Military **I**nstitute of **S**cience and **T**echnology (**MIST**)

(New syllabus applicable for L-IT-I of Session 2017-18 and onward)

Second Edition

Department of Industrial and Production Engineering
July, 2017

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DISCLAIMER

PREFACE

The information booklet for undergraduate students, in its second edition, has published the modified and updated new course curriculum for undergraduate studies of Industrial and Production Engineering in MIST. This curriculum was passed by the academic council of MIST in its 54th meeting held on 27.07.2017.

Efforts have been made to change the course after a long time. This new content is applicable from the session 2017-2018. Along with this new syllabus the old syllabus will be running simultaneously till the graduation of the students of session 20016-2017.

The purpose of the booklet is to incorporate the information that an undergraduate student of the department and his/her advisor may need to know for carrying out their academic activities.

Various aspects of the course system, in addition to their credit hour requirements, detail course outline and courses offered in different terms by the department are introduced.

As with the practice of any course system, it is likely that some of the rules and regulations mentioned in this booklet may be modified in the future.

Students are, therefore, strongly advised to be in touch with their advisors regarding modifications that may be introduced. Students may clarify any confusion regarding the contents of the booklet with their respective advisors, or any member of the department

It is hoped that the information booklet will be of much use of the undergraduate students of the Department of Industrial & Production Engineering

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Editors

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Chapter 1

PREAMBLE

1.1 History of the Institute

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), Khulna University of Engineering and Technology (KUET), Rajshahi University of Engineering and Technology (RUET), Chittagong University of Engineering and Technology (CUET) 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) have started their journey to fulfill the motto of MIST.

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.

1.2 Academic Activities

Undergraduate courses in the faculty of Civil Engineering, Electrical & Electronic Engineering and Mechanical Engineering extend over four years and lead to B.Sc. 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 are offered by the Institute.

Postgraduate studies and research works are the other primary functions of the university. Most of the departments like Computer
Engineering, Electrical, Electronic and Communication Engineering, Civil Engineering, Mechanical Engineering, Aeronautical Engineering, Science and Humanities, Biomedical Engineering offer M.Sc. Engineering and M. Engg. degrees and some of these departments also have Ph.D. programmes.

1.3 Faculties and Departments

Faculty of Mechanical Engineering	
Department of Mechanical Engineering	UG & PG
Department of Aeronautical Engineering	UG & PG
Department of Naval Architecture and Marine Engineering	UG only
Department of Industrial and Production Engineering	UG only
Faculty of Civil Engineering	
Department of Civil Engineering	UG & PG
Department of Civil, Environment, Water Resource and Coastal Engineering	UG only
Department of Architecture	UG only
Department of Petroleum and Mining Engineering	UG only
Faculty of Science and Engineering	
Department of Science and Humanities	PG only
Department of Biomedical Engineering	UG & PG
Department of Nuclear Science and Engineering	UG only
Faculty of Electrical and Computer Engineering	
Department of Electrical, Electronic and Communication Engineering	UG & PG
Department of Computer Science and Engineering	UG & PG

1.4 MIST Teachers and Administration

Commandant	Maj Gen Md. Abul Khair, ndc

List of administrative Officers

Director of R & D (SI, CE Dept)	Brig Gen Md Abdul Wohab, ndc
Director of Admin	Col M Mahmudul Hassan
Director of Student Welfare (DSW)	Brig Gen Md Khalil-Ur-Rahman, psc, te
Director ICT	Colonel Abu Zafor Mohammad Salahuddin

Deans of Faculties

Dean Faculty of Electrical and Computer Engineering	Brig General Md Shohail Hossain Khan, psc
Dean Faculty of Civil Engineering	Brig General K M Salzar Hossain, ndc, psc
Dean Faculty of Science and Engineering	Col Nazrul Islam, PBGM
Dean Faculty of Mechanical Engineering	Cdre M Munir Hassan (E), BN

Chapter 2

DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING (IPE)

2.1 About the Department

Industrial and production Engineering (IPE) department was established 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 syllabus is prepared based on BAETE manual -2017 and focused on Outcome Based Education (OBE) conforming to the Washington accord (WA).Whether Industrial and Production engineers are manufacturing superior automobiles, shortening a roller coaster line, streamlining an operating room, or distributing products worldwide, these challenges concentrate on the common goal of saving companies' money and increasing efficiencies.

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.

Improvising a stereotypical under-graduate course on Industrial & Production Engineering emphasizes on manufacturing and improvement of productivity, our students will also learn the trends of dynamics and control and hence will develop a sound knowledge about overall industrial production and management systems. He/she will also learn to analyze the emerging technological trends of the industry

2.2 Faculty Members

Col. M Mustafa Kamal	B.Sc. Engg. (Mech), M. Engg (Mech)
Lt. Col. A K M Khabirul Islam, EME	B.Sc. Engg. (Mech), M. Engg (IPE)
Capt. Ismat Ara,EME	B.Sc. Engg. (Mech)
Asst. Prof. Tanmoy Das	B.Sc. Engg. (IPE), M. Engg (USA)
Lec. Nadia Tanzeem	B.Sc. Engg. (IPE)
Lec. Nighat Afroz Chowdhury	B.Sc. Engg. (IPE)
Lec. Ashfaqur Arefin	B.Sc. Engg. (IPE)
Lec. Saiara Samira Sajid	B.Sc. Engg. (IPE)

2.3 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. Ergonomics & Safety Lab

The laboratory is planned to serve the need of optimized work design centers around two basic components; namely, workplace layout and method engineering. Relevant knowledge and expertise needed by an IPE graduate cannot be exaggerated in the context of the demands of present day world. In workplace layout practices, ergonomic principles dictate the terms while in method engineering, a traditional discipline dealing with analysis and synthesis of man machine interaction leads to the optimized utilization of human resources and facilities.

2. Material Handling & Maintenance lab

In the Material Handling Laboratory students get a broad idea about the flow of materials and plant layout in a manufacturing facility. They also get familiarized with the material handling equipment and learn the working principles of this equipment. The laboratory is equipped with Screw conveyors, Belt conveyors, Roller Conveyors and different types of raw materials that are used in a manufacturing plant. This laboratory serves the purpose

of making students learn with the essence of working in a real industrial environment and give them a practical experience to design a custom material handling system for any industry.

3. Simulation Lab

Simulation is done to verify the performances, identify the possible configuration and parameter values of a system. Computers and software for simulation of complex systems of manufacturing and services are used in this laboratory

4. Metrology lab

The Metrology Laboratory serves the students in acquiring profound knowledge of different measuring instruments and measurement processes. They also work with real life case study on quality control like sampling and finding the most crucial quality factors in a manufacturing environment. The laboratory is equipped with most advanced prototypes and measuring equipment like robots for industrial automation, super micrometer etc

5. Machine Tools Lab

For any discrete manufacturing practice, in piece or batch production, machine tools are indispensable. The laboratory serves the students in acquiring profound knowledge about different types of machines and manufacturing processes. The machine tools laboratory is equipped with machine tools such as CNC Lathe, Injection Molding, Engine Lathe, Shaper, Milling, Surface Grinding, Turret Lathe, Drill and Gear Shaper.

6. CAD Lab

This laboratory aims to teach the students extensively about simulation software (ARENA), different types of designing software (AutoCAD, Solid Works, CATIA), Finite Element Analysis software (ANSYS) and programming language. The laboratory is equipped with modern computers, multimedia projector and high speed internet connections.

7. Instrumentation & Control Lab

This laboratory consists of basic equipment like precision dimensional measuring equipment which can measure length, angles, surface profile, texture and roundness. The laboratory is facilitated with various gauges and surface profile measuring instrument. Students are expected to learn about the use of the modern instruments and to thoroughly understand and identify the sources of error in measurements

8. Measurement and Quality Control lab

This lab focuses on measuring various system parameters and defining the condition of the process. In this lab students are to solve various real life production problems and provide solution to them using different types of software like Minitab, MS excel etc.

2.4 Research

The department possesses a strong research base. The faculty members are actively involved in different research works. The major thrust of research are in the areas of CAD/CAM, CIM, New Materials and Processing, Operations Research, Intelligent Manufacturing, Advanced Quality Management, Facility Planning, Rapid Prototyping, Technology Management, MRP, ERP, Supply Chain Management, Production Planning and Control, Inventory Management, Maintenance Management, Marketing Management, Industrial Environment Management and Optimization Software Development. The department is planning for joint research established linkage with the industry and science organization.

2.5 Industrial Tour

Department emphasizes the importance of practical knowledge gained through various industrial tours and visits. These types of visits are well planned and structured so that the students are adequately exposed to the real industrial environment. Students are sent to different industries such as Bangladesh Machine Tools Factory, BITAC etc. to conduct their laboratory works from the department.

2.6 Industrial Practice

The course curriculum of IPE department contains one 2-credit hours course titled "Industrial Practice". For this course, the students have to undertake 4 weeks of industrial attachment. During this period, the students will be actively involved in the activities of the industry. At the end of the course their performance will be evaluated jointly by the academic supervisors and industry supervisors.

Chapter 3

RULES AND REGULATIONS FOR UNDERGRADUATE PROGRAM AS PER COURSE SYSTEM INTRODUCTION

The Course System

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.

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.

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.

Number of Terms in a Year

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

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.

Duration of Terms

The duration of each of Term I and Term II (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

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:

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

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.

Course Designation System

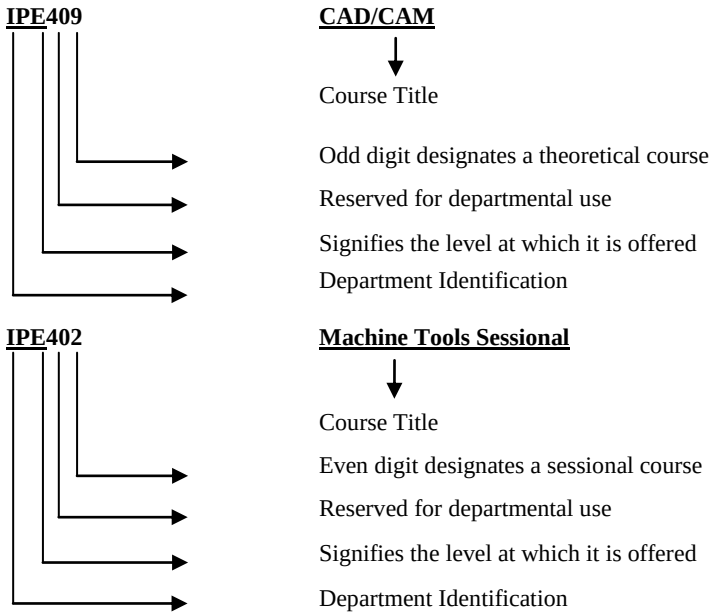
Each course is designated by a maximum of three/four letter code identifying the department offering the course followed by a three-digit number having the following interpretation:

a. The first digit corresponds to the year/level in which the course is normally taken by the students.

b. The second digit is reserved for departmental use. It usually identifies a specific area/group of study within the department.

c. The last digit is an odd number for theoretical courses and an even number for sessional courses.

The course designation system is illustrated as Follows:



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.

Types of Courses

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

a. 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 all the designated core courses of his/her discipline.

b. Prerequisite Courses: Some of the core courses are identified as prerequisite courses for a specific subject.

c. Optional Courses: 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.

Course Offering and Instruction

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.

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.

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.

Student Adviser

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.

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.

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.

Course Registration

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.

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.

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.

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.

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.

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 Comdt, 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.

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.

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.

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).

Distribution of Marks

Theory. Thirty percent (30%) 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. This 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 classes. Distribution of marks for a given course per credit is as follows:

Class Participation/Observation	5%
Class Attendance	5%
Homework assignment/Quizzes/CTs	20%
Final Examination (Section A & B)	70%
Total	**100%**

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 Attendance	5
b.	Class performance/observation	5
c.	Lab Test/Report Writing/project work/Assignment	50
d.	Quiz Test	30
e.	Viva Voce	10
	Total	**100%**

Sessional Course in English. The distribution will be as under:

a.	Class Attendance	5
b.	Class performance/observation	5
c.	Written Assignment	15
d.	Oral Performance	25
e.	Listening Skill	10
f.	Group Presentation	30
g.	Viva Voce	10
	Total	**100%**

Basis for awarding marks for class attendance.

This will be as follows:

	Marks
90% and above	100%
85% to less than 90%	80%
80% to less than 85%	60%
75% to less than 80%	40%
Below 75%	0%

Collegiate and Non-collegiate

Students having class attendance of 90% or above in individual subject will be treated as collegiate and less than 90% and up to 75% 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 75% will be treated as dis-collegiate and will not be allowed to appear in the examination and treated as fail. 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.

Calculation of CGPA

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 C1, C2, ..., Cn and his grade points in these courses are G1, G2, ...Gn respectively, then

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

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

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

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 TC1, TC2, ... , TCn and his GPA in these terms are GPA1, GPA2,... , GPAn, respectively then

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

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	10.5
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	5.625
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**			70.5

$$\boldsymbol{GPA} = \frac{\mathbf{70.5}}{\mathbf{20.25}} = \mathbf{3.48}$$

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**

$$\boldsymbol{CGPA = \frac{318.105}{81.50} = 3.90}$$

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 Architecture is 2.20.

Impacts of Grade Earned

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.

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.

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.

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.

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.

Classification of Students

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/URP	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

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

a. **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.

b. **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.

c. **Category 3:** This category consists 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.

Definition of Graduating Student. Graduating students are those students who will have ≤ 24 credit hour for completing the degree requirement.

Performance Evaluation

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.

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.

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.

Rules for Self-Study Courses

A self-study course is among the regular courses listed in the course catalog. This type of course is offered only in exceptional cases. The following rules are applicable to all self study courses:

a. Whether a course is to be floated as a self study course will be decided by the Head of the concerned department in consultation with the teacher/course coordinator concerned. Such a decision also has to be reported to the Academic Council.

b. A self study course may be offered in a particular term only if the course is not running in that term as a regular course.

c. The self study course is offered to a student in his/her graduating term if it helps him/her to graduate in that term.

d. A student is allowed to register for a maximum of two theory courses on a self-study basis.

e. Students should have 75% class attendance.

f. Normally no lecture will be delivered for a self study course but laboratory/design classes may be held if they form part of a course.

g. The course coordinator/course teacher will assign homework, administer quizzes, and final examination for giving assessments at the end of the term.

h. No Laboratory/Sessional Course can be taken as self study course.

Rules for Courses Offered in Short Term

A Short Term course will be conducted after one week of completion of Term II Final Examination in each year. The following rules are applicable to Short Term courses:

a. The courses to be run during the short term shall be decided on the recommendations of departments on the basis of essential deficiencies to be made up by a group of students. Once floated, other students could be allowed to register in those courses subject to the capacity constraints and satisfaction of prerequisites.

b. Student will be allowed to register in a maximum of three theory courses during the Short Term.

c. Graduating students may register for Short Term examinations after finalization of result of Term 2 final examination.

d. A certain fee for each credit hour to be registered to be borne by the students who enroll during Short Term.

Minimum Earned Credit and GPA Requirement for Obtaining Degree

Minimum credit hour requirements for the award of bachelor's degree in engineering (BSc. Engg) and architecture (B. Arch.) will be decided by the respective department (BUGS). However, at least 157 credit hours for engineering and 189 credit hours for architecture must be earned to be eligible for graduation, and this must include the specified core courses. The minimum GPA requirement for obtaining a Bachelor's degree in engineering and architecture is 2.20.

A student may take additional courses with the consent of his/her Adviser in order to raise GPA, but he/she may take a maximum of 15 such additional credits in engineering and 18 such additional credits in architecture beyond respective credit-hour requirements for Bachelor's degree during his/her entire period of study.

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.

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.

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.

Teacher-Student Interaction

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.

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).

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.

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. **Short Term Examination:** Short Term may be conducted after one week completion of Term 2 final examination. Students will be allowed to take maximum three theoretical courses in the Short Term. Examination will be conducted at the end of Short Term (6^{th} week class). However, Head

of concerned department with the approval of Commandant may decide to take Supplementary examination instead of Short Term. No Laboratory/Sessional Courses can be taken in short term.

c. **Supplementary Examination:** It will take place once in a year, after each term-I final break. It should be completed within first 3 weeks of a new term. Students will be allowed to appear this examination for one subject at a time. Graduating students will be allowed to appear maximum two subjects during supplementary examination in their last Term. However, Head of the concerned department with the approval of Commandant may decide to take another Supplementary Examination instead of Short Term. In that case, a student will be allowed to take only one failed course in the particular Supplementary Examination. This examination will be conducted in the previous week of the beginning of Term I. Highest achieved grade for all courses of Supplementary Examination will be B+.

d. **Improvement Examination:** It will be taken during supplementary and short term examination. Questions will be same as the question of the regular examination of that Short Term Final Examination (if any). Student can take two subject at a time 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.

e. **Self-Study Course Examination:** Only graduating students (level-4) will be allowed to appear at Self Study course examination. It will be taken with Term Final Examination. No regular class will be arranged for this, but teachers will be assigned for supervising and guiding the students for study,

conducting class test/quiz and regular assessment for 30% marks. Maximum two theory courses may be taken as self-study course by a student. Highest achieved grade for these courses will be B+. In that case a student will be allowed to take maximum 24 credit instead of 15 in the last Term of his/her graduation.

f. **Special Referred Examination:** Since course system will start from 1st Term of 2018, for all casualty cases like referred, backlog, failed courses, level repeat students will be given chance to clear their respective all failed courses by appearing in this examination. It will be held after the confirmation of the result of Term-II Final Examination of 2017 and before starting of the class of the Term-I of 2018. Students of all levels, failed in any courses even after appearing in Special Referred Examination-1, will be allowed to re-appear again in the failed courses during Special Referred Examination-2 to be held during Mid Term break of Term-1 of 2018. Student of Level-4 of 2017, failed in any courses even after appearing in these two referred examinations, will be allowed to clear failed courses as a last chance, during Term-1 final examination of 2018 (as a Special Referred Examination-3). Students of other levels, failed in any courses even after appearing in two Special Referred Examinations, will be allowed to clear these failed courses as per normal rules of course system (either by retaking these courses or appearing at the supplementary Examination). Highest grade for courses in all these examinations will be 'B+'.

Rules of Different Examinations

Term Final Examination.

Following rules to be followed:

a. Registration to be completed before commencement of the class. 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 one week 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.

Short Term Examination. Following rules to be followed:

a. Short Term for period of 6 weeks may be offered by a department after one week of completion of Term II Final Examination.

b. Short Term Final Examination is to be conducted on 7th week of Short Term.

c. Only repeat course can be offered, not any fresh course.

d. Classes will be arranged for the students who register a failed course in the Short Term.

e. After 6 (six) weeks of class, in the 7th week short Term Examination will be held. Academic calendar for this Short Term will be declared by the Department during the Mid-Term break of Term-II.

f. One student can take only three (failed/improvement) courses at a time in the Short Term.

g. Students will have to complete registration of course for Short Term by paying all the fees, before starting of the Term-II final Exam.

h. Graduating students may register for Short Term examinations after finalization of result of T 2 final examination.

j. Maximum grading will be 'B+'.

k. Question Setting, Moderation, Result Publication will be done following the same rules of Term Final Exam as per Exam Policy. Separate Tabulation sheet will be made for this examination.

However, Head of concerned department with the approval of Commandant may decide to take Supplementary Examination instead of Short Term.

Supplementary Examination. Following rules to be followed:

a. After the final break of every Term-I, Supplementary Examination will be held (once in a year).

b. Examination will be taken on 70% marks like Term Final examination. Remaining 30% marks on continuous assessment earned previously in that particular course will be counted. If a student fails in a course more than once in regular terms, then best one of all continuous assessment marks will be counted.

c. A student will be allowed to take one course at a time for each supplementary examination, but in the graduating Term one student can take two courses if required.

d. Highest grade of supplementary examination will be 'B+'.

e. Registration for supplementary courses to be done during the mid-term break of Term 1, paying the required fees.

f. Examination will be completed after Term I End break within three weeks of Term II.

g. 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. But anyone fails twice in a course consecutively, he has to take approval of Academic Council of MIST for appearing third/last time in a course and need to pay extra financial penalty.

h. If anyone fails in the sessional course, that course cannot be cleared in the supplementary examination.

j. Question setting, Moderation, Result Publication will be done following the same rules of Term Final Examination as per Examination Policy.

k. However, Head of the concerned department with the approval of Commandant may decide to take another Supplementary Examination instead of Short Term. In that case, a student will be allowed to take only one failed course in that particular Supplementary Examination. This examination will be conducted in the previous week of the beginning of Term 1. Registration of that Supplementary Examination should be completed during registration of Short Term course.

Improvement Examination. Following rules to be followed:

a. 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.

b. Highest grade of Improvement examination will be 'B+'.

c. 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.

d. For Improvement examination, registration is to be done before Term 2 Final Examination with the Short Term Courses or, during the registration of Supplementary Courses by paying all the fees.

e. Improvement examination to be taken during the supplementary and short term examinations.

f. Choice of Improvement course is restricted within the offered courses of that Short Term by the Departments and in two courses at a time.

g. Question Setting, Moderation and Result Publication to be done with courses of regular Term Final Examination.

Self-Study Course and Examination. Following Rules to be followed:

a. An irregular student for completion of his graduation, can take maximum two repeat courses as self-study course in the graduating Term if he desires and is accepted by department.

b. One student can take maximum 24 credit hours course in the graduating Term to complete his graduation.

c. Registration for self-study course by paying all fees, must be completed with other course of regular Term.

d. To run the self-study course, concerned Department will assign one teacher each for every self-study course offered. No regular theory class will be held, but that assigned teacher will take necessary class Tests, Quiz Test and give attendance and observation marks to give 30% marks at the end of the Term. For remaining 70% marks written examination will be taken with the Term Final Examination.

e. Assigned teacher for self-study examination will be responsible for setting questions of 70% marks and other examination formalities.

f. Question Setting, Moderation, and Result Publication to be done with courses of Term Final Examination.

g. Grading of Self Study course and examination will be maximum 'B+'.

Special Referred Examination. Following rules will be followed:

a. Immediately after the finalization of result of Term-2 final exam of 2017, for all failed/leftover courses, special referred examination will be arranged and students will have to register the courses for the examination by paying required fees and charges. Following the registration, Admit Card will be issued.

b. Examination will be held before commencement of Term-1 of 2018.

c. One student can appear at all of his failed courses (Referred/Backlog) in the Referred Examination including present level-repeat students.

d. Highest grade for all courses in this Examination will be ‘B+’.

e. Question Setting, Moderation and Result Publication will be done following the same rules of Term Final Examination as per Examination Policy.

f. Separate Tabulation Sheet will be made for this special referred examination.

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 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	Contract Hours	Credit Hours
Phy 131	Structure of matter, electricity and magnetism, and modern physics	3	3.00
Chem 107	Chemistry	3	3.00
Math 101	Differential and integral calculus	3	3.00
Hum 103	Industrial 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 practice	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	Contract Hours	Credit Hours
Math 103	Vector, matrix and geometry	3	3.00
Phy 133	Waves and oscillations, optics and wave mechanics	3	3.00
IPE 105	Engineering materials	4	4.00
Hum 119	Managerial accounting and economics	3	3.00
EECE 171	Basic electrical & electronic circuit	3	3.00
Total theoretical		16.00	16.00
Phy 132	Physics laboratory	3	1.50
EECE 172	Basic electrical & electronic circuit sessional	3	1.50
IPE 106	Engineering materials sessional	3	1.50
Total sessional		9.00	4.50
Grand term total		25.00	20.50

Level 2 Term I

Course No	Course Title	Contract Hours	Credit Hours
Math 201	Differential equation and laplace transform	3	3.00
EECE 271	Electrical machines and electronics	3	3.00
CSE 281	Computer programming techniques	3	3.00
IPE 201	Manufacturing processes i	3	3.00
ME 271	Engineering mechanics and theory of machines	3	3.00
Total theoretical		15.00	15.00
EECE 272	Electrical machines and electronics sessional	3	1.50
CSE 282	Computer programming techniques 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		25.50	20.25

Level 2 Term II

Course No	Course Title	Contract 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	3/2	0.75
Total sessional		4.50	2.25
Grand term total		20.50	18.25

Level 3 Term I

Course No	Course Title	Contract Hours	Credit Hours
ME 351	Fluid mechanics & machinery	3	3.00
IPE 301	Measurement, instrumentation and control	3	3.00
IPE 303	Product design I	3	3.00
IPE 305	Operations research	4	4.00
IPE 317	Ergonomics and safety management	3	3.00
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
IPE 318	Ergonomics and safety management sessional	3/2	0.75
Total sessional		9.00	4.50
Grand term total		25.00	20.50

Level 3 Term II

Course No	Course Title	Contract 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
IPE 320	Industrial practice	4 weeks	2.00
Total sessional		7.50	5.75
Grand term total		22.50	20.75

Level 4 Term I

Course No	Course Title	Contract Hours	Credit Hours
IPE 405	Supply chain management	3	3.00
IPE 415	Project management	3	3.00
IPE 417	Industrial automation	3	3.00
IPE 419	Modeling and simulation	3	3.00
IPE ---	Optional-I	3	3.00
Total theoretical		15.00	15.00
IPE 400	Project and thesis	6	3.00
IPE 420	Modeling and simulation sessional	3/2	0.75
IPE 418	Industrial automation sessional	3/2	0.75
Total sessional		9.00	4.50
Grand term total		24.00	19.50

Level 4 Term II

Course No	Course Title	Contract Hours	Credit Hours
IPE 421	Machine Tools	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 422	Machine Tools Sessional	3	1.50
IPE 412	CAD/CAM Sessional	3/2	0.75
IPE 450	Business Communication Seminar II	2	1.00
Total Sessional		13.50	6.25
Grand Term Total		26.50	19.25

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

Course No	Course Title	Contract Hours	Credit Hours
IPE 423	Robotics	3	3.00
IPE 425	Marketing Management	3	3.00
IPE 427	Control Engineering	3	3.00
IPE 429	Organizational Behavior	3	3.00
IPE 431	Computer Integrated Manufacturing	3	3.00
IPE 433	Production Planning and control	3	3.00
IPE 435	Metal Cutting Process	3	3.00
IPE 437	Entrepreneurship Development and Micro Industries	3	3.00
IPE 439	Green Manufacturing	3	3.00
IPE 441	Modern Manufacturing Process	3	3.00
IPE 443	Total Quality Management	3	3.00
IPE 447	Advanced material & Process	3	3.00

4.4 List of Courses Offered to Other Department

Course No	Course Title	Contract Hours	Credit Hours
IPE 351	Production Process	4	4.00
IPE 352	Production Process sessional	1.5	0.75
IPE 353	Measurement and Quality Control	3	3.00
IPE 354	Measurement and Quality Control sessional	1.5	0.75
IPE 411	CAD/CAM	3	3.00
IPE 433	Production Planning and control	3	3.00
IPE 435	Metal Cutting Process	3	3.00
IPE 441	Modern Manufacturing Process	3	3.00
IPE 455	Machine Tools	3	3.00
IPE 456	Machine Tools Sessional	1.5	0.75
IPE 481	Industrial Management	4	4.00
IPE 485	Operations Research	3	3.00
IPE 487	Material Handling	3	3.00

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)

Introduction to IPE, Career, Input-Process-Output, Efficiency, Life Cycle of Product, Forecasting - Simple Moving Average, Line Balance - cycle time, maximum output, CPM, Plant Layout, Locational Economics; Quality Engineering: 7 Tools of Quality, Total Quality Management, ISO 9000, Statistical Process Control, Control chart, Control charts for variables and attributes. Process capability assessment, Six Sigma, Production Planning & Control: Inventory Control - EOQ, ABC analysis, Value Analysis, Scheduling – forward & backward, Lean Engineering; Statistics - sample & population, sampling, type I, type II error, Computer, Programming, CAD/CAM, Computer Integrated Manufacturing, 7 waste, JIT, 5S, Kaizen, Work Measurement, method and time study

Manufacturing: Definition, Manufacturing industries and products, Manufacturing capabilities, Manufacturing system; Engineering Materials: Classification, Selection of materials; Manufacturing Processes classification; Solidification Processes: Metal Casting, Shaping processes for plastics and polymer matrix composites; Particulate Processing: Pressing and Sintering, Processing of plastics; Deformation Processes: Metal forming, Sheet metal working; Material Removal Process: Machining and part geometry, Turning and related operations, Drilling and related operations, Milling Operations, Shaping and Planning operations; Material Handling and Management: Principles, Unit load, Major Equipment Categories

IPE 105: Engineering Materials (4 credit hours)

Introduction**:** Engineering materials, materials cycle, application and selection criteria of materials. Atomic structure & bonding: Elementary particles, electronic distribution and atomic size/structure, bonding-primary and secondary, effect of bonding on material properties. Structure of solids: Crystallinity in metals, ceramics, semiconductors and polymers; crystal system/lattice/structure, crystallographic indexing of planes & directions, atomic aggregates and their structure, significance of microstructure; crystalline defects: dimensions, origin and their effect on properties; amorphous structure.
Phase diagrams**:** Origin, construction, interpretation and application of binary phase diagrams with reference to a few important metallic and ceramic systems. Properties of materials: physical, mechanical, chemical, electrical, semi/super conducting, magnetic, optical, thermal properties of solids; units and testing.

Engineering materials**:** Structure, properties, processing, fabrication and application of metals and alloys, ceramics, polymers, rubber, plastics, semiconductors, Magnetic Materials and composites.

Heat treatment**:** Annealing, quenching, normalizing, tempering etc. Surface treatments: Surface hardening, cyaniding, carbo-nitriding, carburizing.

IPE 106: Engineering Materials Sessional (1.5 credit hours)

Sessional work based on course IPE 105.

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

Engineering Drawing: 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.

Drawing of different real life products e.g. table, knife, glass, gear, car, drone etc. in SolidWorks. All major libraries needed for engineering drawing including Sketch, Feature, Surface Modeling, Simulation, Weldmelt.

IPE 201: Manufacturing Process I (3 credit hours)

Introduction to manufacturing processes.

Casting processes for ferrous and non-ferrous metals and alloys: sand, die, centrifugal, slush, plaster mold, loam mold, precision investment etc. casting processes, casting defects, design of molds, riser, gate sprue and core.

Forming and shaping processes: rolling, forging, hot and cold extrusion; press working operations, wire drawing, sheet metal forming etc.

Welding processes: gas, arc, TIG, MIG, thermit, resistance, friction, electro slag, submerged arc etc. Special welding processes: LASER, electron beam etc.

Other joining processes: Soldering, brazing, adhesive joining etc.

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

Manufacture of ceramic and glass products.

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)

Conventional machining processes: turning, drilling, shaping, planning, milling, grinding, reaming, broaching, etc.

Modern machining processes: electro-chemical, electro-discharge, plasma etc., LASER beam, electron beam, ultrasonic and water jet, abrasive jet machining.

Theory of Machining: mechanism of machining, mechanism of chip formation, cutting tool geometry and tool wear phenomenon, tool life and tool life equation, cutting fluids.

Powder metallurgy: Powder manufacture, powder testing and evaluation, powder mixing and blending, compacting, sintering, powder injection molding (PIM)

Rapid prototyping and 3D Printing.

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)

Based on any topics taught in level 1 and level 2

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 based on course 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, quality function development, understanding customer needs, establishing product function specification, specification development, concept generation and evaluation.

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

Sessional work based on course 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, use of standard parts, application of CAD software. DOE and DOP.
Product life cycle and cost analysis

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 equipment, 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 based on course 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, Deming's principle on quality and productivity, quality costs and their interpretation, DMAIC

Methodologies: Six Sigma, Lean Manufacturing, 8D, FMEA, Control Plan, 7 tools for Quality, 7 wastes.

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, design of experiments- identification of key variables for major variations, Acceptance sampling plans
Failure mode and effect 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 based on course 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 317: 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 318: Ergonomics and Safety Management Sessional (0.75 credit hours)

Sessional work based on course IPE 317.

IPE 320: 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 400: Project and Thesis (6 credit hours)

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 411: CAD/CAM (3 credit hours)

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

CAM: Fundamental concepts, trend of development of NC; Principles of NC; NC coding systems; NC manual part programming; CNC part programming using APT language; programming using CAD database, CAD and CAM integration; Rapid prototyping and manufacturing, implementing CAD/CAM system principles to FMS.

Robotics: Industrial robots, robot anatomy (structure) and robot configuration, robot drive and control system, robot sensors, robot application.

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

Sessional work based on course IPE 411.

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 415: Project 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.

IPE 417: Industrial Automation (3 credit hours)

Introduction to Industrial automation; Automation system utilized in manufacturing industries. Basic control systems: in pressure, flow, level, temperature etc. Fluid power controls: pumps, valves, indicators, switches, recorders, transmitters, signal conditioners, drives etc. Typical electronic controls used to position pneumatic and hydraulic cylinders found in many mechanical processes, actuators, servo valves etc. Introduction to system sensors, use of sensor in automation image and vision processing, web based manufacturing monitoring system.
PLC: basic principles of operation and programming of PLC/PID, computer based PLC simulation and real PLCs for programming practice. PLC programming and control knowledge in typical industrial operation. PLC for controlling pressure, flow, level, temperature, analytic and electro-mechanical systems.

Data acquisition and control system: multiple Human Machine Interface (HMI/MMI) computer software programs used in industry today. PC hardware interfacing, PC communications, data acquisition and display, Supervisory Control and Data Acquisition (SCADA), Distributed Control System (DCS) and data highways.

IPE 418: Industrial Automation Sessional (0.75 credit hours)
Sessional work based on course IPE 417.

IPE 419: Modeling and Simulation (3 credit hours)

Basic concepts of simulation (definitions and types of simulations), Mechanism of discrete event simulation, Random number generation, Input data analysis (input distribution modeling), Simulation modeling using Arena package, Review of probability and statistics, Simulation output analysis, Monte Carlo simulation, Verification and validation of simulation models, Other simulation approaches (Time driven simulations), Component-based simulation and modeling tools, Simulation protocol concepts, designs, and implementations, Simulation experimentation and

analysis, Network system simulation modeling, Multi-resolution, multi-aspect modeling, Parallel simulation modeling concepts and methods.

IPE 420: Modeling and Simulation Sessional (1.5 credit hours)

Sessional work based on course IPE 419.

IPE 421: Machine Tools (4 credit hours)

Introduction, concept, definition and classification of machine tools; gearing diagrams, mechanisms, transmission ratios, typical parts: bearings, couplings, mechanisms for indexing.

Drive system of machine tools: mechanical drive, speed gear boxes, feed gear boxes, infinitely variable drives**,** CVT, PIV and other mechanical step less drives,

Power drives: drives used in an automated system or in CNC system- Electrical drives, Hydraulic drives, Pneumatic drives

CNC, NC and DNC machines.

Case study of conventional and automatic lathes and milling machine, Vertical machining center, dynamics of machine tools,

Locating principles and locators, clamps, dies, jigs and fixtures.

Installation, commissioning and acceptance of machine tools.
Maintenance of machine tools.

IPE 422: Machine Tools Sessional (1.5 credit hours)

Sessional work based on course IPE 421.

IPE 450: Business Communication Seminar II (1 credit hour)
Based on any topics taught in level 3 and level

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, Successive differentiation of various types of functions, Leibnitz's theorem, Roll's mean-value theorems, Taylor's theorem finite and infinite forms, Maclaurin's theorem in finite and infinite forms, L'Hospitals rule, tangent and normal in Cartesian and polar coordinates, partial differentiation, Euler's theorem, maxima and minima for functions and its applications, curvature, asymptotes.

Integral Calculus: Integration by parts, integration by the method of substitutions, standard integrals, integration by the method of successive reduction, definite integrals, properties of definite integrals, Walli'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, area of surface, volume of solids of revolution.

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

Vectors: Definition 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, differentiation and integration of vectors together with elementary applications, gradient of a scalar function, divergence and curt of a vector function, Green's theorem, Gauss's theorem, Stocke's theorem and their applications.

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

Geometry: Introduction to geometry, 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), system of circles (radical axes, coaxial circles, limiting points). Three dimensional co-ordinate system, 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.

Math-201: Differential Equations and Laplace Transform (3 credit hours)

Differential Equations:

Ordinary Differential Equations: Formulation 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, Legendre Polynomials and their properties.

Partial Differential Equations: Linear and non linear first order differential equations; Standard forms of linear equations of higher order; Equation of second order with variable coefficients.

Laplace Transform:
Definition of Laplace Transform; Laplace transforms of some elementary functions; Properties of Laplace transform; Laplace transforms of derivatives; Inverse Laplace transforms; Convolution Theory; Solution of differential equations by Laplace transform; Evaluation of improper integrals by Laplace Transform.

Phy 131: Structure of Matter, Electricity and Magnetism, and Modern Physics (3 credit hours)

Structure of matter:
States of matter, classification of solids, amorphous, crystalline, ceramic and polymers, atomic arrangement in solid, crystal system, miller indices, packing factor, defects is crystal, X- ray diffraction; Bragg's law, different types of bonds in solids, Inter atomic distances and forces of equilibrium, metal, insulator and semiconductor, plasticity and elasticity.

Electricity and Magnetism:
Electric charges and Coulomb's law, electric field and related problems, electric field due to point charge and dipole, electric, flux and Gauss' law, electric potential and related problems, electric potential due to point charge and dipole, capacitors, capacitance, dielectrics and atomic view, dielectric and Gauss' law, current and resistances, current density, ohm's law, resistivity-an atomic view, Ampere's law, Faraday's law; Lenz's law, self-inductance and mutual inductance.
Magnetic properties of matter, magnetic field intensity, permeability, susceptibility; classification of magnetic materials, magnetization curves.

Modern physics:
Galilean transformation, Lorentz transformation, special theory of relativity, relative velocity, length contraction, Time dilation, relative mass, mass energy relation,

Photoelectric effect, Compton effect, de-Broglie wave, Bohr atomic model, classification of nuclei, radioactivity, radioactive decay law and half-life, nuclear reaction, nuclear binding energy, introduction to nuclear reactor.

Phy-133: Waves and Oscillations, optics and Wave mechanics. (3.00 Credit hours)

Waves and Oscillation
Differential equation of Simple harmonic oscillator, total energy and average energy, combination of Simple harmonic oscillations, Lissajous figures; spring mass system, two body oscillations, reduced mass torsional pendulum, compound pendulum, damped oscillations, forced oscillation, differential equation of a progressive wave, power and intensity of wave motion, stationary wave, phase velocity and group velocity.

Optics
Lens, equivalent lens, defects of images, optical instruments, Interference of light, Young's double slit experiment, Newton's rings, Interferometers. Diffraction of light, Fresnel and Fraunhofer diffraction, Diffraction by single slit and double slits and N-slits, diffraction gratings, polarization of light, production and analysis of polarized light, optics of crystals, Nicole prism, optical activity, specific rotation.
.
Wave mechanics
Principle of statistical physics, probabilities, classical statistics, quantum statistics, Bose-Einstein statistics, Fermi-Dirac statistics and their applications, Fundamental postulates of wave mechanics, time dependent schrodinger's equation, steady state schrodinger's equation, properties of wave function, particle in a potential well.

Phy 132: Physics Laboratory (1.5 credit hours)

Sessional based on Phy 131 and Phy 133.

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 103: Industrial Sociology (3 credit hours)

Nature, scope, aim and rise of industrial sociology. History of industrialization-ancient and modern. The development of industry and industrial society in Bangladesh. The worker and the factory: the factory system, its characteristics. The formal relations of production in the factory system. The industrial bureaucracy: Industry and social stratification: nature and causes of industrial conflict, role and functions of trade unionism, resolution of industrial conflict, collective bargaining. Industrialization and development: patterns of industrial development in developing countries-role of foreign capital and borrowed technology. Technology and social structure. Classification of industries: role of cottage industries, labour intensive vs. heavy industries. Modernization.

Industrial Law: Basic Industrial laws
Factory Act: Introduction, Inspector, and Certifying Surgeons; Health and Hygiene; Safety; Welfare; Working Hours of Adults; Employments of Young persons; Leave and Holidays with wages etc.

Hum 119: Managerial Accounting and Economics (3 credit hours)

Elements of accounting: The accounting equations; accounts; transactions, double entry mechanisms, financial statements, basic concepts: scope and application of cost and management in manufacturing companies, material costing and labor costing, overheads and their allocations, 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.

Introduction to Economics, Fundamental economic problems, Basic elements of demand, Supply and product market, Theory of utility and preferences, Theory of production and cost, Theory of the farm and market structure, Economics of development and planning.

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.

Shop 172: Machine Shop Practice (1.5 credit hours)

Foundry. Introduction to foundry, tools and equipment; Patterns: function, pattern making; Molding: molding materials sand preparation, types of mold, procedure; Cores: types, core making materials; Metal melting and casting; Inspection of casting and casting defects.

Welding. Metal joints: rivetting, grooving, soldering, welding; Welding practice: electric arc, Types of electrode; Welding defects: visual, destructive and non-destructive tests of welding. Gas welding and equipment; Types of flame; Welding of different types of materials; Gas welding defects; Test of gas welding.

Tools: common bench and hand tools, marking and layout tools, measuring tools, cutting tools, machine tools; Bench work on jobs; Practices on machine tools: drilling machine, lathe machine, shaper machine, milling machine, grinding machine.

CSE 281: 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 282: Computer Programming Techniques Sessional (1.5 credit hours)

Sessional work based on course CSE 281 using C programming language.

EECE 171: Basic Electrical and Electronic Circuit (3 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)

Sessional work based on course 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)

Sessional work based on course 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 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 work based on course ME 255

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 (0.75 credit hours)

Sessional work based on course 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 work based on course ME 351.

5.3 Optional Courses for IPE Students

IPE 423: 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.

IPE 425: 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 427: 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.

IPE 429: 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 431: Computer-Integrated Manufacturing (3 credits hours)

Hardware components of computer controlled manufacturing systems: PLC, AGV, ASRS, Robots etc. Software components: CAD, CAM and their integration.

Product data management: Direct translation between CAD systems; CAD/CAM data exchange. Production process system: Flexible manufacturing cells; Planning and

layout of flexible manufacturing system; Agile manufacturing; Lean production system; Reconfigurable manufacturing system.

Process planning: Process design and planning; Computer aided process planning; Group technology and cellular manufacturing; Concurrent engineering. Shop floor communication: Data logging and acquisition; Integration through information system; Networking and data communication.

IPE 433: Production Planning and control (3 credits 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 435: Metal Cutting Process (3 credit hours)

Introduction, historical background, essential features of metal cutting, turning: tool point reference system; Geometry of single point cutting tool; Mechanism of chip formation; Classification of chips.

Chip-tool interface; Chip flow under the condition of seizure, built-up edge, machined surface; Forces acting on the cutting tool, stress on the shear plane, minimum energy theory, stress on the tool, work done and power consumption in metal cutting; Effect of various factors on cutting forces, formulae for calculating components of cutting force, measurement of cutting force and dynamometry.

Heat generation in metal cutting: sources of heat and its distribution, temperature field of the chip and the tool, formulae for calculation of cutting temperatures, effect of various factors on cutting temperature, heat flow, methods of tool temperature measurement, temperature distribution in tool, relationship of tool temperature and cutting speed;

Cutting tool materials: tool life, conditions of use, HSS, cemented carbide, ceramic tools. Ultra-hard tool materials: alumina based composites, sialon, diamond, cubic boron nitride.

Machinability: magnesium, aluminum, copper, steel and cast iron, nickel, zirconium, titanium and their alloys; Methods of machinability improvement. Coolants and lubricants.

IPE 437: 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 439: Green Manufacturing (3 credits hours)

The concept of Green manufacturing and its basics. Sustainability and global conditions, the aim of Sustainable Manufacturing. Material and solid waste management. Scarcity of resources and its risks. Energy management Alternative energy sources, Chemical waste management and green chemistry. Climate change and air emissions management. Supply water and waste water management. Biomass and Methods of biomass Utilization (Direct firing, Co-firing and gasification in air). Pyrolysis, Hydrolysis and fermentation.

IPE 441: Modern Manufacturing Process (3 credit hours)

Introduction to modern manufacturing process.

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 443: 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 447: Advance material and Process (3 credits hours)

Super alloys; Metal matrix composites, Ceramic matrix composites, other composites; Polymers; Biodegradable plastics: Ceramics: Electronic materials. Powder metallurgy and particulate materials. Smart Materials.

5.4 Courses Offered to Undergraduate Students of Other Departments

IPE 351: 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.

Rapid prototyping and 3D Printing.

IPE 352: Production Process Sessional (0.75 credit hours)

Sessional work based on course IPE 331.

IPE 353: 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 354: Measurement and Quality Control Sessional (0.75 credit hours)

Sessional work based on course IPE 381.

IPE 411: CAD/CAM (3 credit hours)

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

CAM: Fundamental concepts, trend of development of NC; Principles of NC; NC coding systems; NC manual part programming; CNC part programming using APT language; programming using CAD database, CAD and CAM integration; Rapid prototyping and manufacturing, implementing CAD/CAM system principles to FMS.

Robotics: Industrial robots, robot anatomy (structure) and robot configuration, robot drive and control system, robot sensors, robot application.

IPE 433: 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 435: Metal Cutting Process (3 credit hours)

Introduction, historical background, essential features of metal cutting, turning: tool point reference system; Geometry of single point cutting tool; Mechanism of chip formation; Classification of chips.

Chip-tool interface; Chip flow under the condition of seizure, built-up edge, machined surface; Forces acting on the cutting tool, stress on the shear plane, minimum energy theory, stress on the tool, work done and power consumption in metal cutting; Effect of various factors on cutting forces, formulae for calculating components of cutting force, measurement of cutting force and dynamometry.

Heat generation in metal cutting: sources of heat and its distribution, temperature field of the chip and the tool, formulae for calculation of cutting temperatures, effect of various factors on cutting temperature, heat flow, methods of tool temperature measurement, temperature distribution in tool, relationship of tool temperature and cutting speed;

Cutting tool materials: tool life, conditions of use, HSS, cemented carbide, ceramic tools. Ultra-hard tool materials: alumina based composites, sialon, diamond, cubic boron nitride.

Machinability: magnesium, aluminum, copper, steel and cast iron, nickel, zirconium, titanium and their alloys; Methods of machinability improvement. Coolants and lubricants.

IPE 441: Modern Manufacturing Process (3 credit hours)

Introduction to modern manufacturing process.

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 455: Machine Tools (3 credit hours)

Introduction, concept, definition and classification of machine tools; gearing diagrams, mechanisms, transmission ratios, typical parts: bearings, couplings, mechanisms for indexing.

Drive system of machine tools: mechanical drive, speed gear boxes, feed gear boxes, infinitely variable drives**,** CVT, PIV and other mechanical step less drives,

Power drives: drives used in an automated system or in CNC system- Electrical drives, Hydraulic drives ,Pneumatic drives

CNC, NC and DNC machines.

Case study of conventional and automatic lathes and milling machine, Vertical machining center, dynamics of machine tools,

Locating principles and locators, clamps, dies, jigs and fixtures.
Installation, commissioning and acceptance of machine tools.

Maintenance of machine tools.

IPE 456: Machine Tools Sessional (1.5 credit hours)

Sessional work based on course IPE 455.

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

Storage and warehousing sorting, warehousing.

Chapter 6

STUDENT ACTIVITIES OF THE DEPARTMENT

6.1 Introduction

Department of Industrial and Production Engineering (IPE) focuses on improvement of productivity and operation related knowledge and supports the cause of value based education. To make the students compatible with the recent trend department of Industrial and Production Engineering (IPE) always encourages extracurricular activities as a part to enhance the capability of the students. Students of this department are always enthusiastic about arranging many programs to enhance their academic and as well as professional career.

6.2 Annual Activities

Seminars and Workshops

Students of the department organize many seminars and workshops throughout the year with the help of the teachers and alumnae to improve their knowledge in different fields. In this regards many industries of our country help the students to organize these programs by sharing their resources.

Lecture Session on 'Scopes of IPE in Manufacturing Industries'

A lecture session on 'Scopes of IPE in Manufacturing Industries' was held at MIST on 18 April 2017. ***Engr Mr Tapash Kumer Mojumder,*** *Executive Director, Walton Hi Tech Industries Ltd.* was the speaker in that event. He gave his valuable speech on recent advancement of manufacturing technologies and addressed the areas where IPE engineers can show their brilliance in manufacturing industries. The objective of the program was to familiarize the students with modern manufacturing processes and make them concerned about current roles and responsibilities of IPE graduates in manufacturing sector.

Lecture Session on 'Scopes of IPE in Manufacturing Industries'

Industrial Visit

Industrial Visit to M & U cycle Ltd.

Faculty and the students of IPE department visited to M & U cycle Ltd. on 08 April 2017. Students explored the industrial aspects of bicycle manufacturing and they gathered real-time experiences over automation, manufacturing line, quality inspection and so on**.**

Industrial Visit to M & U cycle Ltd

Industrial Visit to Bangladesh Machine Tools Factory (BMTF)

Faculty and the students of IPE department paid an industrial visit to Bangladesh Machine Tools Factory (BMTF) on 22 April, 2017. The objective of the industrial visit was to help the students acquire practical knowledge on industrial manufacturing and automation processes. Students explored the assembly process of automobiles, manufacturing of electric poles & different kinds of shoes.

Industrial Visit to BMTF

Picnic

An annual picnic is organized every year to give students a break from their mundane life. This break not only helps them to refresh their mind but also strengthens inter departmental bond.

Picnic of IPE department

6.3 Major Achievements in Extra Curricular Activities

AUTOMOBILE QUIZ COMPETITION

A group of three students from IPE-1 participated in an Automobile Quiz Competition organized by BUET Auto Mobile Club on December 2017 in BUET. The team was named "Hellaflush" .They had beaten all teams from other universities and secured the prestigious first position in the competition.

Champion "Hellaflush" team

TechFest 2017 Bangladesh Round, Segment- CADathon

In December, 2017 TechFest 2017 Bangladesh Round, Segment- CADathon was held in Bangladesh University of Engineering & Technology (BUET) and the final round is to be held in IIT, Mumbai, India. In this competition a group from IPE-1 participated and became first runners up by designing a concrete cutting machine that can cut at sound level below 20 dB.

HULT Prize 2018 at MIST

HULT prize is the most renowned and prestigious Business Case Competition which address various social problems. In "HULT Prize 2018 at MIST" two teams from IPE department secured the first position and the first Runners up position. The team named **Mavericks** were the champions and the team named **Alacrity** was **f**irst Runners up.

Champion Mavericks team

First Runners up Alacrity team

IEEE R10 HTC 2017 WIE Track

A team from IPE-1 named “The Dreamers” participated in IEEE R10 HTC 2017 WIE Track, where they made a mobile app named “AURA”. This mobile app can help to detect breast cancer and will inform about it in the early stage so that proper steps can be taken. This team got the Best Idea Presenter Award.

IEEE R10 HTC 2017 WIE Track:Best Idea Presenter Team-“The Dreamers”