti Equation	
Week 9	**Dielectric Properties Of Materials**	
Class 25	Spontaneous Polarization	
Class 26	Frequency Dependence Of Dielectric Constant, Dielectric Loss	
Class 27	Piezoelectricity, Ferro Electricity, Pyro Electricity	
Week 10	**Magnetic Properties Of Materials**	Mid Term
Class 28	Magnetic Moment, Origin Of Ferromagnetism And Magnetic Domains.	
Class 29	Magnetization And Relative Permittivity	
Class 30	Different Types Of Magnetic Materials	
Week 11	**Magnetic Properties Of Materials**	
Class 31	Origin Of Ferromagnetism And Magnetic Domains	
Class 32	Zero Resistance	
Class 33	Meissner Effect,	
Week 12	**Introduction To Superconductivity**	CT3
Class 34	Type I Superconductors	
Class 35	Critical Current Density	
Class 36	Type II Superconductors	

Week	Topic	CT
Week 13	**Introduction To Superconductivity**	CT3
Class 37	Magnetic Recording Materials,	
Class 38	Continue	
Class 39	Josephson Theory	
Week 14	**Introduction To Meta-Materials**	
Class 40	Meta-Materials	
Class 41	Revision	
Class 42	Review Of The Syllabus	

ASSESSMENT STRATEGY			CO	Blooms Taxonomy
Components		Grading		
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1,	C1
			CO3	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam / Project)	10%	CO2 & CO3	C2, C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C3
			CO4	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Electrical Properties of Materials- Laszlo Solymar, Donald Walsh, Richard R. A. Syms
2. Introduction to Magnetic Materials- B. D. Cullity , C. D. Graham
3. Introduction to Magnetism and Magnetic Materials- David Jiles

COURSE INFORMATION			
Course Code Course Title	AEAV 451 Avionics Technology	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
This course is provided to gather knowledge about communication, navigation and guidance systems of an aircraft for their proper implementation in future workplace or studies.

OBJECTIVES

1. To provide a fundamental understanding and knowledge of conventional and modern design and working principles of radar, guidance and navigation for air vehicles.
2. To provide the basic mathematical concepts of radar, navigation by NDB, VOR, GPS and Inertial Navigation approaches, and guidance laws.
3. To provide an expansive view into the technological trends of future aircraft navigation and guidance systems designs

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **understand** the air navigation, navigation parameters and principle of different types of navigation. Dead Reckoning (DR) Computation, Inertial Navigation System (INS).	PO1	C1			K3	T, F, ASG
CO2	Be able to **Explain** Hyperbolic Navigation, Doppler Navigation, Satellite Navigation, Automatic Direction Finder (ADF), VHF Omni-directional Range (VOR), Distance Measuring Equipment (DME), Instrumental Landing System (ILS).	PO1	C2			K3	T, Mid Term Exam, F
CO3	Be able to **understand** basic principles & fundamental elements, Amplitude modulation-demodulation, frequency modulation (FM)-demodulation, Radar Principle, Radar range equation, Doppler Effect- Continuous wave radars, moving target indicator, Radar antenna- Antenna parameters.	PO2	C1			K3	Mid Term Exam, F, ASG

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO4	Be able to **explain** Transformer- Ideal transformer, transformation ratio, no-load and load vector diagrams; DC generator-Types, no load voltage characteristic, effect of speed on no-load and load characteristics and voltage regulation, DC motor- Torque, Three Phase Alternator.	PO2	C2			K3	T, F, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project

Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Introduction to Navigation: Block diagram of navigation system, Types of navigation, Coordinate Frames, Coordinate transformation, Frame of Reference.

Methods of navigation: Dead Reckoning (DR) Computation, Inertial Navigation System (INS), Hyperbolic Navigation, Air Data Navigation, Doppler Navigation, Satellite Navigation, Automatic Direction Finder (ADF), VHF Omni-directional Range (VOR), Distance Measuring Equipment (DME), Instrumental Landing System (ILS).

Communication: Overview of communication systems: Basic principles & fundamental elements. Continuous wave modulation: Amplitude modulation-demodulation, frequency modulation (FM)-demodulation.

Radar Systems: Radar Principle, Functional block diagrams, Radar range equation, Factors affecting radar performance; Doppler Effect- Continuous wave radars, moving target indicator and phase-Doppler radars; Radar antenna- Antenna parameters, radiation pattern and aperture distribution.

Electro-mechanical System: Transformer- Ideal transformer, transformation ratio, no-load and load vector diagrams; DC generator- Types, no load voltage characteristic, effect of speed on no-load and load characteristics and voltage regulation; DC motor- Torque, counter emf, torque-speed characteristics, starting and speed regulation; Three Phase Alternator: Overview, Principle of operation.

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
1	Be able to **understand** the air navigation, navigation parameters and principle of different types of navigation. Dead Reckoning (DR) Computation, Inertial Navigation System (INS).	3											
2	Be able to **explain** Hyperbolic Navigation, Doppler Navigation, Satellite Navigation, Automatic Direction Finder (ADF), VHF Omni-directional Range (VOR), Distance Measuring Equipment (DME), Instrumental Landing System (ILS).	3											
3	Be able to **understand** basic principles & fundamental elements, Amplitude modulation-demodulation, frequency modulation (FM)-demodulation, Radar Principle, Radar range equation, Doppler Effect-Continuous wave radars, moving target indicator, Radar antenna- Antenna parameters.		3										

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
4	Be able to **explain** Transformer- Ideal transformer, transformation ratio, no-load and load vector diagrams; DC generator- Types, no load voltage characteristic, effect of speed on no-load and load characteristics and voltage regulation, DC motor- Torque, Three Phase Alternator.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	42
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	42
Non-face-to-face learning	
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method
COURSE SCHEDULE

Week	Topic	CT
Week 1	**Air Navigation**	CT 1,F
Class 1	Introduction to Air Navigation, Phases of flight	
Class 2	Basic navigation and navigation parameters.	
Class 3	Continue	
Week 2	**Wind Triangle Analysis**	
Class 4	Wind Triangle Analysis theory	
Class 5	Wind Triangle Analysis problem solving	
Class 6	Coordinate Frames, Frame of Reference	
Week 3	**Coordinate transformation**	
Class 7	Coordinate transformation from 2D to 3D	
Class 8	Continue.	
Class 9	Angular transformation	
Week 4	**Types of navigation**	CT 2,F
Class 10	Classification of different Types of navigation with block diagram	
Class 11	Visual Flight Rules	
Class 12	Instrument Flight Rules	
Week 5	**Visual Flight Rules**	
Class 13	Navigation by Pilotage	
Class 14	Celestial Navigation	
Class 15	Continue	

Week	Topic	CT
Week 6	**Instrument Flight Rules**	CT 2,F
Class 16	Radio Navigation, Doppler Navigation	
Class 17	Dead Reckoning (DR) Computation	
Class 18	Different Types of Navigation Techniques	
Week 7	**Navigation Techniques**	
Class 19	Inertial Navigation System (INS), Sensors- Accelerometers, Gyroscopes	
Class 20	Inertial measurement unit (IMU).	
Class 21	Air Data Navigation	
Week 8	**Navigational Equipment**	CT 3, F
Class 22	Automatic Direction finder (ADF)	
Class 23	VHF Omnidirectional Range (VOR)	
Class 24	Distance Measuring Equipment (DME)	
Week 9	**Navigational Equipment**	
Class 25	Instrumental Landing System (ILS)	
Class 26	Basic-6 and Basic-T aircraft instrument	
Class 27	Continued	
Week 10	**Instrumentation and Measurement**	
Class 28	Basic-6 and Basic-T aircraft instrument	
Class 29	Continued	
Class 30	Continued	

Week	Topic	CT
Week 11	**Radar System**	Mid Term, F
Class 31	Radar principle and operation	
Class 32	Different terminologies related to Radar system	
Class 33	Numerical problems related to radar design	
Week 12	**Communication System**	
Class 34	Basic principles & fundamental elements	
Class 35	Modulation	
Class 36	Antenna	
Week 13	**Electro-mechanical System**	
Class 37	Introduction of transformer	
Class 38	Basics of generators	
Class 39	Basics of motors	
Week 14	**Electro-mechanical System:**	
Class 40	Three Phase Alternator	
Class 41	Overview of principle of operation.	
Class 42	Review of whole Syllabus	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO 2	C1
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam / Project)	10%	CO 2, CO3	C1 C2
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C1
			CO 3	C2
			CO4	C2
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Avionics Fundamentals- Jeppesen; Highflyn.
2. Avionics Navigation Systems – Myron Kayton; Wiley-Interscience
3. Elements of Electronic Navigation- N S Nagaraja; McGraw-Hill.
4. A Text Book of Electrical Technology (Volume-II)- B L Theraja and A K Theraja; S.Chand& Company Ltd.
5. Introduction to RADAR systems - M. Skolnik; McGraw-Hill International.
6. Modern Digital & Analog Communication System - B. P. Lathi; Oxford University Press

CHAPTER 6

DETAIL OUTLINE OF UNDERGRADUATE COURSES OFFERED BY OTHER DEPARTMENTS TO AE STUDENTS

COURSE INFORMATION			
Course Code Course Title	PHY 101 Waves and Oscillations, Optics and Modern physics	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn the basic concepts of Waves and Oscillations, Optics and Modern physics			
OBJECTIVES			
1. To define the different parameter and concepts of Waves and Oscillations, Optics and Modern physics. 2. To explain the basic concepts of Waves and Oscillations, Optics and Modern physics. 3. To solve analytical problems regarding Waves and Oscillations, Optics and Modern physics.			

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **Define** the different parameters such as periodic motion, simple harmonic motion, undammed oscillations, interference, diffraction, polarization and prism, photoelectric effect, Compton effect, matter wave, atomic model radioactive decay, fusion, fission etc.	PO1	C1	1		3	T, F, ASG
CO2	Be capable to **Explain** the wave motion for different systems along with energy, the techniques to derive different formula for interference, diffraction, polarization and prism, different theory regarding modern physics such as special theory of relativity, Compton theory, materials according to magnetic properties, nuclear transformation, and nuclear reaction etc.	PO1	C2	1		3	T, Mid Term Exam, F
CO3	Be skilled to **Solve** quantitative problems in the field of Waves and Oscillations Optics and Modern physics such as energy of wave motion, wavelength diffraction pattern, relativistic energy, photon energy, Compton shift, nuclear binding energy etc.	PO1	C3	1		3	Mid Term Exam, F, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

a. Main Contents: Waves and Oscillations, Optics, Modern physics

b. Detail Contents:

Waves and Oscillations

Simple Harmonic Motion (SHM) and its properties, Differential equation of a SHM and its solution, total energy of a body executing SHM, average kinetic and potential energy of a body executing SHM, LC oscillatory circuit,

Pendulum: simple, compound and torsional pendulum, spring-mass system, two body oscillation and reduced mass, damped harmonic motion and its different condition, forced oscillation and its different condition, resonance, equation of a progressive wave, differential equation of a progressive wave, energy density of wave motion, average kinetic and potential energy of a body executing SHM, Stationary wave

Optics

Lens, equivalent lens and power, defects of images and different aberrations, Interference of light, Young's double slit experiment, Interference in thin film and Newton's ring method, diffraction of light, diffraction by single slit, diffraction by double slits, Fraunhofer and Fresnel bi-prism, diffraction gratings, polarization of light, Brewster's law, Malus law, polarization by double refraction Nicole prism, optical activity and polar meters, optical instruments, resolving power of optical instrument, Laser: spontaneous and stimulated emission.

Modern Physics

Galilean relativity & Reference frame, Special theory of relativity postulates, Galilean transformation, Lorentz Transformation, Length contraction, Time dilation, Velocity addition, relativity of mass, mass energy relation, Momentum energy relation, Photoelectric effect, Compton effect, de Broglie matter wave, Bohr atom model and explanation, atomic orbital and energy equation, classification of nucleus, nuclear binding energy, radioactivity, radioactive decay law, half-life, mean life, nuclear reaction, introduction to nuclear reactor

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	Be able to Define the different parameters such as periodic motion, simple harmonic motion, undammed oscillations, interference, diffraction, polarization and prism, photoelectric effect, Compton effect, matter wave, atomic model radioactive decay, fusion, fission etc.	3											
CO2	Be capable to **Explain** the wave motion for different systems along with energy, the techniques to derive different formula for interference, diffraction, polarization and prism, different theory regarding modern physics such as special theory of relativity, Compton theory, materials according to magnetic properties, nuclear transformation, and nuclear reaction etc.	3											
CO3	Be skilled to Solve quantitative problems in the field of Waves and Oscillations Optics and Modern physics such as energy of wave motion, wavelength diffraction pattern, relativistic energy, photon energy, Compton shift, nuclear binding energy etc.												

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home **Preparation for final examination**	 42 21 21
Formal Assessment Continuous Assessment Final Examination	2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE		
WEEK-1	**TOPIC**	**CT/MID**
Class 1	Introductory class: Brief discussion on total syllabus, basic requirements of the course, assessment of the course	CT1
Class 2	Simple harmonic motion (SHM) and its differential equations, graphical representation of SHM	
Class 3	Average K.E and total energy	
WEEK-2		
Class 4	Spring-mass system , electric oscillatory circuit	
Class 5	Spring-mass system , electric oscillatory circuit	
Class 6	Combination of two SHM	
WEEK-3		
Class 7	Combination of two SHM	
Class 8	Two body oscillations, reduced mass	
Class 9	Damped oscillations and its differential equation	
WEEK-4		CT2
Class 10	Displacement equation of damped oscillation, electric damped oscillatory circuit	
Class 11	Forced oscillation and its differential equation	
Class 12	Displacement equation of forced oscillation, resonance	
WEEK-5		
Class 13	Plane progressive wave, energy density of wave	
Class 14	Stationary wave	
Class 15	Lens and combination of lenses, power of lens	

WEEK-6		
Class 16	defects of images and different aberrations	
Class 17	defects of images and different aberrations	
Class 18	Interference of light, young's double slit expeiment	
WEEK-7		
Class 19	Interference in Thin films, Newton's ring	
Class 20	Diffraction : Fresnel & Fraunhofer diffraction	
Class 21	Diffraction by single slit	
WEEK-8		MID
Class 22	Diffraction by double slit, Diffraction gratings	
Class 23	Polarization and Production and analysis of polarized light	
Class 24	Optics of crystals, Nicole prism	
WEEK-9		
Class 25	Brewster's and Malus law	
Class 26	Optical activity and polarimeter	
Class 27	Laser & its applications	
WEEK-10		
Class 28	Theory of relativity: Frame of Reference, Postulates of special relativity, Galilean Transformation	
Class 29	Theory of relativity: Lorentz Transformations, Length Contraction and Time dilation	
Class 30	Velocity addition, Relativistic mass: Concept of relativistic mass and its expression	
WEEK-11		CT3
Class 31	Theory of relativity: Mass and Energy equivalence equation and concept of Massless particle and its expression. Related numerical problems	
Class 32	Photoelectric Effect, photocurrent and work function, kinetic energy, stopping potential	
Class 33	photoelectric equation, characteristics of photoelectric effect	
WEEK-12		
Class 34	Compton effect: Definition, Compton wavelength shift, limitation	
Class 35	De Broglie Concept, Condition for wave and particle behavior, Bohr atomic model	
Class 36	Expression for Bohr radii and orbital energy for hydrogen atom	
WEEK-13		
Class 37	Classification of Nucleus, nuclear binding energy	
Class 38	Radioactivity and its transformation, Radioactive Decay Law,	
Class 39	half- life, Mean life, nuclear reaction	
WEEK-14		
Class 40	Concept of Fusion, Fission and nuclear chain reaction	
Class 41	General idea on nuclear reactor and nuclear power plant	
Class 42	Follow up of the course	

ASSESSMENT STRATEGY				
Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1	C1, C2
			CO3	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO2, CO3	C3
Final Examination (Section A & B)		60%	CO1	C1
			CO2	C2
			CO3	C3
TOTAL		100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)				

REFERENCE BOOKS:

1. **Fundamentals of Physics:** Halliday, Resnick and Walker

2. **Physics for Scientists and Engineers**: Serway and Jewett

3. **Concept of Modern Physics**: Arthur Beiser

4. **University Physics with Modern Physics**: Hugh D. Young and Roger A. Freedman

5. **Modern Physics for Science and Engineering**: Marshall L. Burns

6. **Waves and Oscillations**: Walter Fox Smith

7. **The Physics of Vibrations and Waves**: H. J. Pain

8. **Waves and Oscillations:** BrijLal and Subramannyam

9. **Fundamental of Optics**: Francis A. Jenkins and Harvey E.White

10. **Introduction to Modern Optics**: Grant R. Fowles

11. **Fundamental Optical Design**: Michael J. Kidger

COURSE INFORMATION			
Course Code	PHY 102	Contact Hours	3.00
Course Title	Physics Sessional	Credit hours	1.50

PRE-REQUISITE

Electronics I (Theory)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn the basic concepts of Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics related parameter in practical

OBJECTIVE

1. To develop basic engineering knowledge practically.

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **Define** the different parameters regarding Wave sand Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc	PO1	C1			K3	R,Q,T
CO2	Be capable to **Describe** the different phenomena regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc..	PO1	C2			K3	R,Q,T
CO3	Be skilled to **Construct** Experiments by an individual or by a group to determine different phenomena regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc.	PO9	P4				R,Q ,T
CO4	Be able to **Complete** a report for an experimental work.	PO10	P2				R, Q, T
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

a. **Main Contents:** Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics

b. **Detail Contents:**

Determination of specific resistance of materials of a wire by using Meter Bridge, Determination of a high resistance by the method of deflection, Determination of ECE of copper by using copper voltameter, Determination of the wavelength of light by using diffraction grating, Determination of the focal length of a plano-convex lens by Newton's ring method, Determination of the specific rotation of sugar by poralimeter Determination of the conductivity of a bad conductor by Lee's method, Determination of the acceleration due to gravity by means of compound pendulum, Determination of the spring constant and the rigidity modulus of a spiral spring, Verification of the law of conservation of linear momentum, Determination of the Young's modulus of bar by bending method, Determination of the Planck's constant using photoelectric effect, Determination of focal length of a concave lens by auxiliary lens method, Determination of specific heat of a liquid by the method of cooling

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **Define** the different parameters regarding Wave sand Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc	3											
CO2	Be capable to **Describe** the different phenomena regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc.	3											
CO3	Be skilled to **Construct** Experiments by an individual or by a group to determine different phenomena regarding Waves and Oscillations, Optics, Mechanics, Electricity, Modern physics and Thermal physics etc.									3			
CO4	Be able to **Complete** a report for an experimental work.										3		

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	14
Practical	28
Total	42
Self-Directed Learning	
Preparation of Lab Reports	10
Preparation of Lab Test	10
Preparation of presentation	05
Preparation of Quiz	10
Engagement in Group Projects	20
Formal Assessment	
Continuous Assessment	14
Final Quiz	1
Total	112

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Introductory class: Brief discussion on total syllabus, basic requirements of the course, evaluation system of the course, grouping, visit different section of the laboratory, introduction to different basic equipment's
Week 2	Determination of specific resistance of materials of a wire by using Meter Bridge / Determination of focal length of a concave lens by auxiliary lens method.
Week 3	Determination of a high resistance by the method of deflection/ Determination of specific heat of a liquid by the method of cooling
Week 4	Determination of ECE of copper by using copper voltameter / Determination of the Young's modulus of bar by bending method,
Week 5	Determination of the wavelength of light by using
Week 6	Determination of the focal length of a plano-convex lens by Newton's ring method
Week 7	Determination of the specific rotation of sugar by poralimeter
Week 8	Determination of the conductivity of a bad conductor by Lee's method / Verification of the law of conservation of linear momentum
Week 9	Determination of the acceleration due to gravity by means of compound pendulum
Week 10	Determination of the spring constant and the rigidity modulus of a spiral spring
Week 11	Determination of the Planck's constant using photoelectric effect

Week 12	Viva & experimental exam
Week 13	Viva & experimental exam
Week 14	Quiz

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	10%	CO 1	C1/ Define
		CO 2	C2/Describe
		CO3	P4/Construct
Report Writing/Programming	30%	CO4	P2/Complete
Mid Term Evaluation (exam/project/assignment)	20%	CO1	C1/ Define
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	C1/ Define, C2/Describe, P4/Construct
Viva Voce/ Presentation	10%	CO1, CO2	C1/ Define, C2/Describe
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. **Practical Physics**: G. L. Squires
2. **Practical Physics**: Dr Giasuddin and Md. Sahabuddin.
3. **B.Sc. Practical Physics**: C. L Arora
4. **Practical Physics**: S.L. Gupta and V. Kumar

COURSE INFORMATION			
Course Code Course Title	PHY 111 Electricity and Magnetism, Thermal Physics and Mechanics	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
To learn the basic concepts of Electricity and Magnetism, Thermal Physics and Mechanics.			
OBJECTIVES			
1. To define the different parameter and concepts of Electricity and Magnetism, Thermal Physics and Mechanics. 2. To explain the basic concepts of Electricity and Magnetism, Thermal Physics and Mechanics. 3. To solve analytical problems regarding Electricity and Magnetism, Thermal Physics and Mechanics.			

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	**Course Outcome**	**Correspon ding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **define** the different parameters such as electric field, potential, capacitance, dielectric, magnetic field, thermometers, thermal conductivity, Reversible and irreversible process, Entropy, Linear momentum, angular momentum, wave function, eigen value, expectation value etc.	PO1	C1	1		3	T, ASG, F
CO2	Be capable to **explain** Gauss's law, Ampere's law, the techniques to derive different formula for potential, capacitance, materials according to magnetic properties, different theory regarding thermal physics and statistical mechanics such as Kinetic theory, thermodynamics, Carnot's theory, Bose-Einstein statistics, Fermi-Dirac statistics, Maxwell-Boltzmann statistics etc	PO1	C2	1		3	T, ASG, F
CO3	Be skilled to **solve** quantitative problems in the field of Electricity and Magnetism, Thermal Physics and Mechanics such as electric field, potential, magnetic field, kinetic energy of gases, motion of planets and satellites, expectation value, probability etc.	PO1	C3	1		3	T, ASG, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Electricity & Magnetism Electric charge, charge quantization, coulomb's law, electric field, electric field lines, electric field due to (a point charge, an electric dipole, charged rod and charged ring), Electric Flux, Gauss' law, electric field due to (a point charge and charged infinite rod), electric potential energy, electric potential, equipotential surface, calculating potential from electric field, calculating electric field from potential, potential due to (a point charge, an electric dipole, charged rod, charged ring and charged disc), capacitor, capacitance, capacitance for (parallel-plate, cylindrical and spherical capacitor), energy stored in a capacitor, dielectric, atomic view of dielectric, current density & resistance, drift speed, atomic view of Ohm's law, Biot-Sevart law, Ampere's law, solenoid, toroid, Faradays law, inductance, Magnetic properties of matter, magnetization, susceptibility, permeability, magnetization curves, susceptibility curves, hysteresis loop, soft and hard magnet **Thermal Physics** Temperature, Thermometers, Process of heat transfer, thermal conductivity, Kinetic theory of gases: kinetic interpretation of temperature, specific heats of ideal gas, and equipartition of energy, mean free path, Maxwell's distribution of molecular speeds, zeroth law of thermodynamics, Heat and work-First law of thermodynamics and its applications, Reversible and irreversible process, Carnot cycle, and second law of thermodynamics, Carnot's theorem, Entropy, thermodynamics functions, Maxwell relations, Clausius-Clapeyron equation **Mechanics** Linear momentum of a particle, linear momentum of system of particles, conservation law of linear momentum, some applications of the conservation law of linear momentum, angular momentum of system of particles, conservation law of angular momentum, some applications of the conservation law of angular momentum, Keplar's law of planetary motion, the laws of universal gravitation, the motion of planets and satellites, principle of statistical mechanics, probabilities, classical statistics, quantum statistics, Bose-Einstein statistics, Fermi-Dirac statistics, Maxwell-Boltzmann statistics, fundamental postulates of wave mechanics, wave function, uncertainty principle, Schrodinger's time dependent and time independent equation, eigen value, expectation value, probability, particle in a potential box

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	Be able to **define** the different parameters such as electric field, potential, capacitance, dielectric, magnetic field, thermometers, thermal conductivity, Reversible and irreversible process, Entropy, Linear momentum, angular momentum, wave function, eigen value, expectation value etc.	3											
CO2	Be capable to **explain** Gauss's law, Ampere's law, the techniques to derive different formula for potential, capacitance, materials according to magnetic properties, different theory regarding thermal physics and statistical mechanics such as Kinetic theory, thermodynamics, Carnot's theory, Bose-Einstein statistics, Fermi-Dirac statistics, Maxwell-Boltzmann statistics etc	3											
CO3	Be skilled to **solve** quantitative problems in the field of Electricity and Magnetism, Thermal Physics and Mechanics such as electric field, potential, magnetic field, kinetic energy of gases, motion of planets and satellites, expectation value, probability etc.	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home **Preparation for final examination**	 42 21 21
Formal Assessment Continuous Assessment Final Examination	2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE		
WEEK-1	**TOPIC**	**CT/MID**
Class 1	Introductory class: Brief discussion on total syllabus, basic requirements of the course, assessment of the course	CT-1
Class 2	Electric charge, charge quantization, coulomb's law,	
Class 3	electric field, electric field lines, electric field due to (a point charge, an electric dipole, charged rod and charged ring)	
WEEK-2		
Class 4	electric field, electric field lines, electric field due to (a point charge, an electric dipole, charged rod and charged ring),	
Class 5	Electric Flux, Gauss' law, electric field due to (a point charge and charged infinite rod)	
Class 6	Electric Flux, Gauss' law, electric field due to (a point charge and charged infinite rod)	
WEEK-3		
Class 7	electric potential energy, electric potential, equipotential surface, calculating potential from electric field, calculating electric field from potential	
Class 8	potential due to (a point charge, an electric dipole, charged rod, charged ring and charged disc)	
Class 9	capacitor, capacitance, capacitance for (parallel-plate, cylindrical and spherical capacitor)	

WEEK-4		MID
Class 10	energy stored in a capacitor, dielectric, atomic view of dielectric	
Class 11	current density & resistance, drift speed, atomic view of Ohm's law	
Class 12	Biot-Sevart law, Ampere's law, solenoid, toroid	
WEEK-5		
Class 13	Faradays law, inductance	
Class 14	Magnetic properties of matter, magnetization, susceptibility, permeability, magnetization curves	
Class 15	susceptibility curves, hysteresis loop, soft and hard magnet	
WEEK-6		
Class 16	Temperature, Thermometers	
Class 17	Process of heat transfer, thermal conductivity, Kinetic theory of gases: kinetic interpretation of temperature	
Class 18	specific heats of ideal gas, and equipartition of energy, mean free path	
WEEK-7		
Class 19	Maxwell's distribution of molecular speeds	
Class 20	zeroth law of thermodynamics, Heat and work-First law of thermodynamics and its applications	
Class 21	Reversible and irreversible process,	
WEEK-8		CT-2
Class 22	Carnot cycle, and second law of thermodynamics	
Class 23	Carnot's theorem, Entropy	
Class 24	thermodynamics functions, Maxwell relations, Clausius-Clapeyron equation	
WEEK-9		
Class 25	thermodynamics functions, Maxwell relations, Clausius-Clapeyron equation	
Class 26	Linear momentum of a particle, linear momentum of system of particles	
Class 27	conservation law of linear momentum, some applications of the conservation law of linear momentum	
WEEK-10		
Class 28	angular momentum of system of particles, conservation law of angular momentum	
Class 29	some applications of the conservation law of angular momentum	
Class 30	Keplar's law of planetary motion	
WEEK-11		CT-3
Class 31	the laws of universal gravitation, the motion of planets and satellites	
Class 32	principle of statistical mechanics, probabilities, classical statistics	
Class 33	quantum statistics, Bose-Einstein statistics	

WEEK-12		
Class 34	Fermi-Dirac statistics	
Class 35	Maxwell-Boltzmann statistics	
Class 36	fundamental postulates of wave mechanics, wave function	
WEEK-13		
Class 37	uncertainty principle	
Class 38	Schrodinger's time dependent and time independent equation,	
Class 39	eigen value, expectation value, probability	
WEEK-14		
Class 40	particle in a potential box	
Class 41	particle in a potential box	
Class 42	Follow up of the course	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO2,CO3	C2, C3
Final Examination (Section A & B)		60%	CO1	C1
			CO2	C2
			CO3	C3
TOTAL		100%		

REFERENCE BOOKS:

1. **Fundamentals of Physics** : Halliday, Resnick and Walker
2. **Physics for Scientists and Engineers**: Serway and Jewett
3. **University Physics**: Hugh D. Young and Roger A. Freedman
4. **Fundamentals of Thermodynamics**: Claus Borgnakke and Richard E. Sonntag
5. **Fundamentals of Engineering Thermodynamics**: Michael J. Moran, Howard N. Shapiro, Daisie D. Boettnerand Margaret B. Bailey
6. **Heat and Thermodynamics**: Brijlal
7. **Elementary statistical mechanics**: Gupta and Kumar
8. **Introduction to quantum mechanics**: D. J Griffiths
9. **Quantum Mechanics**: S P Singh, M KBagde and Kamal Singh

COURSE INFORMATION			
Course Code Course Title	CHEM-101 Fundamentals of Chemistry	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
To learn the basic concepts of inorganic, organic and physical chemistry.

OBJECTIVES
1. To define the different parameter and concepts of inorganic chemistry. 2. To apply different chemical theory to evaluate structure of molecules. 3. To explain the basic concepts of physical chemistry. 4. To describe basic reaction mechanism of selective organic reactions.

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **define** the different parameter and concepts regarding atomic structure, periodic table, chemical bonding, acids and bases.	PO1	C1	1		3	T, F, ASG
CO2	Be able to **apply** different theory on chemical bonding and hybridization to **evaluate** structure of molecules.	PO1	C2	1		3	T, Mid Term Exam, F
CO3	Be able to **classify** hydrocarbons and **explain** the mechanism of selective organic reactions.	PO1	C3	1		3	Mid Term Exam, F, ASG
CO4	**Be able to** explain chemical equilibrium, thermo-chemistry, chemical and ionic equilibria, electro-chemical cells.	PO2	C4				T, F, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

a. Main Contents: Inorganic Chemistry, Organic Chemistry and Physical Chemistry

b. Detail Contents:

Atomic Structure: Atomic structure & quantum theory, Different atom models, Heisenberg's uncertainty principle

Periodic Table: Electronic configurations, Periodic classification of elements, Periodic properties of elements, Properties and uses of noble gases

Alkali metals: Chemical properties and uses

Chemical Bonding: Types and properties, Lewis theory, VBT, MOT, Hybridization and shapes of molecules

Basic concepts of organic chemistry: History, Physical and chemical properties, Classification

Hydrocarbon: Chemistry of hydrocarbon, Nomenclature, Properties

Selective organic reactions: Oxidation-reduction, Substitution, Addition, Polymerization, Alkylation reactions

Acids-Bases/Buffer Solution: Different concepts of acids-bases, Buffer solution, Mechanism of buffer solution, Henderson-Hasselbalch equation, Water chemistry and pH of water

Solutions: Solutions and their classification, Unit expressing concentration, Colloid and colloidal solution, Colligative properties and dilute solutions, Raoult's law, Van't

Hoff isotherm

Thermochemistry: Laws of thermochemistry, Enthalpy, Hess's law, Heat of formation, Heat of neutralization, Heat of reaction

Electrochemistry: Electrolytic conduction and its mechanism, Faraday's law, Kohlrausch Law, Debye-Huckel-Onsagar theory, Conductrometric titrations, Different types of cells

Chemical Equilibria: Equilibrium law/constant, Kp and Kc, Homogeneous and heterogeneous equilibria, Le Chatelier's principle

Phase Rule: Basic terms and phase rule derivation, Phase Diagram of water and carbon dioxide

Chemical Kinetics: Pseudo and zero order reaction, Half-life, Determination and factors affecting the rate of a reaction, First order reaction, Second order reaction, Collision theory, Transition state theory

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	Define the different parameter and concepts regarding atomic structure, periodic table, chemical bonding, acids and bases	3											
CO2	Apply different theory on chemical bonding and hybridization to evaluate structure of molecules.	3											
CO3	Classify hydrocarbon and explain the mechanism of selective organic reactions	3											
CO4	Explain chemical equilibrium, thermo-chemistry, chemical and ionic equilibria, electro-chemical cells.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home **Preparation for final examination**	 42 21 21
Formal Assessment Continuous Assessment Final Examination	2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week	Class	Atomic Structure	CT
Week 1	Class 1	Concepts of atomic structure, Different atom models	CT-1
	Class 2	Concepts of atomic structure, Different atom models	
	Class 3	Hydrogen spectral lines, Quantum numbers	
Week 2		**Atomic Structure/Periodic Table**	
	Class 4	Heisenberg's uncertainty principle	
	Class 5	Electronic configuration, Periodic classification of elements	
	Class 6	Electronic configuration, Periodic classification of elements	
Week 3		**Periodic Table/Alkali Metals/Chemical Bonding**	
	Class 7	Periodic properties of elements, Properties and uses of noble gases	
	Class 8	Alkali metals: Chemical properties and uses	
	Class 9	Chemical bonding (types, properties, Lewis	

		theory, VBT)	
Week 4		**Chemical Bonding**	
	Class 10	Molecular orbital theory (MOT)	
	Class 11	Molecular orbital theory (MOT)	
	Class 12	Hybridization and shapes of molecules	
Week 5		**Chemical Bonding/Organic Chemistry**	
	Class 13	Hybridization and shapes of molecules	
	Class 14	Hybridization and shapes of molecules	
	Class 15	Basic concepts of organic chemistry: History, Physical & chemical properties, Classification	**CT-2**
Week 6		**Organic Chemistry**	
	Class 16	Chemistry of hydrocarbon, Nomenclature, Properties	
	Class 17	Selective organic reactions: Oxidation-reduction, Substitution	
	Class 18	Selective organic reactions: Addition, Polymerization, Alkylation	
Week 7		**Acids-Bases**	
	Class 19	Different concepts of acids-bases	
	Class 20	Buffer solution, Mechanism of buffer solution	**CT-3/Mid Term**
	Class 21	Henderson-Hasselbalch equation	
Week 8		**Acids-Bases/Solutions**	
	Class 22	Water chemistry and pH of water	
	Class 23	Solutions and their classification, Unit expressing concentration	
	Class 24	Colloid and colloidal solution	
Week 9		**Solutions/Thermochemistry**	
	Class 25	Colligative properties and dilute solutions	
	Class 26	Raoult’s law, Van’t Hoff isotherm	
	Class 27	Thermochemistry: Laws of thermochemistry	
Week 10		**Thermochemistry/Electrochemistry**	
	Class 28	Enthalpy, Hess's law	
	Class 29	Heat of formation, Heat of neutralization, Heat of reaction	
	Class 30	Electrolytic conduction and its mechanism	
Week 11		**Electrochemistry**	
	Class 31	Faraday's law, Kohlrausch Law, Debye-Huckel-Onsagar theory	
	Class 32	Conductrometric titrations	
	Class 33	Different types of cells	

Week 12		**Chemical Equilibrium**	**CT-4**
	Class 34	Equilibrium law/constant, Kp and Kc,	
	Class 35	Homogeneous and heterogeneous equilibria	
	Class 36	Le Chatelier's principle	
Week 13		**Phase Rule/Chemical Kinetics**	
	Class 37	Phase Rule: Basic terms and phase rule derivation	
	Class 38	Phase Diagram of water and carbon dioxide	
	Class 39	Pseudo and zero order reaction, Half-life	
Week 14		**Chemical Kinetics**	
	Class 40	Determination and factors affecting the rate of a reaction	
	Class 41	First order reaction, Second order reaction	
	Class 42	Collision theory, Transition state theory	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1	C1, C2
			CO3	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO2, CO3	C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C3
			CO4	C4
Total Marks		100%		

REFERENCE BOOKS:

1. Modern Inorganic Chemistry – S. Z. Haider
2. Concise Inorganic Chemistry – J. D. Lee
3. A Textbook of Organic Chemistry – Arun Bahl And B. S. Bahl
4. Organic Chemistry – Morrison and Boyd
5. Principles of Physical Chemistry – Haque and Nawab
6. Essentials of Physical Chemistry – Bahl and Tuli
7. Physical Chemistry – Atkins

COURSE INFORMATION			
Course Code Course Title	: CHEM 102 : Chemistry Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE
Course Code: N/A Course Title: N/A

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
To learn the basic concepts of inorganic and physical chemistry.

OBJECTIVE
1. To familiarize the students with experimentation of acid and base neutralization, titration and quantitative analysis of metals etc. 2. To make students proficient in iodimetric and iodometric analysis and complexometric titration etc. 3. To develop students' ability in estimating zinc, ferrous content in water sample by using various titrimetric methods.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **describe** the different parameters regarding acid and base neutralization, titration and quantitative analysis of metals etc. and others key words like primary standard substances, secondary standard substances, molarity, normality, indicator, equivalent weights and so on.	1	P1			1,2	R,Q,T

CO2	Be able to **explain** the different phenomena and **perform** experimentation regarding iodimetric and iodometric method, complexometric titration etc.	1,5,10	P2,P3, P4,P5			1,2	R,Q,T
CO3	Be able to **measure** zinc, ferrous content in water sample by using various titrimetric methods.	1,5,10	P3,P4,P5			1,2	R,Q,T , Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Quantitative chemical analysis in the field of inorganic and physical chemistry such as:
Acid-base titration, Redox titration, Iodometric and Iodimetric titration, Complexometric titration.

CO-PO MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO 1	Be able to **describe** the different parameters regarding acid and base neutralization, titration and quantitative analysis of metals etc. and others key words like primary standard substances, secondary standard substances, molarity, normality, indicator, equivalent weights and so on.	2											
CO 2	Be able to **explain** the different phenomena and **perform** experimentation regarding iodimetric and iodometric method, complexometric titration etc.	2				2				3			
CO 3	Be able to **measure** zinc, ferrous content in water sample by using various titrimetric methods.	2				2				3			

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **define** the different parameters regarding acid and base neutralization, titration and quantitative analysis of metals etc. and others key words like primary standard substances, secondary standard substances, molarity, normality, indicator, equivalent weights and so on.	2											
CO2	Be able to **explain** the different phenomena regarding iodimetric and iodometric method, complexometric titration etc.		2										
CO3	Be able to **estimate** zinc, ferrous content in water sample by using various titrimetric methods			2									
CO4	Be able to **summarize** a report of any project work and apply in real life.				2								

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical Total	 14 28 42
Self-Directed Learning Preparation of Lab Reports Preparation of Lab Test Preparation of presentation Preparation of Quiz Engagement in Group Projects	 10 10 5 10 20
Formal Assessment Continuous Assessment Final Quiz	 14 1
Total	112

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method

COURSE SCHEDULE	
Week 1	Introduction
Week 2	Standardization of Sodium Hydroxide (NaOH) Solution with Standard Oxalic Acid dihydrate ($C_2H_2O_4.2H_2O$) Solution
Week 3	Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Hydroxide (NaOH) Solution.
Week 4	Standardization of Hydrochloric Acid (HCl) Solution with Standard Sodium Carbonate (Na_2CO_3) Solution.
Week 5	Determination of Calcium (Ca) Content in a Calcium Chloride dihydrate ($CaCl_2.2H_2O$) Solution with Standard Di-Sodium Ethylene DiammineTetraAceticAcid (Na2-EDTA) Solution
Week 6	Standardization of Sodium ThiosulphatePentahydrate ($Na_2S_2O_3.5H_2O$) Solution with Standard Potassium Dichromate ($K_2Cr_2O_7$) Solution
Week 7	Estimation of Copper (Cu) Content in a Copper SulphatePentahydrate ($CuSO_4.5H_2O$) (Blue Vitriol) Solutions by Iodometric Method with Standard Sodium ThiosulphatePentahydrate ($Na_2S_2O_3.5H_2O$) Solution.
Week 8	Standardization of Potassium Permanganate ($KMnO_4$) Solution with Standard Oxalic Acid dihydrate ($C_2H_2O_4.2H_2O$) Solution
Week 9	Determination of Ferrous (Fe) Content in a Ammonium Ferrous Sulphate (Mohr`s Salt) [$FeSO_4.(NH_4)_2SO_4.6H_2O$] Solution with Standard Potassium Permanganate ($KMnO_4$) Solution
Week 10	Determination of Zinc (Zn) Content in a Zinc SulphateHeptahydrate ($ZnSO_4.7H_2O$) Solution with Standard Di-Sodium EthyleneDiamineTetraAcetic acid (Na2-EDTA) (Na2-EDTA) Solution by using Eriochrome black T indicator.

Week 11	Practice Lab
Week 12	Lab Test
Week 13	Quiz Test
Week 14	Viva

ASSESSMENT STRATEGY

Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	C1/Remember
		CO 2	C4/Analyse
Report Writing/Programming	15%	CO 1	C1/Remember
		CO 2	C4/Analyse
Mid Term Evaluation (exam/project/assignment)	20%	CO3	P2/ Manipulation
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2, C03	C1/Remember, C4/Analyse, P2/ Manipulation
Viva Voce/ Presentation	10%	CO1, CO2, C03	C1/Remember, C4/Analyse, P2/ Manipulation
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. Practical Chemistry - A Jabbar & M Haque
2. Quantitative Chemical Analysis - A I Vogel
3. Analytical chemistry - Gary D. Christian

COURSE INFORMATION			
Course Code Course Title	Math 101 Differential and Integral Calculus	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

Purpose of this course is to introduce basic knowledge of Differential Calculus and use it in engineering study

OBJECTIVES

1. Be able to impart basic knowledge on differential and Integral Calculus to solve engineering problems and other applied problems.

2. Developing understanding some of the important aspects of rate of change, area, tangent, normal and volume.

3. Be expert in imparting in depth knowledge of functional analysis such as increasing, decreasing, maximum and minimum values of a function

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Define the limit continuity and differentiability of functions, identify the rate of change of a function with respect to independent variables and describe the different techniques of evaluating in definite and definite integrals.	PO1	C1	1		3	T, F, ASG
CO2	**Apply** the concepts or techniques of differentiation and integration to solve the problems related to engineering study.	PO1	C2	1		3	T, Mid Term Exam, F
CO3	Calculate the length, area, volume, center of gravity and average value related to engineering study	PO1	C3	1		3	Mid Term Exam, F, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project
Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Differential Calculus: Introduction, Differential Calculus for Engineering ,Function and Limit, Continuity and Differentiability, Successive Differentiation, Leibnittz's Theorem, Rolle's Theorem, Mean Value Theorem, Taylor's theorem, Expansion of Finite and Infinite forms, Lagrange's form of remainder, Cauchy's form of remainder, Expansion of functions differentiation and integration, Indeterminate form, Cartesian differentiation, Euler's theorem, Tangent, sub tangent and Normal, sub normal, Maxima and Minima, Curvature, Asymptotes, Partial differentiation.

Integral Calculus: Definition of Integration, Importance of Integration in Eng., Integration by substitution, Integration by parts, Standard integrals, Integration by successive reduction, Definite integrals and its use, Integration as a limit of sum, summing series, Walli's formula, Improper Integrals, beta and gamma function, multiple integral and its application, Area, volume of solid revolution, Area under a plain curve, Area of the region enclosed by two curves, Arc lengths of curves.

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	Define the limit continuity and differentiability of functions, identify the rate of change of a function with respect to independent variables and describe the different techniques of evaluating in definite and definite integrals.	3											
CO2	**Apply** the concepts or techniques of differentiation and integration to solve the problems related to engineering study.	3											
CO3	Calculate the length, area, volume, center of gravity and average value related to engineering study	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	42
Lecture	-
Practical / Tutorial / Studio	-
Student-Centered Learning	
Self-Directed Learning	
Non-face-to-face learning	42
Revision of the previous lecture at home	21
Preparation for final examination	21
Formal Assessment	2
Continuous Assessment	3
Final Examination	
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

WEEK-1	TOPIC	CT/MID
Class 1	Introduction to Differential Calculus for Engineering study, Limit of a function and its properties.	CT-1
Class 2	Basic limit theorems with proofs, Limit of infinity and infinite limit, Sandwich (Squeezing) theorem with problems.	
Class 3	Basic limit theorems with proofs, Limit of infinity and infinite limit, Sandwich (Squeezing) theorem with problems.	
WEEK-2		
Class 4	Basic concept of Differentiability, definition, derivative of a function, differentiable function.	
Class 5	Differentiability – one sided derivative (R.H.D and L.H.D), solving problems	
Class 6	Successive differentiation – Concept and problem solving	
WEEK-3		
Class 7	Leibnitz's theorem and its applications	
Class 8	Leibnitz's theorem and its applications	
Class 9	Mean Value theorem, Taylor theorem	
WEEK-4		MID
Class 10	Expansion of finite and infinite forms, Lagrange's and Cauchy's form of remainder.	
Class 11	Indeterminate forms – concept and problem solving,	
Class 12	Hospital's rules with application	
WEEK-5		
Class 13	Partial differentiation - partial derivatives of a function of two variables and problems	
Class 14	Partial differentiation - partial derivatives of a homogeneous function of two variables, Euler's theorem for two variables and problems	
Class 15	Partial differentiation - partial derivatives of a homogeneous function of several variables, Euler's theorem for several (three and m) variables and problem solving	
WEEK-6		
Class 16	Tangents and Normal – Tangents and Normal in Cartesian, equation of tangent at the origin, equation of normal of functions of explicit and implicit forms, Angle between two intersection of two curves; problem solving	
Class 17	Tangents and Normal – Tangents and Normal in polar, Angle between two intersection of two curves; problem solving	
Class 18	Tangents and Normal – Subtangent and subnormal's in Cartesian and polar coordinate; problem solving	

WEEK-7		
Class 19	maxima and minima of functions of single variables – concept, Increasing and decreasing function, Concave up and down with problems	
Class 20	Curvature	
Class 21	Asymptotes	
WEEK-8		CT-2
Class 22	Introduction to integral calculus	
Class 23	Standard integrals – concept of definite and indefinite integrals, applications.	
Class 24	Indefinite integrals – Method of substitution, Techniques of integration	
WEEK-9		
Class 25	Indefinite integrals – Integration by parts, Special types of integration, integration by partial fraction	
Class 26	Integration by the method of successive reduction	
Class 27	Definite integrals – definite integrals with properties and problems	
WEEK-10		
Class 28	Definite integrals – Reduction formula, Wally's formula	
Class 29	Definite integrals – definite integral as the limit of the sum	
Class 30	Beta function – concept and problem solving	
WEEK-11		CT-3
Class 31	Gamma function - concept and problem solving	
Class 32	Relation between beta and gamma function, Legendre duplication formula, problems and applications	
Class 33	Multiple integrals – double integrals	
WEEK-12		
Class 34	Multiple integrals – triple integrals	
Class 35	Multiple integrals – successive integration for two and three variables	
Class 36	Area in Cartesian	
WEEK-13		
Class 37	Area in polar	
Class 38	Volume of solid revolution	
Class 39	Area under a plain curve in Cartesian and polar coordinates	
WEEK-14		
Class 40	Area of a region enclosed by two curves in Cartesian and polar coordinates	
Class 41	Arc lengths of curves in Cartesian coordinates	
Class 42	Arc lengths of curves in polar coordinates	

ASSESSMENT STRATEGY				
Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1	C1
			CO2	C2
			CO3	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO2, CO3	C2, C3
Final Examination (Section A & B)		60%	CO1	C1
			CO2	C2
			CO3	C3
TOTAL			100%	
CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)				

REFERENCE BOOKS:

1. Calculus (9th Edition) by Howard Anton (Author), Irl C. Bivens (Author), Stephen Davis.

2. Calculus: An Intuitive and Physical Approach By Morris Kline

COURSE INFORMATION			
Course Code Course Title	Math 103 Differential Equations and Matrix	Lecture Contact Hours Credit hours	3.00 3.00
PRE-REQUISITE			
Math 101			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
Purpose of this course is to introduce basic knowledge to identify and solve differential equations and concept of matrix.			
OBJECTIVES			

1. Be able to impart basic knowledge on ordinary and partial differential equations.
2. Developing understanding some of the important aspects of ordinary and partial differential equations.
3. Be able to provide knowledge on using concept of Differential equations and matrix in engineering problems and solve other applied problems.
4. Be expert in imparting in depth knowledge on inverse matrix.

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	**Define** various types of differential equations and identify the classifications of partial differential equations.	PO1	C1, C2	1		3	T, F, ASG
CO2	**Apply** the knowledge and solve ordinary and partial differential equations.	PO1	C3	1		3	T, Mid Term Exam, F
CO3	**Apply** the technique to obtain the inverse matrix that solve the system of linear equations.	PO1	C3	1		3	Mid Term Exam, F, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project
Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Differential Equations (DE): Introduction & Formulation of DE, Degree and order of Ordinary Differential Equation (ODE), solution of first order but higher degree DE by various methods, solution of general DEs of second and higher order, Solution of Euler's homogeneous linear DEs, Solution of DEs by methods based on factorization, Frobenious methods, Bessel's functions, Legendre's polynomial, linear first order Partial Differential Equation (PDE), Nonlinear first order PDE, Standard form DEs of higher order and wave equation, particular solutions with boundary and initial condition, Non-linear PDE of order one, Charpit's method, Linear PDE with constant coefficients, Applications of DE.

Matrix: Definition of Matrix, different types of matrices, Algebra of Matrices, Transpose and adjoint of a matrix and inverse matrix, rank and elementary transformation, solution of linear equation or System of Linear Equation, Matrix polynomials determination characteristic roots and vectors, characteristic subspace of matrix and Eigen values and Eigen Vectors, Cayley Hamilton theorem.

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	**Define** various types of differential equations and identify the classifications of partial differential equations.	3											
CO2	**Apply** the knowledge and solve ordinary and partial differential equations.	3											
CO3	**Apply** the technique to obtain the inverse matrix that solve the system of linear equations.	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home **Preparation for final examination**	42 21 21
Formal Assessment Continuous Assessment Final Examination	2 3
Total	131

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

WEEK-1	TOPIC	CT/MID
Class 1	Introduction & Formulation of DE in Engineering, Degree and order of ODE	CT-1
Class 2	Introduction & Formulation of DE in Engineering, Degree and order of ODE	
Class 3	Introduction & Formulation of DE in Engineering, Degree and order of ODE	
WEEK-2		
Class 4	Solution of first order but higher degree DE by various methods	
Class 5	Solution of first order but higher degree DE by various methods	
Class 6	Solution of first order but higher degree DE by various methods	
WEEK-3		
Class 7	Solution of general DEs of second and higher order, Solution of Euler's homogeneous linear DEs	
Class 8	Solution of general DEs of second and higher order, Solution of Euler's homogeneous linear DEs	
Class 9	Solution of general DEs of second and higher order, Solution of Euler's homogeneous linear DEs	
WEEK-4		MID
Class 10	Solution of DEs by methods based on factorization, Frobenious methods, Bessel's functions, Legendre's polynomial	
Class 11	Solution of DEs by methods based on factorization, Frobenious methods, Bessel's functions, Legendre's polynomial	
Class 12	Solution of DEs by methods based on factorization, Frobenious methods, Bessel's functions, Legendre's polynomial	
WEEK-5		
Class 13	Linear first order PDE, Non linear first order PDE	
Class 14	Standard form DEs of higher order and wave equation	
Class 15	Standard form DEs of higher order and wave equation	
WEEK-6		

Class 16	Particular solutions with boundary and initial condition, Non-linear PDE of order one: Charpit's method	
Class 17	Particular solutions with boundary and initial condition, Non-linear PDE of order one: Charpit's method	
Class 18	Particular solutions with boundary and initial condition, Non-linear PDE of order one: Charpit's method	
WEEK-7		
Class 19	Linear PDE with constant coefficients, Applications of DE	
Class 20	Linear PDE with constant coefficients, Applications of DE	
Class 21	Linear PDE with constant coefficients, Applications of DE	
WEEK-8		CT-2
Class 22	Wave equations	
Class 23	Particular solutions with boundary and initial conditions	
Class24	Particular solutions with boundary and initial conditions	
WEEK-9		
Class 25	Second order PDE and classifications to canonical (standard)- parabolic, elliptic, hyperbolic solution by separation of variables,	
Class 26	Second order PDE and classifications to canonical (standard)- parabolic, elliptic, hyperbolic solution by separation of variables,	
Class 27	Second order PDE and classifications to canonical (standard)- parabolic, elliptic, hyperbolic solution by separation of variables,	
WEEK-10		
Class 28	Application of OD and PDE in Eng study	
Class 29	Definition of Matrix, different types of matrices, Algebra of Matrices,	
Class 30	Transpose and adjoint of a matrix and inverse matrix	
WEEK-11		CT-3
Class 31	Solution of linear equation or System of Linear Equation	
Class 32	Solution of linear equation or System of Linear Equation	
Class 33	Solution of linear equation or System of Linear Equation	
WEEK-12		
Class 34	Solution of linear equation using Inverse Matrix	
Class 35	Rank, Nullity and elementary transformation	
Class 36	Rank, Nullity and elementary transformation	
WEEK-13		
Class 37	Dependent and independent of vectors	
Class 38	Dependent and independent of vectors with examples	
Class 39	Matrix polynomials determination characteristic roots and vectors	
WEEK-14		
Class 40	Characteristic subspace of matrix and Eigen values and Eigen Vectors,	

Class 41	Characteristic subspace of matrix and Eigen values and Eigen Vectors,	
Class 42	Cayley Hamilton theorem and its application. Finding inverse matrix using this theorem.	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1	C1, C2
			CO2	C3
			CO3	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO2, CO3	C3
Final Examination (Section A & B)		60%	CO1	C1
			CO2	C2
			CO3	C3
TOTAL			100%	
CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)				

REFERENCE BOOKS:

1. Elementary Linear Algebra 10th Edition by Howard Anton (Author).

2. Ordinary and Partial Differential Equations By Dr. M.D. Raisinghania , S. Chand Publishing

COURSE INFORMATION			
Course Code Course Title	Math 201 Vector Analysis, Laplace Transform & Co-ordinate Geometry	Lecture Contact Hours Credit hours	3.00 3.00

PRE-REQUISITE

Math 101 and Math 103

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

Purpose of this course is to introduce basic knowledge to identify and solve vector mathematical problems, to demonstrate practical applications of Laplace Transform and analyze co-ordinate geometry.

OBJECTIVES

1. Be able to impart basic knowledge on the vector analysis, Laplace transform and geometry.

2. Achieving ability to familiarize the students with straight lines, pair of straight lines, circles, conics in 2D and 3D co-ordinate systems.

3. Be able to find the length, volume and area of objects related to engineering study by using vector, application of Laplace transform to ordinary differential equations and also solve the problems of the pair of straight lines, circles, system of circles, parabola, ellipse etc.

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	**Course Outcome**	**Correspon ding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	**Know** the physical explanation of different vector notation and **Define** Laplace transform, inverse Laplace transform, different types of matrices, and their properties	PO1	C1-C2	1		3	T, F, ASG
CO2	**Explain the** characteristics of conics and familiarize with straight lines, pair of straight lines, circles, radical axis and center in 2D and3D co-ordinate systems.	PO1	C2	1		3	T, Mid Term Exam, F
CO3	**Calculate** length, volume and area of objects related to engineering study by using vector, **Apply** Laplace transform to ODE and Demand the knowledge of geometry in engineering study. **Solve** the problems of the pair of straight lines, circles, system of circles parabola, ellipse etc.	PO1	C3	1		3	Mid Term Exam, F, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project
Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS
Vector Analysis: Definition of Vector and scalers & vector algebra, Scaler and vector products of two vectors and their geometrical interpretation, Triple products and multiple products, Linear dependence and independence of vectors, Differentiation of vectors, Gradient of scaler functions, Divergence and curl of point functions, physical significance of gradient, divergence and curl, Definition of line, surface and volume integral, Integration of Vectors, Green's theorem and its application, Stoke's theorem and its application, Gauss theorem and its application in Engineering. **Laplace Transform (LT):** Definition of LT and Application of LT for Engineering, LT of some elementary functions and properties of LT, Sufficient condition for existence of LT, Inverse LT, LT of derivatives, Unit step function, Periodic function, Some special theorems on LT, Partial fraction, Solution of DEs by LT, Heaviside expansion formula, Convolution theorem, Evaluation of improper integral, Application of LT **Co-ordinate Geometry:** Introduction to geometry for Engineering and Rectangular co-ordinates, Transformation of co-ordinates, changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms and properties, circles (tangents, normal, chord of contact, pole and polar), Equation of conics, homogeneous equations of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves, equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points), Three dimensional co-ordinate system, direction cosines, projections, the plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane) and the straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid straight lines, standard equation of coincides, sphere and ellipsoid.

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	**Know** the physical explanation of different vector notation and **Define** Laplace transform, inverse Laplace transform, different types of matrices, and their properties	3											
CO2	**Explain the** characteristics of conics and familiarize with straight lines, pair of straight lines, circles, radical axis and center in 2D and3D co-ordinate systems.	3											
CO3	**Calculate** length, volume and area of objects related to engineering study by using vector, **Apply** Laplace transform to ODE and Demand the knowledge of geometry in engineering study. **Solve** the problems of the pair of straight lines, circles, system of circles parabola, ellipse etc.	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home **Preparation for final examination**	 42 21 21
Formal Assessment Continuous Assessment Final Examination	2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE		
WEEK-1	**TOPIC**	**CT/MID**
Class 1	Definition of Vector and scalers & vector algebra, Scaler and vector products of two vectors and their geometrical interpretation	CT-1
Class 2	Definition of Vector and scalers & vector algebra, Scaler and vector products of two vectors and their geometrical interpretation ,	
Class 3	Definition of Vector and scalers & vector algebra, Scaler and vector products of two vectors and their geometrical interpretation	
WEEK-2		
Class 4	Triple products and multiple products, Linear dependence and independence of vectors, Differentiation of vectors	
Class 5	Gradient of scaler functions, Divergence and curl of point functions	
Class 6	Physical significance of gradient, divergence and curl	
WEEK-3		
Class 7	Definition of line, surface and volume integral, Integration of Vectors, Green's theorem and application	
Class 8	Definition of line, surface and volume integral, Integration of Vectors,Green's theorem and application	

Class 9	Green’s theorem and its application	
WEEK-4		MID
Class 10	Gauss theorem and application in Engineering	
Class 11	Stoke's theorem and it’s application.	
Class 12	Introduction to geometry for Engineering and Rectangular co-ordinates,Transformation of co-ordinates	
WEEK-5		
Class 13	Introduction to geometry for Engineering and Rectangular co-ordinates, Transformation of co-ordinates, changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms and properties	
Class 14	Changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms and properties	
Class 15	Changes of axes, pair of straight lines, general equation of second degree and reduction to its standard forms and properties	
WEEK-6		
Class 16	Circles (tangents, normal, chord of contact, pole and polar), Equation of conics, homogeneous equations of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves	
Class 17	Circles (tangents, normal, chord of contact, pole and polar), Equation of conics, homogeneous equations of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves	
Class 18	Circles (tangents, normal, chord of contact, pole and polar), Equation of conics, homogeneous equations of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves	
WEEK-7		
Class 19	Circles (tangents, normal, chord of contact, pole and polar), Equation of conics, homogeneous equations of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves	
Class 20	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points	
Class 21	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points	

WEEK-8		CT-2
Class 22	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points	
Class 23	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points	
Class 24	Equations of parabola, ellipse in Cartesian and polar coordinates, system of circles (radical axes, coaxial circles, limiting points	
WEEK-9		
Class 25	Three dimensional co-ordinate system, direction cosines, projections, the plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane) and the straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid	
Class 26	Three dimensional co-ordinate system, direction cosines, projections, the plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane) and the straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid	
Class 27	Three dimensional co-ordinate system, direction cosines, projections, the plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane) and the straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid	
WEEK-10		
Class 28	Three dimensional co-ordinate system, direction cosines, projections, the plane (angle between two planes, parallel & perpendicular plane, distance of a point from a plane) and the straight line (coplanar lines, shortest distance between two given straight lines), standard equation of sphere, ellipsoid, hyperboloid	
Class 29	Definition of LT and Application of LT for Engineering, LT of some	
Class 30	Definition of LT and Application of LT for Engineering, LT of some	
WEEK-11	elementary functions and properties of LT	CT-3
Class 31	Sufficient condition for existence of LT	
Class 32	LT of derivatives and it's application	
Class 33	LT of Integration with application, LT of sine and cosine integral	
WEEK-12		
Class 34	Unit step function and it's application	
Class 35	Periodic function with examples, LT of some special function.	

Class 36	Definition of inverse Laplace Transform and it's properties	
WEEK-13		
Class 37	Partial fraction and it's application in inverse Laplace Transform	
Class 38	Heaviside formula and it's application	
Class 39	Convoulution theorem, Evaluation of improper integral, Application of LT	
WEEK-14		
Class 40	Solve ODE s by Laplace transform	
Class 41	Solve ODE s by Laplace transform	
Class 42	Application of LT in Engineering study	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO2	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO2,CO3	C2, C3
Final Examination (Section A & B)		60%	CO1	C1
			CO2	C2
			CO3	C3
TOTAL		100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain				

REFERENCE BOOKS:

1. Vector Analysis, 2nd Edition 2nd Edition by Murray Spiegel, Seymour Lipschutz, Dennis Spellman

2. Schaum's Outline of Laplace Transforms by Murray R. Spiegel.

3. Engineering Mathematics, Volume Two 2 II: Containing Coordinate Geometry of Two Dimensions, Co-ordinate Geometry of Three Dimensions, Matrices.

4. Theory of Equations and Vector Calculus by K. Kandasamy, P.; Thilagavathy, K.; Gunavathy

5. A Text Book on Co-ordinate Geometry with Vector Analysis - Rahman & Bhattacharjee.

COURSE INFORMATION			
Course Code Course Title	MATH 217 Complex Variable, Fourier Analysis and Statistics	Lecture Contact Hours Credit hours	4.00 4.00

PRE-REQUISITE

MATH 101 (Differential and Integral Calculus) and MATH 103 (Differential Equations and Matrix)

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To teach the students the basic concepts and principles of complex variables, Fourier analysis and statistics. It is targeted to provide a basic foundation for mathematics areas complex number system, Fourier expansion, grouped sample data hypothesis etc. Finally, this course is designed to develop a capability of solving real life problems through complex variable, Fourier integrals and statistics.

OBJECTIVES

1. Be able to understand basic knowledge of complex number system, Fourier transformation on real and complex function and also be expert in recognizing about frequency distribution, graphical representation of data including stem, moments, skewness, kurtosis, grouped sampled data, estimation, tests of hypothesis.
2. Achieving ability to familiarize the students with the principle terms such as complex variables, Fourier transform and statistics.
3. Achieving ability to provide a physical interpretation of the boundary value problem, complex variable and calculating sample data, skewness, kurtosis and related hypothesis test. And also be expert in applying Fourier analysis, complex variables, statistics and their methods of solution in solving complex problems.

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **recognize and define** complex number system, complex variable, Fourier expansion and **express**	PO1	C1, C2	1		3	T, ASG, F
CO2	Interpreting the complex function, the integrals of complex functions, Fourier integral and explaining the concept of a frequency distribution, moments, skewness, kurtosis, grouped sampled data etc.	PO1	C2	1		3	T, ASG, F
CO3	Be proficient to **measure** the integrals of complex functions, Fourier integral and **solving** the differential equations	PO1	C3	1		3	T, ASG, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Main Contents: Complex Variable, Fourier Analysis and Statistics **Detail Contents:** **Fourier Analysis:** Real and complex form, Finite transform: Fourier Integral, Fourier transforms and their uses in solving boundary value problems. **Complex Variables.** Complex number system, General functions of a complex variable, Limits and continuity of a function of complex variable and related theorems, Complex function, Differentiation and the Cauchy-Riemann Equations, Line integral of a complex function, Cauchy's Integral Formula, Liouville's Theorem, Taylor's and Laurent's Theorem, Singular Residues, Cauchy's Residue Theorem. **Statistics:** Measures of central tendency, Standard deviation, Chebychev‟s theorem, Z-scores, Frequency distribution, Graphical representation of data including stem, Leaf and Box Plot, Moments, Skewness, Kurtosis. Elementary sampling theory, Treatment of grouped sampled data, Estimation, Tests of hypothesis, Regression and correlation.

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	Be able to **recognize and define** complex number system, complex variable, Fourier expansion and **express**	3											
CO2	Interpreting the complex function, the integrals of complex functions, Fourier integral and explaining the concept of a frequency distribution, moments, skewness, kurtosis, grouped sampled data etc.	3											
CO3	Be proficient to **measure** the integrals of complex functions, Fourier integral and **solving** the differential equations	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 56 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 56 28 28
Formal Assessment Continuous Assessment Final Examination	 3 3
Total	174
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

WEEK-1	TOPIC	CT/MID
Class 1	Real and complex form	**Class Test 1**
Class 2		
Class 3		
Class 4		
WEEK-2		
Class 5	Finite transform: Fourier Integral	
Class 6		
Class 7		
Class 8		
WEEK-3		
Class 9	Fourier transforms and their uses in solving boundary value problems	
Class 10		
Class 11		
Class 12		
WEEK-4		**Class Test 2**
Class 13	Complex number system, General functions of a complex variable	
Class 14		
Class 15		
Class 16		

WEEK-5		
Class 17 Class 18 Class 19 Class 20	Limits and continuity of a function of complex variable and related theorems	
WEEK-6		
Class 21 Class 22 Class 23 Class 24	Complex function, Differentiation and the Cauchy-Riemann Equations	
WEEK-7		
Class 25 Class 26 Class 27 Class 28	Line integral of a complex function, Cauchy's Integral Formula	
WEEK-8		**Mid Term**
Class 29 Class 30 Class 31 Class 32	Liouville's Theorem, Taylor's and Laurent's Theorem	
WEEK-9		
Class 33 Class 34 Class 35 Class 36	Singular Residues, Cauchy's Residue Theorem	
WEEK-10		
Class 37 Class 38 Class 39 Class 40	Measures of central tendency, Standard deviation	
WEEK-11		**Class Test 3**
Class 41 Class 42 Class 43 Class 44	Chebychev"s theorem, Z-scores, Frequency distribution	
WEEK-12		
Class 45 Class 46 Class 47 Class 48	Graphical representation of data including stem, Leaf and Box Plot, Moments, Skewness, Kurtosis	
WEEK-13		
Class 49 Class 50 Class 51 Class 52	Elementary sampling theory, Treatment of grouped sampled data, Estimation,	

WEEK-14		
Class 53	Tests of hypothesis, Regression and correlation	
Class 54		
Class 55		
Class 56		

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2 C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO 2	C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2	C2
			CO 3	C3
Total Marks		100%		

REFERENCE BOOKS:

1. Fourier Analysis with Applications to Boundary Value Problems- Schaum's Out-line Series by Murray R. Spiegel.
2. Complex variable (2nd ed) – Schaum's Out-line Series by Spiegel (2009).
3. Statistics and Random Processes, B. Praba, Aruna Chalam and Sujatha.
4. Probability and Statistics for Engineers, Scheaffer & McClave.
5. Schaum's Outline of Probability and Statistics, 4th Edition; By John J. Schiller Jr, John J. Schiller Jr and Murray R. Spiege
6. Theory and functions of complex variables, Shanti Narayan.
7. Mathematical Physics, B D Gupt

COURSE INFORMATION			
Course Code	LANG 102	Contact Hours	3.00
Course Title	Communicative English-I	Credit hours	1.50

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course has mainly been designed to improve speaking and oral communication skills of the students. The course includes instructions and experience in speech preparation and speech delivery within various real life situations, formal and informal. Emphasis will be given on various speeches, such as informative, persuasive and interactive. This course will help students progress in real life both personally and professionally. Students will be able to understand class lectures and can comfortably continue the Engineering course, and also to compete in the global job market and increase career skills.

OBJECTIVE

1. To develop the four basics skills of English language, i.e. listening, speaking, reading and writing.
2. To develop students' interpersonal skills engaging them in various group interactions and activities.
3. To improve students' pronunciation in order to improve their level of comprehensibility in both speaking and listening.
4. To give the students exposure to different types of texts in English in order to make them informed using different techniques of reading.
5. To gain an understanding of the underlying writing well-organized paragraphs and also to teach how to edit and revise their own as well as peer's writing.

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Listen, **understand** and speak English quickly and smartly using the technics learnt in the class.	PO1	C2			K3	L
CO2	**Perform** the techniques of academic reading and academic writing	PO1	P2			K3	R
CO3	**Execute** the ability to Communicate effectively within the shortest possible time to present ideas and opinions.	PO10	P2				P
CO4	**Develop** competency in oral, written	PO10	C6				Pr
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, L – Listening test ; R – Descriptive Writing ; P – Public Speaking ; Pr – Presentation)							

COURSE CONTENT	
Main Contents	**Detail Contents**
Speaking	Introduction to Language: Introducing basic skills of language. English for Science and Technology
	Self-introduction and introducing others: How a speaker should introduce himself to any stranger / unknown person / a crowd. Name, family background, education, experience, any special quality/interest, likings/disliking, etc.
	Asking and answering questions, Expressing likings and disliking; (food, fashion etc.) Asking and giving directions
	Asking and answering questions, Expressing likings and disliking; (food, fashion etc.) Asking and giving directions
	Discussing everyday routines and habits, Making requests /offers /invitations /excuses /apologies/complaints
	Describing personality, discussing and making plans(for a holiday or an outing to the cinema), Describing pictures / any incident / event
	Practicing storytelling, Narrating personal experiences/Anecdotes
	Telephone conversations (role play in group or pair) Situational talks / dialogues: Practicing different professional conversation (role play of doctor-patient conversation, teacher –student conversation)
Listening	Listening and understanding: Listening, note taking and answering questions; Students will listen to recorded text, note down important information and later on will answer to some questions
	Difference between different accents: British and American accents; Documentaries from BBC and CNN will be shown and students will try to understand
	Listening to short conversations between two persons/more than two
Reading	Reading techniques: scanning, skimming, predicting, inference;
	Reading Techniques: analysis, summarizing and interpretation of texts;
Writing	Introductory discussion on writing, prewriting, drafting
	Topic sentence, paragraph development, paragraph structure, describing a person/scene/picture, narrating an event
	Paragraph writing, Compare-contrast and cause- effect paragraph

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Listen, **understand** and speak English quickly and smartly using the technics learnt in the class.	3											
CO2	**Perform** the techniques of academic reading and academic writing	3											
CO3	Execute the ability to Communicate effectively within the shortest possible time to present ideas and opinions.										3		
CO4	**Develop** competency in oral, written										3		

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	14
Practical	28
Total	42
Self-Directed Learning	
Preparation of Lab Reports	10
Preparation of Lab Test	10
Preparation of presentation	05
Preparation of Quiz	10
Engagement in Group Projects	20
Formal Assessment	
Continuous Assessment	14
Final Quiz	1
Total	112

TEACHING METHODOLOGY

Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
WEEK	**TOPIC**
Week 1	Introduction to Language: Introducing basic skills of language. English for Science and Technology
	Self-introduction and introducing others: How a speaker should introduce himself to any stranger / unknown person / a crowd. Name, family background, education, experience, any special quality/interest, likings/disliking, etc.
	Self-introduction and introducing others: How a speaker should introduce himself to any stranger / unknown person / a crowd. Name, family background, education, experience, any special quality/interest, likings/disliking, etc.
Week 2	Asking and answering questions, Expressing likings and disliking; (food, fashion etc.) Asking and giving directions
	Asking and answering questions, Expressing likings and disliking; (food, fashion etc.) Asking and giving directions
	Asking and answering questions, Expressing likings and disliking; (food, fashion etc.) Asking and giving directions
Week 3	Discussing everyday routines and habits, Making requests /offers /invitations /excuses /apologies/complaints
	Discussing everyday routines and habits, Making requests /offers /invitations /excuses /apologies/complaints
	Discussing everyday routines and habits, Making requests /offers /invitations /excuses /apologies/complaints
Week 4	Describing personality, discussing and making plans(for a holiday or an outing to the cinema), Describing pictures / any incident / event
	Describing personality, discussing and making plans(for a holiday or an outing to the cinema), Describing pictures / any incident / event
	Describing personality, discussing and making plans(for a holiday or an outing to the cinema), Describing pictures / any incident / event
Week 5	Practicing storytelling, Narrating personal experiences/Anecdotes
	Practicing storytelling, Narrating personal experiences/Anecdotes
	Practicing storytelling, Narrating personal experiences/Anecdotes

Week 6	Telephone conversations (role play in group or pair) Situational talks / dialogues: Practicing different professional conversation (role play of doctor-patient conversation, teacher –student conversation
	Telephone conversations (role play in group or pair) Situational talks / dialogues: Practicing different professional conversation (role play of doctor-patient conversation, teacher –student conversation
	Telephone conversations (role play in group or pair) Situational talks / dialogues: Practicing different professional conversation (role play of doctor-patient conversation, teacher –student conversation
Week 7	Listening and understanding: Listening, note taking and answering questions; Students will listen to recorded text, note down important information and later on will answer to some questions
	Listening and understanding: Listening, note taking and answering questions; Students will listen to recorded text, note down important information and later on will answer to some questions
	Listening and understanding: Listening, note taking and answering questions; Students will listen to recorded text, note down important information and later on will answer to some questions
Week 8	Difference between different accents: British and American accents; Documentaries from BBC and CNN will be shown and students will try to understand
	Difference between different accents: British and American accents; Documentaries from BBC and CNN will be shown and students will try to understand
	Difference between different accents: British and American accents; Documentaries from BBC and CNN will be shown and students will try to understand
Week 9	Listening to short conversations between two persons/more than two
	Listening to short conversations between two persons/more than two
	Listening to short conversations between two persons/more than two
Week 10	Reading techniques: scanning, skimming, predicting, inference
	Reading techniques: scanning, skimming, predicting, inference
	Reading techniques: scanning, skimming, predicting, inference
Week 11	Reading Techniques: analysis, summarizing and interpretation of texts
	Reading Techniques: analysis, summarizing and interpretation of texts
	Reading Techniques: analysis, summarizing and interpretation of texts

Week 12	Introductory discussion on writing, prewriting, drafting
	Introductory discussion on writing, prewriting, drafting
	Introductory discussion on writing, prewriting, drafting
Week 13	Topic sentence, paragraph development, paragraph structure, describing a person/scene/picture, narrating an event
	Topic sentence, paragraph development, paragraph structure, describing a person/scene/picture, narrating an event
	Topic sentence, paragraph development, paragraph structure, describing a person/scene/picture, narrating an event
Week 14	Paragraph writing, Compare-contrast and cause- effect paragraph
	Paragraph writing, Compare-contrast and cause- effect paragraph
	Paragraph writing, Compare-contrast and cause- effect paragraph

ASSESSMENT STRATEGY

Components	**Grading**	CO	Blooms Taxonomy
Listening Test	15%	CO1	C1/Understand
Descriptive Writing	25%	CO2	P2/Precision
Public Speaking	30%	CO3	P2/Precision
Presentation	30%	CO4	C6/Creat
Total Marks	100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. Langan, J. (2005). College Writing Skills with Readings (6th Ed). McGraw-Hill Publication
2. Interactions 1 (Reading), John Langan, Latest edition, McGraw-Hill Publication
3. Jones, L. (1981). Functions of English. (Student's Book, 2nd Ed.) Melbourne, Australia: Cambridge University Press.
4. Dixon, R.J. (1987). Complete course in English. (Book 4). New Delhi, India: Prentice Hall of India. (For book presentation)
5. From Paragraph to Essay - Maurice Imhoof and Herman Hudson
6. Headway Series – Advanced Level (2 parts with CDs): Oxford University Press Ltd.
7. Speak like Churchill stand like Lincoln - James C. Humes
8. Cambridge IELTS Practice Book
9. Selected Sample Reports and Selected Research Articles

COURSE INFORMATION			
Course Code	LANG 202	Contact Hours	3.00
Course Title	Communicative English-II	Credit hours	1.50

PRE-REQUISITE
Communicative English-I

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

The English language course is designed for the students to develop their competence in communication skills for academic purposes especially in reading and writing. The approach will be communicative and interactive and will involve individual, pair and group work. Students will be exposed to different types of texts to develop efficient reading skill. Reading will also involve activities and discussions leading to effective writing. The course incorporates a wide range of reading texts to develop students' critical thinking which is one of the most essential elements required to write a good piece of academic writing. Emphasis is particularly put on the various forms of essay writing such as descriptive, narrative, cause-effect, compare-contrast, and argumentative. Upon completion of this course, students are expected to be able to communicate at various situations, participate in group activities and prepare formal speech for academic, professional and social purposes. This course also incorporates classroom instructions to provide guidelines on presentations and communication skills. In addition, the course emphasizes on providing constructive feedback on students' oral performances.

OBJECTIVE

1. To develop English language skills to communicate effectively and professionally.
2. To strengthen students' presentation skills.
3. To develop competency in academic reading and writing.

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **understand** the techniques of academic reading and become acquainted with technical vocabularies	PO1	C2			K3	L
CO2	Be able to **understand** the techniques of effective academic writing such as research article/report writing	PO1	C2			K3	R
CO3	Be able to **communicate effectively** within the shortest possible time to present any report and research work	PO10	P3				P
CO4	Be able to **analyze** any problem critically, analyze and interpret data and synthesize information to provide valid conclusions	PO10	C4				Pr
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, L – Listening test ; R – Descriptive Writing ; P – Public Speaking ; Pr – Presentation)							

COURSE CONTENT

Main Contents	Detail Contents
Reading	Reading Comprehension: Practice using different techniques
	Academic reading: comprehension from departmental or subject related passages
	Vocabulary for Engineers (some common Engineering terms for both general and dept specific)
	Reading subject specific text to develop vocabulary
Writing	Writing semi-formal, Formal/official letters, Official E-mail
	Applying for a job: Writing Cover Letter and Curriculum Vitae
	Statement of Purpose (SOP) writing, Proposal Writing: writing steps, principles and techniques, outlining, revising, editing, proofreading
	Report writing, article writing: comparison-contrast and cause – effect, argumentative and opinion expression, assignment writing
	Analyzing and describing graphs or charts
	Practicing analytical and argumentative writing
Speaking	Public Speaking: Basic elements and qualities of a good public speaker
	Set Speech: How to get ready for any speech
	Individual / Group presentation: How to be ready for presentation, prepare script for good speech, preparing power point slides, etc. Selected books/Selected stories for presentation
Listening	Listening to long lecture on some topics
	Listening and understanding speeches/lectures of different accent

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **understand** the techniques of academic reading and become acquainted with technical vocabularies	3											
CO2	Be able to **understand** the techniques of effective academic writing such as research article/report writing	3											
CO3	Be able to **communicate effectively** within the shortest possible time to present any report and research work										3		
CO4	Be able to **analyze** any problem critically, analyze and interpret data and synthesize information to provide valid conclusions										3		

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical Total	 14 28 42
Self-Directed Learning Preparation of Lab Reports Preparation of Lab Test Preparation of presentation Preparation of Quiz Engagement in Group Projects	 10 10 05 10 20
Formal Assessment Continuous Assessment Final Quiz	 14 1
Total	112

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Reading Comprehension: Practice using different techniques
Week 2	Academic reading: comprehension from departmental or subject related passages
Week 3	Vocabulary for Engineers (some common Engineering terms for both general and dept specific) Reading subject specific text to develop vocabulary
Week 4	Writing semi-formal, Formal/official letters, Official E-mail
Week 5	Applying for a job: Writing Cover Letter and Curriculum Vitae
Week 6	Statement of Purpose (SOP) writing: writing steps, principles and techniques, outlining, revising, editing, proofreading
	Proposal writing: writing steps, principles and techniques, outlining, revising, editing, proofreading
Week 7	Report writing: comparison-contrast and cause – effect, argumentative and opinion expression, assignment writing
	Article writing: comparison-contrast and cause – effect, argumentative and opinion expression, assignment writing
Week 8	Analyzing and describing graphs or charts
Week 9	Practicing analytical and argumentative writing
Week 10	Public Speaking: Basic elements and qualities of a good public speaker
Week 11	Set Speech: How to get ready for any speech
Week 12	Individual / Group presentation: How to be ready for presentation, prepare script for good speech, preparing power point slides, etc. Selected books/Selected stories for presentation.
Week 13	Listening to long lecture on some topics
Week 14	Listening and understanding speeches/lectures of different accents

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Listening Test	15%	CO1	C2/Understand
Descriptive Writing	25%	CO2	C2/Understand
Public Speaking	30%	CO3	P3/Precision
Presentation	30%	CO4	C4/Analyse
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. Jones, L. (1981). Functions of English. (Student's Book, 2nd Ed.) Melbourne, Australia: Cambridge University Press.
2. Dixon, R.J. (1987). Complete course in English. (Book 4). New Delhi, India: Prentice Hall of India. (For book presentation)
3. Langan, J. (2005). College Writing Skills with Readings (6th Ed). McGraw-Hill Publication
4. Interactions 1 (Reading), John Langan, Latest edition, McGraw-Hill Publication
5. Headway Series – Advanced Level (2 parts with CDs): Oxford University Press Ltd.
6. Speak like Churchill stand like Lincoln - James C. Humes
7. Cambridge IELTS Practice Book
8. Selected Sample Reports and Selected Research Articles

COURSE INFORMATION			
Course Code Course Title	GEBS 101 Bangladesh Studies	Lecture Contact Hours Credit hours	2.00 2.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
This course has been designed for undergraduate engineering students to help them learn the rich history of Bangladesh, and to provide them with basic knowledge of historical events which eventually led to the formation of Bangladesh and constitution of Bangladesh, current trends in economic development, legislation, citizen charter, cultural aspects which will make them responsible citizen			
OBJECTIVES			
1. To equip students with factual knowledge that will enable them to learn the history of Bangladesh. 2. To trace the historical roots of Bangladesh as an independent state focusing on the social, cultural and economic developments that have taken place since its independence. 3. To promote an understanding of the development of Bangladesh and its culture. 4. To create an awareness among the students about the Geography, Economy, Politics and Culture of Bangladesh.			

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	**Identify** specific stages of Bangladesh's political history, through the ancient, medieval, colonial and post-colonial periods and variety of cultural identities of Bangladesh.	PO6	C3			7	T,Q,ASG,F
CO2	**Explain** the economy and patterns of economic changes through qualitative and Quantitative analysis.	PO6	C2			7	T,Q,ASG,F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project
Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

a. Main Contents: Impact of Geography, History, Environment, Economy, Constitution and Culture of Bangladesh in Engineering Application

b. Detail Contents:

Bangladesh Geography: Location, Area, Boundary, Physiography, River system, Forest and Climate, Demography of Bangladesh, Maritime zones.

History: Overview of the ancient Bengal; anthropological identity of the Bengali race; main trends in the history of medieval Bengal; Bengal under the East India Company; religious and social reform movements; nationalist movements, division of the Indian sub-continent; language movement 1948-1952; education movement of 1962; six-point movement of 1966; mass uprising of 1969; war of independence and emergence of Bangladesh in 1971, Constitution of Bangladesh, Pre and post liberation development in the field of engineering and technology, Bangladesh's contribution to world peace and its security, engineering developments in Bangladesh (Kaptai Dam, Padma bridge, power plants, Karnaphuli River Tunnel etc) and its impact on socio-economic aspect .

Environment, Economy and Culture

Land, Characteristics of tropical monsoon climate, Forests and biomass, Fish, Minerals, Health, Education, Agriculture, Industries, NGOs, Population, Sociological and Cultural aspects of Bangladesh, Economy and National development, Development and Progress of the Millennium Development Goals (MDGs), Public Administration in Bangladesh, State of Good Governance in Bangladesh, Art and Literature, Main traditional cultural events, Vision-2021, Digitalization, Tourism and Natural Resources, Bangladesh and International Relations.

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	**Identify** specific stages of Bangladesh's political history, through the ancient, medieval, colonial and post-colonial periods and variety of cultural identities of Bangladesh.						3						
CO2	**Explain** the economy and patterns of economic changes through qualitative and Quantitative analysis.						3						

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

COMPONENTS	TEACHING AND LEARNING ACTIVITIES	STUDENT' LEARNING TIME (SLT)
Face to Face	Lecture (2 hours/week x 14 weeks)	28
Guided Learning	Tutorial/ Assignments (2 hours/week x 5 weeks)	10
Independent Learning	Individual learning (1-hour lecture ≈ 1hour learning) Preparation for tests and examination	24 13
Assessment	Pop Quiz/Class Test/Mid-Term Exam Final examination	2 3
	TOTAL	80
	CREDIT = SLT/40	2

COURSE SCHEDULE

WEEK-1	TOPIC	CT/MID
Class 1	Introductory class: Brief discussion on the total syllabus, basic requirements of the course, methods of assessment of the course.	CT-1
Class 2	Bangladesh Geography: Location, Area, Boundary, Physiography, River System, Forest and Climate, Demography of Bangladesh.	
WEEK-2		
Class 3	Overview of the ancient Bengal; anthropological identity of the Bengali race; main trends in the history of medieval Bengal	
Class 4	Bengal under the East India Company	
WEEK-3		
Class 5	Religious and Social reform movements	
Class 6	Nationalist movements, division of the Indian sub-continent	
WEEK-4		MID
Class 7	Language movement 1948-1952, Education movement of 1962	
Class 8	Language movement 1948-1952, Education movement of 1962	
WEEK-5		
Class 9	Six-point movement of 1966; Mass uprising of 1969;	
Class 10	War of Independence and Emergence of Bangladesh in 1971	
WEEK-6		
Class 11	Constitution of Bangladesh	
Class 12	Constitution of Bangladesh	

WEEK-7		
Class 13	Bangladesh's contribution to world peace and security, Pre and post liberation development of engineering and technology	
Class 14	Bangladesh's contribution to world peace and security, Pre and post liberation development of engineering and technology	
WEEK-8		CT-2
Class 15	Land, Characteristics of tropical Monsoon climate, Forests and biomass, Fish	
Class 16	Engineering development in Bangladesh (Kaptai Dam, Padma bridge, power plants, Karnaphuli River Tunnel etc) and its impact on socio-economic aspect	
WEEK-9		
Class 17	Minerals, Health and Education,	
Class 18	Agriculture, Industries	
WEEK-10		
Class 19	NGOs, Population, Sociological and Cultural aspects of Bangladesh	
Class 20	Economy and national development,	
WEEK-11		CT-3
Class 21	Development and Progress of the Millennium Development Goals (MDGs),	
Class 22	Public Administration in Bangladesh, State of Good	
WEEK-12	Governance in Bangladesh	
Class 23	Art and Literature	
Class 24	Traditional cultural events	
WEEK-13		
Class 25	Vision-2021, Digitalization	
Class 26	Tourism and Natural Resources	
WEEK-14		
Class 27	Bangladesh and International Relations	
Class 28	Revision of the course	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO1 CO2	C2, C3
Final Examination (Section A & B)		60%	CO1 CO2	C2, C3
Total Marks		100%		

REFERENCE BOOKS:

1. **Bangladesh Studies**: Md. Shamsul Kabir Khan and Daulatunnahar Khanam
2. **The Constitution of the People's Republic of Bangladesh**
3. **Discovery of Bangladesh**: Akbar Ali Khan
4. **History of Bangladesh, Vols, 1-3**: Sirajul Islam
5. **History of Modern Bengal, Vol, 1**: R C Majumdar
6. **Dynastic History of Bengal**: Dr. Abdul Mumin Chowdhury
7. **A History of Bangladesh**: William Van Schendel
8. **Geography of Bangladesh**: Harun Er Rashid
9. **Banglapedia: National Encyclopedia of Bangladesh, Vols, 1-10**: Sirajul Islam
10. **History of Bengal: (Mughal Period 1526-1765)**: R. A. Chandra
11. **Land of Two Rivers:** Nitesh Sengupta
12. **A History of Bangladesh**: Cambridge University Press
13. Bengali Nationalism and the Emergence of Bangladesh : A.F Salahuddin Ahmed
14. Language Movement and The Making of Bangladesh: Safar Ali Akanda

COURSE INFORMATION			
Course Code Course Title	GEA 101 Principles of Accounting	Lecture Contact Hours Credit hours	2.00 2.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
OBJECTIVES			

1. Understand the meaning, history and definition of accounting, the users and uses of accounting, importance of ethics in financial reporting.

2. Understand the International Financial Reporting (IFRS), Generally Accepted Accounting Principles (GAAP), cost principle, monetary unit assumption and the economic entity assumption.

3. Understand the worksheet, preparation of financial statements, cost benefit analysis of different projects with honesty and integrity.

4. To provide the students with an in-depth knowledge of Management Accounting to enable them to apply its methods and techniques for preparing and presenting information for management decision-making and control purposes.

5. Applying selected management accounting techniques and analyze the implications of the techniques with regards to cost-volume profit analysis, budgeting, standard costing and variance analysis

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	**Course Outcome**	**Bloom's Taxonomy**	**PO**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	**Understand** the cost principle, monetary unit assumption and the economic entity assumption and ethics in financial reporting for each and every project. .	C2				3	
CO2	**Understand** worksheet, preparation of financial statements, cost benefit analysis of different projects.	C2				3	
CO3	**Acquire** knowledge of Management Accounting and apply it for preparing and presenting information for management decision-making and control purposes.	C3				3	
CO4	**Apply and Analyze** the cost-volume profit, budgeting, standard costing and variance analysis for any project. .	C4				3	

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS
(1) Accounting in Action (2) Recording Process (3) Adjusting the Accounts and prepare financial statement (4) Financial Statement Analysis (5) Computerized Accounting System and (6) Cost Concepts (7) Absorption costing and Variable costing (8) Job Order Costing and Process Costing

(9) Short & Long-Term Decision-Making in Accounting
b. Detail Contents:
(1) Accounting in Action
(a) History & Definition of Accounting,
(b) Objectives and Importance of Accounting
(c) Accounting & Engineering
(d) International Financial Reporting Standard (IFRS), Generally Accepted Accounting Principles (GAAP), Ethics in Accounting
(e) Accounting Equation (Math)
(2) Recording Process : Journal, Ledger, T-account and Trial balance
(3) Adjusting the Accounts : Adjusting Entries , Adjusted Trial Balance, Income Statement, Retained Earnings Statement and Statement of Financial Position (Balance Sheet) , Worksheet
(4) Financial Statement Analysis : Horizontal Analysis, Vertical Analysis and Ratio Analysis
(5) Computerized Accounting System: Manual vs. Computerized Accounting system, Some Accounting Software: NetSuite ERP. Tipalti. Sage Business Cloud Accounting. Sage 50cloud. Plooto. Tradogram. Tally accounting software.

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	**Understand** the cost principle, monetary unit assumption and the economic entity assumption and ethics in financial reporting for each and every project.	3											
CO2	**Understand** worksheet, preparation of financial statements, cost benefit analysis of different projects	3											

CO3	**Acquire** knowledge of Management Accounting and apply it for preparing and presenting information for management decision-making and control purposes.		3										
CO4	**Apply and Analyze** the cost-volume profit, budgeting, standard costing and variance analysis for any project.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

COMPONENTS	**TEACHING AND LEARNING ACTIVITIES**	**STUDENT' LEARNING TIME (SLT)**
Face to Face	Lecture (2 hours/week x 14 weeks)	28
Guided Learning	Tutorial/ Assignments (2 hours/week x 5 weeks)	10
Independent Learning	Individual learning (1-hour lecture ≈ 1hour learning) Preparation for tests and examination	24 13
Assessment	Pop Quiz/Class Test/Mid-Term Exam Final examination	2 3
	TOTAL	80
	CREDIT = SLT/40	2

COURSE SCHEDULE

WEEK-1	TOPIC	CT/MID
Class 1	Meaning, history and definition of accounting	CT-1
Class 2	The users and uses of accounting.	
WEEK-2		
Class 3	Ethics in financial reporting	
Class 4	The cost principle, monetary unit assumption and the economic entity assumption	
WEEK-3		
Class 5	Accounting equation and its components	
Class 6	The effects of business transactions on the	
WEEK-4		MID
Class 7	Four financial statements and how they are prepared	
Class 8	Journal	
WEEK-5		
Class 9	Journal	
Class 10	T-account, Ledger, Trial balance	
WEEK-6		
Class 11	Adjusting Accounts	
Class 12	Worksheet.	
WEEK-7		
Class 13	Completion of the Accounting cycle.	
Class 14	Managerial Accounting Basics	
WEEK-8		CT-2
Class 15	Managerial Accounting Basics	
Class 16	Cost Concepts	
WEEK-9		
Class 17	Job Order Cost Accounting	
Class 18	Job Order Cost Accounting	
WEEK-10		
Class 19	Process Cost Accounting	
Class 20	Process Cost Accounting	
WEEK-11		CT-3
Class 21	Cost-Volume-Profit Relationships	
Class 22	Cost-Volume-Profit Relationships	
WEEK-12		
Class 23	Performance Evaluation through Standard Costs	
Class 24	Performance Evaluation through Standard Costs	
WEEK-13		
Class 25	Incremental Analysis	
Class 26	Incremental Analysis	
WEEK-14		
Class 27	Capital Budgeting	
Class 28	Capital Budgeting	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO3	C1, C2
			CO4	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO 2	C3
Final Examination (Section A & B)		60%	CO 1	CO 1
			CO 2 CO3	CO 2 C3
			CO4	C4
Total Marks		100%		

REFERENCE BOOKS:

1. Financial Accounting IFRS edition by Weygand, Kimmel & Kieso (3th)
2. Accounting Principles by Weygandt, Kieso& Kimmel (IFRS Latest edition)

COURSE INFORMATION			
Course Code Course Title	GEE 201 Fundamentals of Economics	Lecture Contact Hours Credit hours	2.00 2.00

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
OBJECTIVES

1. Students will demonstrate their knowledge of the fundamental and technical concepts of economics.
2. To work effectively in the organizations with honesty and integrity.
3. Students will be able to understand consumer behavior, elasticity and different market structure.
4. Students will be able to identify the determinants of various macroeconomic aggregates such as national income, full employment, unemployment, consumption and savings function, inflation, productivity and the major challenges associated with the measurement of these aggregates.
5. Students will apply the basic theories of economics in critical thinking and problem solving.
6. Students will be able to identify the basic features of economic development and regarding planning for the economy of the country.

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	**Understand** the basic concepts and principles of Micro and Macro Economics.	PO1	C2			3	T,ASG,Q,F
CO2	**Identify and apply** the indifference curve theory and market equilibrium in real life situation	PO1	C3			3	T,ASG,Q,F
CO3	**Explain** time-value of money concept and **apply** the knowledge of inflation, investment and cost benefit analysis	PO2	C3, C5			3	T,ASG,Q,F
CO4	**Understand** the Economic Development and Planning for the country. To get idea of international economy.	PO1	C2			3	T,ASG,Q,F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

Broad Topic	Details Topic
Fundamental of Economics	Definition
Production Possibility Frontier and Engineering Decision	1. PPF Curve. 2. Applying the PPF to Society's Choices by the Engineers.
Utility Theory	Law of diminishing marginal utility.
Demand	1. Definition. 2. Law of Demand. 3. Market Demand. 4. Reason for demand curve downward slopping. Mathematical Analysis
Supply	1. Definition. 2. Supply curve. 3. Market Equilibrium.
Elasticity of Demand	1. Different types of elasticity. 2. Different types of price elasticity. 3. Relation between AR, MR and elasticity 4. Mathematical Analysis
Indifference Curve Analysis and Consumers Equilibrium	Budget Line, MRS, Consumer Choice
Production Function from Engineering point of view	1. TP, AP, MP. 2. Law of Variable proportion. 3. Law of returns
Cost Analysis and Engineering Economics	1. TC, AC, MC. 2. Short run cost analysis
Analysis of Market Structure and Engineering Decision	1. Perfectly Competitive Market 2. Monopoly and Monopolistic Market
Key concept of Macroeconomics	Definition
National Income	GDP, GNP, NNP, NI
Circular Flow of National	Two, Three and Four sector Economy

Income and Engineering Resources	
Savings	Consumption functions, APC, MPC
Engineering Plan considering the Inflation Rate of the Country	Demand-Pull and Cost-Push Inflation
The Effect of Monetary policy on Engineering Plan	Impact and Use
The Effect of Fiscal Policy on Engineering Plan	Impact and Use
Theories of Developments	1 or 2 Theories of Economic Development
Economic Problems in Developing Countries especially in Bangladesh.	

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	**Understand** the basic concepts and principles of Micro and Macro Economics.	3											
CO2	**Identify and apply** the indifference curve theory and market equilibrium in real life situation	3											
CO3	**Explain** time-value of money concept and **apply** the knowledge of inflation, investment and cost benefit analysis		3										

CO4	**Understand** the Economic Development and Planning for the country. To get idea of international economy.	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

COMPONENTS	**TEACHING AND LEARNING ACTIVITIES**	**STUDENT' LEARNING TIME (SLT)**
Face to Face	Lecture (2 hours/week x 14 weeks)	28
Guided Learning	Tutorial/ Assignments (2 hours/week x 5 weeks)	10
Independent Learning	Individual learning (1-hour lecture ≈ 1hour learning) Preparation for tests and examination	24 13
Assessment	Pop Quiz/Class Test/Mid-Term Exam Final examination	2 3
	TOTAL	80
	CREDIT = SLT/40	2

COURSE SCHEDULE

WEEK-1	TOPIC	CT/MID
Class 1	Introduction to Engineering Economics Importance of Economics in Engineering.	CT-1
Class 2	Definition of economics, Difference between micro and macroeconomics. Production possibility frontier (PPF) and Engineering choice.	
WEEK-2		
Class 3	Demand and determinants of Demand	
Class 4	Demand curve related basic idea and Mathematical Application	
WEEK-3		
Class 5	Demand curve related basic idea and Mathematical Application	
Class 6	Consumer Choice (Indifference Curve and Budget Line)	
WEEK-4		MID
Class 7	Indifference Curve, Properties of IC, MRS	
Class 8	Theory of production in the point of view of Engineers	
WEEK-5		
Class 9	Theory of cost, Short run and long run cost curve	
Class 10	Firms Equilibrium (Concepts)	
WEEK-6		
Class 11	Different types of Market.	
Class 12	How the Engineers will act in perfectly Competitive market.	
WEEK-7		
Class 13	How the Engineers will act in Monopoly Market	
Class 14	National Income analysis	
WEEK-8		CT-2
Class 15	Aggregate Demand and Aggregate Supply	
Class 16	Determination of Level of Income and Employment	
WEEK-9		
Class 17	Keynes Full Employment. Theory	
Class 18	Circular flow of Income and Expenditure (How engineers will utilize the resources and decision-making process of project plan)	
WEEK-10		
Class 19	Consumption Function	
Class 20	Saving Function	
WEEK-11		CT-3
Class 21	Inflation, Type of Inflation	
Class 22	Impact of Inflation	
WEEK-12		
Class 23	Unemployment problem and its impact on society	
Class 24	Cost benefit analysis	
WEEK-13		
Class 25	Theories of Economic Development	
Class 26	Economic Problems in Developing Countries	

WEEK-14		
Class 27	Contribution of the Engineers in the Economic Development of Bangladesh.	
Class 28	How the Engineers compare their development projects in the context of World Economy.	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C1, C2
			CO3	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO 2 CO3	C2, C3
Final Examination (Section A & B)		60%	CO 1	C1
			CO 2 CO3	C2 C3
			CO4	C4
Total Marks		100%		

REFERENCE BOOKS:

1. Economics by P. A. Samuelson and W. D. Nordhaus (7th Edition)
2. Microeconomics by Robert S. Pindyck and Daniel L. Rubinfeld (8th Edition)
3. Macroeconomics by N. Gregory Mankiw (8th Edition)
4. Principle of Economics by N. Gregory Mankiw (8th Edition)
5. Engineering Economics by Niall M. Fraser and Elizabeth M. Jewkes. (5th Edition)

COURSE INFORMATION			
Course Code Course Title	GES 101 Fundamentals of Sociology	Lecture Contact Hours Credit hours	2.00 2.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

OBJECTIVES

1. **Understand** the basic nature, scope and perspective of sociology
2. **Understand** the stages of social research process and methodologies
3. **Analyse** different culture and civilization
4. **Apply** contextual knowledge to assess societal and cultural issues in national and global context
5. **Analyse** different social problems and stratifications and design solutions for those
6. **Analyse** socialism, capitalism and economic life and manage projects
7. **Apply** the knowledge of sociology in environmental context for sustainable development

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	**Understand** the basic nature scope and perspectives of sociology**.** **Apply** sociological imagination to the context of social problems of BD society	PO1, PO2, PO3	C2, C3			3, 5	T, Q, ASG, F
CO2	**Understand** the stages of social research processes and methodologies **Analyze** different cultures, civilizations and different social problems and design solutions for those	PO7	C2,C4			7	T, Q, ASG, F
CO3	**Understand** and **analyze** social stratification, different social systems, socialism, capitalism and relate them to BD society	PO7	C2, C4			7	T, Q, ASG, F
CO4	**Apply** contextual knowledge to assess societal and cultural issues in environmental context for sustainable development	PO7	C3			7	T, Q, ASG, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS
Main Contents: Understanding society, social phenomena and social change **Detail Contents:** Nature and scope Sociological imagination, Perspectives of sociology, Stages of social research and research method, Culture and civilization, Socialization and self -development, Globalization and social changes, Media and individual, Social organizations and social problems, social stratification; industrial revolution, Capitalism and socialism, Work and economic life, Environment and human activities, Climate change and global risk, Population and human society, Urbanization and city development, Social changes and technology

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	**Understand** the basic nature scope and perspectives of sociology**.** **Apply** sociological imagination to the context of social problems of BD society	3	3	3									
CO2	**Understand** the stages of social research processes and methodologies **Analyze** different cultures, civilizations and different social problems and design solutions for those							3					
CO3	**Understand** and **analyze** social stratification, different social systems, socialism, capitalism and relate them to BD society							3					
CO4	**Apply** contextual knowledge to assess societal and cultural issues in environmental context for sustainable development							3					

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

COMPONENTS	**TEACHING AND LEARNING ACTIVITIES**	**STUDENT' LEARNING TIME (SLT)**
Face to Face	Lecture (2 hours/week x 14 weeks)	28
Guided Learning	Tutorial/ Assignments (2 hours/week x 5 weeks)	10
Independent Learning	Individual learning (1-hour lecture ≈ 1hour learning) Preparation for tests and examination	24 13
Assessment	Pop Quiz/Class Test/Mid-Term Exam Final examination	2 3
	TOTAL	80
	CREDIT = SLT/40	2

COURSE SCHEDULE

WEEK-1	TOPIC	CT/MID
Class 1	Definition, nature and scope of sociology	CT-1
Class 2	Sociological imagination	
WEEK-2		
Class 3	Perspectives of sociology	
Class 4	Orientation of sociological theories	
WEEK-3		
Class 5	Social research and its process	
Class 6	Research designs and techniques.	
WEEK-4		MID
Class 7	Introducing culture and its variations	
Class 8	civilization	
WEEK-5		
Class 9	Cont Defining family and its changes inue	
Class 10	Socialization process and development of self	
WEEK-6		
Class 11	Introducing globalization and its impact on human	
Class 12	l Factors responsible to globalization	
WEEK-7		
Class 13	Media and its impact in modern society	
Class 14	Addressing social problems of Bangladesh	
WEEK-8		CT-2
Class 15	Introducing social groups and Organizations.	
Class 16	Introducing bureaucracy and good governance Continue	
WEEK-9		
Class 17	Introducing social stratifications and social inequality	
Class 18	Poverty and its types and dimensions	
WEEK-10		
Class 19	Industrial revolution and aftermath	
Class 20	Urbanization and city development	
WEEK-11		CT-3
Class 21	Capitalism: features and influence	
Class 22	Socialism: features and influence	
WEEK-12		
Class 23	Unemployment problem and its impact on society	
Class 24	Climate change and global risk	
WEEK-13		
Class 25	Population of Bangladesh: problem or prospect	
Class 26	Crime and deviance: a brief analysis	
WEEK-14		
Class 27	Review Class	
Class 28	Review Class	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-3	20%	CO1, CO2	C2, C3, C4
			CO3	C2,C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO 2 CO3	C2, C3, C4
Final Examination (Section A & B)		60%	CO 1	C2, C3
			CO 2	C2, C4
			CO3	C2, C3
			CO4	C3
Total Marks		100%		

REFERENCE BOOKS:

1. Sociology in Modules: by – Richard Schaefer, 2nd edition, 2013
2. Sociology - Primary Principles: by CN Shankar Rao
3. Anthony Giddens- 5th edition
4. Relevant journal

COURSE INFORMATION			
Course Code Course Title	GEEM 339 Engineering Ethics and Moral Philosophy	Lecture Contact Hours Credit hours	2.00 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To formulate philosophical thoughts about engineering with emphasis on moral philosophy and ethical decision making.

OBJECTIVES

1. To learn to identify ethical aspects of engineering problems.
2. To acquire skills for preventing or dealing with ethics problems.
3. To develop moral imagination so as to enter into the outlooks of engineers.
4. To think systematically and analytically about particular ethical dilemmas.

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **explain** theories and tools about ethical issues in the engineering profession.	PO1	C2			K3	T, Q, ASG, F
CO2	Be able to **identify** ethical problems, dilemmas, and areas of responsibility in engineering practice.	PO1, PO8	C3			K3, K7	T, Q, ASG, F
CO3	Be able to **discuss** the moral philosophy and professional responsibilities of engineers.	PO6, PO8	C4			K5, K7	T, Q, ASG, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project
Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Basic ethical theories such as consequentialism, deontology, and virtue ethics, but also more modern theories such as discourse ethics, feminist ethics as well as theories about justice and equal opportunities. Decision-making models and frameworks within engineering ethics

.

Case Study: Analysis of examples of situations which engineers may encounter in their professional life with the help of the studied ethical theory. Interview with professionally active engineers on ethical issues they have encountered during their career. The social and value dimensions of technology, trust and reliability, risk and liability in engineering, engineers in organizations, theories of whistle blowing, Individual, professional, and institutional values and competency with good character.

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	Be able to **describe** theories and tools about ethical issues in the engineering profession.	3											
CO2	Be able to **identify** ethical problems, dilemmas, and areas of responsibility in engineering practice.	3							3				
CO3	Be able to **discuss** the moral philosophy and professional responsibilities of engineers.						3		3				

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

COMPONENTS	**TEACHING AND LEARNING ACTIVITIES**	**STUDENT' LEARNING TIME (SLT)**
Face to Face	Lecture (2 hours/week x 14 weeks)	28
Guided Learning	Tutorial/ Assignments (2 hours/week x 5 weeks)	10
Independent Learning	Individual learning (1-hour lecture ≈ 1hour learning) Preparation for tests and examination	24 13
Assessment	Pop Quiz/Class Test/Mid-Term Exam Final examination	2 3
	TOTAL	80
	CREDIT = SLT/40	2

COURSE SCHEDULE

WEEK-1	TOPIC	CT/MID
Class 1	Consequentialism, deontology, and virtue ethics	CT-1
Class 2	Continue	
WEEK-2		
Class 3	Discourse ethics, feminist ethics, theories about justice and equal opportunities	
Class 4	Continue	
WEEK-3		
Class 5	Decision-making models and frameworks within engineering ethics	
Class 6	Continue	
WEEK-4		MID
Class 7	Case Studies	
Class 8	Continue	
WEEK-5		
Class 9	Continue	
Class 10	Continue	
WEEK-6		
Class 11	The social and value dimensions of technology	
Class 12	Continue	
WEEK-7		
Class 13	Trust and reliability	
Class 14	Continue	
WEEK-8		CT-2
Class 15	Risk and liability in engineering	
Class 16	Continue	
WEEK-9		
Class 17	Engineers in organizations,	
Class 18	Continue	
WEEK-10		
Class 19	Theories of whistle blowing	
Class 20	Continue	
WEEK-11		
Class 21	Interview with professionally active engineers on ethical issues they have encountered during their career	
Class 22	Continue	
WEEK-12		
Class 23	Unemployment problem and its impact on society	
Class 24	Continue	
WEEK-13		
Class 25	Competency with Good Character	
Class 26	Continue	
WEEK-14		
Class 27	Review Class	
Class 28	Continue	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-2	20%	CO1, CO2	C2, C3
			CO3	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO2 CO3	C3, C4
Final Examination (Section A & B)		60%	CO1	C2
			CO2	C3
			CO3	C4
Total Marks		100%		

REFERENCE BOOKS:

1. Vincenti, W. G. *What Engineers Know and How They Know It: Analytical Studies from Aeronautical History*. Reprint ed. Baltimore, MD: The Johns Hopkins University Press, 1993.
2. Davis, M., ed. *Engineering Ethics*. Burlington, VT: Ashgate Publishing Co., 2005.
3. Koen, B. V. *Discussion of the Method: Conducting the Engineer's Approach to Problem Solving*. New York, NY: Oxford University Press, 2003.
4. Pinkus, R. L. B., et al. *Engineering Ethics: Balancing Cost, Schedule, and Risk - Lessons Learned from the Space Shuttle*. New York, NY: Cambridge University Press, 1997.

COURSE INFORMATION			
Course Code Course Title	GERM 352 Fundamentals of Research Methodology (Sessional)	Lecture Contact Hours Credit hours	4.00 2.00
PRE-REQUISITE			
None			
CURRICULUM STRUCTURE			
Outcome Based Education (OBE)			
SYNOPSIS/RATIONALE			
The *Fundamentals of Research Methodology* is a hands-on course designed to impart education in the foundational methods and techniques of academic research in Science and Engineering context. UG students would examine and be practically exposed to the main components of a research framework i.e., problem definition, research design, data collection, ethical issues in research, time management, report writing, and presentation. Once equipped with this knowledge, participants would be well-placed to conduct disciplined research under supervision in an area of their choosing. In addition to their application in an academic setting, many of the methodologies discussed in this course would be similar to those deployed in professional research environments.			
OBJECTIVES			
1. The primary objective of this course is to develop a research orientation among the UG students and to acquaint them with fundamentals of research methods. Some other objectives of the course are: 2. To evaluate/review related extant literature, form a variety of sources, pertinent to the research objectives/questions. 3. To expose students to various research methodologies (design), relevant to the research problem needing to be addressed. 4. To explain and justify how researchers will collect and analyze research data. 5. To educate students in the common mistakes, research misconduct, and ethical considerations in the field of research methodology			

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	**Understand** the research fundamentals and formulate problem statement and research questions/ objectives.	PO2	C2	1		3	T, ASG, F
CO2	**Formulate** and compose a research proposal considering research activities/design, background studies, and following standard guidelines.	PO3, PO12	C3	1		3	T, ASG, F
CO3	**Develop** writing and presentation skill, and demonstrate ethical considerations in conducting research	PO8, PO10	C3	1		3	T, ASG, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)							

COURSE CONTENTS

1. Foundations of Research: Meaning of Research; Definitions of Research; Objectives of Research; Motivation in Research; General Characteristics of Research; Criteria of Good Research; Types of Research; Concept of theory, empiricism, deductive and inductive theory; Characteristics of scientific method.

2. Problem Identification and Formulation: Meaning and need of Review of Literature; How to Conduct the Review of literature; Research Question – Investigation Question – Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing – Logic & Importance.

3. Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental/Computational Design: Concept of Independent & Dependent variables.

4. Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association.

5. Research Misconduct and Ethics: Understand the research misconduct; type of research misconduct; Ethical issues in conducting research; Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

6. Use of Tools / Techniques for Research: Layout of a Research Paper; Methods to search required information effectively; Reference Management Software like Zotero/Mendeley; Software for paper formatting like LaTeX/MS Office; Software for detection of Plagiarism. Time management and developing Gantt Charts

SKILL MAPPING

CO	Course Outcome Lists	Program Outcome Lists											
		01	02	03	04	05	06	07	08	09	10	11	12
CO1	**Understand** the research fundamentals and formulate problem statement and research questions/ objectives.		3										
CO2	**Formulate** and compose a research proposal considering research activities/design, background studies, and following standard guidelines.			1									2
CO3	**Develop** writing and presentation skill, and demonstrate ethical considerations in conducting research								1		3		

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	42 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home **Preparation for final examination**	 42 21 21
Formal Assessment Continuous Assessment Final Examination	2 3
Total	131
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

WEEK-1	TOPIC	Assessment
Class 1 Class 2 Class 3 Class 4	Foundations of Research: Meaning of Research; Definitions of Research; Objectives of Research; Motivation in Research; Genera l Characteristics of Research; Criteria of Good Research; Types of Research; Concept of theory, empiricism, deductive and inductive Theory; Characteristics of scientific method.	
WEEK-2		
Class 5 Class 6 Class 7 Class 8	Practice session on Foundations of Research	
WEEK-3		Continuous Assessment (presentation/quiz/other assignment)
Class 9 Class 10 Class 11 Class 12	Problem Identification & Formulation: Meaning & need of Review of Literature; How Conduct the Review of literature; Research Question Investigation Question Measurement Issues – Hypothesis – Qualities of a good Hypothesis –Null Hypothesis & Alternative Hypothesis. Hypothesis Testing Logic & Importance.	
WEEK-4		
Class 13 Class 14 Class 15 Class 16	Practice session on Problem Identification & Formulation	
WEEK-5		Assignment 1 Assignment has to provide before, here students will submit report and give PPT
Class 17 Class 18 Class 19 Class 20	Research Design: Concept and Importance in Research – Features of a good research design – Exploratory Research Design – concept, types and uses, Descriptive Research Designs – concept, types and uses. Experimental Design: Concept of Independent & Dependent variables.	
WEEK-6		
Class 21 Class 22 Class 23 Class 24	Practice session on Research Design	
WEEK-7		
Class 25 Class 26 Class 27 Class 28	Data Analysis: Data Preparation – Univar ate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing Hypothesis of association.	

WEEK-8		
Class 29	Practice session on Data Analysis	
Class 30		
Class 31		
Class 32		
WEEK-9		
Class 33	Research Misconduct and Ethics: Understand the research misconduct; type of research misconduct; Ethical issues in conducting research; Ethical issues related to publishing, Plagiarism and Self-Plagiarism.	
Class 34		
Class 35		
Class 36		
WEEK-10		**Continuous Assessment** (presentation/ quiz/other assignment)
Class 37	Practice session on Research misconduct and Ethics	
Class 38		
Class 39		
Class 40		
WEEK-11		
Class 41	Use of Tools / Techniques for Research: Layout of a Research Paper; Methods to search required information effectively; Reference Management Software like Zotero/Mendeley; Software for paper formatting like LaTeX/MS Office; Software for detection of Plagiarism. Time Management and developing Gantt Charts.	
Class 42		
Class 43		
Class 44		
WEEK-12		
Class 45	Practice session on Use of tools / techniques for Research	
Class 46		
Class 47		
Class 48		
WEEK-13		**Assignment 2** Assignment has to provide before, here students will submit report and give PPT
Class 49	Review Session (Theory) – I /Final Presentation	
Class 50		
Class 51		
Class 52		
WEEK-14		
Class 53	Review Session (Theory) – I /Final Presentation	
Class 54		
Class 55		
Class 56		

ASSESSMENT STRATEGY			
Assessment Criteria		CO	Blooms Taxonomy
Components	Grading		
Assignment I	20%	CO1 & CO3	C2-C3
Assignment II	50%	CO2 & CO3	C2-C3
Continuous Assessment	30%	CO1 & CO2	C2-C3
Total Marks	100%		
CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

REFERENCE BOOKS:

1. Engineering Research Methodology: A Practical Insight for Researchers. Springer, by Deb, Dipankar, Dey, Rajeeb, Balas, Valentina E.

2. Research Methods for Engineers, 1st Edition, by David V. Thiel.
3. Handbook of Research Methodology by Talati, J.K.

4. Introducing Research Methodology: A Beginner′s Guide to Doing a Research Project by Uwe Flick

5. DRM, a Design Research Methodology by Lucienne T.M. Blessing and Amaresh Chakrabarti

6. Research Methods: Information, Systems, and Contexts by Kirsty Williamson, Graeme Johanson

7. Zelkowitz, M. V. and Wallace, D. R. (1998), Experimental models for validating technology, *Computer*, vol. 31, no. 5, pp. 23-31.

8. Internet, mail, and mixed-mode surveys : the tailored design method (3rd ed.) by Dillman, D. A., Smyth, J. D., & Christian, L. M.

9. Improving survey questions: design and evaluation. Sage Publications, by Fowler, F. J.

10. Applied multiple regression/correlation analysis for the behavioral sciences (3rd ed.). Mahwah, NJ: Lawrence Erlbaum Associates, by Cohen, J., Cohen, P., West, S., & Aiken, L.

11. Experimental and Quasi-Experimental Design for Generalized Causal Inference. Boston, Mass: Houghton Mifflin, by Shadish W.R., Cook T.D. & Campbell P.T.

12. Computational handbook of statistics (4th ed.). New York: Longman, by Bruning, J.
    a. L. & Kintz, B. L.

REFERENCE SITES:

Sl. No.	Criteria	Task Attainment Level				Grade
		Beginner (0-40%)	Progressing (41-60%)	Competent (61-80%)	Proficient (81-100%)	
1	Subject Knowledge	Does not have grasp of required knowledge and core competence.	Uncomfortable in Dealing with the relevant subject matter with only rudimentary understanding.	Adequate grasp of knowledge of subject matter but failure to elaborate on the salient points	Complete grasp of required knowledge as expected of the student level. Elaboration of all relevant topics.	
2	Organization & Clarity	No proper organization, no clear connection between main topics and presentation difficult to follow.	Difficult to follow as there is only minimal organization and sequence. Rudimentary connection and minimal clarity of information, topics and presented matter.	Information presented in ordered and logical manner with proper sequence. Clear and connections apparent. Minimal confusion with some difficulty in following.	Logical, sequential and comprehensive coverage of essential points. Clear connection between topics and information. Natural flow of topics and easy to follow presentation.	
3	Style & Delivery	Informal delivery and lack of proper	Semi-formal delivery style with little	Formal delivery style, student is	Superior performance, formal delivery,	

		style in emphasizing important issues. No use of subject specific language with poor eye contact.	emphasis on important issues and connections. Some mastery of official and subject specific jargon and language. Some eye contact but not sufficient.	respectful and mostly emphasizes important issues. Adequate use of technical jargon. Good eye contact but reliance on slides.	respectful mannerism and expert emphasis on important points. Effective mastery of technical jargon and good eye contact.	
4	Time Management	Presentation could not be completed within the prescribed time. Much content left out that hampers understanding.	Presentation not complete within time but finished with some extension of time. Understandable presentation.	Adequate completion of the presentation with some skipping or omission of slides and content to stay within the time limit	Successful completion of all aspects of presentation and question/answer session within the given time. Proper time spent for each content or topic.	

COURSE INFORMATION			
Course Code Course Title	GELM 275 Leadership and Management	Lecture Contact Hours Credit hours	2.00 2.00

PRE-REQUISITE
None

CURRICULUM STRUCTURE
Outcome Based Education (OBE)

SYNOPSIS/RATIONALE
The course is designed to make students understand the overlapping connection between engineering and management in an organization through the study of varied management practices and leadership traits as an engineer

OBJECTIVES

1. To introduce different management functions and approaches.
2. To expose students to different views and styles of leadership.
3. To understand how an organization functions collaboratively with managers and engineers.
4. To understand various personality traits and its impact on leadership and management.
5. To solve real-world management problems as an engineer.

	COURSE OUTCOMES & GENERIC SKILLS						
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	**Familiarize** with the fundamental concepts of leadership and management skills	PO9, PO10	C1-C2			1	T,R,F
CO2	**Understand** the role and contribution of a leader in achieving organizational goals	PO9, PO10, PO11	C1-C2			1	T, ASG, R, F
CO3	**Understand** the contribution of leadership traits and management skills in decision making and solving real life problems	PO2, PO8, PO9, PO10, PO11, PO12	C1-C2			1	T, ASG, R,

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

a. Main Contents:

Introduction to Leadership and Management; Management Fundamentals; Leadership Motivation; Organizational Management; Planning and goal setting; Control; Change and Innovation; Attitude; Personality; Perception and Individual Decision Making; Understanding Work Team; HR Management; Operations Management; Information Technology and Management; Case studies.

b. Detailed Contents:

Introduction to Leadership and Management: Definition of leadership and management; basic difference between a leader and a manager; relation of leaders and managers with respect to efficiency and effectiveness; qualities of leader and managers with examples from history.

Management Fundamentals: Definition of management & manager; levels of management; management functions and skills; Mintzberg's managerial roles; Henri Fayol's management principles; strategic management.

Leadership & Motivation: Motivation, Maslow's hierarchy needs; theory of X & Y; motivators and hygiene factors; goal setting theory; reinforcement theory; equity theory; expectancy theory; Leadership styles; leadership trait theory; managerial grid; contemporary leadership; conflicts negotiation; leadership issues in 21st century; cross cultural leadership; engineer as a leader and some simple case discussions on leadership (positive and toxic leadership) in the class (Interactive Learning).

Organizational Management: Organization; departmentalization; chain of command; unity of command; cross functional area; authority; centralization and decentralization; traditional & contemporary organization; matrix project structure; learning structure; organizing collaboration.

Planning and goal setting: Foundation of planning; goals of plan; types of goal; types of goal & plan; goal setting; MBO; well written goal.

Control: Controlling process; controlling for organizational performance; types of control: (feed-forward, feedback & concurrent); balanced scorecard; contemporary issues in control; workplace concern & workplace violence.

Change and Innovation: Change and innovation; internal and external for change; changing process; creativity vs innovation.

Attitude: Components of Attitude; behavior model and characteristics model; behavior vs. attitude; job attitude; job involvement; job satisfaction and customer satisfaction.

Personality: Personality determinants: heredity and environment; Myers-Briggs Type Indicator; Big five personality model; personality traits (core self-evaluation, Machiavellianism, narcissism, self-monitoring, risk taking, proactive personality).

Perception and Individual Decision Making: Factors influencing perception; attribution theory; errors/biases in attribution; Factors of individual decision making; rational decision making; bounded rationality; satisfice; common errors in decision making; creativity in decision making.

Understanding Work Team: Work group; work team; problem solving team; self-managed work team; cross functional team; virtual team; team effectiveness; team challenges.

HR Management: Process of Human Resource Planning; forecasting demand for labor; staffing; internal supply of labor; performance appraisal.

Operations Management: Project managing basics; goals and boundary of project; WBS; scheduling a project; Demand and supply forecasting; inventory control.

Information Technology and Management: Management Information System (MIS); Enterprise Resource Planning (ERP) - For introductory knowledge.

SKILL MAPPING

Course Learning Outcomes		Engineering Knowledge **PO1**	Problem Analysis **PO2**	Design /Development of Solutions **PO3**	Investigation **PO4**	Modern Tool Usage **PO5**	The Engineer and Society **PO6**	Environment andSustainability **PO7**	Ethics **PO8**	Communication **PO9**	Individual and TeamWork **PO10**	Project ManagementandFinance **PO11**	Life Long Learning **PO12**
CO1	**Familiarize** with the fundamental concepts of leadership and management skills									3	3		
CO2	**Understand** the role and contribution of a leader in achieving organizational goals									3	3	2	
CO3	**Understand** the contribution of leadership traits and management skills in decision making and solving real life problems		2						3	3	3	2	2

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	28 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home **Preparation for final examination**	 10 14 14
Formal Assessment Continuous Assessment Final Examination	2 3
Total	71
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE		
WEEK-1	**TOPIC**	**CT/MID**
Class 1	**Introduction to Leadership and Management:** Definition of leadership and management; basic difference between a leader and a manager; relation of leaders and managers with respect to efficiency and effectiveness; qualities of leader and managers with examples from history.	CT-1
Class 2	**Management Fundamentals:** Definition of management &manager; levels of management; management functions and kills; Mintzberg's managerial roles; Henri Fayol'smanagement principles; strategic management.	
WEEK-2		
Class 3	**Leadership & Motivation**: Motivation, Maslow's hierarchy needs; theory of X & Y; motivators and hygiene factors; goal setting theory; reinforcement theory; equity theory; expectancy theory	
Class 5		

WEEK-3		
Class 5	**Leadership:** Leadership styles; leadership trait theory; managerial grid;	
Class 6	contemporary leadership; conflicts negotiation; leadership issues in 21st century; cross cultural leadership; engineer as a leader and some simple case discussions on leadership (positive and toxic leadership) in the class (Interactive Learning).	
WEEK-4		MID
Class 7	**Case Study – I : Engineer as Great Leaders**	
Class 8		
WEEK-5		
Class 9	**Organizational Management:** Organization; departmentalization; chain of command; unity of command; cross functional area; authority; centralization and decentralization; traditional & contemporary organization; matrix project structure; learning structure; organizing collaboration.	
Class 10	**Planning and goal setting:** Foundation of planning; goals of plan; types of goal; types of goal & plan; goal setting; MBO; well written goal.	
WEEK-6		
Class 11	**Control:** Controlling process; controlling for organizational performance; types of control: (feed-forward, feedback &concurrent); balanced scorecard; contemporary issues in control; workplace concern & workplace violence.	
Class 12	**Change and Innovation:** Change and innovation; internal and external for change; changing process; creativity innovation.	
WEEK-7		
Class 13	**Case Study – II : Planning and Goal Setting; A Managerial Approach: Engineer as Great Managers (Interactive Discussions in the Class)**	
Class 14	**Attitude:** Components of Attitude; behavior model and characteristics model; behavior vs. attitude; job attitude; job involvement; job satisfaction and customer satisfaction.	
WEEK-8		CT-3
Class 15	**Personality:** Personality determinants: heredity and environment; Myers-Briggs Type Indicator; Big five personality model; personality traits (core self-evaluation, Machiavellianism, narcissism, self-monitoring, risk taking, proactive personality).	
Class 16	**Perception and Individual Decision Making**: Factors influencing perception; attribution theory; errors/biases in attribution	

WEEK-9		
Class 17	**Perception and Individual Decision Making**: Factors of individual decision making; rational decision making; bounded rationality; satisfice; common errors in decision making; creativity in decision making.	
Class 18	**Case Study – III : A Case on Decision Making – Involves both leadership and managerial skills (Interactive Discussion in the Class)**	
WEEK-10		
Class 19	**Understanding Work Team:** Work group; work team; problem solving team; self-managed work team; cross functional team; virtual team; team effectiveness; team challenges.	
Class 20	**HR Management:** Process of Human Resource Planning; forecasting demand for labor; staffing.	
WEEK-11		CT-3
Class 21	**HR Management:** Internal supply of labor; performance appraisal.	
Class 22	**Operations Management:** Project managing basics; goals and boundary of project; WBS; scheduling a project.	
WEEK-12		
Class 23	**Operations Management:** Demand and supply forecasting; inventory control.	
Class 24	**Exercise – Use of Microsoft Project (MSP) for scheduling a project at student level**	
WEEK-13		
Class 25 Class 26	**Case Study – IV:** A case that covers all relevant theories taught throughout the course and involves both leadership and management issues, e.g., Columbia's Final Mission. (This may be given as group assignment followed by in class short presentations/discussions)	
WEEK-14		
Class 27	**Information Technology and Management:** Management Information System (MIS); Enterprise Resource Planning (ERP) - For introductory knowledge.	
Class 28	REVISION	

ASSESSMENT STRATEGY

Components		Grading	CO	Bloom's Taxonomy
Continuous Assessment (40%)	Class test 1-2	20%	CO 1	C1-C2, P1
			CO 2	C1-C2
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO 1	C1-C2, P1, A1
			CO 2	C1-C2, P1-P2, A1-A2
			CO 3	C1-C2, P1-P2, A1-A2
Final Examination (Section A & B)		60%	CO 1	C1-C2, P1, A1
			CO 2	C1-C2, P1-P2, A1-A2
			CO 3	C1-C2, P1-P2, A1-A2
Total Marks		100%		

REFERENCE BOOKS:

1. Students must be provided with SOLID reading material instead of referring text books. However, course teacher may select any text book as per his choice.
2. Engineering Management (Revised Edition) – A.K. Gupta
3. Industrial Engineering and Production Management - Martand T. Telsang
4. Leadership in Organizations – Gary Yukl
5. Developing Management Skills – David A. Whetten and Kim S. Cameron

COURSE INFORMATION			
Course Code Course Title	GESL 409 Environment Sustainability and Law	Lecture Contact Hours Credit hours	2.00 2.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education
(OBE)

SYNOPSIS/RATIONALE

This course is designed to introduce students to environmental law. In doing so, the course not only provides students with an understanding of general legal principles, methods and institutions but also provides them with a framework for understanding and analyzing environmental law.

OBJECTIVES

1. To examine a wide range of legislative measures at different levels of government that are intended to contribute to the goal of environmental sustainability;
2. To understand the impact of environmental laws on corporations;
3. To understand the role of courts and tribunals in relation to the effective implementation of these legislative measures.
4. To explore the legal aspects of several critical sustainability issues (for example, climate change, water scarcity, genetically modified organisms)

COURSE OUTCOMES & GENERIC SKILLS							
NO.	**Course Outcome**	**Corresponding PO**	**Bloom's Taxonomy**	**CP**	**CA**	**KP**	**Assessment Methods**
CO1	Be able to **identify** the key principles of, and institutions within, environmental law	PO1	C2			K1	T, F
CO2	Be able to **analyze** and **reflect** on the interplay between politics, policy, science and values in environmental law	PO2	C4			K1	T, ASG, F
CO3	Be able to **explain** and **analyze** the impact of environmental laws on ecology and the methods for enhancing sustainability	PO7	C4			K7	T, F

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

The concept of environmental sustainability and its reflection in specific legal principles (precaution, inter and intra-generational equity, the polluter pays); the key components of environmental sustainability law; responsibility for the development and implementation of environmental sustainability law under the Constitution; introduction to tools and mechanisms for the achievement of environmental sustainability (regulatory mechanisms; economic instruments; and voluntary measures); examination of key legislation relevant to the delivery of environmental sustainability (pollution controls and waste management; land-use controls and environmental impact assessment; natural resource management; and biodiversity protection); the role of courts and tribunals in relation to the implementation of environmental sustainability legislation; case-studies of legal aspects of emerging environmental sustainability issues – for example, climate change, water scarcity, genetically modified organisms.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **identify** the key principles of, and institutions within, environmental law	3											
CO2	Be able to **analyze** and **reflec**t on the interplay between politics, policy, science and values in environmental law		3										
CO3	Be able to **explain** and **analyze** the impact of environmental laws on ecology and the methods for enhancing sustainability							3					

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 28 - -
Self-Directed Learning Non-face-to-face learning Revision of the previous lecture at home Preparation for final examination	 28 14 14
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	89
TEACHING METHODOLOGY	
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method	

COURSE SCHEDULE

Week-1	**Topic**	**CT**
Class-1	The concept of environmental sustainability.	CT-1
Class-2	Reflection of environmental sustainability in specific legal principles (precaution)	
Week-2		
Class-3	Reflection of environmental sustainability in specific legal principles (inter-generational equity)	
Class-4	Reflection of environmental sustainability in specific legal principles (intra-generational equity)	

Week-3		
Class-5	Reflection of environmental sustainability in specific legal principles (the polluter pays)	
Class-6	Review of the reflection of environmental sustainability in specific legal principles.	
Week-4		
Class-7	The key components of environmental sustainability law.	
Class-8	Review	Mid Term
Week-5		
Class-9	Responsibility for the development and implementation of environmental sustainability law under the Constitution.	
Class-10	Review	
Week-6		
Class-11	Introduction to tools and mechanisms for the achievement of environmental sustainability (regulatory mechanisms)	
Class-12	Introduction to tools and mechanisms for the achievement of environmental sustainability (economic instruments)	
Week-7		
Class-13	Introduction to tools and mechanisms for the achievement of environmental sustainability (voluntary measures)	
Class-14	Review	

Week-8		CT-2
Class-15	Examination of key legislation relevant to the delivery of environmental sustainability (pollution controls and waste management; land-use controls and environmental impact assessment; natural resource management; and biodiversity protection)	
Class-16	Examination of key legislation relevant to the delivery of environmental sustainability (land-use controls and environmental impact assessment)	
Week-9		
Class-17	Review	
Class-18	Examination of key legislation relevant to the delivery of environmental sustainability (natural resource management)	
Week-10		
Class-19	Examination of key legislation relevant to the delivery of environmental sustainability (biodiversity protection)	
Class-20	Review	
Week 11		
Class-21	The role of courts and tribunals in relation to the implementation of environmental sustainability legislation.	
Class-22	Review	
Week 12		
Class-23	Case-studies of legal aspects of emerging environmental sustainability issues (i.e. climate change)	
Class-24	Review	
Week 13		
Class-25	Case-studies of legal aspects of emerging environmental sustainability issues (i.e. water scarcity)	
Class-26	Review	

Week 14		
Class-27	Case-studies of legal aspects of emerging environmental sustainability issues (i.e. genetically modified organisms)	
Class-28	Review	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-2	20%	CO1, CO2	C2, C4
			CO3	C4
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO2	C4
Final Examination (Section A & B)		60%	CO1	C2
			CO2	C2
			CO3	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. The Global Environment: Institutions, Law, and Policy by Regina S. Axelrod and Stacy D. Van Deveer;
2. Resolving Environmental Conflicts (Social Environmental Sustainability) by Chris Maser;
3. Environmental Ethics and Sustainability: A Casebook for Environmental Professionals by Hal Taback and Ram Ramanan;
4. International Environmental Law and Policy by David Hunter and James Salzman.

COURSE INFORMATION

Course Code Course Title	GEPM 469 Project Management and Finance	Lecture Contact Hours Credit hours	2.00 2.00

PRE-REQUISITE

Principles of Accounting

CURRICULUM STRUCTURE

Outcome Based Education
(OBE)

SYNOPSIS/RATIONALE

This course will provide a general introduction to project management. This course will equip the students to various feasibility analyses – Market, Technical, Financial and Economic. To equip them with the knowledge and skills required to be successful in applying Project Management. To make them understand techniques for Project planning, scheduling and Execution Control. Lectures the focus will be on quizzes, group projects and case studies.

OBJECTIVES

1. To make them understand the concepts of Project Management and Finance for planning to execution of projects.
2. To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
3. To enable them to comprehend the fundamentals of Contract Administration, Costing, Finance and Budgeting.
4. To analyze, apply and appreciate contemporary project management tools and methodologies in Bangladeshi context.

COURSE OUTCOMES & GENERIC SKILLS

NO.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **understand** project characteristics and various stages of a project finance and have the conceptual clarity about project organization and feasibility analyses – Market, Technical, Financial and Economic	PO1	C2	P1,P3		K3	T, ASG, F
CO2	Be able **Prepare** a project plan and explain various stages of project management process	PO11	C2			K3	T, F
CO3	Be able to **apply** economic and financial principles to economic decision-making and **seek** cost-estimation in a project	PO11	C4& Affective/ Valuing		A1		T, ASG, F,Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project
Q – Quiz; ASG – Assignment; F – Final Exam)

COURSE CONTENTS

Introduction to Applied Project Management, Project Definition: Project Feasibility Analysis, Developing a Project Execution Plan, Setting up a Project Organization, Resource Scheduling, Cost Estimating, Controlling Project Execution, Project Control, Planning and Scheduling, Cost Engineering and Detailed Engineering, Project Procurement, Construction Management, Construction Progress, Productivity and Supervision, Subcontract Administration and Control.

SKILL MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **understand** project characteristics and various stages of a project finance and have the conceptual clarity about project organization and feasibility analyses – Market, Technical, Financial and Economic	3											
CO2	Be able **Prepare** a project plan and explain various stages of project management process											3	
CO3	Be able to **apply** economic and financial principles to economic decision-making and **seek** cost-estimation in a project											3	

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	28
Practical / Tutorial / Studio	-
Student-Centered Learning	-
Self-Directed Learning	
Non-face-to-face learning	28
Revision of the previous lecture at home	14
Preparation for final examination	14
Formal Assessment	
Continuous Assessment	2
Final Examination	3
Total	89

TEACHING METHODOLOGY
Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week-1	Topic	CT
Class-1	Introduction to Applied Project Management	
Class-2	Introduction to Applied Project Management	
Week-2		CT-1
Class-3	Project Feasibility Analysis	
Class-4	Developing a Project Execution Plan	
Week-3		
Class-5	Developing a Project Execution Plan	
Class-6	Setting up a Project Organization	
Week-4		
Class-7	Setting up a Project Organization	
Class-8	Resource Scheduling, Cost Estimating	Mid exam
Week-5		
Class-9	Resource Scheduling, Cost Estimating	
Class-10	Controlling Project Execution	
Week-6		
Class-11	Controlling Project Execution	
Class-12	Project Control, Planning and Scheduling	
Week-7		
Class-13	Cost Engineering and Detailed Engineering	
Class-14	Cost Engineering and Detailed Engineering	
Week-8		CT-2
Class-15	Project Procurement	
Class-16	Project Procurement	

Week-9		
Class-17	Construction Management	
Class-18	Construction Progress	
Week-10		
Class-19	Productivity and Supervision	
Class-20	Productivity and Supervision	
Week 11		
Class-21	Productivity and Supervision	
Class-22	Productivity and Supervision	
Week 12		
Class-23	Subcontract Administration and Control	
Class-24	Subcontract Administration and Control	
Week 13		
Class-25	Subcontract Administration and Control	
Class-26	Subcontract Administration and Control	
Week 14		
Class-27	Review classes	
Class-28	Review classes	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Class Test/ Assignment 1-2	20%	CO1, CO3	C2, C4
			CO2	C3
	Class Performance	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO2	C2
Final Examination (Section A & B)		60%	CO1	C2
			CO2	C2
			CO3	C4
Total Marks		100%		

TEXT AND REFERENCE BOOKS:

1. Prasanna Chandra; Projects- Planning, Analysis, Selection, Financing, Implementation and Review',VI Edition, Tata Mc Graw Hill, 8th Edition 2015.
2. Project Finance in Theory and Practice: Designing, Structuring, and Financing Private and Public Projects 3rd Edition by Stefano Gatti

COURSE INFORMATION			
Course Code Course Title	: CSE 173 : Computer Programming and Application	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

Course Code: None
Course Title: None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course is designed to introduce the fundamental principles, mechanism of programming skills and develop basic programming skills to design and develop computer programs. Apart from these, this course will also introduce the important topics related to Arduino programming.

OBJECTIVE

1. To understand the basic idea of computer programming in C/C++.
2. Learn how to solve problems with Structured Programming using C/C++.

LEARNING OUTCOMES& GENERIC SKILLS

No.	Course Learning Outcome	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	**Explain** the fundamental concepts and purpose of computer programming.	C2, C3	1	-	1	F, T
CO2	**Identify** classes, objects, members of a class and the relationships among them needed for a specific problem.	C1	-	-	3	F, MT
CO3	**Develop** programming skills with respect to program design and development.	C6	1,3	-	5	T, F, MT
CO4	**Develop** the communication skill by presenting topics on programming phenomena.	A2	-	-	5	PR, Q

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile,T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

Introduction to digital computers. Programming languages, algorithms and flow charts. Structured Programming using C. Variable and constants, operators, expressions, control statements, function, arrays, pointers, structure unions. User defined data types. Input output and files.
Advantages of OOP over structured programming; Object oriented Programming using C++: Introduction, classes and objects.
Arduino Programming.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Explain** the fundamental concepts and purpose of computer programming.	H											
CO2	**Identify** classes, objects, members of a class and the relationships among them needed for a specific problem.		H										
CO3	**Develop** programming skills with respect to program design and development.			H									
CO4	**Develop** the communication skill by presenting topics on programming phenomena.										L		

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1 – PO1	H	In order to solve complex engineering problems using computer engineering knowledge, the knowledge and concepts of procedural language is very important.
CO2 – PO2	H	To identify and analyse the complex engineering problems regarding computer science, one must be able to identify classes, objects, members of a class and the relationships among them for a specific problem.
CO3 – PO3	H	To design and develop solutions for complex computer engineering problems, one need to develop basic programming skills.
CO4-PO10	L	In order to give presentation on the selective topics from the course taught one needs to have strong communication skills.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centred Learning	 42 - -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 42 21 21
Formal Assessment Continuous Assessment Final Examination	 2 3
Total	131

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lecture	Topics	Assessment Methods
1	Lec 1 Lec 2 Lec 3	Introduction to Digital Computers, Programming languages, Algorithms and Flow charts, Structured Programming using C: Variable and Constants, Expressions, Data types, basic input/output	**Class Test – 1**
2	Lec 4 Lec 5 Lec 6	Control Structure: If, Else if, Nested If-Else, Switch	
3	Lec 7 Lec 8 Lec 9	Control Structure: loop, nested loop	

4	Lec 10 Lec 11 Lec 12	Array: one-dimensional array	
5	Lec 13 Lec 14 Lec 15	Array: multi-dimensional	
6	Lec 16 Lec 17 Lec 18	Character String	**Class Test – 2**
7	Lec 19 Lec 20 Lec 21	Function: Function definition, function declaration, function call	
8	Lec 22 Lec 23 Lec 24	Pointers, Dynamic Memory Allocation	
9	Lec 25 Lec 26 Lec 27	User defined data types: Structure, union, enumeration	**Mid Term**
10	Lec 31 Lec 32 Lec 33	File I/O, header files	
11	Lec 28 Lec 29 Lec 30	Preprocessors, error handling	
12	Lec 34 Lec 35 Lec 36	Introduction to C++: Basic Ideas of OOP-encapsulation, inheritance and polymorphism	
13	Lec 37 Lec 38 Lec 39	Introduction to C++: Classes and objects	**Class Test – 3**
14	Lec 40 Lec 41 Lec 42	Arduino Programming	

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Test 1-3	20%	CO1	C1-C3
			CO3	C6
	Class Participation	5%		
	Class Attendance	5%		
	Mid-Term Assessment (Exam/Project)	10%	CO2	C4
			CO3	C6
Final Examination (Section A & B)		60%	CO1	C1-C3
			CO2	C4
			CO3	C6
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Teach Yourself C (3rd Edition) by Herbert Schidlt
2. Programming in Ansi C (6th Edition) by E Balagurusamy
3. C: The Complete Reference (4th Edition) by Herbert Schildt
4. C++: The Complete Reference (4th Edition) by Herbert Schildt
5. C Programming Language (2nd Edition) by Dennis M. Ritche

COURSE INFORMATION			
Course Code Course Title	: CSE 174 : Computer programming and Application Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE

Course Code: None
Course Title: None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

This course is designed to practically introduce the fundamental principles, mechanism of programming skills and develop basic programming skills to design and develop computer programs. Apart from these, this course will also introduce the important topics related to Arduino programming.

OBJECTIVE

1. The course is designed to provide practical knowledge of C language.
2. Students will be able to develop logics which will help them to create programs, applications in C.
3. Learning the basic programming constructs using other languages like C++ and Arduino Programming in future.

LEARNING OUTCOMES& GENERIC SKILLS

No.	Course Learning Outcome	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Solve problems systematically using a structured logic approach, OOP and Arduino programming.	C1-C3	1	-	4	T, ASG
CO2	Practically analyze the fundamental principles, typical characteristics and mechanisms of a structured programming language.	C4	3	-	4, 5	T, ASG, Q
CO3	Construct or develop complete programs for simple to moderate problems individually.	C6	1, 3	2	5,7	T, ASG

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile,T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam, MT- Mid Term Exam)

COURSE CONTENT

a. **Main Contents:** Introduction to computer programming; Number System; Basic programming Structures; Control Structure; Array; Function; Pointer; Dynamic Memory Allocation; User defined data types; Bitwise Operations; File I/O, header files, preprocessors, error handling; Introduction to C++; Introduction to MATLAB; Introduction to Arduino

b. **Detailed Contents:**
- Introduction to computer programming: Programming Concepts, Mathematical problems using printf, scanf

- Basic programming Structures: Data types and their memory allocation, operators, expressions, basic input/ output
- Control Structure: if-else, switch case, nested if-else, loop, nested loop
- Array: one-dimensional array, multi-dimensional array, character array/ string
- Function: Function definition, function declaration, function call
- Pointer: Different types of pointers, pass pointer as arguments, call by value vs call by reference
- Dynamic Memory Allocation: Malloc, calloc, free, realloc
- User defined data types: Structure, union, enumeration
- File I/O, header files, preprocessors, error handling
- Introduction to C++: Basic Ideas of OOP- encapsulation, inheritance and polymorphism, Classes and objects
- Fundamentals on Arduino Programming: Setup the Arduino software and start outputting code

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Solve problems systematically using a structured logic approach, OOP and Arduino programming.						H						
CO2	Practically analyze the fundamental principles, typical characteristics and mechanisms of a structured programming language.						H						
CO3	Construct or develop complete programs for simple to moderate problems individually.									M			

(H – High, M- Medium, L-low)

JUSTIFICATION FOR CO-PO MAPPING

Mapping	Level	Justifications
CO1 – PO6	H	To apply reasoning informed by the contextual knowledge one need to know how to solve problems using a structured logic approach.
CO2 – PO6	H	To apply reasoning informed by the contextual knowledge one need to know how to practically analyze the fundamental principles, typical characteristics and mechanisms of a structured programming language.
CO3 – PO9	M	To function effectively as an individual, one need to know how to develop complete programs individually.

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture Practical / Tutorial / Studio Student-Centered Learning	 - 42 -
Self-Directed Learning Non-face-to-face learning Revision Assessment Preparations	 21 _ _
Formal Assessment Continuous Assessment Final Examination	 4 3
Total	70

TEACHING METHODOLOGY

Lecture and Discussion, Co-operative and Collaborative Method, Problem Based Method

COURSE SCHEDULE

Week	Lab	Topics	Remarks
1	Lab 1	Mathematical problems using printf, scanf	
2	Lab 2	Number System: Conversion between different number systems such as binary, octal, decimal and hexadecimal systems	Evaluation
3	Lab 3	Control Structure: if-else, switch case, nested if-else, loop, nested loop	Evaluation
4	Lab 4	Control Structure: loop, nested loop	Evaluation
5	Lab 5	Array: one-dimensional array, multi-dimensional array, character array/ string	Evaluation
6	Lab 6	Function: Function definition, function declaration, function call	Evaluation
7	Lab 7	Online – 1	
8	Lab 8	Pointer: Different types of pointers, pass pointer as arguments, call by value vs call by reference	Evaluation
9	Lab 9	Dynamic Memory Allocation: Malloc, calloc, free, realloc	Evaluation
10	Lab 10	User defined data types: Structure, union, enumeration	Evaluation
11	Lab 11	Bitwise operations: AND, OR, NOT, XOR, Left shift, Right Shift; File I/O, header files, preprocessors, error handling	Evaluation
12	Lab 12	Introduction to C++: Classes and objects; Introduction to MATLAB: MATLAB environment, matrices, function, loop, file I/O	Evaluation
13	Lab 13	Introduction to Arduino: Setup the Arduino software and start outputting code	Evaluation
14	Lab 14	Online – 2	Viva/ Quiz

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Lab Test	20%	CO1	C1-C3
			CO2	C4
			CO3	C6
	Class Performance	5%	CO1	C1-C3
	Assignment	15%	CO1	C1-C3
			CO2	C4
			CO3	C6
Online Test – 1		20%	CO1	C1-C3
			CO2	C4
			CO3	C6
Online Test – 2		20%	CO1	C1-C3
			CO2	C4
			CO3	C6
Viva/ Quiz		20%	CO2	C4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Teach Yourself C (3rd Edition) by Herbert Schidlt
2. Programming in Ansi C (6th Edition) by E Balagurusamy
3. C: The Complete Reference (4th Edition) by Herbert Schildt
4. C++: The Complete Reference (4th Edition) by Herbert Schildt
5. C Programming Language (2nd Edition) by Dennis M. Ritche

COURSE INFORMATION			
Course Code Course Title	: EECE 161 : Electrical Circuit Analysis I	Lecture Contact Hours Credit Hours	: 3.00 : 3.00

PRE-REQUISITE

None

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn and familiarize the basics of electrical circuit components as well as the analysis of DC circuit.

OBJECTIVE

1. To learn the basic electrical quantities, their applications and unit.
2. To study the different electrical network theorems and apply those theorems in solving complex circuit networks.
3. To use the principles of DC circuit in various practical fields.
4. To understand the basic working principle of various energy storage devices like capacitors, inductors and resistors.
5. To be able to apply the basics of transient circuit in alternating current analysis.
6. To understand the ac circuit and their practical applications in day to day life uses.

COURSE OUTCOMES & GENERIC SKILLS

No.	Course Outcomes	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Analysis of Resistive Circuits and Solution of resistive circuits with independent sources Understand the most important concepts like mesh and nodal analysis	PO 2	C4			1	T, F
CO2	Two Terminal Element Relationships for inductors and capacitors and analysis of magnetic circuit.	PO 3	C4	P1		3	T, F
CO3	Analysis of Single-Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits	PO 2	C4	P1		3	Mid Term
CO4	Will be able to explain the concept of capacitance and inductance and the concept of two terminal linear devices.	PO 1	C1	P1		3,4	Mid Term

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test; PR – Project; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

Circuit variables and elements: Voltage, current, power, energy, independent and dependent sources, resistance. Basic laws: Ohm‗s law, Kirchoff‗s current and voltage laws.
Simple resistive circuits: Series and parallel circuits, voltage and current division, wye-delta transformation.
Techniques of circuit analysis: Nodal and mesh analysis including supernode and supermesh. Network theorems: Source transformation, Thevenin‗s, Norton‗s and superposition theorems with applications in circuits having independent and dependent sources, maximum power transfer condition and reciprocity theorem.
Energy storage elements: Inductors and capacitors, series parallel combination of inductors and capacitors. Responses of RL and RC circuits: Natural and step responses.
Introduction to Alternating current: Instantaneous current, voltage, power, Effective current and voltage, average power, Phasors and complex quantities, impedance, real and reactive power, Series RL, RC and RLC circuits, analysis of three phase supply.

CO-PO MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Analysis of Resistive Circuits and Solution of resistive circuits with independent sources Understand the most important concepts like mesh and nodal analysis		3										
CO2	Two Terminal Element Relationships for inductors and capacitors and analysis of magnetic circuit.			3									
CO3	Analysis of Single-Phase AC Circuits, the representation of alternating quantities and determining the power in these circuits		3										
CO4	Will be able to explain the concept of capacitance and inductance and the concept of two terminal linear devices.	3											

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning Lecture	42
Self-Directed Learning Non-face-to-face learning Revision of previous and (or) subsequent lecture at home Preparation for final Exam	42 21 21
Formal Assessment Continuous Assessment Final Examination	2 3
Total	131

TEACHING METHODOLOGY

Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE

Week 1	**Circuit Variables And Elements**	CT 1
Class 1	Electricity, Electric element and components, Electric Circuit, Current (AC or DC), Voltage	
Class 2	Power and energy, Active elements, Passive elements, Independent and Dependent source	
Class 3	Ohm's law, Resistor, Conductor, Insulator, Semi-conductor, Branch, Node, Loop, Mesh	
Week 2	**Series and Parallel DC Circuits**	
Class 4	Series-parallel connection	
Class 5	KCL, KVL, Analysis of equivalent resistance of electrical circuit	
Class 6	Analysis of voltage, current and power	
Week 3	**Current Divider Rule and Voltage Divider Rule**	
Class 7	Analysis of current in different branches	
Class 8	Analysis of voltage in different parts of circuit	
Class 9	Practice mathematical problems related to current divider and voltage divider rule.	
Week 4	**Y-Δ and Δ-Y conversion**	CT 2
Class 10	Y to Δ conversion derivation	
Class 11	Analysis of electrical circuits with Y-Δ connection	
Class 12	Practice problems related to Y-Δ connection	
Week 5	**Source Calculation Nodal Analysis**	
Class 13	Multiple numbers of current and voltage source calculation	
Class 14	Method of Obtaining Node voltages	
Class 15	Various mathematical problems solving nodal analysis	

Week 6	**Nodal and Mesh Analysis**	
Class 16	Method of obtaining mesh currents using mesh analysis	
Class 17	Method of obtaining mesh currents using mesh analysis	
Class 18	Method of obtaining mesh currents using mesh analysis	
Week 7	**Network Theorem**	
Class 19	Superposition Theorem and Application of Superposition Theorem	
Class 20	Thevenin's Theorem Procedure	
Class 21	Application of Thevenin Theorem and Norton's Theorem	
Week 8	**Energy Storage Element- Capacitor & Inductor**	
Class 22	Electric field and capacitance of capacitor and construction and types of capacitor	MID
Class 23	Inductance, Inductance voltage	
Class 24	Transient response of capacitive networks	
Week 9	**Energy Storage Element-Capacitor**	
Class 25	Transient response of capacitive networks- Charging phase	
Class 26	Transient response of capacitive networks- Discharging phase	
Class 27	Transient response of capacitive networks- initial condition and instantaneous value	
Week 10	**Energy Storage Element-Inductor**	
Class 28	Transient response of capacitive networks- Charging phase	
Class 29	Transient response of capacitive networks- Discharging phase	
Class 30	Transient response of capacitive networks- initial condition and instantaneous value	
Week 11	**Magnetic Circuits**	
Class 31	Ohm's law and Ampere's circuital law	
Class 32	Instantaneous current, voltage, power, Effective current and voltage, average power, Phasors.	
Class 33	complex quantities, impedance, real and reactive power, Series RL, RC and RLC circuits, analysis of three phase supply.	
Week 12	**AC Circuits**	CT 3
Class 34	Instantaneous power	
Class 35	Effective current and voltage, average power	
Class 36	Phasors	
Week 13	**AC Circuits**	
Class 37	Complex quantities	
Class 38	Impedance, real and reactive power	
Class 39	Series RL< RC and RLC circuits	
Week 14	**AC Circuits**	
Class 40	Analysis of three phase supply	
Class 41	Analysis of three phase supply	
Class 42	Analysis of three phase supply	

ASSESSMENT STRATEGY

<table>
<tr><th colspan="2">Components</th><th>Grading</th><th>CO</th><th>Bloom’s Taxonomy</th></tr>
<tr><td rowspan="4">Continuous Assessment (40%)</td><td>Class Test/ Assignment 1-3</td><td>20%</td><td>CO1, CO2</td><td>C4</td></tr>
<tr><td>Class Performance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Class Attendance</td><td>5%</td><td></td><td></td></tr>
<tr><td>Mid-Term Assessment (Exam/Project)</td><td>10%</td><td>CO3, CO4</td><td>C1, C4</td></tr>
<tr><td colspan="2" rowspan="2">Final Examination (Section A & B)</td><td rowspan="2">60%</td><td>CO 1</td><td>C4</td></tr>
<tr><td>CO 2</td><td>C4</td></tr>
<tr><td colspan="2">Total Marks</td><td>100%</td><td colspan="2"></td></tr>
</table>

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

TEXT AND REFERENCE BOOKS

1. Fundamentals of Electric Circuit- Alexander & Sadiku.
2. Introductory Circuit Analysis - R.L. Boylestad; Prentice Hall of India Private Ltd.
3. Introductory Circuits for Electrical & Computer Engineering - James. W. Nilson; Prentice Hall of India Private Ltd.
4. Alternating Current Circuits – Russell & George F. Corcoran; John Wiley and Sons

***Details of program outcome and grading policy are attached as Annex A and Annex B.

COURSE INFORMATION			
Course Code Course Title	: EECE 162 : Electrical Circuit Analysis-I Sessional	Lecture Contact Hours Credit Hours	: 3.00 : 1.50

PRE-REQUISITE

Course Code: EECE 161
Course Title: Electrical Circuit Analysis-I

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

To learn and familiarize the basics of electrical circuit components as well as the analysis of DC circuit practically.

OBJECTIVE

1. To learn about IC used in building up and development of any required circuit.
2. To know about design and implementation of any desire circuit.
3. To learn to generate desired output of any circuit
4. To compare the theoretical and practical values of circuit.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Outcomes	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to construct an electronic device for application in real life adapting the desired requirements.	PO 5	P1			6	R,Q,T
CO2	Be able to construct electrical circuits practically applying the knowledge of basic electrical components and networks.	PO 5	P4			6	R,Q,T
CO3	Be able to construct an electrical device for application in real life adapting the desired requirements.	PO 9	P5	1			Pr,PR

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)

COURSE CONTENT

In this course, students will perform experiments to practically verify the theories and concepts learned in EECE 161 using different hardware equipment and simulation software.

CO-PO MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to describe the properties of basic electrical networks.					3							
CO2	Be able to construct electrical circuits practically applying the knowledge of basic electrical components and networks.					3							
CO3	Be able to construct an electrical device for application in real life adapting the desired requirements.									3			

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	14
Experiment	28
Self-Directed Learning	
Preparation of Lab Reports	30
Preparation of Lab-test	4
Preparation of Quiz	5
Preparation of Presentation	5
Engagement in Group Projects	24
Formal Assessment	
Continuous Assessment	10
Final Quiz	1
Total	121

TEACHING METHODOLOGY

Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE

Week 1	Introduction of DC electrical circuits and various switches implemented for 220 Volts AC systems
Week 2	Implantation of Mesh analysis and verification of Kirchhoff's Voltage Law in a DC network.
Week 3	Implantation of Nodal analysis and verification of Kirchhoff's Current Law in a DC network.
Week 4	Verification of Superposition theorem in DC linear networks and its realization in practical field.
Week 5	Verification of Thevenin's theorem in DC networks and its realization in practical field.
Week 6	Lab Test-1
Week 7	Study of Wheatstone bridge and wye- delta circuit.
Week 8	Study of the various types of Alternating Current waveforms and their properties
Week 9	Experimental analysis of Non-linear circuit elements (R-L-C) and their effects on current and voltage
Week 10	Construction of Tuning Circuit using the concepts of series resonant R-L-C network.
Week 11	Construction of Wave Traps using the concepts parallel resonant R-L-C network.
Week 12	Lab Test-2
Week 13	Quiz and Viva
Week 14	Project Presentation

ASSESSMENT STRATEGY

Components		Grading	CO	Blooms Taxonomy
Continuous Assessment (40%)	Lab participation and Report	10%	CO 1	P1
			CO 2	P4
	Labtest-1, Labtest-2	30%	CO 1	P1
			CO 2	P4
	Project and Presentation	30%	CO 3	P5
Lab Quiz		30%	CO 1	P1
			CO 2	P4
Total Marks		100%		

(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)

REFERENCE BOOKS

1. Introductory Circuit Analysis - R.L. Boylestad; Prentice Hall of India Private Ltd.
2. Introductory Circuits for Electrical & Computer Engineering - James. W. Nilson; Prentice Hall of India Private Ltd

***Details of program outcome and grading policy are attached as Annex A and Annex B.

COURSE INFORMATION			
Course Code Course Title	: ME 249 : Engineering Mechanics (Statics and Dynamics)	Lecture Contact Hours Credit Hours	: 4.00 : 4.00

PRE-REQUISITE
None
CURRICULUM STRUCTURE
Outcome Based Education (OBE)
SYNOPSIS/RATIONALE
To provide the students with the basic knowledge in the mechanics of rigid body which will be helpful while studying strength of materials, aircraft structures etc.
OBJECTIVE
1. To be able to express and resolve the position and force into vector unit components. 2. To determine the forces in the members of trusses and frames using the method of joints and sections. 3. To draw and describe the free-body diagram and to solve the problems using the equations of equilibrium. 4. To determine to the location of centre of gravity and centric for a system and to determine the moment of inertia for an area. 5. To apply Newton's laws of motion and conservation principles to solve real life 6. To understand the principles and methods used in analyzing motion of a particle.

LEARNING OUTCOMES & GENERIC SKILLS

No.	Course Outcomes	Corresponding PO	Bloom's Taxonomy	KP	CP	CA	Assessment Methods
CO1	**Explain** basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts).	1	C1,C2	1			Q, ASG, F
CO2	**Demonstrate** use of basic dynamics concepts- Work-Energy principle, Impulse-Momentum principle to solve dynamics problems	2	C3,C4	1,2			Q, ASG, F
CO3	**Apply** scalar and vector analytical techniques for analyzing forces in statically determinate structures	5	C3	6	1,2		Q, F, CS

CO4	**Evaluate** equilibrium of particles and bodies in real world problems.	2	C4,C5	1,2	1,2		Q, F, CS, Pr

(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; CS – Case study, F – Final Exam)

COURSE CONTENT

a. Main Contents:

i. Properties of forces, moments, couples and resultants;

ii.Moment of inertia of areas and masses;

iii. Principle of work, energy, impulse and momentum

iv. System of particles;

v. Kinematics of rigid bodies

b. Detail Contents:

Statics of particles and rigid bodies; Properties of forces, moments, couples and resultants; Analysis of two- and three-dimensional problems; Centroids of lines, areas and volumes; Forces in truss, frames, and cables; Friction; Moments of inertia of areas and masses; Relative motion.
Planar mechanisms, linkages, mobility; instant centers of rotation, Kennedy's theorem; Velocity and acceleration polygons; Euler's first law; angular momentum and Euler's second law.
Kinetics of particles: Newton 's second law of motion; Principles of work, energy, impulse and momentum; System of particles; Kinematics of rigid bodies;
Kinetics of plane motion of rigid bodies: forces and acceleration; Principles of work and energy.

CO-PO MAPPING

No.	Course Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	**Explain** basic kinematics concepts – displacement, velocity and acceleration (and their angular counterparts).	2											
CO2	**Demonstrate** use of basic dynamics concepts- Work-Energy principle, Impulse-Momentum principle to solve dynamics problems		3										
CO3	**Apply** scalar and vector analytical techniques for analyzing forces in statically determinate structures					2							
CO4	**Evaluate** equilibrium of particles and bodies in real world problems.		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	70
Self-Directed Learning	84
Formal Assessment	6
Total	**160**

TEACHING METHODOLOGY

Class Lecture, Pop quiz, Case study, Problem solving

COURSE SCHEDULE

Week-1	Topic	CT
Class-1	Fundamental concepts and principles	CT-1
Class-2	Systems of units and conversion from one system of units to another	
Class-3	Forces in a plane	
Class-4	Forces on a particle: resultant of two forces	
Week-2	**Statics of Particles**	
Class-5	Addition of vectors	
Class-6	Resultant of several concurrent forces	
Class-7	Resolution of a force into components and rectangular components of a force: unit vectors	
Class-8	Equilibrium of a particle	
Week-3	**Rigid Bodies: Equivalent Systems of Forces**	
Class-9	Moment of a force about a point, given axis	
Class-10	Varignon's theorem	
Class-11	Moment of a couple	
Class-12	Reduction of a system of forces to one force and one couple	
Week-4	**Equilibrium of Rigid Bodies**	Mid Exam
Class-13	Equilibrium in two dimensions	
Class-14	Equilibrium of a two force body	
Class-15	Equilibrium of a three force body	
Class-16	Equilibrium in three dimensions	
Week-5	**Distributed Forces: Centroids and Centres of Gravity**	
Class-17	Centre of Gravity of a two dimensional body	
Class-18	Determination of centroids by integration	
Class-19	Centre of Gravity of a three dimensional body	
Class-20	Determination of centroids of volumes by integration	
Week-6	**Analysis of structures**	
Class-21	Analysis of trusses by method of joints	
Class-22	Analysis of trusses by method of sections	
Class-23	Analysis of frames	
Class-24	Analysis of cables	
Week-7	**Friction**	CT-2
Class-25	Introduction	
Class-26	The Laws of Dry Friction, Coefficients of Friction	
Class-27	Angles of Friction	
Class-28	Problems involving Dry Friction	
Week-8	**Distributed Forces: Moments of inertia**	
Class-29	Moments of inertia of areas	
Class-30	Polar moment of inertia and radius of gyration of an area	
Class-31	Moments of inertia of a mass	
Class-32	Moments of inertia of composite bodies	
Week-9	**Instant centres of rotation, Kennedy's theorem, Velocity and acceleration polygons**	
Class-33	Instant centres of rotation	
Class-34	Kennedy's theorem	
Class-35	Velocity and acceleration polygons	
Class-36	Velocity and acceleration polygons	

Week-10	**Euler's First Law, Angular Momentum and Euler's Second law**	CT-3
Class-37	Euler's first law	
Class-38	Angular momentum	
Class-39	Angular momentum	
Class-40	Euler's second law	
Week 11	**Kinetics of Particles: Newton’s Second Law**	
Class-41	Newton’s second law of motion	
Class-42	Linear momentum of a particle : rate of change of linear momentum	
Class-43	Equations of motion	
Class-44	Annear momentum of a particle : rate of change of angular momentum	
Week 12	**Kinetics of Particles: Energy and Momentum Methods**	
Class45	Kinetic energy of a particle: principles of work and energy	
Class-46	Applications of principles of work and energy	
Class-47	Principle of impulse and momentum	
Class-48	Problems involving energy and momentum	
Week 13	**System of Particles**	
Class-49	Linear and angular momentum of system of particles	
Class-50	Conservation of momentum of a system of particles	
Class-51	Kinetic energy of a system of particles	
Class-52	Principle of impulse and momentum of a system of particles	
Week 14	**Kinematics of rigid bodies**	
Class-53	Rotation about a fixed axis	
Class-54	General plane motion	
Class-55	Instantaneous centre of rotation in plane motion	
Class-56	Absolute and relative acceleration in plane motion	

ASSESSMENT STRATEGY

COs	Assessment Method	(100%)	Remarks
	Class Assessment		
1	Assignment	**20**	
2	Assignment	**20**	
	Exam		
1	Final Exam, CT	**80**	
2	Final Exam, CT, MID	**80**	
3	Final Exam, CT	**80**	
4	Final Exam, CT, Mid	**80**	

REFERENCE BOOKS

1. Vector Mechanics for Engineers: Statics and Dynamics – Ferdinand P. Beer, E Russell Jr. Johnstone; McGraw-Hill Companies, 5th edition 1988.
2. Engineering Mechanics - Timoshenko, D H Young, J V Rao
3. Engineering Mechanics – Andrew Pytel, JaonKiusaloas
4. Engineering Mechanics, Statics and Dynamics – Joseph F Shelley; McGraw-Hill, 1980.
5. Engineering's Mechanics - J.L. Merian& LG Kraige

***Details of program outcome and grading policy are attached as Annex A and Annex B.

COURSE INFORMATION			
Course Code Course Title	: SHOP 108 : Workshop Technology Sessional – I	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE

Course Code: N/A
Course Title: N/A

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

Workshop is a place where students acquire knowledge on the operation of various processes involved in manufacturing and production. The workshop practical courses make students competent in handling practical work in engineering environment.

OBJECTIVE

1. To know about Foundry Shop: Study of Foundry Shop: Patterns, Molds, Cores, create molding by using molding sand and analyze metal melting and Casting inspection of casting and casting defects.
2. To know about Electric arc welding, Gas welding, Metal Inert Gas (MIG) welding, Tungsten Inert Gas (TIG) welding and analyze the procedure of different welding.
3. To create a congenial environment that promotes learning, growth and imparts ability to work with multi-disciplinary groups in professional, industry and research organizations.

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	. Be able to **construct** mold by using molding sand and analyze metal melting and Casting inspection of casting and casting defects.	3	P4			K5	R, Q, T , ASG, F
CO2	Be able to **analyze** about Electric arc welding, Gas welding, Metal Inert Gas (MIG) welding, Tungsten Inert Gas (TIG) welding and analyze the procedure of different welding.	2	C4			K3	R, Q,T, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

Exp No	Exp Name
1.	Familiarization of Foundry Shop: Study of Foundry Shop: Patterns, Molds, Cores. Create molding by using molding sand.
2.	Analyze metal melting and Casting, inspection of casting and casting defects.
3.	Electric arc welding and analyze the procedure of arc welding. Resistance Welding and Spot Welding.
4.	Gas welding and analyze the procedure of Gas welding.
5.	Metal Inert Gas (MIG) welding and Tungsten Inert Gas (TIG) welding and analyze the procedure of these both

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **construct** molding by using mold sand and analyze metal melting and Casting inspection of casting and casting defects.			2									
CO2	Be able to **analyze** about Electric arc welding, Gas welding, Metal Inert Gas (MIG) welding, Tungsten Inert Gas (TIG) welding and analyze the procedure of different welding..		3										
(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)													

TEACHING LEARNING STRATEGY	
Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	07
Practical	14
Total	21
Self-Directed Learning	
Preparation of Lab Reports	05
Preparation of Lab Test	05
Preparation of presentation	03
Preparation of Quiz	05
Engagement in Group Projects	10
Formal Assessment	
Continuous Assessment	07
Final Quiz	01
Total	57

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Familiarization of Foundry Shop: Study of Foundry Shop: Patterns, Molds, Cores. Create molding by using molding sand.
Week 2	Analyze metal melting and Casting, inspection of casting and casting defects.
Week 3	Electric arc welding and analyze the procedure of arc welding. Resistance Welding and Spot Welding.
Week 4	Gas welding and analyze the procedure of Gas welding.
Week 5	Metal Inert Gas (MIG) welding and analyze the procedure
Week 6	Tungsten Inert Gas (TIG) welding and analyze the procedure
Week 7	Lab Test and Lab Quiz

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P4/ Articulation
		CO 2	C4/Analyse
Report Writing/Programming	15%	CO 1	P4/ Articulation
		CO 2	C4/Analyse
Mid Term Evaluation (exam/project/assignment)	20%	CO1	P4/ Articulation
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2,	C4/Analyse, P4/ Articulation
Viva Voce/ Presentation	10%	CO1, CO2	C4/Analyse, P4/ Articulation
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. Machine Shop Practice – James Anderson; W. A. Chapman.
2. Shop Theory –Anderson & Tatro.

COURSE INFORMATION			
Course Code Course Title	: SHOP 112 : Workshop Technology Sessional –II	Lecture Contact Hours Credit Hours	: 1.50 : 0.75

PRE-REQUISITE

Course Code: SHOP 108
Course Title: Workshop Technology Sessional –I

CURRICULUM STRUCTURE

Outcome Based Education (OBE)

SYNOPSIS/RATIONALE

Workshop is a place where students acquire knowledge on the operation of various processes involved in manufacturing parts and production of samples. The workshop practical courses make students competent in handling practical work in engineering environment. This course gives undergraduates the opportunity to engage in machine shop operation under the supervision of qualified machine shop personnel. Students learn to operate the lathe, milling and drilling machines. The course may be repeated for credit multiple times, either on different topics (e.g., CNC coding).

OBJECTIVE

1. To Know about Lathe machine, Milling machine, Shaper Machine, CNC Milling Machine and create part by doing different operations.

2. To learn to use CNC Milling machine to manufacture a part automatically by using a CAD drawing.

COURSE OUTCOMES & GENERIC SKILLS							
No.	Course Outcome	Corresponding PO	Bloom's Taxonomy	CP	CA	KP	Assessment Methods
CO1	Be able to **demonstrate** the use of Lathe machine, Milling machine, Shaper Machine, CNC Milling Machine	5	P3			K6	R, Q, T, ASG, F
CO2	Be able to **analyze** a job for CNC Milling machine to manufacture a part automatically by using a CAD drawing.	2	C4			K3	R, Q, T, F
(CP- Complex Problems, CA-Complex Activities, KP-Knowledge Profile, T – Test ; PR – Project ; Q – Quiz; ASG – Assignment; Pr – Presentation; R - Report; F – Final Exam)							

COURSE CONTENT

Exp No	Exp Name
1.	Study of Lathe Machine and Its Various Operations in Manufacturing parts.
2.	Study of Milling Machine and Its Various Operations in Manufacturing gears.
3.	Study of Shaping Machine and Its Various Operations in Manufacturing grooves.
4.	Study of Drilling Machine and Its Various Operations.
5.	Study of CNC Machine and Its Various Operations in Manufacturing parts.

SKILL MAPPING

No.	Course Learning Outcome	PROGRAM OUTCOMES (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
CO1	Be able to **demonstrate** the use of Lathe machine, Milling machine, Shaper Machine, CNC Milling Machine					2							
CO2	Be able to **analyze** a job for CNC Milling machine to manufacture a part automatically by using a CAD drawing..		3										

(Numerical method used for mapping which indicates 3 as high, 2 as medium and 1 as low level of matching)

TEACHING LEARNING STRATEGY

Teaching and Learning Activities	Engagement (hours)
Face-to-Face Learning	
Lecture	07
Practical	14
Total	21
Self-Directed Learning	
Preparation of Lab Reports	05
Preparation of Lab Test	05
Preparation of presentation	03
Preparation of Quiz	05
Engagement in Group Projects	10
Formal Assessment	
Continuous Assessment	07
Final Quiz	1
Total	57

TEACHING METHODOLOGY
Lecture followed by practical experiments and discussion, Co-operative and Collaborative Method, Project Based Method

COURSE SCHEDULE	
Week 1	Study of Lathe Machine and Its Various Operations in Manufacturing parts.
Week 2	Study of Milling Machine and Its Various Operations in Manufacturing gears.
Week 3	Study of Shaping Machine and Its Various Operations in Manufacturing grooves.
Week 4	Lab Test-1
Week 5	Study of Drilling Machine and Its Various Operations.
Week 6	Study of CNC Machine and Its Various Operations in Manufacturing parts.
Week 7	Lab Quiz

ASSESSMENT STRATEGY			
Components	**Grading**	CO	Blooms Taxonomy
Conduct Lab Test/ Class Performance	25%	CO 1	P3/Precision
Report Writing/Programming	15%	CO 1	P3/Precision
Mid Term Evaluation (exam/project/assignment)	20%	CO1	P3/ Precision
Final Evaluation (Exam/project/assignment)	30%	CO1, CO2	P3/Precision, C4/Analyse
Viva Voce/ Presentation	10%	CO1, CO2	P3/Precision, C4/Analyse
Total Marks	100%		
(CO = Course Outcome, C = Cognitive Domain, P = Psychomotor Domain, A = Affective Domain)			

TEXT AND REFERENCE BOOKS

1. Machine Shop Practice – James Anderson; W. A. Chapman.
2. Shop Theory –Anderson & Tatro.