Chapter 1

GENERAL INFORMATION

1.1 INTRODUCTION

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 also started on 31 January 1999. Bachelor courses on Electrical, Electronic & Communication Engineering and Mechanical Engineering started its journey on 08 February 2003. Bachelor of Science program on Aeronautical Engineering (AE) has started from Feb 2009. Department of Naval Architecture & Marine Engineering (NAME) has been commenced on February 2013. Department of EWCE, NSE and BME has been opened from 2015. From 2016 another two new departments named Industrial and Production Engineering (IPE), and Petroleum and Mining Engineering (PME) are going to open to fulfill the motto of MIST.

1.2 Aim

The aim of MIST is to conduct undergraduate (B.Sc. Engg.), postgraduate(M.Sc. Engg. / M. Engg.) and Ph.D. courses in various disciplines of Engineering according to syllabi conferred by the Bangladesh University of Professionals (BUP) for officers of the armed forces and civil students from home and abroad.

1.3 Objectives

The objectives of MIST are:

- To offer the following courses with a view to meeting the increasing demand in the Armed Forces as well as in the country:

  Four-year bachelor's courses in Civil Engineering (CE), Computer Science and Engineering (CSE), Electrical Electronic and Communication Engineering (EECE), Mechanical Engineering (ME) and Aeronautical Engineering(AE), Naval Architecture & Marine Engineering (NAME), Environmental, Water Resources & Coastal Engineering (EWCE), Architecture, Nuclear Science & Engineering (NSE), Biomedical Engineering (BME), Industrial and Production Engineering (IPE),Petroleum and Mining Engineering (PME)and other programs to be opened in future.

- To produce well-disciplined self-motivated, dedicated and skilled engineers, computer professionals and business administration experts.
- To make provisions for research and development and dissemination of knowledge in appropriate fields of science and technology.

1.4 Location

MIST is located at Mirpur Cantonment, northwest edge of the greater Dhaka city, a hub of knowledge for the Armed Forces. Mirpur Cantonment is a small, calm and quiet education village and free from all possible pollution of a city life. A garland like lake with migratory birds, three sides with extended green fields in the summer and water bodies in the rainy season, whistling birds on the tree branches and overall bounty of nature adds to the already existing splendid academic atmosphere. Other neighboring academic institutions are National Defense College (NDC) and Defense Services Command and Staff College (DSCSC) and Bangladesh University of Professionals (BUP) - three international standard education centers.

1.5 Eligibility of Students for Admission in MIST

The students must fulfill the following requirements:

- **For Bangladeshi Students**

Minimum qualifications to take part in the admission test are as follows:

- Applicants must have passed SSC/Dhakhil/equivalent examination from Board of Intermediate and Secondary Education/ Madrasa Education Board/ Technical Education Board in Science group with minimum GPA 4.00 in a 5-point scale.

- Applicants must have passed HSC/Alim/equivalent examination from Board of Intermediate and Secondary Education/ Madrasa Education Board/ Technical Education Board in Science group with minimum GPA 4.00 in a 5-point scale.

- In HSC/Alim/equivalent examination the applicant must have obtained minimum 'A' grade in any two (02) subjects out of four (04) subjects including Mathematics, Physics, Chemistry & English and minimum 'A-' (A minus) grade in rest two (02) subjects.

- Applicants with GCE 'O' Level/equivalent background must have to qualify in minimum five (05) subjects including Mathematics, Physics, Chemistry and English with minimum 'B' grade in average.

- Applicants with GCE 'A' Level/equivalent background must have to qualify in minimum three (03) subjects including Mathematics, Physics and Chemistry with minimum 'B' grades separately.

- Applicants who have passed HSC or equivalent examination in the current year or one year before the notification for admission can apply.

- Sex: Male and Female.

- **For Foreign Students**

Foreign student may also be admitted. Vacancies are offered to foreign through Armed Forces Division (AFD), Prime Minister's Office of the Government of the People's Republic of Bangladesh. The candidates must fulfill the following requirements:

- Equivalent qualifications as that of Bangladeshi Students.
- Sex - Male and Female.
- Must have security clearance from respective Embassy/ High Commission in Bangladesh.

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

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 in Bengali and English of 200 marks (03 hours duration).The distribution of marks is given below:

Srl	Subjects		Marks
a.	Mathematics	=	80
b.	Physics	=	60
c.	Chemistry	=	40
d.	English	=	20
	Total	=	**200**

1.6.2 Final Selection

Students will be selected on the basis of results of the written admission test-75%, GPA of SSC/equivalent examination without 4th subject-10% and GPA of HSC/equivalent examination without 4th subject-15%. 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 Checkup

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 (BSc) Engineering programs, in various disciplines are planned for 04 regular levels, comprising of 08 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:

- Students failing in maximum two courses/subjects in any level, each comprising of two regular terms will be allowed to appear in the referred/re-examination on failed course(s)/subject(s) after a short term as per academic schedule.

- Referred/re-examination, after a short term is to be conducted within 02 (two) weeks of commencement of the next academic session at the latest.

- Students failing in maximum one course/subject in the referred/re-examination will be promoted to the next higher level. The failed course/subject will be termed as "Backlog" subject and the students have to pass the "Backlog" subject in the next scheduled referred/re-examination, but without any short term. Otherwise, he/she will be withdrawn permanently from the course/program.

- No student will be allowed to appear in the referred/re-examination in the same subject more than twice in the whole undergraduate program.

- Students in all levels will be allowed to appear in the referred/re-examination on two courses/subjects including the "Backlog" one.

- Students will be promoted to the second term of each level irrespective of their results in the first term of the level.

- Students failing in three or more courses/subjects in any level, comprising of two regular terms, will be allowed to repeat the level once. Students repeating a level will be granted exemption for that/those subject(s) in which they earned "B+" and above grade in the previous academic year. For a military student, repeating a level will be subject to the approval of the respective Services Headquarters.

- Students will be allowed to repeat a particular level only once in the whole undergraduate program.

- After level-4 referred/re-examination, if any military student fails in maximum one course/subject, but not the "Backlog" subject, then he/she will leave MIST and will be allowed to appear in the next scheduled referred/re-examination of the respective course. In that examination if he/she cannot pass the course/subject, or if he/she does not appear in the referred examination within 06 (six) years of registration will lose the scope of completing graduation. This failure will also be recorded in the dossier of military student officers.

- 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 from the date of his/her registration.

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

- Failure to secure/achieve minimum CGPA of 2.20 in two consecutive levels will also lead to withdrawal of the student from the program.

1.1.1 Expulsion / Withdrawal on Disciplinary Ground

1.1.1.1 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 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:

- Communication with fellow students for obtaining help in the examination.
- Copying from another student's script/report/paper.
- Copying from desk or palm of a hand or from other incrimination documents.
- Possession of any incriminating document whether used or not.

1.1.1.2 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.

1.1.1.3 Other Indiscipline Behavior

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.

1.1.1.4 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.

1.1.2 Withdrawal on Own Accord

A student who has already completed some courses and has not performed satisfactorily may apply for a permanent withdrawal. A student, if he/she applies, may be allowed to withdraw temporarily from the program, subject to the approval of Academic Council of MIST, but he/she has to complete the whole program within 06 (six) academic years from the date of his/her registration.

Chapter 2

DEPARTMENT OF IPE

2.1 Introduction

Industrial and production Engineering (IPE) department is going to establish in 2016 under the faculty of Mechanical Engineering to develop much needed professionals required for the growth of modern industries. The focus of undergraduate program in IPE is on manufacturing and quality, process design and productivity improvement, management and host of core subjects to meet the emerging technological needs of the industry. The curriculum has been prepared keeping view with the basic requirements of modern industries, manufacturing factories and in line with the changing trends in this field.

The learning will be continually evaluated through rubric based assessment. Education in IPE is very much leaned to practical situations and it is not possible to acquire proper knowledge in this field without sufficient exposure to industrial environment. The relationship of the department with the industries will be strengthened through their involvement in curriculum development and various programs such as seminars, visits and student projects. The students will be encouraged to develop themselves through various co-curricular and extra-curricular activities. The department of IPE aims not only to produce efficient engineers, but also well-educated conscientious leaders who can contribute to the development of the country through ameliorating our industries.

A typical under-graduate course on Industrial & Production engineering emphasizes on manufacturing and improvement of productivity. A student will also learn the trends of dynamics and control and hence will develop a sound knowledge about overall industrial production and management. He/She will also learn to analyses the emerging technological trends of the industry.

2.2 Aim

To buildup professionals in the following fields of IPE:

- Production Planning and Control
- Operations and Maintenance
- Statistical Quality Control
- Financial Management
- Materials Management
- Operations Research
- Value Engineering
- Network Models

2.3 Applications of Industrial and Production Engineering

Industrial and production engineers find ample job opportunities in manufacturing companies. They can also be absorbed in several other organizations including banks,

hospitals, finance, agriculture, public utilities, wholesale and retail trade, transportation, construction and government.

Both public and private sectors require industrial and production engineers for the smooth functioning of their Instrumental Manufacturing Industries and Industrial automation units. Those who have higher degrees and adequate managerial expertise can get top positions in the industrial/management field with attractive remuneration and incentives.

Industrial Engineers can also work as plant engineers, manufacturing engineers, quality engineers, process engineers and industrial managers in different industries, management and service sector in the middle management cadre. Most of the opportunities are in the private sector.

2.4 Laboratory Facilities of the Department

The department will take endeavor to provide its faculty members and students adequate laboratory, library and other facilities, departmental undergraduate courses are laboratory intensive and these requirements are catered for by following laboratories:

1. Manufacturing Lab
2. Product Design & Development Lab
3. Ergonomics & Safety Lab
4. Material Handling & Maintenance lab
5. Computer Lab
6. Simulation Lab
7. Metrology lab
8. Machine Tools Lab
9. CAD Lab
10. Sheet metal lab
11. Fluid Mechanics Lab
12. Heat Transfer Lab
13. Material & Production Process Lab
14. Measurement & Quality Control lab
15. Drawing Shop
16. Instrumentation & Control Lab

Chapter 3

RULES AND REGULATIONS FOR UNDERGRADUATE PROGRAM

3.1 Number of Terms in a Year (Level)

There will be two regular terms (Term I and Term II) in an academic year. Those who will not be able to clear all the subjects, will require to appear in the re-examination after a short term of about 6 weeks and fulfilling the other conditions as per examination policy.

3.2 Duration of Terms

The duration of each of Term will be as follows:

Events	**Durations**			**Remarks**
	Academic	Others	Total	
Classes	7 weeks			
Mid Term vacation		1 week		
Classes (7 weeks min), Makeup Class and Preparatory leave	9 Weeks			
Term Final Examination	2 weeks			May change
Term End Vacation		2 week		May change
Total	18 weeks	3 weeks	**21 weeks**	

The duration for short term and reexamination will be as follows:

Short term/ Preparatory Leave	* 6 weeks	* Duration may vary depending on the situation.
Examination	1 weeks	
Total	**7 Weeks**	

3.3 Course Pattern and Credit Structure

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

3.3.1 Course Designation System

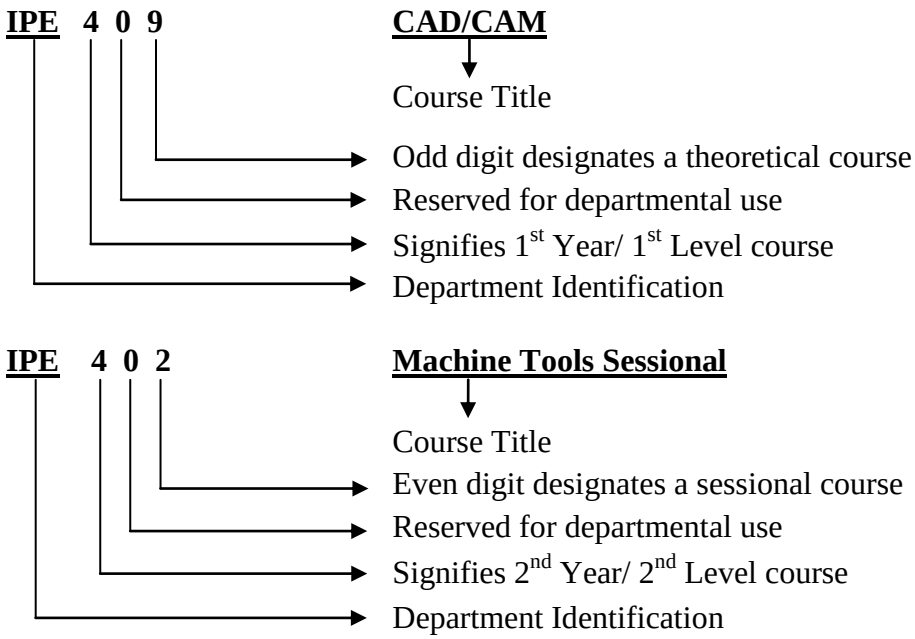
Each course is designated by a maximum of four letter code identifying the department offering the course followed by a three-digit number having the following interpretation:

- The first digit corresponds to the year/level 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.

- The last digit is an odd number for theoretical courses and an even number for laboratory courses.

- The course designation system is illustrated as follows:

(Example.....



3.3.2 Assignment of Credits

The assignment of credits to theoretical course is different from that of laboratory course, which is stated as follows:

- For theoretical courses one hour lecture per week per term is equivalent to one credit.
- For laboratory courses two hours sessional per week per term is equivalent to one credit.
- Credits are also assigned to project work taken by the students. The amount of credits assigned to such works may vary from one discipline to another.

3.3.3 Types of Courses

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

- **Core Courses**

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.

- **Prerequisite Courses**

Some of the core courses are identified as prerequisite courses for a specific subject. A prerequisite course is one, which is required to be completed before some other course(s) can be taken.

- **Optional Courses**

Apart from the core courses, the students can choose from a set of Elective courses. A required number of Elective courses from a specified group have to be chosen.

3.4 The Grading System

3.4.1 The Letter Grade

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 evaluation, class participation, homework assignment and a term final examination. The assessment in laboratory courses is made by evaluating performance of the students at work during the class, viva-voce during laboratory hours and quizzes. Each course has a certain number of credits, which describes its corresponding weightages. A letter grade with a specified number of grade points is awarded in each course for which a student is registered. 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 awarded in accordance to the provisions shown below:

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

* Subject in which the student gets F grades shall not be counted towards credit hours requirements and for the calculation of Grade Point Average (GPA)

3.4.2 Distribution of Marks (For Theoretical course only)

Thirty percent (30%) of marks of a theoretical course shall be allotted for continuous assessment, i.e. quizzes, home assignments, class evaluation and class participation. The rest of the marks will be allotted to the Term Final Examination that is conducted centrally by the Dhaka University. There are internal and external examiners for each course in the Term Final Examination of 3-hour duration.

Distribution of marks for a given course is as follows:

Class Participation/Observation	5%
Class Attendance	5%
Homework assignment and quizzes	20%
Final Examination (3 hours)	70%
Total	**100%**

Basis for awarding marks for attendance will be as follows:

Attendance	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%
65% to less than 70%	50%
60% to less than 65%	40%
Below 60%	00%

The number of quizzes of a course shall be at least n+1 where n is the number of credits of the course. Evaluation of performance in quizzes will be on the basis of the best n quizzes. The scheme of continuous assessment that a particular teacher wishes to follow for a course will be announced on the first day of classes.

3.4.3 Calculation of GPA

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 $C_1, C_2, \ldots, C_n$ and his grade points in these courses are $G_1, G_2, \ldots, G_n$ respectively then

$$GPA = \frac{\sum_{i=1}^{n} C_i * G_i}{\sum_{i=1}^{n} C_i}$$

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 $TC_1, TC_2, \ldots, TC_n$ and his GPA in these terms are $GPA_1, GPA_2, \ldots, GPA_n$ respectively then

$$CGPA = \frac{\sum_{i=1}^{n} TC_i * GPA_i}{\sum_{i=1}^{n} TC_i}$$

(Example.....

- **A Numerical Example**

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

Course	Credits, C_i	Grade	Grade Points, G_i	C_I*G_i
Phy 105	3.00	A-	3.50	9.00
Chem 101	3.00	A	3.75	11.25
Math 161	4.00	B+	3.25	13.00
Hum 155	2.00	A+	4	8.00
IPE 101	3.00	B	3	9.00
ME 160	1.50	A	3.75	11.25
Shop 172	0.75	A-	3.50	2.625
Chem 114	1.50	B	3	4.50
Hum 186	1.50	A+	4	6.00
Total	**20.25**			74.625

GPA = 74.625/20.25 = 3.69

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

Level	Term	Credit Hours Earned, TC_I	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

3.4.4 Minimum Earned Credit and GPA Requirement for Obtaining Degree

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 GPA requirement for obtaining a Bachelor's degree in engineering and other discipline is 2.20.

3.5 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 for any reason 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)

Chapter 4

COURSE REQUIREMENTS FOR THE DEGREE OF B.Sc. ENGG. IN IPE

4.1 INTRODUCTION

The undergraduate students of the Department of Industrial and Production Engineering have to follow the course schedule given in this chapter. The letter prefix in any course number indicates the department offering the course viz. IPE for Industrial and Production Engineering, ME for Mechanical Engineering, EECE for Electrical & Electronics Engineering, CSE for Computer Science and Engineering, Chem for Chemistry, Phy for Physics, Math for Mathematics, Hum for Humanities and Shop for Workshops. The first digit in the number indicates the year/level for which the course is intended. Odd number courses are theory courses and even numbered courses are sessional courses.

4.2 COURSES OFFERED IN DIFFERENT TERMS FOR B.Sc. ENGG. (IPE)

Level 1 Term I

Course No	Course Title	Contact Hours	Credit Hours
Phy 101	Structure of Matter, Electricity, Magnetism and Modern Physics	3	3.00
Chem 107	Chemistry	3	3.00
Math 101	Differential and Integral Calculus	3	3.00
Hum 101	Sociology	3	3.00
IPE 101	Introduction to Industrial and Production Engineering	3	3.00
	Total Theoretical	**15.00**	**15.00**
ME 160	Mechanical Engineering Drawing	3	1.50
Shop 172	Machine Shop	3	1.50
Chem 108	Inorganic Quantitative Analysis Sessional	3	1.50
Hum 186	English Language Practice	3	1.50
	Total Sessional	**12.00**	**6.00**
	Grand Term Total	**27.00**	**21.00**

Level 1 Term II

Course No	Course Title	Contact Hours	Credit Hours
Math 103	Vector, Matrix and Solid Geometry	3	3.00
Phy 103	Waves and Oscillations, Physical Optics and Wave Mechanics	3	3.00
IPE 103	Principles of Cost and Managerial Accounting	3	3.00
CSE 181	Computer Programming Techniques	3	3.00
EECE 171	Basic Electrical & Electronic Circuit	3	3.00
	Total Theoretical	**15.00**	**15.00**
Phy 104	Physics Sessional	3	1.50
CSE 182	Computer Programming Techniques Sessional	3	1.50
EECE 172	Basic Electrical & Electronic Circuit Sessional	3	1.50
	Total Sessional	**9.00**	**4.50**
	Grand Term Total	**24.00**	**19.50**

Level 2 Term I

Course No	Course Title	Contact Hours	Credit Hours
Math 201	Differential Equation, Vector Calculus and Laplace Transform	3	3.00
EECE 271	Electrical Machines and Electronics	3	3.00
ME 231	Engineering Materials	4	4.00
IPE 201	Manufacturing Processes I	3	3.00
ME 271	Engineering Mechanics and Theory of Machines	3	3.00
	Total Theoretical	**16.00**	**16.00**
EECE 272	Electrical Machines and Electronics Sessional	3	1.50
ME 232	Engineering Materials Sessional	3	1.50
IPE 202	Manufacturing Processes I Sessional	3/2	0.75
IPE 200	Engineering Graphics and Introduction to CAD Sessional	3	1.50
	Total Sessional	**10.50**	**5.25**
	Grand Term Total	**26.50**	**21.25**

Level 2 Term II

Course No	Course Title	Contact Hours	Credit Hours
IPE 203	Manufacturing Process II	3	3.00
IPE 205	Probability and Statistics	4	4.00
IPE 207	Engineering Economy	3	3.00
ME 243	Mechanics of Solids	3	3.00
ME 251	Thermodynamics and Heat Transfer	3	3.00
	Total Theoretical	**16.00**	**16.00**
IPE 204	Manufacturing Processes II Sessional	3/2	0.75
ME 244	Mechanics of Solids Sessional	3/2	0.75
ME 252	Thermodynamics and Heat Transfer Sessional	3	1.50
	Total Sessional	**6.00**	**3.00**
	Grand Term Total	**22.00**	**19.00**

Level 3 Term I

Course No	Course Title	Contact Hours	Credit Hours
ME 351	Fluid Mechanics & Machinery	3	3.00
IPE 301	Measurement, Instrumentation and Control	3	3.00
Hum 301	Fundamentals of Economics	3	3.00
IPE 303	Product Design I	3	3.00
IPE 305	Operations Research	4	4.00
	Total Theoretical	**16.00**	**16.00**
ME 352	Fluid Mechanics & Machinery Sessional	3	1.50
IPE 302	Measurement, Instrumentation and Control Sessional	3/2	0.75
IPE 304	Product Design I Sessional	3	1.50
	Total Sessional	**7.50**	**3.75**
	Grand Term Total	**23.50**	**19.75**

Level 3 Term II

Course No	Course Title	Contact Hours	Credit Hours
IPE 307	Product Design II	3	3.00
IPE 309	Material Handling and Maintenance Management	3	3.00
IPE 311	Operations Management	3	3.00
IPE 313	Quality Management	3	3.00
IPE 315	Numerical Analysis	3	3.00
	Total Theoretical	**15.00**	**15.00**
IPE 308	Product Design II Sessional	3	1.50
IPE 310	Material Handling and Maintenance Management Sessional	3/2	0.75
IPE 314	Quality Management Sessional	3/2	0.75
IPE 300	Business Communication Seminar-I	3/2	0.75
	Total Sessional	**7.50**	**3.75**
	Grand Term Total	**22.50**	**18.75**

Level 4 Term I

Course No	Course Title	Contact Hours	Credit Hours
IPE 401	Project and Environmental Management	3	3.00
IPE 403	Ergonomics and Safety Management	3	3.00
IPE 405	Supply Chain Management	3	3.00
IPE 407	Robot and Computer Controlled Machines	3	3.00
IPE ---	Optional-I	3	3.00
	Total Theoretical	**15.00**	**15.00**
IPE 400	Project and Thesis	6	3.00
IPE 404	Ergonomics and Safety Management Sessional	3/2	0.75
IPE 420	Industrial Practice	4 Weeks	2.00
	Total Sessional	**11.50**	**5.75**
	Grand Term Total	**25.50**	**20.75**

Level 4 Term II

Course No	Course Title	Contact Hours	Credit Hours
IPE 409	Machine Tools and Machining	4	4.00
IPE 411	CAD/CAM	3	3.00
IPE 413	Industrial and Business Management	3	3.00
IPE ---	Optional II	3	3.00
	Total Theoretical	**13.00**	**13.00**
IPE 400	Project and Thesis	6	3.00
IPE 410	Machine Tools Sessional	3	1.50
IPE 412	CAD/CAM Sessional	3/2	0.75
IPE 430	Industrial Simulation Sessional	3/2	0.75
IPE 450	Business Communication Seminar II	2	1.00
	Total Sessional	**14.00**	**7.00**
	Grand Term Total	**27.00**	**20.00**

Grand total credit hours required for the degree of B.Sc. Engineering in Industrial and Production Engineering is**160.00**.

4.3 LIST OF OPTIONAL COURSES

IPE 415: CNC Machine Tools
IPE 419: Computer Integrated Manufacturing
IPE 421: Modern Machinery and Machining Processes
IPE 425: Micro-manufacturing
IPE 427: Marketing Management
IPE 429: Technology Management
IPE 445: Entrepreneurship Development and Micro Industries
IPE 453: Information Technology in Business
IPE 461: Organizational Behavior
IPE 463: Total Quality Management
IPE 465: Intelligent Manufacturing
IPE 467: Energy Management
ME 447: Robotics
ME 461: Control Engineering
CSE 443: Digital Logic and Micro-Processor Technology

Chapter 5

DETAIL OUTLINE OF UNDERGRADUATE COURSES

5.1 COURSES OFFERED TO IPE STUDENTS BY THE DEPARTMENT OF IPE

IPE 101: Introduction to Industrial and Production Engineering (3 credit hours)

Evolution of industrialization; Involvement of Industrial and Production Engineering in the entire life cycle of a product; Design of product; Basic processes for product manufacturing; Machineries for manufacturing; Computer in manufacturing; Managing manufacturing system; Improvement of systems–optimization, quality management, ergonomics, safety, organizational behavior etc.

IPE 103: Principles of Cost and Managerial Accounting (3 credit hours)

Elements of accounting: the accounting equation; accounts, transactions, double entry mechanisms, financial statements, basic concepts: scope and application of cost and management accountancy, costing methods and techniques, income measurement in manufacturing companies, material costing and labor costing, overheads and their allocation, marginal costing and decision making among alternative courses of action, marginal costing vs. total absorption costing, financial statement analysis: understanding the financial statement, tests for probability liquidity, solvency and overall measure, budgets and their control.

IPE 200: Engineering Graphics and Introduction to CAD Sessional (1.5 credit hours)

Product graphics: drafting codes as per ISO, tolerances and dimensioning, ensuring co-axiality, perpendicularly and parallelism compatible to manufacturing and assembly requirements, schematic product symbols for welding and piping systems. System graphics: working drawings of cumulative and non-cumulative assemblies, dimensioning of assembled parts, use of standard parts threads, fasteners and springs, detailing of assembled parts.

CAD software (2D and 3D): Use of interactive menu driven software for preparation of line drawings, graphic co-ordinate system. Commands for draw, erase, move, rotate, mirror, hatch, trim, planes, parallelism and perpendicularity, surfaces; intersections and development etc. Blocks and layers. Dimensional drawing files, saving, editing and plotting.

IPE 201: Manufacturing Process I (3 credit hours)

Classification of manufacturing processes, casting processes for ferrous and non-ferrous metals, sand, die, centrifugal, slush, plaster mold, loam mold, precision investment casting etc. Casting defects, design of moulds, riser, gate sprue and core, cost analysis.

Joining methods: soldering, brazing, welding, conventional welding processes: gas, arc, TIG, MIG, thermit, resistance, friction, electro slag etc. Special welding processes: LASER, electron beam, submerged arc etc. Precision and non-precision surface finishing operation, hot and cold extrusion, press working operations etc. Manufacturing of ceramic and glass products, powder metallurgy.

IPE 202: Manufacturing Process I Sessional (0.75 credit hours)

Sessional work based on course IPE 201.

IPE 203: Manufacturing Process II (3 credit hours)

Metal removing processes: chip formation and tool design, tool geometry, chip breakers.

Bulk deformation, rolling, forging and extrusion and sheet metal forging Process.

Different machining processes: turning, drilling, shaping, planning, milling, grinding, reaming, broaching, etc. manufacture of threads and gears, modern machining processes: electro-chemical, electro-discharge, plasma etc., LASER beam, electron beam, ultrasonic and abrasive jet machining.

Plastics: plastic product manufacturing processes: compounding, extrusion, injection molding, compression molding, blow molding, vacuum forming and hand layup.

Selection of manufacturing processes on the basis of product characteristics and manufacturing economy.

IPE 204: Manufacturing Process II Sessional (0.75 credit hours)

Sessional work based on course IPE 203.

IPE 205: Probability and Statistics (4 credit hours)

Basic laws of probability, conditional probability, random variables, measures of central tendency and dispersion, mathematical exception, probability distributions, transformation of variables, moments and moment generating functions, sampling, central limit theorem, chi-square distribution, t-distribution, f-distribution: estimation and confidence interval, statistical hypothesis and testing, goodness-of-fit tests.

Correlation and regression analysis, analysis of variance, experimental designs, randomized block design, factorial design, introduction to stochastic problems in engineering.

IPE 207: Engineering Economy (3 credit hours)

Introduction to engineering economic decision making common to engineering, cash flow analysis and basic concepts of discounting, cost of capital, required ROR equivalence etc.

Business mathematics, investment appraisal criteria for economic decisions, present worth, internal rate of return, social consideration in investment, benefit-cost ratio, etc.

Decisions involving taxes, depreciation and inflation and sensitivity analysis.

IPE 300: Business Communication Seminar I (0.75 credit hours)

IPE 301: Measurement, Instrumentation and Control (3 credit hours)

Introduction to fundamentals of engineering measurements, study and use of instrumentation, and control systems.

Linear measuring system, instruments limits, fits and gauges: ISO system of limits and fits.

Precision dimensional measurement of length and angles, roundness profiles and flatness, surface roughness and texture, wear Taylor's principles on limit gauges, Abbey's principle, measuring threads, gears, measurement, ultrasonic measurement, measurement by light-wave interference, electrical and electronic measurement, digital recording by LASER beam dimension measuring system, opto-electronic, dimensional gauging, non-destructive testing methods (NDT methods), inspection and kinds of inspection, testing and calibration testing of gauges, dynamic measurement.

The characteristics and use of analogue and digital instrumentation applicable to industrial engineering problems, statistical methods for developing system specifications, basic concepts of modern instrumentation.

Concepts and importance of control system, control system description, state variable and transfer function representation, sensitivity, concepts of feedback-the feedback control system, electromechanical controls, digital computer control.

IPE 302: Measurement, Instrumentation and Control Sessional (0.75 credit hours)

Sessional work compatible to course no. IPE 301.

IPE 303: Product Design I (3 credit hours)

Functional aspects of a product, environment and human factors in design, value engineering, design morphology, standardization, ISO 9001, understanding customer needs, establishing product function specification, development, concept generation and evaluation.

Designing of machine parts for strength, deflection, stiffness, fatigue impact etc., designing of shaft, key and power screw, coupling, clutches and brakes.

IPE 304: Product Design I Sessional (1.5 credit hours)

Sessional work compatible to course no. IPE 303.

IPE 305: Operations Research (4 credit hours)

Introduction and scope of operations research, introduction to mathematical modeling: different kinds of modeling and their characteristics.

Classical optimization techniques involving single variable and multiple variables with and without constraints.

Linear models: simplex algorithm, duality, sensitivity analysis, transportation and assignment algorithm, game theory.

Integer programming, dynamic programming, queuing models, introduction to simulation, application: engineering, business and other sectors of economy.

IPE 307: Product Design II (3 credit hours)

Reverse engineering, alternative solutions and their evaluation, designing for assembly and disassembly, reliability, product life cycle, cost analysis, use of standard parts, application of CAD software.

Prototype design, designing of engineering systems involving shafts, bearings, linkages, couplings, clutches brakes, gears, power transmission etc.

IPE 308: Product Design II Sessional (1.5 credit hours)

Integrated design based on the knowledge of reverse engineering reliability, cost analysis, strength, etc.

IPE 309: Material Handling and Maintenance Management(3 credit hours)

Issues and importance of handling of materials: analysis of material handling problems, classification of materials, unit load, bulk loads, study of material handling systems and their efficiency, selection and classification of material conveying equipment.

Product handling: design system configuration conforming to various kinds of product features and layout characteristics.

Designing concepts of common handling and transfer equipments, different types of conveyors such as belt, screw, chain, flight, bucket elevators, pneumatic hydraulic cranes and forklifts, design of ware house facilities appropriate for relevant handling and transfer device, automatic packaging devices: testing procedure of packages: vibration test, drop test, performance limits and testing machines, algorithms to design and analyze discrete parts material storage and flow system such as automated storage/retrieval system (ASRS), order picking, automated guided vehicle system (AGVS).

Maintenance management: concept of maintenance and value of maintenance management, maintenance organization and department structure (resource and administration), types of maintenance, fixed time replacement, condition based maintenance, preventive and corrective maintenance, replacement strategies, documentation and computer control in maintenance management, Implementation of maintenance planning, plant asset management, human factors in motivation skills in a maintenance environment.

IPE 310: Material Handling and Maintenance Management(0.75 credit hours)

Sessional work compatible to course no. IPE 311.

IPE 311: Operations Management (3 credit hours)

Integrated purchase-production-marketing system, production systems, product/service life cycle, forecasting models, bill of materials, material and inventory management: inventory models, ABC analysis, coding and standardization, aggregate planning, MPS, MRP, capacity planning, operating scheduling.

Work study: MRP II, optimized production technology, group technology, TQC and JIT.

IPE 313: Quality Management (3 credit hours)

Emergence of modern concept of quality and its management, quality redefined, identification of quality characteristics: quality of design, conformance and performance, Deming's principle on quality and productivity, quality costs and their interpretation.

Control and measurement concept of quality: elementary SPC tools-PDCA cycle, Pareto's law, cause and effect (fishbone), control charts-attribute control charts and variable control charts, measurement of variation and process capability analysis, design of experiments-identification of key variables for major variations.

Acceptance sampling plans: OC curves, single and double sampling plants, sequential and rectifying inspection plans AOQ.

Quality and reliability: failure and survival probability, hazard rate, component and system reliability and its prediction, failure mode and fault tree analysis, reliability testing.

Quality standards and their compliance, ISO 9000 and ISO 14000, foundations of quality revised – total quality management (TQM), application of TQM philosophy, frontiers of quality.

IPE 314: Quality Management Sessional (0.75 credit hours)

Sessional work compatible to course no. IPE 313.

IPE 315: Numerical Analysis (3 credit hours)

Errors and approximations in numerical computations, rules of polynomials and transcendental equations, multiple roots, solution of linear algebraic equations: Gauss elimination, Guass-Jordan elimination, Choleski's decomposition, Guass-Siedel iteration,

Eigen-value problems, interpolation and extrapolation techniques, Curve fitting, numerical differentiation and integration, solution of ordinary differential equations: Taylor's series method, Euler's method, Milne's method, Runge-Kutta methods, numerical optimization techniques.

IPE 400: Project and Thesis (6 credit hours)

IPE 401: Project and Environment Management (3 credit hours)

Project: identification, planning, appraisal, project implementation, project organization, budgeting, scheduling, using bar diagram, CPM, PERT, resource allocation, information system and project control, project termination, project organizations, matrix organization, project manager, contract negotiation and conflict resolution, case study, planning and evaluation of an investment project.
Environmental impact assessment of projects.

Source of degradation of earth's ecosystem, technological development, greenhouse gases, ozone layer depletion, toxic gases and industrial wastes, Montreal protocol, remedies Noxious China-sun refrigerant technologies and use of catalysts, environmental economics and accounting system.

IPE 403: Ergonomics and Safety Management (3 credit hours)

Man-machine-material interfaces in manufacturing: physical and cognitive aspects, comparative advantages of man and machine, physical work and human muscular effort, bio-mechanics and bio-engineering.

Anthropometry, work place design and work place layout, human performance under environment temperature, illumination, vibration, noise, pollution radiation static and dynamic conditions.

Evolution of modern safety concepts, industrial hazard, safety and risk management, productivity, worker health and safety, proactive management techniques for safety management, safety standards and regulations for engineering works, case studies.

IPE 404: Ergonomics and Safety Management Sessional (0.75 credit hours)

Sessional work compatible to course no. IPE 403.

IPE 405: Supply Chain Management (3 credits hours)

Introduction to supply chain management: supply chain, systems approach to management, materials management, major areas of supply chain management, forward and backward linkage.

Materials planning: role of forecasting, market demand estimation.
Procurement management: procurement cycle, materials sourcing, vendor evaluation and selection, make-buy decision, multi-criteria decision, making in supplier selection, negotiation, transportation, logistics, incoming materials inspection.

Inventory systems management: different types of product structures for materials planning, management of raw materials, work-in-process (WIP), finished good and spare parts inventories, lead time management, cycle time reduction.

Stores management: stores layout planning, addressing systems, codification systems, traceability, physical verification and counting, surplus and waste management.

Physical distribution: network planning, packaging, materials handling, carrier systems, distribution inventory, legal aspects and common rules of transportation.

IPE 407: Robot and Computer Controlled Machines (3 credit hours)

Robot: Robot anatomy, Drive systems of robots, Electrical and hydraulic systems, AC and DC drives, Servo drives using voltage control, current control and direct torque control, PID control systems and performance issues. Feedback systems. Single loop and multi-loop, DSP based motion control systems, Sensors for industrial robots, encoders, resolvers, hall-effect

sensors, acoustic sensors, ultrasonic and optical/infrared sensors, Elements of robot vision, Integration using PLCs. Digital motion planning systems.
Computer Control Machines: Introduction, classification, design features and control features of CNC machines; Programming: G and M Code programming, Offline (APT-like) programming; free form surface machining: Isoparametric, Isoplanar and Isoscallop machining strategies.

IPE 409: Machine Tools and Machining (4 credit hours)

Machine Tools: Concept and definition of machining and machine tools. History of developments of machine tools. Concept of producing geometrical surfaces by generatrix and directrix. Kinematic systems and structures of conventional machine tools. Electromechanical and hydraulic drives and control of machine tools. Machine tool automation. Classification and specification of machine tools. Construction, working principle and application of various semi-automatic and automatic lathes. Flexible automation need, principle and advantages. Basic constructional features, working principle and application of CNC machine tools, machining center and FMS.

Machining: Tool geometry, mechanism of chip formation. Mechanics of machining. Cutting temperature; causes, effects, estimation, measurement and control. Cutting fluid applications. Failure modes, wear and life of cutting tools. Cutting tool materials. Role of geometrical and process parameters and cutting fluid on machine-ability. Mechanics of grinding. Economy of machining and grinding. Special techniques and advanced technology of machining and grinding.

IPE 410: Machine Tools and Machining Sessional (1.5 credit hours)

Sessional work compatible to course no IPE 409.

IPE 4011: CAD/CAM (3 credit hours)

Introduction: The meaning and origin of CIM–The changing manufacturing and management scene–External communication–Islands of automation and software–Dedicated and open systems – Manufacturing automation protocol–Product related activities of a company–Marketing engineering–Production planning–Plant operations–Physical distribution–Business and financial management.

Group technology: History of group technology– Role of GT in CAD/CAM integration– Part families–Classification and coding– DCLASS and MICLASS and OPITZ coding systems – Facility design using GT–Benefits of GT–Cellular manufacturing
Computer aided process planning: Process planning–Role of process planning in CAD/CAM integration–Approaches to computer aided process planning–Variant approach and generative approaches – CAPP and CMPP process planning systems.
Shop floor control: Shop floor control–Phases–Factory data collection system–Automatic identification methods–Bar code technology–Automated data collection system
Introduction of FMS: FMS–Components of FMS–Types–FMS workstation–Material handling and storage systems–FMS layout–Computer control systems–Application and benefits.
Automated manufacturing systems: Automated production line – system configurations, work part transfer mechanisms–Fundamentals of Automated assembly system–System

configuration, Part delivery at workstations – Design for automated assembly – Overview of material handling equipments – Consideration in material handling system design – The 10 principles of Material handling.
AGV and ASRS: Automated Guided Vehicle system–Types of vehicles and AGVs applications–Vehicle guidance technology–Vehicle management and safety. Storage system performance – storage location strategies – Conventional storage methods and equipments – Automated storage/Retrieval system and Carousel storage system. Deadlocks in Automated manufacturing systems – Petrinet models – Applications in dead lock avoidance
CIM implementation and DATA communication: CIM and company strategy–System modeling tools– DEF models– Activity cycle diagram – CIM Open System Architecture (CIMOSA) – Manufacturing enterprise wheel – CIM architecture – Product data management – CIM implementation software – Communication fundamentals – Local area networks – topology – LAN implementations – Network management and installations.

IPE 412: CAD/CAM Sessional (0.75 credit hours)

Sessional work compatible to course no. IPE 409.

IPE 413: Industrial and Business Management (3 credit hours)

Business and management process, managerial function of business and then relative importance, managerial skills and development.

Emergence of management thought and the patterns of management analysis scientific management and Taylor's Principle, modern operational-management theory, emergence of the behavioral sciences, recent contributors to management thought.

Management and society: the external environment, social responsibility and ethics.

Organization and management: system approach to organization, organization theory and organizing practices, basics of organizing.

Personnel and human resource management in business, human factors and motivation, leadership, group decision making and communication, job gradation, process of performance appraisal and reward systems.

Managing information for decisions and management information systems.

Management in operations and business: systems approach to operation management and business, managing the marketing of goods and service, total marketing activity, marketing mix, some selected topics of marketing such as industrial and consumer selling, advertising, new product strategy and decisions.

Management in the international selling, management revisited and challenges for management in the twenty first century.

IPE 420: Industrial Practice (4 weeks, 2 credit hours)

Students have to go to different industries by some groups to know the production process and have to submit a report and also have to give an oral presentation both in the industry (if needed) and IPE department (Must). Each group has to find a case in the industry and they have to provide suitable solution to that case.

IPE 430: Industrial Simulation Sessional (0.75 credit hours)

IPE 450: Business Communication Seminar II (1 credit hours)

Shop 172: Machine Shop

5.2 COURSES OFFERED TO IPE STUDENTS BY OTHER DEPARTMENTS

Math 101: Differential and Integral Calculus (3 credit hours)

Differential calculus: limit, continuity and differentiability, differentiation of explicit and implicit functions and parametric equations, differential, Successive differentiation of various types of functions, Leibniz's theorem, Roll's mean-value theorems, Taylor's theorem infinite and infinite forms, Maclaurin's theorem in finite and infinite forms, L'Hospitals rule. tangent and normal, sub tangent and subnormal in Cartesian and polar coordinates, partial differentiation, Euler's theorem maxima and minima for functions points of inflection, applications, curvature, evaluation & involutes asymptotes, envelopes, curve tracing.

Integral calculus: integration by parts, integration by the method of substitutions, standard integrals, integration by the method of successive reduction, definite integrals, kits properties and uses, Wally's formula, improper integrals, beta function and gamma function, area under plane curves in Cartesian and polar coordinates, area of the region enclosed by two cures in Cartesian and polar coordinates, arc-lengths of curves in Cartesian & polar coordinates, parametric, pedal and intrinsic equations, volume of solids of revolution, volume of hollow solids of revolution by shell method, area of surface of revolution.

Math 103: Vector, Matrix and Co-ordinate Geometry (3 credit hours)

Vectors: definition of vectors, equality of vectors, addition, subtraction and multiplication of vectors, scalar and vector product of two vectors and their geometrical interpretation, triple products and multiple products and their application to geometry and mechanics, linear dependence and independence of vectors.

Matrix: definition of matrix, different types of matrices, algebra of matrices, adjoin and inverse of a matrix, rank and elementary transformations of matrices, normal and canonical forms, solution of linear equations, quadratic forms, matrix polynomials, Eigen values and Eigen vectors.

Co-ordinate geometry: transformation of co-ordinates & identification of conics three dimensional co-ordinate system projection direction cosines, equations of planes and lines angle between lines and planes, distance from appoint to a plane, coplanar lines, shortest distance between two given straight lines, standard equations of sphere, ellipsoid, hyperboloid of one sheet, hyperboloid of two sheets, tangent planes, normal lines, condition of tangency.

Math 201: Different Equation, Vector Calculus and Laplace Transform and Co-Ordinate Geometry (3 credit hours)

Ordinary differential equation: formation of differential equations, solution of first order differential equations by various methods, solution of general linear equations of second and higher orders with constant coefficients, solution in series by Frobenious method, Bessel function, legendry polynomials and their properties.

Vector calculus: differentiation and integration of vectors together with elementary applications, line, surface and volume integrals, gradient of a scalar function, divergence and

curt of a vector function, physical significance of gradient, divergence and curt, Gauss's theorem, Stocke's theorem, Green's theorem and their applications.

Laplace transform: definition of Laplace transform, elementary transformation sand properties, convolution, solution of differential equation by Laplace transform, evaluation of improper integrals by Laplace transforms.

Phy 101: Structure of Matter, Electricity and Magnetism, and Modern Physics (3 credit hours)

Structure of matter, states of matter, solid, liquid and gas, classification of solids: amorphous crystalline ceramics & polymers. Atomic arrangement in solids, different types of bonds in solids, metallic, Vander Waals, covalent and ionic bond, packing in solid, inter atomic distances and forces of equilibrium, x-ray diffraction, Bragg's law, plasticity and electricity, distinction between metal insulator and semi-conductor.
Electricity and magnetism: electric charge, Coulomb's law, the electric field, calculation of the electric flux and Gauss's law, some application of Gauss's law, electric potential V, relation between E and V, electric potential energy, capacitors, capacitance, dielectrics and atomic view, dielectrics and Gauss's law: current and resistance, current and current density, Ohm' law, resistivity, an atomic view, Ampere's law, Faraday's law, Lenz's law, self-inductance and mutual inductance, Magnetic properties of matter: magneto-motive force, magnetic field intensity and permeability, susceptibility, classification of magnetic materials, magnetization curves, modern physics.

Michelson Morley's experiment, Galilean transformation, special theory of relativity, Lorenz transformation, relative velocity, length contraction, time dilation mass-energy relation, photo-electric effect, Compton effect, de Broglie wave, Bohr's atomic model, radioactive decay, half-life, mean life, isotopes, nuclear binding energy, alpha, beta, gamma decay.

Phy 103: Waves & Oscillations, Geometrical Optics and Wave Mechanics (3 credit hours)

Waves & oscillations: differential equation of a simple harmonic oscillator, total energy and average energy, combination of simple harmonic oscillations, Lissajous figures, spring- mass system, calculation of time period of torsional pendulum, damped oscillation, determination of damping co-efficient, forced oscillation, resonance, two-body oscillation, reduced mass, differential equation of a progressive wave, power and intensity of wave motion, stationary wave, group velocity and phase velocity, architectural acoustics, reverberation and Sabine's formula.

Geometrical optics: combination of lenses: equivalent lens and equivalent focal length, cardinal points of a lens, power of a lens: defects of images: spherical aberration, astigmatism, coma, distortion, curvature, chromatic aberration, optical instruments, compound microscope, polarizing microscope, resolving power of a microscope, camera and photographic techniques.

Waves mechanics: principles of statistical physics, probabilities, classical statistics, quantum statistics, base-Einstein statistics, Fermi-direct statistics and their application, fundamental postulates of wave mechanics, time dependent Schrödinger equation, Schrödinger equation for one-electron atom and its solution.

Reflection, transmission and intensity of sound waves, variation of sound intensity with distance, units of sound intensity: decibel and other units, Doppler's principle.

Light: illumination and photometry, luminous intensity, their measurements and units, phosphorescence, fluorescence, discharge lamps, theories of light: interference: Young's double slit experiment, determination of thickness of a film, diffraction: diffraction due to a single slit, polarization: different methods of polarization, intensity of polarized light.

Heat: humidity, vapor pressure, temperature related humidity, transmission of heat: conduction, conductivity, rectilinear flow of heat, determination of thermo-conductivity of good and bad conductors, heat flow through compound walls, convection, free and forced convection, domestic and industrial applications, ventilation, radiation, different laws of radiation, black body radiation, radiation from surfaces, solar radiation.

Phy 104: Physics Sessional (1.5 credit hours)

Sessional based on Phy 101 and Phy 103.

Chem 107: Chemistry (3 credit hours)

Modern concepts of atomic structure, advanced concepts of bonds and molecular structure, crystal structures, modern periodic table, chemistry of transition metals, properties and uses of noble gases, acids and bases, chemistry of solutions, properties of dilute solutions, chemical equilibrium, thermo chemistry, electrochemical cells, ionization of water and ph, chemical kinetics, phase rule and phase diagrams, selected topics on organic chemistry, introduction to organic polymer, basic concepts of dyes color and constitution.

Chem 108: Inorganic Quantitative Analysis Sessional (1.5 credit hours)

Volumetric analysis: volumetric analysis: acidimetry-alkalimetry, titrations involving redox reactions, determination of Cu, Fe and Ca volumetrically, complexometric titration, determination of Ca, Mg in water.

Hum 101: Sociology and Technology (3 credit hours)

Scope: some basic concepts, social evolution and techniques of production, cultural and civilization, social structure of Bangladesh, population and world resources, oriental and occidental societies, industrial revolution, family-urbanization and industrialization, urban ecology, co-operative and socialist movements, rural sociology.

Relationship between Technology and Society, Technology, rationality and science, Historical perspective of Technology, Social perspective of Technology, Social Complexity and Technology, Technology and the Human Body, Globalization and Human Rights, Biomedical Technology

Hum 186: English Languages Practice Sessional (1.5 credit hours)

English phonetic: ways of correct English pronunciation, dialogue: improving speaking skill, composition: spoken composition on general topics, vocabulary: improving stock of words,

listening comprehension: improving listening skill through audio-visual methods, correspondence: business communication including writing for mass media.

Report writing: writing technical report on different topics.

Hum 301: Fundamental of Economics (3 credit hours)

Introduction to economics, economics and engineering, different economic systems, fundamental economic problems, basic elements of demand, supply and product market, theory of utility and preferences, consumer's surplus, theory of production and cost, theory of the firm and market structure , optimization.

Introducing macroeconomics, national income accounting, the simple Keynesian analysis of national income, employment and inflation, savings, investment and decision making, fiscal policy and monetary policy, money and interest rate, income and spending.

Economics of development and planning.

CSE 181: Computer Programming Techniques (3 credit hours)

Introduction to number system: binary, octal, hexadecimal, binary arithmetic, basic programming concepts, program development stages: flow charts, pseudo codes, programming constructs: data types, operators, expressions, statement, control statements, single dimensional arrays, functions and program structure: parameter passing conventions, scope rules, recursion, library functions, pointers, strings, multidimensional arrays, user defined data types: structures, unions, enumerations, input and output: standard input and output, formatted input and output, file access, command line parameters.

CSE 182: Computer Programming Techniques Sessional (1.5 credit hours)

Sessional work based on course CSE 181 using C programming language.

EECE 171: Basic Electrical and Electronic Circuit (4 credit hours)

Direct current circuits: laws and theorems, DC network analysis, alternating current: AC quantities and sinusoidal waveforms, phasors, AC circuit analysis: series and parallel branches-RL, RC, and RLC balanced three-phase circuits. Semiconductor diode: operation, characteristics and applications, introduction to bipolar junction transistors (BJTs), characteristic, common-emitter (CE), common-base (CB), common-collector (CC), and amplifier configurations.

EECE 172: Basic Electrical and Electronic Circuit Sessional (1.5 credit hours)

Laboratory experiments based on EECE 171.

EECE 271: Electrical Machines and Electronics (3 credit hours)

Single phase transformer, DC motor: principle and applications, three phase induction motor: principle and applications, introduction to synchronous motors and fractional horse power motors.

Introduction to operational amplifiers (OP-AMPs) and applications, silicon controlled rectifiers (SCR): operation and characteristics, power control using SCR, transducers: strain, temperature, pressure, speed and torque measurements.

EECE 272: Electrical Machines and Electronics Sessional (1.5 credit hours)

Laboratory experiments based on EECE 271.

ME 160: Mechanical Engineering Drawing (1.5 credit hours)

Introduction: instruments and their uses, first and third angle projections, orthographic drawings, isometric views, missing lines and views, sectional views and conventional practices, auxiliary views.

ME 231: Engineering Materials (4 credit hours)

Properties of metals, ceramics and polymers, processing of materials from liquid, solid and paste, choosing materials for products, atomic, molecular, crystalline and amorphous structures for metals, ceramic and polymers, elastic and plastic behavior of materials in service: fracture, ductile-brittle transition, fatigue, creep, oxidation and degradation, corrosion and corrosion protection, materials as mixtures of elements: mixtures nears and far from equilibrium, phase diagrams, phase changes, non-ferrous metals: production and uses, iron and steel production: production and uses: types of cast iron, effects of impurities, plain carbon steel: the iron-iron carbide phase diagram, constituents and structures of plain carbon steels, head treatment of steels, alloy steels: principles and effects of alloying, different alloy steels and their uses.

Polymers: structure and properties of polymers and copolymers, thermoplastics and thermo sets; composites: theory of composites, fabrication structure and uses of different types of composites, properties of composites

ME 232: Engineering Materials Sessional (1.5 credit hours)

Sessional work based on course ME 231

ME 243: Mechanics of Solids (3 credit hours)

Stress analysis: statically indeterminate axially loaded member, axially loaded member, thermal and centrifugal stresses, stresses in thin and thick walled cylinders and spheres.

Beams: shear force and bending moment diagrams, various types of stresses in beams: flexure formula, deflection 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: principle stress, Mohr's circle, columns: Euler's formula, intermediate column formulas, the secant formula, flexure formula of curved beams.

Introduction to experiment stress analysis techniques, stain energy, failure theories.

ME 244: Mechanics of Solids Sessional (0.75 credit hours)

Sessional based on ME 243.

ME 251: Thermodynamics and Heat Transfer (3 credit hours)

Basic concepts and definitions: sources of energy: conventional and renewable, thermodynamics: fundamental concepts and laws, non-flow and flow processes, thermodynamic cycles, introduction to: steam generating units, internal combustion engines, steam turbines, gas turbines, refrigeration and air conditioning systems.

Introduction to heat transfer, modes of heat transfer, study and unsteady state heat conduction and radiation head transfer, convection heat transfer, natural and forced convection, heat exchangers.

ME 252: Thermodynamics and Heat Transfer Sessional (1.5 credit hours)

Based on ME 251.

ME 271: Engineering Mechanics and Theory of Machines (3 credit hours)

Basic concepts of mechanics, force in trusses and frames, friction, centroids and moment of inertia, kinetics of particles and rigid bodies.

Mechanisms: displacement, velocity and acceleration, static and dynamic balancing of rotating components. under damped and damped free vibration of one and two degrees of freedom, forced vibrations, whirling of shafts and rotors, power transmission by ropes, bells chains, gears and gear trains, study of cams.

ME 351: Fluid Mechanics and Machinery (3 credit hours)

Fluid properties, fluid statics, basic hydrostatic equation, manometer, pressure variation in static incompressible and compressible fluids.

One dimensional flow of fluid: equation of continuity, Bernoulli's equation, fluid flow measurements, real fluid flow, frictional losses in pipes and fittings.

ME 352: Fluid Mechanics and Machinery Sessional (1.5 credit hours)

Sessional based on ME 351.

5.3 OPTIONAL COURSES FOR IPE STUDENTS

IPE 415: CNC Machine Tools (3 credit hours)

CNC concepts: hardware, input-output systems and interfacing in CNC machine tools. Principles of CNC machine tool elements: actuators, feedback devices, interpolators, machine control unit, micro-electro-mechanical devices. Control systems of CNC machine tools: point-to-point system, contouring system, adaptive control.

Case-study of a CNC machine tool.

IPE 419: Computer-Integrated Manufacturing (3 credits hours)

Role of computers in manufacturing, computer aided process planning, hardware, and software components of computer automations: PLC, robots and software: automated material handling and storage systems, computer control of manufacturing systems, flexible manufacturing system, and factory of the future.

IPE 421: Modern Machinery and Machining Processes (3 credits hours)

Modern machining processes: ultrasonic machining, abrasive jet machining, abrasive flow machining, orbital grinding, water jet cutting, electrochemical machining, electrical discharge machining, electron beam machining, LASER beam machining, plasma arc machining, chemical machining, working principles of the related machines.

IPE 425: Micro-Manufacturing (3 credits hours)

Micro elements: design and fabrication, basics of micro-fabrication technology: thin film growth and deposition, photolithography, X-ray, lithography, wet and dry chemical etching, electrochemical machining, ultrasonic machining, plasma machining and LASER machining.

IPE 427: Marketing Management (3 credits hours)

Marketing concepts: market orientation, relationship marketing, market segmentation and measurement, buyer behavior, marketing planning and budgeting.

Concept of marketing mix: product, price, place and promotion, Strategic and tactical decisions, new product planning processes, global marketing, case studies.

IPE 429: Technology Management (3 credits hours)

Introduction to technology, growth of technology, types and components of technology: technology and environment, technology forecasting, technology assessment, transfer of technology, technological development and planning.

IPE 445: Entrepreneurship Development and Micro Industries (3 credits hours)

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.

IPE 453: Information Technology in Business (3 credit hours)

Introduction to IT, scope and importance of IT in businesses and management, e-Commerce, m-Commerce, database management system: management information system (MIS), project management, networking architectures: LAN, WAN, internet, intranet, extranet, Wi-Fi, Wi-Max, networking equipment, security issues in data management and networking, current trends

IPE 461: Organizational Behavior (3 credits hours)

Behavior of individuals in organizations: values and attitudes, motivation, group and group processes: group dynamics, communication, power & conflict, organizational system: structure, job design, appraisal of performance, processes of organizational change and development.

IPE 463: Total Quality Management (3 credits hours)

TQM definition, origins and growth of TQM, benefits of TQM, philosophies of TQM: quality circle approach, Deming's approach, Juran's approach, Philip Crosby's approach.

Planned implementation of TQM: planning and commitment, participation, continuous improvement.

IPE 465: Intelligent Manufacturing (3 credits hours)

AI Technologies and expert system: components and features, knowledge system, knowledge engineer, domain expert, knowledge engineering languages. Artificial neural network and fuzzy logic.

Expert manufacturing systems: CIM, manufacturing communication system and intelligent manufacturing, flexible manufacturing system, case study of EMS.

IPE 467: Energy Management (3 credits hours)

Energy systems: commercial-noncommercial, rural-urban, renewable-no-renewable energy, energy planning, energy generation and distribution systems management, generation mix, dispatch system energy policy: national energy policy and tariff policy.

ME 447: Robotics (3 credit hours)

Introduction to robotics, definitions, plane, rotational and spatial motion with applications to manipulators, geometric configurations: structural elements, linkages, arms and grippers, kinematics of manipulators, motion characteristics, trajectories, dynamics and control of manipulators, actuators and sensors for manipulators, application of industrial robots and

programming, Tele operators, mobile robots and automated guided vehicles, special purpose robots.

ME 461: Control Engineering (3 credit hours)

Introduction to control systems and their representation by different equations and Laplace transformations, block diagrams and transfer functions, analog computer solution of system equations, system response, control action, and system types, frequency response, system analysis, system compensation, analogues of control systems, hydraulic and pneumatic control systems, elements of electromechanical controls, introduction to digital computer control.

CSE 443: Digital Logic and Microprocessor Technology (3 credits)

Logic gates, flip-flops, counters, registers, memory systems, A/D and D/A Converters, multiplexers and DE multiplexers, address memory, control unit, digital system design, introduction to different types of microprocessors, microprocessor architecture, instruction set, I/O operations, interrupt structure, interfacing & interfacing ICs, micro-processor based system design.

5.4 COURSES OFFERED TO UNDERGRADUATE STUDENTS OF OTHER DEPARTMENTS

IPE 331: Production Process (4 credit hours)

Selection of Machining Processes.

Casting: sand, dies, centrifugal and other types of casting, casting design and casting defects. Chipless metal forming process: different types of hot and cold working processes. Welding: Arc, gas, TIG, MIG, resistance, thermit, and special types, brazing and soldering.

Tool geometry and chip formation processes.

Metal removing processes: turning, drilling, shaping, planning, milling, broaching, grinding, precision and non-precision finishing processes.

IPE 332: Production Process Sessional (0.75 credit hours)

Experiments based on IPE 331.

IPE 381: Measurement and Quality Control (3 credit hours)

Organization of inspection kinds of inspection, standards of length, scope and techniques for maintaining tolerances, grades of manufacturing accuracy, assembly selective and interchangeable assembly, gauging and limit gauges, Abbey's principle, measuring tools for angles and tapers, instruments for checking straightness and flatness and for alignment test, gear measurement of surface finish, surface roughness, electrical and electronic measurements, nondestructive test.

Frequency distribution, measures of central tendency and dispersion, concept of probability, conditional and Bayes' Theorem, probability distributions, moment and moment generating function, sampling theory, estimation hypothesis testing, acceptance sampling plans-single, double, sequential, rectifying inspection plans, control charts, S, R and C charts, regression analysis, analysis of variance, concepts of quality circle, TQM and TQC.

IPE 382: Measurement and Quality Control Sessional (0.75 credit hours)

Experiments based on IPE 381.

IPE 431: Machine Tools (3 credit hours)

Mechanical, electrical hydraulic and pneumatic drives in machine tools, bearings, slide ways, structure and control of machine tools, detailed case study of engine lathe, turret lathe, milling machine, grinding machine and gear shaping machine. Installation and acceptance tests of machine tools. Locating principles and locators, clamps, dies, Jigs/fixtures.

IPE 432: Machine Tools Sessional (0.75 credit hours)

Experimental based on IPE 431.

IPE 433: Metal Cutting Process (3 credit hours)

Theory of metal cutting: mechanism of chip formation, chip breaker, chip-tool contact process, type of chip.

Tool materials, tool design and manufacturing. Theoretical and experimental determination of cutting forces, heat phenomenon, cutting fluid, tools wear and tool life, economics of metal cutting. Gear and thread manufacturing processes.

IPE 435: Modern Manufacturing Technology (3 credit hours)

Introduction to modern manufacturing technology.

Modern manufacturing processes, electro-discharge machining (EDM), electro-chemical machining (ECM), electron-beam (EBM), LASER-beam machining (LBM), ultrasonic machining (USM), plasma are machining (PAM), abrasive jet machining (AJM) and related machines.

Protective coatings and hard facing, Modern welding processes.

Automatic and semi-automatic machine tools and automatic transfer lines.

Introduction to NC, CNC and DNC.

IPE 437: CAD/CAM (3 credit hours)

CAD: fundamental concepts, application, benefits, hardware and software, types of CAD systems, common 2D CAD software features, basic 3D CAD features.

CAM: fundamental concepts, trend of development of numerical control (NC), principles of NC, types of NC systems, types of NC machines, CNC (manual) part programming, CNC part programming using CAM software, interfacing CAM software with CNC machines, computer aided machining.

IPE 479: Engineering Management (3 credit hours)

Management: evolution of management thought, classical quantitative and behavioral schools, interactions schools, interactions between organizations and their environment. Management principles, management functions, the management team, management by objectives. Organizational structures, co-ordinations and spans of control, the informal organization, authority delegation and decentralization, groups and committees, managing organizational change and conflict. Motivation, performance satisfaction, leadership, training, incentive systems, performance appraisal. Quantitative techniques in management decision, decision making process, optimization techniques, and their applications to industrial problems.

Financial management, budgetary control, cost management and control, investment schedule, criterion of investment.

Operations management: types of production; forecasting, inventory management, scheduling, maintenance management, quality management, layout planning, management information system.

IPE 481: Industrial Management (4 credit hours)

Organization and management evolution, management functions, organization structure, development of organization theory, study of various types of organization and management information system, concepts and scope of applications. Cost management elements of cost of products, cost centers and allocation of overhead costs, management accounting: marginal costing, standard costing, cost planning and control, budget and budgetary control, development and planning process, annual development plan, national budget.

Financial management: objectives, strategy, financing, performance analysis of enterprises, investment appraisal, criteria of investment.

Personnel management: importance, scope, need hierarchy, motivation, defense mechanism, productivity and satisfaction, leadership, group dynamics, job evaluation and merit rating personnel development-hiring, training, wage systems.

Marketing management: marketing concept, marketing organization, industrial and consumer selling, channel decisions, advertising decisions, and new product strategy.

Technology management.

Case study.

IPE 483: Production Planning Control (3 credit hours)

Elements of production planning and control, types of production system.

Forecasting methods and their application, aggregate planning, master production scheduling, MRP, coding and standardization, capacity planning, inventory management, ABC analysis, production scheduling techniques, CPM and PERT, line balancing capacity planning, plant location and layout, work study and method study, plant performance measurement introduction to product development and design.

Computers in production planning and control and MRPII, JIT.

IPE 485: Operations Research (3 credit hours)

Introduction, linear programming (simplex and transportation model), Network analysis dynamic programming, introduction to simple queuing models, introduction to probabilistic inventory models, game and decision theory, simulation integer programming, scheduling, and reliability.

IPE 487: Material Handling (3 credit hours)

Material handling importance and scope of material handling, classification of materials, unit load and bulk loads, analysis of material handling problems, system concept, selection and classification of conveying equipment, efficiency of material handling systems, general theory of conveyors, computer control material handling (AGV, ASRS etc.), description and design of belt, chain, screw, pneumatic and hydraulic conveyors, operation and selection of industrial truck loads.

Packaging: packaging materials, layout for packaging.

Testing procedure of packages: vibration test, drop test, performance limit and testing machines.

Storage and warehousing sorting, warehousing.

IPE 489: Engineering Management (4 credit hours)

Management: evolution of management thought, classical quantitative and behavioral schools, interactions schools, interactions between organizations and their environment. Management principles, management functions, the management team, management by objectives. Organizational structures, co-ordinations and spans of control, the informal organization, authority delegation and decentralization, groups and committees, managing organizational change and conflict. Motivation, performance satisfaction, leadership, training, incentive systems, performance appraisal. Quantitative techniques in management decision, decision making process, optimization techniques, and their applications to industrial problems.

Financial management, budgetary control, cost management and control, investment schedule, criterion of investment.

Operations management: types of production; forecasting, inventory management, scheduling, maintenance management, quality management, layout planning, management information system.

Project management.

Marketing management: concepts, sales and marketing strategies.

Case studies.

IPE 491: Engineering Management (3 credit hours)

Introduction: evaluation and various thoughts of management principles, need functions, organization and environment.

Organization: theory and structure, coordination, span of control, authority delegation, groups, committee and task force, manpower planning.

Personnel management: need hierarchy, motivation, leadership, performance appraisal, wages and incentives, informal group, organizational planning change and conflict.

Operations management: types of production, forecasting, inventory control, scheduling, maintenance management, using conventional and analytical techniques, safety management, quality management, manages of performance, work measurement, management information System, location and layout of plant need facilities.

Cost and financial management: elements of costs of products, depreciation, break-even analysis, investment analysis, budgetary control, benefit-cost ratio.

Marketing management: concepts, sales and marketing strategies, patents laws.

Technology management: management of innovation and changes, technology life cycle, Hi-tech management.

Case studies.

IPE 493: Industrial Management (3 credit hours)

Management functions and organization: Evolution, management function: organization, theory and structure, span of control, authority delegation, manpower planning.

Personnel management: importance, need hierarchy, motivation, leadership, wage incentives, performance appraisal, participative management.

Operation management: production planning and control (PPC) functions, quantitative methods applied in production, quality management, location and layout planning safety and loss management.

Cost and financial management: elements of cost of products, cost analysis, investment analysis, benefit-cost analysis, risk analysis.

Management accounting: cost planning and control, budget and budgetary control.

Marketing management: concepts, strategy, sales promotion, patent laws.

Technology management: management of innovation and changes, technology life cycle.

Case studies.