Bangladesh Army University of Engineering & Technology (BAUET)
Qadirabad, Natore



Department of
Mechanical Engineering (ME)

Syllabus for
Bachelor of Science (B.Sc.) in
Mechanical Engineering (ME)

Applicable for Session 2020-21 and onward

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The information of this syllabus intends to provide guidance to those who are concerned with undergraduate studies in the Department of Mechanical Engineering. The Department of Mechanical Engineering of Bangladesh Army University of Engineering & Technology will carry no responsibility, if any inconvenience or expenditure is caused to any person because of the information of this booklet or any error in quoting the rules and regulations described herein. In addition, the information contained in it, are subjected to change at any time without any prior notification.

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Preface to First Edition

Bangladesh Army University of Engineering & Technology (BAUET) offers undergraduate programs in the faculty of Mechanical Engineering (ME). This syllabus is for the undergraduate students in the Department of Mechanical Engineering (ME) of BAUET. Although this syllabus has been written mainly for the students, course coordinators and teachers will find it valuable as a reference document. Also, anybody who desires to know about the course contents of ME Department will find this syllabus helpful.

Department of Mechanical Engineering (ME), with its excellent professional competence, pragmatic curricular, expert teaching view points and capabilities of training will achieve an excellent grade. The department of ME has smart class rooms, modern laboratories to learn and practice. This department will produce highly qualified and skilled mechanical engineers. Over the years, this curriculum provides the leadership skills to the undergraduate students who will prove their potentiality at home and abroad. Our curricula, faculty and research areas focus on an array of topics including Heat transfer, Fluid mechanics, Thermodynamics, Refrigeration and air conditioning, Machine Dynamics and Mechatronics.

Students considering majoring in ME should have shown considerable ability in mathematics and logical reasoning. In view of that a number of courses on mathematics and basic science have been felt mandatory to be included in the syllabus. In addition to some Social Science, Management, Accounting, Economies and Communication skills development related classes have been incorporated to make the syllabus a balanced and reasonably complete one.

The ME program of BAUET is approved by UGC. According to the policy of BAUET, the syllabus is revised minimum once in every three years. Some of the information recorded in this syllabus is likely to be modified from time to time. Everybody concerned is strongly advised to be in touch with the advisers or the undersigned regarding modifications to be introduced later. It is hoped that this syllabus will be of much use to everybody concerned.

Head,
Department of Mechanical Engineering
Bangladesh Army University of Engineering & Technology.

Table of Contents

1 General Information **1**

1.1 About BAUET 1
1.2 About Mechanical Engineering 1
1.3 Vision and Mission 1
1.4 Vision of Mechanical Engineering 2
1.5 Mission of Mechanical Engineering 2
1.6 Faculties, Departments and Degree Awarded 2
1.7 Laboratory Facilities 3
1.8 Program Outcomes 3
1.9 Generic Skills 4

2 Rules and Regulations for Undergraduate Program **5**

2.1 Introduction 5
2.2 Degree Offered 5
2.3 Admission Eligibility 5
2.4 Number of Terms in a year 5
2.5 Duration of Terms 5
2.6 Course Pattern and Credit Structure 6
2.7 Course Designation System 6
2.8 Types of Courses 7
2.9 Assignment of Credits 7
2.10 Teacher-Student Interaction 8
2.10.1 Student Mentoring 8
2.10.2 Student Adviser 8
2.11 Course Registration 8
2.11.1 Registration Procedure 8
2.11.2 Pre-Conditions for Registration 9
2.11.3 Registration Deadline 9
2.11.4 Penalty for Late Registration 9
2.12 Course Appraisal and Lesson Plan 9
2.13 Time Limits for Completion of Bachelor's Degree 9
2.14 Attendance, Conduct and Discipline 9
2.14.1 Attendance 9
2.14.2 Conduct and Discipline 10
2.15 The Grading System 10
2.16 Distribution of Marks 11
2.17 Calculation of GPA (Grade Point Average) 12
2.18 Promotion to the Next Term 14
2.19 Minimum Earned Credit and CGPA Required for Obtaining a Degree 14
2.20 Consequences of Poor Performance (Referred/ Improvement/Backlog) 14
2.21 Course Repetition 14
2.22 Withdrawal Policy 14
2.23 Types of Different Examination 14
2.24 Class Tests 14
2.25 Earned Credits 14

2.26 Rounding off the Decimal Marks 14
2.27 Rounding off the GPA/CGPA 14
2.28 Number of Grade Sheets 15
2.29 Transcript 15
2.30 Certificate 15
2.31 Recognition of Performance 15
3 Course Curriculum for Bachelor Degree in ME 16
3.1 Introduction 16
3.2 Core Courses 16
3.3 List of Elective Courses 18
3.4 Contact hours and Credit Hours Distribution: 20
4 Detail Outline of Courses Offered by the Department of ME 25
5 Detail Outline of Undergraduate Courses Offered by Other Department to ME 63

Chapter 1
General Information

1.1 About BAUET

Bangladesh Army University of Engineering & Technology (BAUET) is one of the premier universities in the country now and has bright prospects for its high standards in teaching and research. Ever since its inception, a strong commitment to excellence in teaching and research has been its main concentration. Its first academic program was launched on 15 February with the maiden batch of Electrical and Electronic Engineering, Civil Engineering and Computer Science and Engineering. It has well equipped classroom, modern built in multimedia, audio-visual and lighting. The medium of instruction of this university is English. BAUET envisages in creating facilities for the students of home and abroad dedicated to pursue their graduation degree. Students from different regions of Bangladesh come here to study. As an institution without any gender biasness, it is already on steady stride upholding its motto 'Knowledge and Technology'.

1.2 About Mechanical Engineering

Mechanical Engineering is perhaps the most diverse and versatile of the engineering disciplines. In addition to physical sciences, it encompasses key elements of aerospace, electrical, civil, chemical and even materials science and bio-engineering. Mechanical engineers analyze applied mechanics and design using the principles of motion, energy, and force- ensuring that machines function safely, efficiently, and reliably, all at a competitive cost. Anything that needs to be manufactured-indeed, anything with moving parts- needs the expertise of a mechanical engineer. To build a sustainable industrial development, the role of a mechanical engineer is remarkable.

1.3 Vision and Missions

University Vision

The university aspires to transform into a center of excellence in Science, Engineering and Technology programs by providing innovative, multi-disciplinary courses and extensive research facility to the young generation of the country and beyond. It endeavors to make the university a hub of knowledge and be recognized as a leading university of the country.

University Mission

- To provide comprehensive education and conduct research in diverse disciplines of science, engineering, technology and engineering management.
- To produce technologically advanced intellectual leaders and professionals with high moral and ethical values to meet the socio-economic development of Bangladesh and global needs.

- To conduct collaborative and research activities with national and international communities for continuous interaction with academia and industry.
- To provide consultancy, advisory and testing services to government, nongovernment, autonomous and individuals for widening practical knowledge and to contribute in sustainable development.

1.4 Vision of Mechanical Engineering

The vision of the Department of Mechanical Engineering is focused on providing an education that builds within students a solid ground in mechanical engineering principles, expands the reasoning, communication and problem solving abilities of students to develop and maintain a world-class research program that addresses the evolving needs of industry and society.

1.5 Mission of Mechanical Engineering

- Provide fundamental knowledge in mechanical engineering.
- Inspire the students to be creative, self-learning and innovative.
- Equipping them with the knowledge of professional responsibility, ethics, global and societal impact of engineering decisions.
- Flourish their leadership roles in a rapidly-changing environment.
- Produce individuals who can work well either independently or in a team.

1.6 Faculties, Departments and Degree Awarded

Faculty Name	Department Name	Degree Awarded
Electrical & Computer Engineering	Electrical and Electronic Engineering	B.Sc. in EEE
	Computer Science and Engineering	B.Sc. in CSE
	Information and Communication Engineering	B.Sc. in ICE
Civil & Environmental Engineering	Civil Engineering	B.Sc. in CE
Mechanical Engineering	Mechanical Engineering	B.Sc. in ME
Business	Business Administration	BBA
Law and Justice	Law	LLB
Science and Humanities	English	BA (Hons) in ELL
	Physics	-
	Chemistry	-
	Mathematics	-
	Sociology	-

1.7 Laboratory Facilities

The department endeavors to provide its faculty members and students adequate laboratory, library and other facilities. Departmental undergraduate courses are laboratory intensive and these requirements are catered by following laboratories:

Sl. No.	Name of the laboratories
1.	Thermodynamics Lab
2.	Fluid Mechanics Lab
3.	Heat Transfer Lab
4.	Materials and Metallurgy Lab
5.	Applied Thermodynamics Lab
6.	Applied Mechanics Lab
7.	Machine Tools Lab
8.	Heat Engine and Automobile Lab
9.	Drawing Shop
10.	Solid Mechanics Lab

1.8 Program Outcomes

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

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, research the literature and analyze complex engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns.

4. **Investigation:** Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusion.

5. **Modern tool usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

7. **Environment and sustainability:** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice.

9. **Individual work and teamwork:** Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings.

10. **Communication**: Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work as a member or a leader of a team to manage projects in multi-disciplinary environments.

12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change.

1.9 Generic Skills

1. Apply the principles and theory of mechanical engineering knowledge to the requirements, design and development of different electrical systems with appropriate understanding.

2. Define and use appropriate research methods and modern tools to conduct a specific project.

3. Learn independently, be self- aware and self- manage their time and workload.

4. Apply critical thinking to solve complex engineering problems.

5. Analyze real time problems and justify the appropriate use of technology.

6. Work effectively with others and exhibit social responsibility.

Chapter 2
Rules and Regulations for Undergraduate Program

2.1 Introduction

BAUET has introduced course system for undergraduate studies from the academic session 2020- 2021. Therefore, the rules and regulations mentioned in this paper will be applicable to students for administering undergraduate curriculum through the course system. This will be introduced with an aim of creating a continuous, even and consistent workload throughout the Term for the students.

2.2 Degree Offered

The department offers a degree named "***Bachelor of Science in Mechanical Engineering".***

2.3 Admission Eligibility

2.2.1 SSC/Dakhil and HSC/Alim Examinations: HSC/Alim or equivalent examination in Science Group with Mathematics, Physics and Chemistry scoring minimum GPA 3.0 for each. The sum total GPA of SSC/Dakhil and HSC/Alim should be minimum 7.0 (with additional subject).

2.2.2 GCE Applicants

a. O Level: Minimum C Grade in five subjects including, Mathematics, Physics and Chemistry (in the scale of A=5, B=4, C=3, D=2 and E=1)
b. A Level: Minimum C Grade in 2 subjects including Mathematics, Physics/Chemistry.
c. The sum total of GOA in GCE A and O level should be 6.
d. The candidates with E grade in any subject will not be considered.

2.4 Number of Semesters in a year

There will be two semesters in an academic year.

a) Semester I (Summer)
b) Semester II (Fall)

2.5 Duration of Semesters

2.5.1 Semesters and Duration: There will be two semesters: Semester I and Semester II. Semester I will be of 24 weeks and Semester II will be of 28 weeks (Total 52 weeks). An Academic Calendar will be provided to all the enrolled students to make them familiar to all academic events. The holiday will also be included in the calendar.

2.5.2 Annual Semester Plan: Duration of Semester I and Semester II will be as follows:

Semester I:

Sl.	Events	Durations
1.	Classes before Mid Semester	7 weeks
2.	Mid Semester Break	1 week
3.	Classes after Mid Semester	7 weeks
4.	Lab Test Week	1 week
5.	Preparatory Leave	2 weeks
6.	Semester Final Examination	3 weeks
7.	Result Publication and Semester End Vacation	3 weeks
Total		**24 weeks**

Semester II:

Sl.	Events	Durations
1.	Classes before Mid Semester	7 weeks
2.	Mid Semester Break	1 week
3.	Classes after Mid Semester	7 weeks
4.	Lab Test Week	1 week
5.	Preparatory Leave	2 weeks
6.	Semester Final Examination	3 weeks
7.	Result Publication and Semester End Vacation	3 weeks
8.	Industrial Training and Survey Practical	4 weeks
Total		**28 weeks**

Note: Those who will not be able to clear any of the courses (only theoretical) of any discipline in a particular Semester (Semester I and Semester II) will be required to appear at the referred examination (Re-examination) for fulfilling the condition as per policy to clear the subject(s).

2.6 Course Pattern and Credit Structure

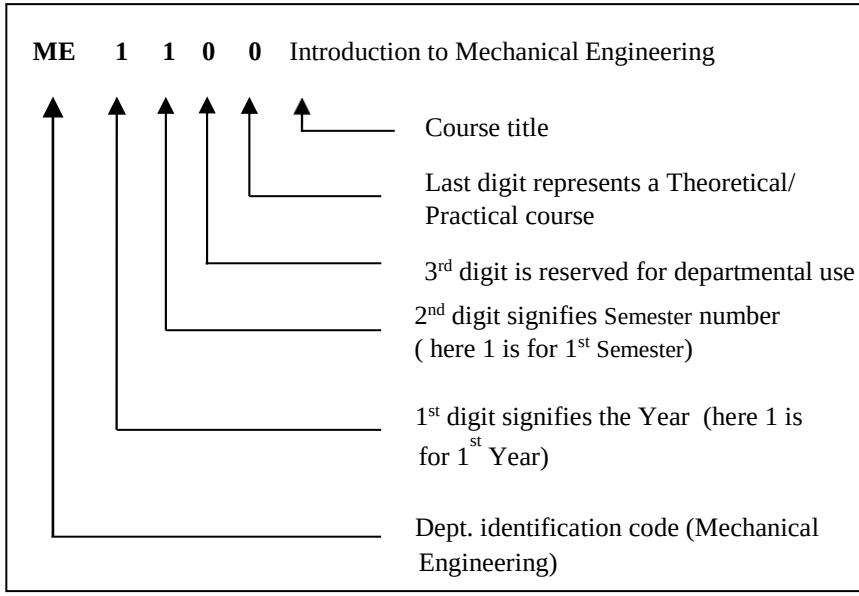
The undergraduate program is covered by a set of theoretical courses along with a set of laboratory (sessional) courses to support them.

2.7 Course Designation System

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

- The first digit will correspond to the year in which the course is normally taken by the students.
- The second digit will correspond to the Semester (1 for 1st and 2 for 2nd) in which the course is normally taken by the students.
- The third digit will be reserved for departmental use. It usually identifies a specific area/group of study within the department.
- The last digit will be odd number for theoretical courses and even number for sessional courses.

The course designation system is illustrated as follows:



2.8 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 semester is equivalent to one credit.

b. **Sessional Courses:** Two sessional contact hour per week per semester is equivalent to one credit.

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

2.9 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 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.

d. **Integrated Design Project (IDP)/Capstone Project and Thesis:** Integrated development project/ Capstone project has to complete in the combine duration of two semester in 3rd year, 2nd semester (credit hour 1.50 and contact hour 3.00) and 4th year, 1st semester (credit hour 3.00 and contact hour 6.00). Thesis/project will have to be undertaken in 4th year by students under separate supervisors in partial fulfillment of the requirement of his/her degree. Credits allotted to the thesis will be 4.50 and corresponding 9.00 contact hours where 3.00 contact hours in 4th year 1st Semester and another 6.00 contact hours in 4th year 2nd Semester.

2.10 Teacher-Student Interaction

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

2.10.1 Student Mentoring

Besides the respective faculty of each subject/program, every student wil have a designated mentor. Students will interact with his/her mentor to discuss the academic progress, difficulties and all other issues relating to their performances. There is definite guideline issued, which specifies the modalities and frequency of mentoring, advising and interactions.

2.10.2 Student Adviser

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

2.11 Course Registration

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

2.11.1 Registration Procedure

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

2.11.2 Pre-Conditions for Registration

a. For first year students, department-wise enrollment/admission is mandatory prior to registration. At the beginning of the first Semester, 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 BAUET 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 Semester, the concerned department may allow him/her to register for a course which depends upon the pre-requisite course provided that his/her attendance and performance in the continuous assessment of the mentioned pre-requisite course is found to be satisfactory.

2.11.3 Registration Deadline

Each student must register for the courses to be taken before the commencement of each Semester. 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 or some other academic commitments that prohibit enrollment prior to the last date of registration.

2.11.4 Penalty for Late Registration

Students who fail to register during the designated dates for registration are charged a late registration fee of Tk. 400.00 (Four hundred only) for each semester. Penalty for late registration will not be waived.

2.14 Course Appraisal and Lesson Plan

All faculty members must have to prepare their respective Course Appraisal and Lesson plan for the entire course before the semester begins. They are advised to leave a copy of the Course Appraisal set to the Head of the Department for review by the Course Committee.

2.15 Time Limits for Completion of Bachelor's Degree

A student must complete his/her studies within a maximum period of six academic years for completion of B.Sc. Engineering degree.

2.16 Attendance, Conduct and Discipline

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

2.16.1 Attendance

Following guidelines are to be adjusted to:

a. All students are required to attend 80% of the classes for all courses.

b. In case of sickness 70% attendance may be considered by the VC with proper medical documents provided by the student.
c. Students failing to attend 80% classes are liable to pay a fine of Tk. 2000/- per course.
d. Students not eligible to sit for exam of a particular course due to poor attendance, their concerned course will be deleted form the Admit Card.
e. A student will not be entitled to Vice Chancellor or the Dean's list of the Semester, in case he/she has not attended 90% if the classes. S/he will also not be considered for any Scholarship/Waiver provide by the University.

The guidelines for attendance marks are as follows:

Category	Marks
For Theory Course	5
For Sessional Courses	10

The attendance marks distribution for the final assessment is as following:

Attendance (100)	Theory (05) Marks	Sessional (10) Marks
90% and above	05	As per earned percentage (%) of Attendance.
85% to 89%	4.5	
80% to 84%	04	
75% to 79%	3.9	
70% to 74%	03	
Below 70%	00	

2.16.2 Conduct and Discipline

During their stay in BAUET 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 BAUET authority in order to enhance student's physical, intellectual, moral and ethical development. Zero tolerance will be shown in regards of sexual abuse and harassment in any forms and drug abuse and addiction in the campus.

2.17 The Grading System

The total performance of a student in a given course is based on a scheme of continuous assessment. For theory course this continuous assessment is made through a set of quizzes/class tests, observations/class participation, homework/assignment and a Semester final examination. The assessment in laboratory courses is made by evaluating performance of the student at work during the class, viva-voce during laboratory hours and quizzes. Each course has a certain number of credits, which describes its corresponding weightages. A letter grade with a specified number of grade points is awarded in each course for which a student is registered. A student's performance is measured by the number of credits completed satisfactorily and by the weighted average of the grade points earned. A minimum Grade Point Average (GPA) is essential for satisfactory progress. A minimum number of earned credits also have to be acquired in order to qualify for the degree. Letter grades and corresponding

grade points will be awarded in accordance with the provisions (as per University Grant Commission-UGC grading system) shown below:

Numerical Score	Letter Grade		Grade points
80% and above	A+	A (Plus)	4.00
75% to below 80%	A	A (Regular)	3.75
70% to below 75%	A-	A (Minus)	3.50
65% to below 70%	B+	B (Plus)	3.25
60% to below 65%	B	B (Regular)	3.00
55% to below 60%	B-	B (Minus)	2.75
50% to below 55%	C+	C (Plus)	2.50
45% to below 50%	C	C (Regular)	2.25
40% to below 45%	D	D (Pass)	2.00
below 40%	F	Fail	0.00
Incomplete	I	-	-
Withdrawal	W	-	-
Projects/Thesis Continuation	X	-	-

*The subject in which the student gets F grade shall not be counted towards credit hours requirements and for the calculation of Grade Point Average (GPA). Students failing in a course/ courses due to being expelled, dis-collegiate, absent will be treated as F according to Grading system.

2.18 Distribution of Marks

Theory: Thirty percent (30%) marks of theoretical course shall be allotted for continuous assessment, i.e., quiz, class tests, home assignments, class evaluation and class participation and 70% shall be allotted to the Semester Final Examination. The Final examination is conducted centrally by the University. Distribution of marks for a given course if as follows.

Marks distribution of Theory courses:

Category	Marks
Class participation/ Observation/Performance	5 %
Homework/Assignment/ Quizzes	5%
Class tests	20%
Final Examination (Maximum 3 Hours)	70%
Total	**100**

Sessional: 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 Semester 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):

Lab/ Project-Based Sessional: The mark distribution will be as under:

Distribution of marks	
Categories	**Marks**
Lab Test/ Project	30%
Written Test/ Quiz	20%
Viva-voce	10%
Attendance	10%
Data Sheet/ Home Assignment/ Report	10%
Class Performance/ Continuous Evaluation	20%
Total	**100%**

Programming Based Sessional:

Categories	**Marks**
Online Test – 1	25%
Online Test – 2	25%
Viva voce	10%
Attendance	10%
Continuous Evaluation	10%
Class Performance	20%
Total	100%

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

Distribution of marks	
Categories	**Marks**
Class Performance	5%
Class Observation	5%
Written Assignment	15%
Oral Performance	25%
Listening Skill	10%
Group Presentation	30%
Viva Voce	10%
Total	**100%**

2.19 Calculation of GPA (Grade Point Average)

Grade Point Average (GPA) is the weighted average of the grade points obtained from all the courses passed/completed by a student. For Example, if a student passes/completes 'n' courses in a Semester having credits of C_1, C_2.....,C_n and her/his grade points in these courses are G_1, G_2,....., G_n respectively,

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

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

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

A Numerical Example:

Suppose a student has completed 09 (nine) courses in a Semester and obtained the following grades:

Course	Credits, C_i	Grade	Grade Point, G_i	$C_i \times G_i$
ME 1101	3.00	A+	4.00	12.00
ME 1102	1.50	A-	3.50	5.25
PHY 1111	4.00	A+	4.00	16.00
PHY 1112	1.50	A+	4.00	6.00
MATH 1111	3.00	B	3.00	9.00
CHEM 1111	3.00	A	3.75	11.25
CHEM 1112	1.00	A	3.75	3.75
HUM 1121	2.00	B-	2.75	5.50
Total	19.00			68.75

GPA = 68.75/19.00= 3.62

Suppose a student has completed 04 (four) Semesters and obtained the following GPA:

Level	Semester	Credit Earned, TC_i	GPA Earned, GPA_i	$GPA_i \times TC_i$
1	1	21.00	3.73	78.330
1	2	20.50	3.93	80.565
2	1	19.75	3.96	78.210
2	2	20.25	4.00	81.000
Total		**81.50**		**318.105**

CGPA = 318.105/81.50 = 3.90

Minimum Earned Credit and GPA Requirement for Obtaining Degree:

[As per BAUET Exam policy]

2.20 Promotion to the Next Semester
[As per BAUET Exam policy]

2.21 Minimum Earned Credit and CGPA Required for Obtaining a Degree
[As per BAUET Exam policy]

2.22 Consequences of Poor Performance (Referred/Improvement/Backlog)
[As per BAUET Exam policy]

2.23 Course Repetition
[As per BAUET Exam policy]

2.24 Withdrawal Policy
[As per BAUET Exam policy]

2.25 Types of Different Examination
Different types of examinations will be conducted as per examination policy in BAUET to evaluate the students of Undergraduate Programs.

2.26 Class Tests
The number for class test of a course shall be at least n+1 where n is the number of credits of the course. Class test will be conducted by the subject teacher. Course teacher must announce results within 10 days of holding the examination. Checked scripts will be shown to the students. If a student misses the class test for acceptable reason, the course teacher may make arrangements to take the test of the students.

2.27 Earned Credits
The courses in which a student has obtained 'D' or a higher grade will be counted as credits earned by her/him. Any course in which a student has obtained 'F' grade will not be counted as credits earned by her/him.

2.28 Rounding off the Decimal Marks
If there is any decimal marks in any of the examinations like class test, tutorial, term paper, viva voce, course final examination, instead of rounding off the decimal figure in the result of every subject/sessional, it is to be rounded off only once during tabulation while converting the total marks to summation of all the subject/sessional marks. To round off, 0.5 and above is to be converted to next higher whole number (Integer) and less than 0.5 is to be converted to previous whole number (For example 58.5% would be 59% and 58.49% would 58%).

2.29 Rounding off the GPA/CGPA
The GPA/CGPA is not to be rounded off like the total marks of each subject sessional, but it is to be rounded off after two figures of decimal. To round of 3.555 and above after two figure of decimal, it is to be rounded off as 3.56 and 3.554 and below after two figure of decimal, it is to be rounded off as 3.55.

2.30 Number of Grade Sheets

The number of Grade sheets to be issued is 08 (eight) for a regular student. Backlog, re-registered courses, sessional courses result will be included in that particular semester result in which the student appeared.

2.31Transcript

Transcripts will be given after approval of the authority of BAUET, academic council and syndicate. Partial transcripts may be given to students with the assigned payment and verification fixed by the authority.

2.32 Certificate

A copy of provisional before original certificate may be given after approval of the authority of BAUET, academic council and syndicate. Provisional certificates, however, should be surrendered during receiving the original certificate.

2.33 Recognition of Performance

a. **Degree with Honors:** Candidates for Bachelor's Degree will be awarded the degree with honors if their overall CGPA is 3.75 and above.
b. **Gold Medal:** Gold medal will be awarded to all students earning CGPA 4 at the end of the entire program.
c. **VC's List:** VC's list will be awarded to all students earning 3.90 and above at the end of each academic level, and all graduating students earning 3.90 and above considering results of entire program.
d. **Dean's List:** Dean's list will be awarded to all students earning CGPA 3.75 - 3.90 at the end of each academic year for 1, 2, 3 and all graduating students earning CGPA 3.75 - 3.90 considering results of entire program.
e. **Other Scholarships and Stipends:** This will be considered by the university authority in due course of time.

****Students must have above 90% attendance to be considered in the Dean's list and VC's list of recognition.**

*[**N.B.** Contradiction among the existing Examination Policy, Syllabus and Standing Instruction (SI) will be solved by a team headed by the honorable VC]*

Chapter-3
Course Curriculum for Bachelor Degree in ME

3.1 Introduction

The list of courses offered to the Undergraduate students of Mechanical Engineering (ME) is categorized into Core courses and Elective courses. Some of the core courses are offered by the Department of ME and some of these are offered by other departments. Students have the flexibility to choose from amongst the Elective courses.

3.2 Core Courses

The students have to complete all the core courses enlisted below.

List of Core Courses- ME

Course Code	Course Title	Contact Hours	Credit Hours
ME 1101	Introduction to Mechanical Engineering	3.0	3.00
ME 1102	Mechanical Engineering Drawing –I	3.0	1.50
ME 2103	Engineering Thermodynamics	3.0	3.00
ME 2104	Engineering Thermodynamics Sessional	3/2	0.75
ME 2110	Workshop Technology Sessional	3.0	1.50
ME 2145	Engineering Mechanics-I	3.0	3.00
ME 2100	Computer Aided Drawing	3.0	1.50
ME 2243	Mechanics of Solids	3.0	3.00
ME 2244	Mechanics of Solids Sessional	3/2	0.75
ME 2261	Numerical Analysis	3.0	3.00
ME 2262	Numerical Analysis Sessional	3/2	0.75
ME 2293	Engineering Materials	3.0	3.00
ME 2294	Engineering Materials Sessional	3/2	0.75
ME 3105	Heat and Mass Transfer	3.0	3.00
ME 3106	Heat and Mass Transfer Sessional	3/2	0.75
ME 3121	Fluid Mechanics-I	3.0	3.00
ME 3122	Fluid Mechanics -I Sessional	3/2	0.75
ME 3133	Manufacturing Technology-I	3.0	3.00
ME 3134	Manufacturing Technology- I Sessional	3/2	0.75
ME 3141	Machine Design	4.0	4.00
ME 3142	Machine Design Sessional	3/2	0.75
ME 3145	Mechanics of Machinery	3.0	3.00
ME 3146	Mechanics of Machinery Sessional	3.0	1.50

ME 3207	Heat Transfer Equipment Design	3.0	3.00
ME 3208	Heat Transfer Equipment Design Sessional	2.0	1.00
ME 3223	Fluid Mechanics– II	3.0	3.00
ME 3224	Fluid Mechanics– II Sessional	3/2	0.75
ME 3235	Manufacturing Technology-II	3.0	3.00
ME 3236	Manufacturing Technology-II Sessional	3/2	0.75
ME 3247	Engineering Mechanics-II	3.0	3.00
ME 3261	Instrumentation and Measurement	3.0	3.00
ME 3266	Electro-Mechanical System Design and Practice	3/2	0.75
ME 3200	Industrial Training	4 weeks	1.00
ME 4100	Integrated Design Project	3.00 2.00	1.50 1.00
ME 4000	Undergraduate Thesis	3.00 + 3.00	3.00 + 3.00
ME 4101	Applied Thermodynamics	3.00	3.00
ME 4102	Applied Thermodynamics Sessional	3/2	0.75
ME 4107	Tool Engineering and Machine Tools	3.0	3.00
ME 4117	Refrigeration and Air Conditioning	3.0	3.00
ME 4183	Production Planning and Control	3.0	3.00
ME 4203	Power Plant Engineering	3.0	3.00
ME 4204	Power plant Sessional	3/2	0.75
ME 4221	Fluid Machinery	3.0	3.00
ME 4222	Fluid Machinery Sessional	3/2	0.75
ME 4281	Industrial Management	3.0	3.00
ME 4267	Automobile Engineering	3.0	3.00
ME 4286	Engineering Research & Business Communication Sessional	3/2	0.75

List of Core Courses- Others

Course Code	Course Title	Contact Hours	Credit Hours
Phy 1109	Physics-I	3.0	3.00
Phy 1207	Physics-II	3.0	3.00
Phy 1208	Physics-Sessional	3.0	1.50

Chem 1113	Inorganic Quantitative Analysis Chemistry	3.0	3.00
Chem 1114	Inorganic Quantitative Analysis Chemistry Sessional	3.0	1.50
Chem 1213	Industrial Chemistry	3.0	3.00
CSE 1271	Computer Programming Language	3.0	3.00
CSE 1272	Computer Programming Language Sessional	3.0	1.50
Math 1161	Mathematics-I	3.0	3.00
Math 1265	Mathematics-II	3.0	3.00
Math 2165	Mathematics-III	3.0	3.00
Math 2267	Mathematics-IV	3.0	3.00
Hum 1259	Communicative English	3.0	3.00
Hum 1260	Technical Report Writing and Presentation	3/2	0.75
Hum 2133	Principle of Accounting	3.0	3.00
Hum 2235	Sociology and Engineering Economics	3.0	3.00
Hum-1153	Bangla language and Literature	2.0	2.00
Hum-1255	Bangladesh Studies (History of Independence)	3.0	3.00
EEE 1159	Fundamentals of Electrical Engineering	3.0	3.00
EEE 1160	Fundamentals of Electrical Engineering Sessional	3/2	0.75
EEE 2159	Electrical and Electronics Technology	3.0	3.00
EEE 2160	Electrical and Electronics Technology Laboratory	3/2	0.75

3.3 List of Elective Courses

Optional-I Course Code	Course Title	Contact Hours	Credit Hours
ME 4105	Advanced Thermodynamics	3.0	3.00
ME 4109	Renewable Energy	3.0	3.00
ME 4111	Combustion and Pollution	3.0	3.00
ME 4113	Energy and Environment	3.0	3.00
ME 4115	Advanced Programming with MATLAB	3.0	3.00
ME 4119	Engineering Multiphase Flows	3.0	3.00

ME 4123	Fluids Engineering	3.0	3.00
ME 4125	Aerodynamics	3.0	3.00
ME 4127	Applied Engineering Mathematics	3.0	3.00
ME 4129	Gas Dynamics	3.0	3.00
ME 4131	Finite Element Method	3.0	3.00
ME 4133	Nanomaterials and Nanotechnology	3.0	3.00
ME 4139	Bio-Fluid Mechanics	3.0	3.00
ME 4141	Theory of Structure	3.0	3.00
Optional-I I Course Code	Course Title	Contact Hours	Credits Hours
ME 4233	Fluidics	3.0	3.00
ME 4235	Introduction to CFD	3.0	3.00
ME 4237	Design of Fluid Machines	3.0	3.00
ME 4245	Noise and Vibration	3.0	3.00
ME 4247	Robotics	3.0	3.00
ME 4249	Composite Materials	3.0	3.00
ME 4253	Applied aerodynamics	3.0	3.00
ME 4261	Control Engineering	3.0	3.00
ME 4263	Petroleum Engineering	3.0	3.00
ME 4265	Applied Statistics	3.0	3.00
ME 4269	Introduction to Nuclear Engineering	3.0	3.00
ME 4271	Bio-Engineering	3.0	3.00
ME 4273	Plastic Process Technology	3.0	3.00
ME 4275	Modern Manufacturing Technology	3.0	3.00
ME 4277	Metal Cutting Processes	3.0	3.00
ME 4279	CAD/CAM	3.0	3.00
ME 4291	Mems Devices - Design and Fabrication	3.0	3.00
ME 4293	Material Handling	3.0	3.00
ME 4295	Mechatronics	3.0	3.00
ME 4297	Textile Technology	3.0	3.00

Undergraduate Research

Undergraduate research will have to be undertaken by students under a supervisor in partial fulfillment of the requirement of his degree. Credit allotted to the undergraduate research will be 6 having 12 contact hours.

Notes:

1. Students can choose from optional courses offered by the Department of Mechanical Engineering.
2. The minimum credit hour requirement for B. Sc. Engg. (Mech.) degree is 161.00.

3.4 Contact hours and Credit Hours Distribution:

Year/Semester.	Theory		Sessional		Total Contact hours	Total Credit hours
	Contact hours	**Credit hours**	**Contact hours**	**Credit hours**		
1st Year 1st Semester	17.00	17.00	7.50	3.75	24.50	20.75
1st Year 2nd Semester	18.00	18.00	7.50	3.75	25.50	21.75
2nd Year 1st Semester	15.00	15.00	10.00	5.00	25.00	20.00
2nd Year 2nd Semester	15.00	15.00	6.00	3.00	21.00	18.00
3rd Year 1st Semester	16.00	16.00	7.50	3.75	23.50	19.75
3rd Year 2nd Semester	15.00	15.00	9.50	5.75	24.50	20.75
4th Year 1st Semester	15.00	15.00	9.50	4.75	24.50	19.75
4th Year 2nd Semester	15.00	15.00	10.50	5.25	25.50	20.25
Total	**126**	**126**	**68**	**35**	**194**	**161**

Sequence of Offered Courses in Eight Semesters:

1st Year 1st Semester				
S. N.	Course Code	Course Title	Contact hours	Credit hours
Theory				
1.	ME 1101	Basic Mechanical Engineering	3.00	3.00
2.	EEE 1159	Fundamentals of Electrical Engineering	3.00	3.00
3.	Phy 1109	Physics-I	3.00	3.00
4.	Chem 1113	Inorganic Quantitative Analysis	3.00	3.00
5.	Math 1161	Mathematics-I	3.00	3.00
6.	Hum 1153	Bangla language and Literature	2.00	2.00
Sessional				
7.	ME 1102	Mechanical Engineering Drawing	3.00	1.50
8.	EEE 1160	Fundamental of Electrical Engineering Sessional	3/2	0.75
9.	Chem 1114	Inorganic Quantitative Analysis Sessional	3.00	1.50
Total:			**24.50**	**20.75**

1st Year 2nd Semester				
S. N.	Course Code	Course Title	Contact hours	Credit hours
Theory				
1.	CSE 1271	Computer Programming Language	3.00	3.00
2.	Phy 1207	Physics-II	3.00	3.00
3.	Math 1265	Mathematics - II	3.00	3.00
4.	Chem 1213	Industrial Chemistry	3.00	3.00
5.	Hum 1259	Communicative English	3.00	3.00
6.	Hum-1255	Bangladesh Studies (History of Independence)	3.00	3.00
Sessional				
7.	CSE 1272	Computer Programming Language Sessional	3.00	1.50
8.	Hum 1260	Technical Report Writing and Presentation	3/2	0.75
9.	Phy 1208	Physics Sessional	3.00	1.50
Total:			**25.50**	**21.75**

2nd Year 1st Semester				
S. N.	Course Code	Course Title	Contact hours	Credit hours
Theory				
1.	ME 2103	Engineering Thermodynamics	3.00	3.00
2.	ME 2145	Engineering Mechanics-I	3.00	3.00
3.	EEE 2159	Electrical and Electronics Technology	3.00	3.00
4.	Math 2165	Mathematics-III	3.00	3.00
5.	Hum 2133	Principles of Accounting	3.00	3.00
Sessional				
6.	EEE 2160	Electrical and Electronics Technology Sessional	2.00	1.00
7.	ME 2104	Engineering Thermodynamics Sessional	2.00	1.00
8.	ME 2110	Workshop Technology Sessional	3.00	1.50
9.	ME 2100	Computer Aided Drawing	3.00	1.50
Total:			**25.00**	**20.00**

2nd Year 2nd Semester				
S. N.	Course Code	Course Title	Contact hours	Credit hours
Theory				
1.	ME 2243	Mechanics of Solids	3.00	3.00
2.	ME 2261	Numerical Analysis	3.00	3.00
3.	ME 2293	Engineering Materials	3.00	3.00
4.	Math 2267	Mathematics - IV	3.00	3.00
5.	Hum 2235	Sociology and Engineering Economics	3.00	3.00
Sessional				
6.	ME 2244	Mechanics of Solids Sessional	3/2	0.75
7.	ME 2262	Numerical Analysis Sessional	3.00	1.50
8.	ME 2294	Engineering Materials Sessional	3/2	0.75
Total:			**21.00**	**18.00**

3rd Year 1st Semester				
S.N.	Course Code	Course Title	Contact hours	Credit hours
Theory				
1.	ME 3105	Heat and Mass Transfer	3.00	3.00
2.	ME 3121	Fluid Mechanics – I	3.00	3.00
3.	ME 3141	Machine Design	4.00	4.00
4.	ME 3145	Mechanics of Machinery	3.00	3.00
5.	ME 3133	Manufacturing Technology-I	3.00	3.00
Sessional				
6.	ME 3106	Heat and Mass Transfer Sessional	3/2	0.75
7.	ME 3122	Fluid Mechanics – I Sessional	3/2	0.75
8.	ME 3142	Machine Design Sessional	3/2	0.75
9.	ME 3146	Mechanics of Machinery Sessional	3/2	0.75
10.	ME 3134	Manufacturing Technology -I Sessional	3/2	0.75
Total:			**23.50**	**19.75**

3rd Year 2nd Semester				
S.N.	Course Code	Course Title	Contact hours	Credit hours
Theory				
1.	ME 3207	Heat Transfer Equipment Design	3.00	3.00
2.	ME 3223	Fluid Mechanics – II	3.00	3.00
3.	ME 3235	Manufacturing Technology-II	3.00	3.00
4.	ME 3247	Engineering Mechanics - II	3.00	3.00
5.	ME 3261	Instrumentation and Measurement	3.00	3.00
Sessional				
6.	ME 3208	Heat Transfer Equipment Design Sessional	2.00	1.00
7.	ME 3224	Fluid Mechanics – II Sessional	3/2	0.75
8.	ME 3236	Manufacturing Technology- II Sessional	3/2	0.75
9.	ME 3266	Electro-Mechanical System Design and Practice	3/2	0.75
10.	ME 3200*	Industrial Training	4 Weeks	1.00
11.	ME 4100	Integrated Design Project	3.00	1.50
Total:			**24.5 + 04 Weeks**	**20.75**

4th Year 1st Semester				
S.N.	Course Code	Course Title	Contact hours	Credit hours
Theory				
1.	ME 4101	Applied Thermodynamics	3.00	3.00
2.	ME 4183	Production Planning and Control	3.00	3.00
3.	ME 4107	Tool Engineering and Machine Tools	3.00	3.00
4.	ME 4117	Refrigeration and Air Conditioning	3.00	3.00
5.	Optional-I	Selected from prescribed optional subjects	3.00	3.00
Sessional				
6.	ME 4102	Applied Thermodynamics Sessional	3/2	0.75
7.	ME 4100	Integrated Design Project	2.00	1.00
8.	ME 4000	Thesis	6.00	3.00
Total:			**24.5**	**19.75**

4th Year 2nd Semester				
S.N.	Course Code	Course Title	Contact hours	Credit hours
Theory				
1.	ME 4203	Power Plant Engineering	3.00	3.00
2.	ME 4281	Industrial Management	3.00	3.00
3.	ME 4221	Fluid Machinery	3.00	3.00
4.	ME 4267	Automobile Engineering	3.00	3.00
5.	Optional-II	Selected from prescribed optional subjects	3.00	3.00
Sessional				
6.	ME 4204	Power Plant Engineering Sessional	3/2	0.75
7.	ME 4222	Fluid Machinery Sessional	3/2	0.75
8.	ME 4286	Engineering Research & Business Communication Sessional	3/2	0.75
9.	ME 4000	Thesis	6.00	3.00
Total:			**25.5**	**20.25**

Chapter-4
Detail Outline of Courses Offered by the Department of ME

ME 1101: Basic Mechanical Engineering

Credit: 3.00, Contact Hour: 3.00

Introduction of sources of energy; forms and sources of conventional and renewable energy; Introduction to system of units; definition of thermodynamics; macroscopic and microscopic approach; thermodynamic system and control volume; properties, processes and cycles; intensive and extensive properties; reversible and irreversible processes; flow and non-flow processes; constant volume, constant pressure, isothermal, adiabatic, polytrophic and isentropic processes; equilibrium, zeroth law of thermodynamics.

Concepts of work and heat; comparison of work and heat; path and point functions, properties of water and steam, different property diagrams; phase rule; thermodynamic property tables and charts; Mollier diagram, dryness fraction of steam, ideal and real gases; equations of state, work and heat transfers in non-flow and flow process, fundamentals of steam, gas and water turbines with their accessories; internal combustion engines, introduction to pumps, blowers and compressors; refrigeration and air conditioning systems, Introduction to boilers, operation of modern steam boilers, accessories and mountings; performance study of steam boiler.

Text and Ref books:

1. Examples in Heat and Heat Engines, T. Peel – Cambridge University Press (2017)

2. Thermodynamics – Yunus A. Cengel, Michael A Boles, McGraw-Hill Education; 8th edition (2014)

ME 1102: Mechanical Engineering Drawing

Credit: 1.50, Contact Hour: 3.00

Graphic Language Fundamentals: Introduction to pictorial drawing, lettering, equipment with their uses, views and projections, concepts of first and third angle projections; generating multi views of solid bodies, dimensioning, orthographic and isometric drawings; views with missing lines, sectional and auxiliary views. Introduction to AutoCAD, basic commands and making simple drawings.

Text and Ref books:

1. Fundamentals of Modern Drafting-2nd Edition, Paul Wallah, Publisher-Glenceo Publishing Co, Inc; 2014

2. Technical Drawing with Engineering Graphics (15th Edition)– Frederick E Giesecke, Alva Mitchell, Henry C. Spencer, 2016

ME 2110: Workshop Technology Sessional

Credit: 1.50, Contact Hour: 3.00

Foundry: Safety practice is workshop, Introduction to foundry, acquaintance with tools and equipment; molding, casting, pattern and core making, bench, practice on simple bench or floor molding, molding sands and defects in casting.

Welding: Safety equipment in welding, arc and gas welding tools and machines, electrodes and their identification, type of flames, using gas and arc welding method to prepare mild steel sheets and plates, different metal joints and welding defects.

Sheet Metal: Tools used in sheet metal, different sheet and plate identification with commercial specification: e.g. CI, GI, MS, GP, BP sheet etc.; sheet metal process practice (bending, joints, cone etc.)

Text and Ref books:

1. Mechanical Workshop Practice Paperback – K. C. John, Prentice-Hall of India Pvt. Ltd; 2nd edition (2010)

2. Machine Tool Practices- 11th edition, Richard R. Kibbe, Roland O. Meyer, Pearson Publishing (2019)

ME 2103: Engineering Thermodynamics

Credit: 3.00, Contact Hour: 3.00

Preliminaries of thermodynamics, the first law of thermodynamics with its corollaries; non-flow energy equation; law of conservation of energy; perpetual motion machine; relation between specific heats; application of the first law to some common closed and open system processes; steady flow energy equation; applications of the steady flow energy equation; non steady flow process, second law of thermodynamics and its corollaries; statement of third law; enthalpy, entropy and internal energy, Maxwell's relations, derivation of general thermodynamic relations, Joule-Thomson coefficient, entropy and exergy analysis.

Vapor power cycle; Brayton cycle, Otto and Diesel cycle, Rankine cycle; reheat cycle and regenerative cycle; calculations of cycle efficiency, Perfect Gas and Mixtures**:** Equation of state, internal energy, enthalpy and specific heat capacities; coefficient of volume expansion and isothermal compressibility ; reversible processes undergone by a perfect gas, perfect gas mixtures; Dalton law; relations involving pressure, volume and composition, internal energy, enthalpy and specific heats of mixtures, different types of fuels; calorific values; alternative fuels, combustion processes; stoichiometry, analysis of the products of combustion; enthalpy of formation; enthalpy and internal energy of combustion; adiabatic flame temperature; evaluation of actual combustion process.

Text and Ref books:

1. Fundamentals of Engineering Thermodynamics, 7th edition- Michael J. Moran & Howard N. Shapiro. Publisher- John Wiley & Sons, Inc. (2010)

2. Thermodynamics – Yunus A. Cengel, Michael A Boles, McGraw-Hill Education; 8th edition (2014)

ME 2104: Engineering Thermodynamics Sessional

Credit: 1.00, Contact Hour: 2.00

Experiments based on ME 2103.

ME 2145: Engineering Mechanics-I

Credit: 3.00, Contact Hour: 3.00

Statics: Basic concepts of free body diagram, concurrent-coplanar- non-coplanar force systems, resultant and resolution of forces, vector algebra, state of equilibrium, couple, resultant of force couple system, wrench, equivalent force system, trusses and frames, forces in members, different types of friction, wheel friction and rolling resistance; method of virtual work and applications; equilibrium positions of composite bodies.

Centroid and Center of Gravity of: line, area, volume, composite bodies; moment of inertia of areas and masses; radius of gyration; product of inertia; parallel axis theorem and angular shift of an axis and transfer formulae; principal axis and principal moments of inertia, ellipsoid of inertia, and center of pressure determination: of submerged bodies, of a contour line to be cut by a punch. Toothed Gears: Law of gearing, velocity of sliding in the mating teeth, different forms of teeth, and length of path and arc of contact, interference, motion and torque transfer by helical, spiral, bevel and worm gear.

Text and Ref books:

1. Vector Mechanics for Engineers: Statics – Ferdinand P. Beer, E Russell Jr. Johnston, Publisher – McGraw-Hill Companies, 12th Edition (2019)

2. Engineering Mechanics: Statics – R.C. Hibbeler, Pearson Publishing, 14th edition (2015)

ME 2100: Computer Aided Drawing

Credit: 1.50, Contact Hour: 3.00

Basic concepts of CAD, simple drawing of machine parts, assembly drawing using Auto CAD, dimensioning, working layout drawings; surface development and intersections, preparing the complete working drawing (detail and assembly) using AutoCAD and CAD project. Design and Drafting Software: Using Pro-engineer/ SolidWorks as a drafting and design tool for solving engineering design problems.

Text and Ref books:

1. Fundamentals of Modern Drafting-2nd Edition, Paul Wallah, Publisher-Glenceo Publishing Co. (2014)

2. Technical Drawing – Frederick E Giesecke, Alva Mitchell, Henry C. Spencer, Ivan Leroy Hill, John T. Dygdon, James E. Novak, Ival L. Hill, Prentice Hall Publishing, 12th edition (2002).

ME 2243: Mechanics of Solids

Credit: 3.00, Contact Hour: 3.00

Definition of stress and strain, various types of stresses, analysis of internal forces, Tension, compression, shear stress, axial stress, bearing and thermal stresses in composites, strain and deformation, stress-strain diagram, elasticity and elastic limits, Hook's law, Poisson's ratio, bi and tri-axial deformations, statically indeterminate members and thin walled pressure vessels, mechanical properties of materials, volumetric strain and bulk modulus, relation between modulus of elasticity and bulk modulus Beams: Introduction to beams, various types of stresses in beams, shear force and bending moment diagrams, flexure formula, economic section, Unsymmetrical beam, reinforced beams, beam deflection; shearing stress and deflection in composite beams, area moment, double integration, superposition method, moment diagram by parts, strain energy method, Castilians theorem and its application.

Statically Indeterminate Beams: Supports in propped and restrained beams, solution by: double integration, area moment and superposition method, design of restrained beams, continuous beams, three moment equation, determination of support reactions of continuous beam, shear and moment diagram, Torsion: Torsion formula, angle of twist of solid and hollow shaft, torsion of hollow thin-walled shaft, torsional stiffness and equivalent shaft, closed coil helical spring. Combined stresses and Strains, Principal stresses and principal planes, combined axial and bending stresses, stress at a point, variation of stress with inclination of element, analytical derivation, Mohr's circle, transformation of strain components, theories of elastic failure, Column Theory, Elastic stability, Euler's column formula, various types of column, empirical formula, secant formula for eccentrically loaded column.

Text and Ref books:

1. Strength of materials, 6th edition- William Nash, Publisher McGraw-Hill International Editions, Schaum's Outline Series (2013)

2. Mechanics of Materials, 7th Edition- Ferdinand P. Beer, E. Russell Johnston, McGraw-Hill Education (2014)

ME 2244: Mechanics of Solids Sessional

Credit: 0.75, Contact Hour: 3/2

Experiments based on ME 2243

ME 2261: Numerical Analysis

Credit: 3.00, Contact Hour: 3.00

Numerical Analysis: Solutions of linear equations by: iterative method, Newton-Raphson method, Gauss's method, Matrix method, Interpolation with equal and unequal intervals, central difference formulae, trapezoidal and Simpson's rule, Newton's formula for forward and backward interpolation. Lagrange's interpolation formula, Striling's interpolation formula, Gauss's central difference formula, Bessel's interpolation formula, numerical differentiation using interpolation and graphical method; numerical integration, solutions of differential equations by numerical methods: Taylor's series, Picard's method, Euler's method, Runga Kutta method.

Finite Element Method: Introduction of Finite element method in Engineering, Finite element modeling.

Text and Ref books:

1. Applied Numerical Analysis (7th edition) – Curtis F. Gerald, Patrick O. wheatley, Addison-Wesley Publishing (2003).

2. Numerical Methods for Engineers (7th edition) – Steven C. Chapra, Raymond P. Carale, McGraw-Hill Publishing Company Ltd. (2015)

ME 2262: Numerical Analysis Sessional

Credit: 1.50, Contact Hour: 3.00
Numerical solution of problems in Engineering using MATLAB.

ME 2293: Engineering Materials

Credit: 3.00, Contact Hour: 3.00

Introduction to Engineering Materials**,** significant properties of material properties-elasticity, plasticity, strength, ductility, brittleness, malleability, hardness, toughness, stiffness, creep, endurance, fatigue, resilience; metal and alloys, measurement and control of high temperature, Crystal Geometry, types of lattices, solidification of metal and alloys, cooling curve, variables affecting solidification, nucleation, grain growth crystal imperfection; iron-carbon alloys, iron-iron carbide equilibrium diagram, deformations and dislocation theories.

Iron and Steel: Pig and wrought iron manufacturing with their properties and uses, types of cast iron, cast iron manufacturing process with properties and uses, Manufacturing of steel, properties and uses of steel, alloy steels, specification of steel, characteristics of tool steel, stainless and heat resisting steel; heat treatment of steel: normalizing, annealing, hardening, tempering, austempering, TTT diagram and different types of case hardening processes, Non Ferrous Metals and Alloys: Composition, properties and uses of copper, Zinc, Aluminum, Nickel, Tin, white metal, noble metals, bearing materials and spring materials etc., powder metallurgy processes, metal powder and their characteristics, method of producing metal powders, characteristics, mixing, compacting, sintering, application, advantages, disadvantages of powder metallurgy, polymers, ceramics, introduction to composite materials, their importance and uses.

Text and Ref books:

1. Introduction to Physical Metallurgy (2nd edition) Sidney H Avner, Publisher –Tata Mc Graw – Hill Edition. (2017)
2. Materials Science and Engineering: An Introduction – W D Callister, Jr. Publisher – John Wiley and Sons,7th edition (2006)

ME 2294: Engineering Materials Sessional

Credit: 0.75, Contact Hour: 3/2

Experiments based ME 2293.

ME 3105: Heat and Mass transfer

Credit: 3.00, Contact Hour: 3.00

Fundamental processes of heat transfer, Fourier's law, Conduction: governing equations and boundary conditions, steady and unsteady heat transfer, resistance concept; one-dimensional heat conduction through: plane wall, cylinder, sphere, composite structures, different types of fins and their use, overall heat transfer coefficient, critical thickness of insulation, thermal contact resistance, unsteady state conduction: lumped heat capacity system, transient heat flow in a semi-infinite solid, transient heat flow with a convection boundary condition, Convection, types of flow and convection, laminar and turbulent convection, forced-convection and natural-convection boundary layers, external flows, flow over a flat plate; momentum, energy and integral equations, heat transfer coefficients.

Radiation, blackbody and gray body exchange, spectral and solar radiation, radiation properties, infinite parallel planes, concentric spheres and long cylinders, enclosure problems; coupled conduction- convection- radiation problems; application of engineering heat transfer problems, Heat transfer mechanism with change of phase, Boiling and condensation; types of condensation; condensation over flat surfaces, inside and outside tubes, boiling curves, Mass Transfer: Introduction; co-efficient of mass transfer; Fick's law of diffusion, evaporation of moisture from wetted surfaces to surrounding gases, mass transfer by diffusion; convection and change of phase; analogy between heat and mass transfer.

Text and Ref books:

1. Heat And Mass Transfer- Yunus Cengel, Mc Graw-Hill, Edition 5th Edition (2014)
2. Heat Transfer – J. P. Holman 10th Edition, Publisher - Mc Graw-Hill Inter (2010)

ME 3106: Heat and Mass Transfer Sessional

Credit: 0.75, Contact Hour: 3/2

Sessional based on ME 3105

ME 3121: Fluid Mechanics-I

Credit: 3.00, Contact Hour: 3.00

Introduction to fluid, concepts of viscosity, compressibility and elasticity, surface tension and capillarity, vapor pressure and manometer, pressure gradient in static incompressible fluids, center of pressure, hydrostatic forces on plane and curved surfaces, buoyant force and flotation, stability of floating and submerged bodies, fluid containers subjected to acceleration and rotation, velocity and acceleration of fluid particles, classification of fluid flow, stream line, streak line and stream tube; relation between system approach and control volume approach; continuity equation, momentum and energy equation, Euler's and Bernoulli's equation, kinetic energy correction factor, special forms of energy and momentum equations and their applications.

Flow Measuring Devices: flow through orifice, pitot tube, venturi-meter, flow through nozzle and orifice meter, notches and weirs, momentum equation for inertial control volume, application of momentum principle for incompressible fluids in variable area duct, impact of jet on fixed and moving vanes, application of momentum principle for jet propulsion and propellers, momentum correction factor, force caused by a flow round a pipe-bend, force at nozzle and reaction of a jet, force on solid body in a flowing fluid, Dimensional Analysis: Fundamental and derived units, dimensional homogeneity, Buckinghum Pi theorem, significance of dimensionless numbers, application of dimensional analysis in fluid flow problems.

Text and Ref books:

1. Fluid Mechanics Fundamentals and Applications-Y. Cengel, Cimbala, McGraw-Hill Education, 3rd edition (2013)

2. Fluid Mechanics – Frank M. White, McGraw-Hill; 5th edition (2002)

ME 3122: Fluid Mechanics– I Sessional

Credit: 0.75, Contact Hour: 3/2

Experiments based on ME 3121.

ME 3141: Machine Design

Credit: 4.00, Contact Hour: 4.00

Prospects of Engineering Design, purpose and approach to design, design methods and procedures, feasibility study, system design cycle, material specification, factor of safety, standard specification and design equations, simple and combined stress, material and their properties, variable load and

stress concentration, manufacturing considerations in design, theories of failures for ductile materials and brittle materials, variable loads, notch sensitivity, fatigue and fatigue failure theories.

Shaft design for fully reverse bending and steady torsion, design for fluctuating bending and fluctuating torsion, Shaft deflection, design of sliding contact and antifriction (ball and roller) bearing, design of helical, bevel and worm gears, Belt (flat, v-belt, vv belt), chain (single and multi-strand) and rope drives, power screw, screwed joints, riveted and welded joints, fasteners, keys, couplings and connections, design of compression, extension and torsional springs in static and dynamic loading, leaf spring, design of column with central and eccentric loading, levers and compliant mechanisms and application of software in design.

Text and Ref books:

1. Mechanical Engineering Design – Joseph Edward Shigley, Charles R. Mischke, Publisher Mc Graw-Hill, 10th Edition (2014)

2. Machine Design: An Integrated Approach – Robert L Norton, Publisher – Prentice Hall, 5th edition (2013)

ME 3142: Machine Design Sessional

Credit: 0.75, Contact Hour: 3/2

Sessional based on ME 3141.

ME 3145: Mechanics of Machinery

Credit: 3.00, Contact Hour: 3.00

Basic concepts of mechanism, structure of mechanisms, kinematic pairs and their classification, links, degree of freedom, redundant constrains and redundant degree of freedom of linkage, main types of mechanisms, kinematic analysis of planer linkages with lower kinematic pairs and position, velocity, acceleration analysis, inertia and kinetic energy of rotating and reciprocating parts, turning moment diagram, fluctuating energy and speed, flywheel, dynamometer, static and dynamic balancing of stationary, rotating and reciprocating parts, balancing of in-line and V-engine, firing order, principle of direct and reverse cranks in balancing problems, balancing machines.

Gear Train: law of gearing and toothed gearing, analytical and tabular methods of simple, compound and epicyclic gear trains, compound epicyclic trains and their applications, torque transfer by gear train, Governors: classification of governor and governing, working principles of different types of governor, controlling force curves, stability and sensitiveness, effort and power of

governor and hunting, Cam and Follower: type of cams, specified motion of followers, cam profiles construction, cams with specific contours, position, velocity, acceleration and jerk analysis.

Vibration: introduction, importance to engineers, free, forced and damped vibration of systems having one degree of freedom; natural frequency, resonance, beat and transient phenomenon in vibrations, torsional oscillation of shafts, whirling and transverse vibration of shaft, pendulum treated by energy method, free vibrations with two degrees of freedom, torsional oscillation of shaft, sources of vibration, vibration isolation and control, vibration measuring instruments, elastic suspension of machinery, isolator materials, and vehicle suspension system.

Text and Ref books:

1. Mechanics of Machines-William Cleghorn, Oxford University Press; 2nd edition (2014)

2. Theory of Machines – Thomas Bevan, CBS Publishers & Distributors Pvt. Ltd (2005)

ME 3146: Mechanics of Machinery Sessional

Credit: 1.50, Contact Hour: 3.00

Laboratory procedures in balancing, analysis of cams and gears, vibration, moment of inertia of machine parts and gyroscopes.

ME 3133: Manufacturing Technology-I

Credit: 3.00, Contact Hour: 3.00

Preliminary concepts, Product concept, market feasibility, engineering design, prototyping, production, manufacturing design, product analysis, materials, and cost, assembly lines, work cells, inventory work flow, quality assurance through production monitoring, product testing, machining processes, finishing, assembly, production machine operations: Presses, Molding/Casting, Drilling/Boring, Machining, Welding, Finishing, Advanced Intelligence Automation, Programmable Logic Controllers, types of motions in machining, turning and Boring, Shaping, Planning and Slotting, Thread cutting, Drilling and reaming, Milling, Broaching, Gear cutting and Grinding, Machining parameters and related quantities.

Different methods of plastic molding, powder metallurgy, production of metallic powders, sintering and hot pressing, applications, Lathe machine and accessories, types of lathes, drilling and other hole making machines, shapers

and planners, milling, Gears and threads: manufacturing and related machines. Finishing operation: grinding, honing, lapping, super-finishing etc.

Text and Ref books:

1. Manufacturing Engineering and Technology (4th edition) – Serope Kalpakjiann, Steven R. Schmid, Prentice Hall, 4th edition, 2004.

2. Principles of Modern Manufacturing, 5th Edition, Mikell P. Groover, Publisher: John Wiley & Sons, Inc (2013)

ME 3134: Manufacturing Technology-I Sessional

Credit: 0.75, Contact Hour: 3/2

Experiments based on ME 3133.

ME 3207: Heat Transfer Equipment Design

Credit: 3.00, Contact Hour: 3.00

Introduction to thermal system design**,** review of fundamental principles of thermodynamics, fluid mechanics, and heat transfer, with application area, analysis of design parameters thermal requirements, material, cost, safety and reliability, optimization including thermo-economic evaluation and energy analysis, economic and environmental impact of energy use, application to thermos-fluid systems such as power plants, concepts of fin, different types, fin design, performance and efficiency of fins, straight fins of rectangular and triangular profiles, analysis of heat transfer from fins.

Heat Exchangers: Basic types of heat exchanger: parallel flow, counter flow, cross flow, shell-and-tube, mixed and unmixed, single and multiple pass, compact heat exchangers, overall heat transfer co-efficient; exchanger effectiveness, efficiency, sizing of heat exchangers, LMTD and NTU method; heat transfer enhancement technique; fouling and scaling, correction factor, heat exchanger applications, Two phase heat transfer equipments, Boiler, Evaporator, Condenser, Cooling tower, Thermal systems with internal heat source: modeling of thermal equipment.

Text and Ref books:

1. Heat Exchanger Design Guide-Manfred Nitsche , Raji O Gbadamosi, Butterworth-Heinemann; 1st edition (2015)

2. Compact Heat Exchangers: Selection, Design and Operation- J.E. Hessel greaves Richard Law, David Reay, Butterworth-Heinemann; 2nd edition (2016)

ME 3208: Heat Transfer Equipment Design Sessional

Credit: 1.00, Contact Hour: 2.00

Experiments based on ME 3207

ME 3223: Fluid Mechanics – II

Credit: 3.00, Contact Hour: 3.00

Viscous flow in pipes, fluid friction, Froude's experiment, Darcy-Weisbech equation, Chezy, Manning and Hazen-Williams formula, flow between parallel flat plates, velocity distribution for fixed or moving horizontal and inclined plates; Hagen-Poiseulle equation, viscous shear stresses in turbulent flow, eddy viscosity, expression for friction factor in turbulent flow, energy correction factors for laminar and turbulent pipe flow, Moody chart and its use, flows in pipe network, Pipe line system design and frictional losses in pipes and fittings.

Boundary Layer concept, boundary layer thickness, displacement and momentum thickness, characteristics of boundary layer, boundary layer with zero pressure gradient, friction drag due to boundary layers, effect of pressure gradient, transition for flat plate, flow separation, wake behind a cylinder, turbulent flat plate boundary layer, introduction to Naiver-Stocks Equation, flow around submerged objects, airfoil, Open Channel Flow: Introduction to open channel flow, optimum shape of flow cross section, hydraulic jump, specific energy, Froude number and its significance in channel flow; critical depth.

Ideal Fluid Flow: Rotational and irrotational flow; circulation and vorticity, velocity potential; stream function, relationship between stream function and velocity potential, stream lines, equipotential lines and flow nets, vortex motion, free and forced vortex motion, doublet, simple flows; superposition of simple flows; flow around a cylinder with and without circulation, Magnus effect and aerodynamic lift.

Text and Ref books:

1. Fluid Mechanics Fundamentals and Applications-Y. Cengel, Cimbala, McGraw-Hill Education, 3rd edition (2013)

2. Fluid Mechanics – Frank M. White, McGraw-Hill; 5th edition (2002)

ME 3224: Fluid Mechanics Sessional –II

Credit: 0.75, Contact Hour: 3/2

Experiments based on ME 3223.

ME 3235: Manufacturing Technology-II

Credit: 3.00, Contact Hour: 3.00

Introduction to machine tools, classification, construction and specifications of lathe, drilling machine, milling machine, boring machine, broaching machine, shaper machine, planer machine, grinding machine0 ,CNC types, constructional details, special features - design considerations of CNC machines for improving machining accuracy. Part programming fundamentals, manual programming, computer assisted part programming. Introduction to digital manufacturing and digital manufacturing science, Cutting tool materials, tool geometry, desirable properties and characteristics of cutting tool materials, cutting tool geometry, cutting fluids and its applications, surface finish, effect of machining parameters on surface finish. Machining equations for cutting operations, introduction to machining processes, chip formation, orthogonal cutting, merchant's model for orthogonal cutting, oblique cutting, mechanics of turning, drilling, milling process, tool wear mechanism, tool wear equations, tool life equations, effect of process parameters on tool life.

Introduction to economics of machining Processes, choice of feed, choice of cutting speed, tool life for minimum cost and minimum production time, machining at maximum efficiency, Frequency distribution, measures of central tendency and dispersion; Concept of probability, conditional probability and Bayes' theorem, moment and moment generating function; Sampling theory; acceptance sampling plans - single, double, sequential, rectifying inspection plans; Control charts, X, R and C charts; Regression analysis; Analysis of variance; Concept of quality circle, TQM and TQC.

Text and Ref Books:

1. Fundamentals of metal cutting and Machine Tools, B.L. Juneja, G.S. Sekhon and Nitin Seth, New Age International Publishers 2nd Edition, (2003)

2. Zude Zhou, Shane (Shengquan) Xie and Dejun Chen, Fundamentals of Digital Manufacturing Science, Springer-Verlag London Limited (2012)

ME 3236: Manufacturing Technology-II Sessional

Credit: 0.75, Contact Hour: 3/2

Experiments based on ME 3235.

ME 3247: Engineering Mechanics-II

Credit: 3.00, Contact Hour: 3.00

Kinematics and Kinetics of particles, Rectilinear and curvilinear motion of particles, position vector, velocity and acceleration, derivative of vector functions, Newton's second law of motion- dynamic equilibrium, angular momentum and its rate of change, motion under a central force and its application to space mechanics, Kepler's laws of planetary motion, satellite motion; equation of orbit; cycle time; orbit change, Kinetics of Rigid Bodies in Two Dimension: Translation, rotation about a fixed axis, absolute/relative velocity and absolute/relative acceleration in plane motion, Coriolis acceleration, instantaneous center of rotation, gyroscopic motion and couple-principles and applications.

Plane Motion of Rigid Bodies: Motions for a plane body, angular momentum and its rate of change, D'Alemberts principle; constrained plane motion; principle of work and energy; conservation of energy and angular momentum; principle of Impulse and momentum; eccentric impact, systems of rigid bodies, Principle of work and energy; conservation of energy; work done by a conservative force; potential energy; principle of Impulse and momentum; impulsive motion, impact, linear and angular momentum of system of particles.

Text and Ref books:

1. Vector Mechanics for Engineers: Dynamics – Ferdinand P. Beer, E Russell Jr. Johnston, Publisher – Mc Graw-Hill Companies, 12th Edition (2019).

2. Engineering Mechanics: Dynamics – R.C. Hibbeler, Pearson Publishing, 14th edition (2015)

ME 3261: Instrumentation and Measurement

Credit: 3.00, Contact Hour: 3.00

Measurement: scope and objective of measurement and instrumentation, basic principles of measurements, gauging and limit gauge, Taylor's principle of limit gauging, measuring and recording methods, calibration of instrument, Abbey's principle, measurement of displacement, pressure, temperature, heat-flux, flow, motion and vibration, force, torque, strain, etc., data acquisition, sources of error in measurements, error analysis, digital measurement techniques, techniques for maintaining standards, allowances and tolerance, types of tolerance, limits and fits, basic hole and basic shaft system, selective assembly and interchangeable manufacturing.

Quality Control: frequency distribution, binomial, hypergeometric, Poisson, normal, exponential, Erlangian, Gamma and Weibull distribution, measures of central tendency and dispersion, concept of probability, conditional probability and Bayes theorem; probability distribution, moment and moment generating function; sampling theory, estimation hypothesis testing; acceptance sampling

plan-single, double, sequential, rectifying inspection plans, control charts, X, R, C charts, regression analysis, analysis of variance, concept of quality circle, TQM and TQC.

Text and Ref books:

1. Experimental Methods for Engineers (6th edition) – J. P. Holman, McGraw-Hill Science, 7th edition (2000)

2. Mechanical Measurements (6th edition)- Thomas G. Beckwith, Roy D. Marangoni, John H. Lientard, Pearson (2006))

ME 3266: Electro-Mechanical System Design and Practice

Credit: 0.75, Contact Hour: 3/2

The objective of this course is to make the students familiar with systems and devices where mechanics, electronics, and intelligent control systems interrelate. The students are required to design a project and execute it using the concepts learned in their theory class. It may involve sensors, actuations, signal conditioning, electronics and applied measurement techniques.

ME 3200: Industrial Training (Sessional)**

Credit: 1.00, Contact Week: 4.00

Students will study organization of the industry and their duties, function of different sections, production process, and raw material used, procurement and marketing, costing of the product, future planning and problem facing by the industry and their probable solution, maintenance of machinery, group presentation, future plan, environmental concerns of the industry and safety practice within the industry.

** It will be conducted after the completion of Level-3, at any convenient time as can be arranged by the Department. Intensive training will be conducted in a particular industry prescribed by the department.

ME 4101: Applied Thermodynamics

Credit: 3.00, Contact Hour: 3.00

Internal Combustion Engines: classification of IC engine, testing and performance analysis of I.C. engines, fuel-air cycle and actual cycle analysis, use of combustion charts, combustion in engines, pre-ignition, ignition-delay, detonation and diesel knock, flame propagation during combustion, knocking in I.C. engines and its effects on engine performance, factors affecting knocking, methods of reducing knock, octane and cetane ratings, combustion chamber

design, fuel injection system in compression ignition engine, carburation in spark ignition engine, volumetric efficiency of I.C. engines, factors affecting volumetric efficiency, Heat transfer in I.C. engines, two-stroke engines, scavenging, scavenging efficiency, supercharging, turbocharging, exhaust emission analysis, modern technologies associated with IC engines.

Gas Power Cycles: Introduction to gas turbine, Brayton cycle, its principle of operation, gas turbine cycles-with inter-cooling, regeneration and reheating, power and efficiency calculations, blade materials and cooling of blades, Thrust Propulsion: concepts of propulsion systems, jet propulsion, turbojet, turbo prop, ramjet, rocket propulsion, propellant and its criteria, estimation of fuel consumption and efficiency, introduction to fuel cells, thermoelectric converters, thermionic devices, magneto-hydrodynamic (MHD) power generators, photo-voltaic cells, and plasma engines with their advantages and limitations.

Text and Ref books:

1. Internal combustion Engine Fundamentals – John B. Heywood Publisher – Mc Graw-Hill Book Company, 2nd edition (2018)

2. Examples in Heat and Heat Engines, T. Peel – Cambridge University Press (2017)

ME 4102: Applied Thermodynamics Sessional

Credit: 0.75, Contact Hour: 3/2

Sessional based on ME 4101.

ME 4183: Production Planning and Control

Credit: 3.00, Contact Hour: 3.00

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, safety and hazards; Work study and method study; Plant performance measurement; Introduction to product development and design, Computers in production planning and control; MRPII and JIT

Text and Ref books:

1. The Fundamentals of Production Planning and Control- Stephen N. Chapman, Pearson (2005)

2. Manufacturing Planning and Control for Supply Chain Management- F. Robert Jacobs, McGraw-Hill Education; 6th edition (2010)

ME 4107: Tool Engineering and Machine Tools

Credit: 3.00, Contact Hour: 3.00

Machine Tool: types of machine tool, specification, description of turret and copying lathe, universal milling machine, shaping machines, planning machine, drilling machine, boring machine, hobbing machine, grinding machine, broaching, lapping and honing machine with their operations, work Holding Devices, objective of work-piece location; degree of freedom, fundamental locating arrangements, clamping devices and force analysis, design and detailed study of jigs and fixtures used in various machining processes, dies and punches, die cutting operations, clearance, piercing and blanking die design cutting by punches, strip layout, bending, forming and drawing dies, drawing forces, blank size determination and punch design, mechanical, electrical, hydraulic and pneumatic drive in machine tools, basic considerations, speed and feed gear boxes, optimum speed, gearbox design, basic principles of cluster gear design, step-less drives, control systems in machine tools.

Machine Installation and Testing: procedures of installation, foundation design, recent trends in the development of modern machine tools, testing after installation, Modern Machining Techniques: numerical control of machine, fundamental concepts, main components of NC machine, types of NC machines, machining center, introduction of part programming, introduction of CNC and DNC, fundamentals of CAM, application of group technology.

Text and Ref books:

1. Technology of Machine Tools- Steve Krar, Arthur Gill, McGraw-Hill Education; 7th edition (2010)

2. Machine Tool Practices- Richard R. Kibbe, John E. Neely, 8th edition (2005)

ME 4117: Refrigeration and Air Conditioning

Credit: 3.00, Contact Hour: 3.00

Refrigeration: introductory concept and application of refrigeration, Car not cycle and reversed Carnot cycle, coefficient of performance, vapor compression refrigeration cycle and its modifications, p-h and T-s diagrams, actual cycle and its analysis, compressor, condenser, expansion device and evaporator used in a refrigeration system, absorption refrigeration, air cycle refrigeration, Bootstrap cycle for aircraft air conditioning, low-temperature refrigeration, multi-pressure systems of refrigeration, defrost mechanism and automatic controls used in

commercial refrigeration systems, manufacture of water ice and dry ice, solar absorption refrigeration, vortex tube refrigeration and thermoelectric refrigeration.

Air Conditioning: introduction, classification of A/C and its use, psychometric properties, comfort air conditioning, cooling and heating load calculation of various applications, air distribution system and duct design, air conditioning equipment, purification of air, leak detection, wiring diagram and service, concept of HVAC systems and troubleshooting, Food Processing and Preservation: chilling, freezing, and free-drying, candy manufacture, bakery products, fruits and vegetables preservation techniques.

Text and Ref books:

1. Heating cooling of Building, Design for Efficiency – J. F. Kreidev, McGraw-Hill International, 2nd Edition, (2009)

2. Refrigeration, Air Conditioning and Heat Pumps- G F Hundy, 5th Edition, (2016)

ME 4203: Power Plant Engineering

Credit: 3.00, Contact Hour: 3.00

Sources of energy, production of power, comparison of different types of power plants, review of power sector in Bangladesh, loads and load curves, variable load analysis and power plant economy, Steam Power Plant layout, principle of operation, gas loop, draft system, selection of fan, economizer and air preheater, water loop, steam generators, water treatment, superheater and reheater, condenser, surface condenser calculations, closed and open feed water heaters, deaerator, evaporator, regeneration and direct contact feed water heaters, calculation of efficiency and heat rate, extraction performance, super critical plants, superposed and binary cycle, cogeneration, combined cycles, fuel handling and burning, circulating water system, use of cooling tower and spray pond, impulse and reaction turbines, compounding, power and efficiency calculations, turbine losses, condition line and reheat factor; turbine arrangement, installation and operation, steam turbine accessories.

Hydroelectric Power Plants, advantages and disadvantages, site selection criteria, layout and installation, selection of water turbines, principles of operation and governing, Nuclear Power Plants: scope of use, energy obtained from fission and fusion, types of nuclear reactors, control systems, radiation hazards, waste disposal and safety requirements, overview of Rooppur Nuclear Plant, Electrical Power Transmission: concept of transmission, types of transmission and distribution systems, instrumentation in power plants, Solar and Wind Mills: scope of solar energy in Bangladesh, solar devices, direct production of electricity, solar thermal energy conservation system, types of

wind mill, wind power, forces on blades, operation procedures, new developments.

Text and Ref books:

1. Power Plant Engineering, Nag P. K, McGraw Hill Publishing Co Ltd, 4th Edition: (2017)

2. Power Plant Technology – M M. El-Wakil, McGraw-Hill Book Company International.

ME 4204: Power Plant Engineering Sessional

Credit: 0.75, Contact Hour: 1.50

In this course, students will visit a power plant and make them familiar with fundamental engineering devices and their working procedures. They will classify the plant, go through the design data and core concepts and working principles.

ME 4281: Industrial Management

Credit: 3.00, Contact Hour: 3.00

Organization and management: evolution, management functions, and organization structure; Development of organization theory; Total Quality Management, Lean manufacturing Tools, 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.

Human Resource management: importance, scope, need hierarchy, motivation; Defense mechanism; Leadership; Group dynamics; Job evaluation and merit rating; hiring, training, wage systems, Marketing management: Core marketing concept, Marketing organization; Advertising decisions; new product and pricing strategy, tapping into global market, Pricing Strategy. Introduction to PPC, Supply Chain Management, Case Study.

Text and Ref books:

1. Marketing Management – Phillip T. Kotler & Kelvin Lane Keller, Pearson; 15th edition (2015)

2. Human Resource Management- Gary Dessler, Pearson; 15th edition (2016)

ME 4221: Fluid Machinery

Credit: 3.00, Contact Hour: 3.00

Compressible fluid flow, energy relation for isentropic and isothermal flow, pressure wave propagation, Mach cone, stagnation properties, converging-diverging nozzles, subsonic and supersonic flow, normal shock relations, introduction to roto-dynamic and positive displacement machinery, Euler's pump turbine equation, impulse and reaction turbines, centrifugal and axial flow pumps, performance of Pelton wheel, Francis turbine and Kaplan turbine, characteristic curves, governing of turbines, selections and model test of turbine, reciprocating pump working principle, types of reciprocating pumps, work done by reciprocating pump co-efficient of discharge, slip, cavitation of reciprocating pumps; effect of acceleration of piston on velocity and pressure in the suction and delivery pipes, indicator diagrams, effect of air vessels.

Centrifugal Pump, work done and efficiency of centrifugal pumps, advantage over reciprocating pumps, types, minimum starting speed, limitation of suction lift, characteristics curves, priming, troubles and remedies, specific speed and model testing, pumps in series and in parallel, deep tube well, axial flow pumps, jet pump, fan, blower, and compressor, Unsteady-flow**:** Introduction, inertia pressure, water hammer, surge tanks, hydraulic transmission: fluid coupling and torque converter, hydraulic crane, selection of fluid machine

Text and Ref books:

1. Fluid Mechanics – J. F. Douglas, J. M. Gaesirek, J. A. S. Waffield., Prentice Hall; 5th edition (2006)

2. Fluid Mechanics Fundamentals and Applications-Yunus Cengel, John Cimbala, McGraw-Hill Education; 3rd edition (2013)

ME 4222: Fluid Machinery Sessional

Credit: 1.50, Contact Hour: 3.00

Study of Pelton wheel, Kaplan Turbine, Centrifugal Pump, Reciprocating Pump, Submergible pump.

ME 4267: Automobile Engineering

Credit: 3.00, Contact Hour: 3.00

Fundamentals: basic concept of motor vehicles and their components, different engine types and construction, frame and body, suspension system, springs, wheels, tires, layout, engine mounting, cooling and lubricating systems, exhaust system, emission control, specification of an automobile, Alternative fuels and

alternative types of engines, performance study, resistance to vehicle motion, tructive effort and propulsive power, Storage battery and its construction, cranking motor and generators, lighting, regulators, indicators, ignition system, electrical safety devices and accessories, electrical and electronic control systems.

Transmission and Control: clutch, gear box, propeller shaft, universal joint, final drive, differential, rear axle and front axle, over drive, under drive, steering system, brakes and braking system, speed control and governing, automatic control system, Safety and environmental considerations: reducing injuries, automotive body, materials and vehicle shape, springs and suspension system, steering system, emissions control, noise pollution and control, vehicle fuel economy, testing of vehicle, motor vehicle regulations, modern electric and hybrid vehicles.

Text and Ref books:

1. Automotive Technology: A Systems Approach- Jack Erjavec, Cengage Learning; 5th edition (2009)

2. Automotive Technology – Jack Erjavec, Delmar Thomson Learning.

ME 4286: Engineering Research and Business Communication Sessional

Credit: 0.75, Contact Hour: 3/2

Application of communication theory, Research Proposal and content Writing Methods, professional practice approaches in a controlled class room environment; this may include CV writing, interview skills, case study analysis, group discussion, preparing small reports and/or research proposals, class room & business presentations.

ME 4000: Thesis

Credit: 3.00+3.00, Contact Hour: 6.00+6.00

The aim of this course is to provide a platform to undertake theoretical and experimental and investigation of various problems related to mechanical engineering under the guidance of a supervisor. Students will get opportunity to develop their habit of initiative, creative ability and engineering judgment.

In the beginning of the Semester, each (or group of) student will select a project/thesis topic and start working on literature survey, theoretical study and develop a research proposal. At the end of the Semester, they will present their research idea practically, submit a detailed report for evaluation and will complete experimental set-up /fabrication, also do some trial runs.

Elective Courses

ME 4105: Advanced Thermodynamics

Credit: 3.00, Contact Hour: 3.00

Phase Equilibrium, review of classical and statistical thermodynamics, equilibrium, stability, reversibility and irreversibility, availability, chemical potential, ideal mixtures, introduction to entropy and disorder, increase of entropy, calculation of entropy changes, statistical interpretation, entropy of mixture, absolute entropy, entropy flow and production, pure substances, ideal gas mixtures of constant composition, mixtures of variable compositions, reversible and irreversible mixing, Gibbs phase rule, Raoults law, phase diagram, distillation, reacting mixtures, stoichiometric coefficients, activity and fugacity.

Thermodynamic Potentials: Helmholtz free energy function, Gibbs free energy function, application of free energy functions, thermodynamic potentials, Maxwell relations, phase transitions, the Clausius-Clapeyron equation, fundamental of Statistical Mechanics, energy states and levels, thermodynamic probability, Bose- Einstein statistics, Fermi-Dirac statistics, thermodynamic properties of system, Special Topics: elastic systems, fuel cells, open circuit voltage, ohmic losses, efficiencies, mass transfer, loss magnetic systems, and thermo-electricity.

Text and Ref books:

1. Advanced thermodynamics for Engineers – K. Wax, Publisher – McGraw-Hill International, 2nd edition (2011)

2. Advanced Thermodynamics for Engineers- D. Winterbone, 2nd Edition, (2015)

ME 4109: Renewable Energy

Credit: 3.00, Contact Hour: 3.00

Introduction to Renewable Energy, the energy cycle, scope of renewable energy sources in Bangladesh, available energy resources for the world, energy demand, levels of extraction and technically feasible extraction methods and concepts of hydropower, geothermal power, wave, tidal energy, solar energy etc, wind Energy, historical overview, technical concepts and components of wind turbines, aerodynamics and aeroelasticity, modelling of wind, power and operation control, structural dynamics, load calculations and basic economic considerations.

Solar Energy, scope of application, solar spectrum, air mass, direct and diffuse irradiance, photovoltaic modules, solar cells, inverter, electrical layout, grid connection, Bioenergy and Biofuels: conventional and alternative fuels, biomass properties related to biofuels, thermodynamics applied to biofuel process concepts, 1st and 2nd generation biofuels, impact of energy sources (coal, oil, natural gas, solar, wind, biomass, hydro, geothermal, tidal, wave, ocean thermal and nuclear) on environment, local, regional and global implications, approaches to mitigate environmental emissions, clean development mechanism.

Text and Ref books:

1. Renewable Energy Engineering – Nicholas Jenkins ,Janaka Ekanayake, Cambridge University Press; 1st Edition (2017)

2. Renewable Energy and Climate Change, John Wiley & Sons Ltd., 2nd Edition, (2019)

ME 4111: Combustion and Pollution

Credit: 3.00, Contact Hour: 3.00

Combustion: basic concepts, complete combustion, composition of air, heat of reaction, adiabatic flame temperature, heating values of fuel, air-fuel ratio, stoichiometric air-fuel ratio, equivalence ratio, lean, rich, stoichiometric mixture, first and second law and applications in combustion systems, chemical composition of products of combustion, thermodynamic and chemical equilibrium, Chemical Kinetics: general concept and rate of reaction, classifying reactions, physical absorption, chemisorption, and heterogeneous catalyst, explosion and flammability limits, oxidation of CO, explosion limits of hydrocarbons, flame and its propagation, unburned gas motions, combustion process characterization.

Pollutant formation and control: nature of problem faced in SI & CI engines, NO and NO_2 formation kinetics and reduction, CO kinetics and reduction, unburned hydrocarbon (UHC) emission and reduction, effects of design and operating parameters on HC and NOx, exhaust gas treatments, catalytic converters, and thermal reactors, FTP emission standards.

Text and Ref books:

1. Combustion and Incineration Processes- Walter R. Niessen, CRC Press; 4th edition (2010)

2. Combustion Engineering – G. Borman, K. W Ragland, McGraw-Hill International, 2nd editions (2011)

ME 4113: Energy and Environment

Credit: 3.00, Contact Hour: 3.00

Introduction, overview of earth system, energy flows and fuels, energy and society, forms of energy, hidden costs of energy, electricity and distribution, heat, fossil fuels, energy conversion , environmental impacts of fossil fuels, nuclear power, geothermal and tidal, biomass energy systems.

Biofuels, carbon capture and reuse, waste to energy technologies, current transportation technologies and infrastructure, emerging transportation technologies (Hybrid and Electric Vehicles, High-Speed Rail, New Trends in Air Transportation, Shared Vehicles, etc.)

Urban and indoor air pollution, sustainability of food production, green buildings, environmental economics and energy management.

Text and Ref books:

1. Energy and the Environment-Robert Ristinen, Wiley; 3rd edition.
2. Energy: Its Use and the Environment- Roger A. Hinrichs, Merlin H. Kleinbach, Cengage Learning, 5th Edition (2012)

ME 4115: Advanced Programming with MATLAB

Credit: 3.00, Contact Hour: 3.00

Brief review of basic MATLAB features, class organization and functionality. Advanced graphical features of MATLAB. Effective use of programs written in C, FORTRAN. Use of SIMULINK. Examples and assignments from engineering disciplines.

Text and Ref Books:

1. Numerical Methods for Engineers and Scientists Using MATLAB - Ramin S. Esfandiari, Routledge; 1st edition (2013)
2. MATLAB Programming for Engineers – Stephen J Chapman, Cengage Learning; 5th edition (2015)

ME 4119: Engineering Multiphase Flows

Credit: 3.00, Contact Hour: 3.00

Fundamental fluid mechanics and heat, mass, and energy transport in multiphase flows. Liquid/vapor/gas (LVG) flows, nucleation, bubble dynamics, cavitating and boiling flows, models of LVG flows; instabilities, dynamics, and wave

propagation; fluid/structure interactions. Discussion of two-phase flow problems in conventional, nuclear, and geothermal power plants, marine hydrofoils, and other hydraulic systems.

Text and Ref Books:

1. Computational Techniques for Multiphase Flows- Guan Heng, Butterworth-Heinemann, 1st edition (2009)

2. Fundamentals of Multiphase Flow- Christopher E. Brennen, Cambridge University Press; 1st edition (2009)

ME 4123: Fluids Engineering

Credit: 3.00, Contact Hour: 3.00

Review of basic concepts, fluid kinematics, Lagrangian and Eulerian description, flow visualization techniques, derivation of mass, momentum and energy equation, and introduction to Navier-Stoke's equations, steady and unsteady flows, flow in 2-D and axisymmetric ducts, Laminar jets; stability of laminar flow, Sommerfield equation; flow in branching pipe systems, turbulence and transient flow in gas pipes, unsteady flow in pipes, water hammer; economics of pipe systems, hydraulic machines: press, intensifier, ram, jigger, lift, jack, multiphase transport of gas-liquid in pipes.

Text and Ref books:

1. Foundation of Fluid Mechanics – S. W. Yuan, Prentice – Hall Private Limited.

2. Engineering Fluid Mechanics- by Donald F. Elger, Barbara A. LeBret, Clayton T. Crowe, Wiley; 11th edition (2015)

ME 4125: Aerodynamics

Credit: 3.00, Contact Hour: 3.00

Introductory concept of aerodynamics, physical units and quantities, characteristics of the atmosphere, lighter than air flight, ballistic flight, aerodynamic flight, Bernoulli's principle and the physics of lift, wind tunnels, principles and operation of wind tunnel, computational fluid dynamics, pressure distribution, lift and drag profiles, stall, and airfoil specification, drag and its classification, thrust, potential function, stream function, circulation and basic flows; Kutta-Joukowski theorem; aerofoil theory and wing theory, propeller driven aircraft, turbojet, turboprop, turbofan engines.

Aircraft performance: speed verses power curves, optimum speed/cruise performance, range and endurance, glide performance, climb performance, Take-off and landing, static performance problems, aircraft stability and control, control surfaces, stability, lateral and directional stability, center of gravity, turns, aircraft design considerations, high speed flight.

Text and Ref books:

1. Fundamentals of Aerodynamics – John D. Anderson, Mc Graw-Hill, 6th edition, (2016)
2. Introduction to Flight- John D. Anderson, Mc Graw-Hill, 8th edition, (2015)

ME 4127: Applied Engineering Mathematics

Credit: 3.00, Contact Hour: 3.00

Introduction to Linear differential equation, Separable differential equations, Homogeneous differential equations, Euler - Cauchy equation, System of Linear Equations, Eigenvalues and Eigenvectors, Method to Find Eigenvalues and Eigenvectors, Diagonalization of Matrices, Non-linear differential equations: asymptotic method, perturbation method, Rayleigh-Ritz method, collocation method, Finite difference method, Finite element method, Boundary element method, Calculus of variations, Chaos theory, Laplace transform and the convolution theorem.

Text and Ref books:

1. Advanced Engineering Mathematics- Erwin Kreyszig, Wiley; 10th edition (2011)
2. Advanced Engineering Mathematics- Dennis Zill, Jones & Bartlett Learning; 4th edition (2009)

ME 4129: Gas Dynamics

Credit: 3.00, Contact Hour: 3.00

Introduction to Compressible Flow: Continuum concept, Perfect Gas Law, Mach regimes, internal energy, enthalpy, entropy, specific heats, Continuity equation, momentum equation, energy equation, control volume, infinitesimal fluid element, Normal shock, steady flow, mass, momentum, energy, speed of sound, Mach number, adiabatic, stagnation, Normal Shock Waves: Conservation equations, normal shock relations, velocity, pressure, temperature, density, Hugoniot Equation, one-dimensional flow with heat addition and friction,

Rayleigh Flow, Fanno Flow, governing equations, property trends, duct flows, thermal and frictional choking.

Oblique Shock Waves: Conservation equations, shock polar, pressure-deflection diagram, shock wave intersection, shock wave reflection, Prandtl-Meyer Expansion: Governing equations, flow expansion, Prandtl-Meyer Function, Shock-Expansion Theory, shock wave drag, shock tubes, shock wave reflection, characteristics lines, unsteady flow, expansions, Introduction to Numerical Techniques, Grid discretization, method of characteristics, finite differences, compatibility equations, unit processes.

Text and Ref books:

1. Gas Dynamics- James E.A., Pearson; 3rd edition (2006)
2. Applied Gas Dynamics- Ethirajan Rathakrishnan, John Wiley & Sons Ltd, 2nd Edition, (2019)

ME 4131: Finite Element Method

Credit: 3.00, Contact Hour: 3.00

Introduction, basic concept of FEM, illustration using spring systems and simple problems, weighted residual methods, Galerkin's method, variational approach, Rayleigh-Ritz method, bar element, beam element, frame element, heat transfer problems, Two-dimensional analysis**,** types of elements, shape functions, natural coordinate systems.

Applications to structural mechanics: numerical integration, solution of finite element equations, fluid flow problems, dynamic problems.

Text and Ref Books:

1. The Finite Element Method in Engineering- Singiresu Rao, Butterworth-Heinemann, 6th Edition (2017)
2. Finite Element Methods: A Practical Guide- Jonathan Whiteley, 1st ed. (2017)

ME 4133: Nanomaterials and Nanotechnology

Credit: 3.00, Contact Hour: 3.00

General and broad introduction to the multi-disciplinary field of nanotechnology. Basic knowledge of the physical phenomena, theoretical concepts and experimental techniques behind the recent vastly improved ability to observe, fabricate and manipulate individual structures on the nanometer scale.

Merge of the top-down approach of microelectronics and micromechanics with the bottom-up approach of chemistry/biochemistry. Recent scientific and technology work in the Nano world to demonstrate the potential of nanoscience and industrial applications of nanotechnology.

Text and Ref Books:

1. Basic Principles of Nanotechnology-Wesley C. Sanders, CRC Press; 1st edition (2018)

2. Nanostructures and Nanomaterials: Synthesis, Properties, and Applications- by Guozhong Cao, World Scientific Publishing Company; 2nd edition (2010)

ME 4139: Bio-fluid Mechanics

Credit: 3.00, Contact Hour: 3.00

Review of principles of fluid mechanics, biomechanics of the human circulation, rheology of blood, viscometers, and pressure-flow relationships in blood, rigid tube model, entrance length, and hemodynamics of atherosclerosis.

Solid mechanics: elasticity, stress and strain, analysis of thin and thick-walled cylindrical tube and simulation of physiological phenomena.

Text and Ref books:

1. Biofluid Mechanics- Ali Ostadfar, Elsevier Publishing, 1st Edition (2016).

2. Applied Biofluid Mechanics- Lee Waite, P.E. Jerry Fine, McGraw-Hill Education, 2nd Edition, (2017)

ME 4141: Theory of Structures

Credit: 3.00, Contact Hour: 3.00

Introduction, type of structures, structural idealization, loads, determinacy, indeterminacy and stability of structures, analysis of determinate trusses, common types of trusses, classification of coplanar trusses, method of joints, method of section, graphical method for analysis, statically determinate rigid jointed plane frame, deflection diagrams and elastic curves.

Moving loads: influence lines for statically determinate beams and planar girders, ILD for shear, reaction and bending moment for beams and planar girders, ILD for axial forces for trusses, calculation of maximum stress functions that is reaction, shear and bending moment in a simply supported beam due to

series of moving loads, absolute maximum bending moment and its evaluation, arches, cables and suspension bridges.

Text and Ref books:

1. Advanced Modelling Techniques in Structural Design- Feng Fu, Wiley-Blackwell; 1st edition (2015)

2. Conceptual Structural Design: Bridging the Gap between Architects and Engineers- Olga Popovich Larsen, ICE Publishing; 2nd edition (2016)

ME 4233: Fluidics

Credit: 3.00, Contact Hour: 3.00

Introduction to hydraulic system with its components, hydraulic system design, pneumatics system with its components, basic gas laws, pneumatic system design, electro fluid power system, hydraulic circuit design including electro-hydraulics circuit, servo-control valves, programmable logic control (PLC) and its components, programming of PLC, ladder diagram with hydraulic components, fluid transmission lines and actuators, power supplies and fluid motors, compressibility and leakage, system modelling, stability and compensation.

Text and Ref books:

1. Engineering Fluid Mechanics- by Donald F. Elger, Barbara A. LeBret, Clayton T. Crowe, Wiley; 11th edition (2015)

2. Fluid Mechanics – J. F. Douglas, J. M. Gaesirek, Prentice Hall; 5th edition (2006)

ME 4235: Introduction to CFD

Credit: 3.00, Contact Hour: 3.00

Introduction to Computational Fluid Dynamics (CFD)- a research, modeling and design tool, historical perspective, commercial CFD packages, mathematical description of physical phenomena, a brief discussion of discretization methods-finite difference, finite element. Introduction to control volume method.

Numerical solution of steady one-dimensional conduction, unsteady one dimensional conduction, two and three- dimensional situations, numerical solution of steady one-dimensional convection- diffusion, discretization equation in two and three-dimensions, Numerical solution of fluid flow

equations, Discretization of continuity and momentum equations for fluid flow, pressure-based algorithms- SIMPLE & SIMPLER

Text and Ref Books:

1. An Introduction to Computational Fluid Dynamics: The Finite Volume Method- H. Versteeg, Pearson; 2nd edition (2007)

2. The Finite Volume Method in Computational Fluid Dynamics- by F. Moukalled , L. Mangani , M. Darwish, Springer; 1st edition (2015)

ME 4237: Design of Fluid Machines

Credit: 3.00, Contact Hour: 3.00

Introduction to hydraulics and pneumatics, fundamental concepts of fluid power, energy transmission based on hydraulics and pneumatics, basic fluid dynamics, functionality and design of pumps, motors, cylinders, valves, accumulators, filters and line components, characteristics of fluids, system design for different hydraulic and pneumatic circuits, calculation methods for components and systems.

Basic system principles for control of position, velocity/speed, force/torque and power, principles for load sensing hydraulic systems and hydrostatic transmissions, characteristics of proportional- and servo-valves, automatic sequence control, measurement transducers in test-stands and control systems.

Text and Ref books:

1. Fluid Mechanics – J. F. Douglas, J. M. Gaesirek, J. A. S. Waffield., Prentice Hall; 5th edition (2006)

2. Engineering Fluid Mechanics- by Donald F. Elger, Barbara A. LeBret, Clayton T. Crowe, Wiley; 11th edition (2015)

ME 4245: Noise and Vibration

Credit: 3.00, Contact Hour: 3.00

Noise: basics of acoustics, identification of noise sources, acoustics of large ,small rooms and manufacturing facilities, environmental noise issues, statistical methods of noise analysis, noise control materials and their applications, noise reduction methods, measuring reverberation, noise control in rooms and auditoriums, noise standards and criteria.

Vibrations: introduction to vibration, basic vibration theory, types of analysis, time domain, FFT, cross-channel, special processing methods, types of sensors

and applications, vibration isolation, analyzer setup and functions, connections and mounting sensors, solving vibration problems on machinery, cause -effect of noise and vibration

Text and Ref books:

1. Noise and Vibration Analysis: Signal Analysis and Experimental Procedures- Anders Brandt, Wiley; 1st edition (2011)

2. Fundamentals of Noise and Vibration Analysis for Engineers - M Norton, Cambridge University Press; 2nd edition (2003)

ME 4247: Robotics

Credit: 3.00, Contact Hour: 3.00

Introduction to robotics, basic components of robot technology, plane, rotational and spatial motion, manipulator features, linkages, arms and gripper geometry, rotation, drive system, work envelopes, mounting, dynamics and control of manipulators, forward and inverse kinematics and dynamics of multi-input, multi-output rigid body systems, computed torque control, adaptive control, internal components of controllers, general features, input power, master control memory, motor primitives, entrainment, locomotion, active sensing, binding models, application of industrial robots, and their programming, teleoperators, mobile robots and automated guided vehicles, special purpose robots.

Text and Ref books:

1. Modern Robotics: Mechanics, Planning, and Control- Kevin M. Lynch, Frank C. Park, Cambridge University Press; 1st edition (2017)

2. Introduction to Robotics: Mechanics and Control-John J. Craig, Pearson; 4th edition (2017)

ME 4249: Composite Materials

Credit: 3.00, Contact Hour: 3.00

Introduction to composite materials, fibrous composites, processing of fiber reinforced composites, composite strength and stiffness, micro-mechanical analysis, elastic properties of unidirectional lamina, laminated composites, analysis of laminated composites and composite beams, failure theories, design of laminates, structural health monitoring and NDT methods, standards, and codes.

Text and Ref books:

1. Introduction to Composite Materials Design- Ever J. Barbero, CRC Press; 3rd edition (2017)

2. Composite Materials: Materials, Manufacturing, Analysis, Design and Repair- Kuen Y. Lin, Create Space Independent Publishing Platform; 2nd edition (2015)

ME 4253: Applied Aerodynamics

Credit: 3.00, Contact Hour: 3.00

Aircraft: Basic structure of aircraft, forces acting on aircraft, temperature changes in atmosphere; Effect of temperature, pressure and density with change of altitude; International standard atmosphere; Local & free stream characteristics; Atmospheric layers; Air Speed & Ground speed, Dimensional analysis; Reynolds Number; Wind tunnel and scale effect; Rayleigh's formula, Equation of Continuity, Bernoulli's theorem, venturi tube; Boundary layer: Laminar and turbulent flow; Circulation and Generation of lift; Static and Dynamic Pressure; Air Operated Instruments: Pilot Static tube; Principle of altimeter; Measurement of Air Speed, Different Shapes of aerofoils, terminologies of airfoil, Air flow and pressure distribution over aerofoil, Pitching moment; Centre of pressure and Aerodynamic centre; Drag; types of drag; Aerofoil characteristics: Lift Curve, Drag Curve, Lift/Drag ratio curve; Aircraft Controls and high lift devices.

Performance: Minimum drag curves; Power Curves; Ceiling; Flight envelope, Stability and control; Static and dynamic stability, different types of wings and their effect; Effect of tail plane; Takeoff and Landing; Climbing and Gliding; Turning, loops, spins, inverted flying; introduction to Transonic, supersonic and Hypersonic speed; Propagation of wave; Mack cone; Formation of shock wave.

Text and Ref books:

1. Fundamentals of Aerodynamics- John Anderson, McGraw-Hill Education; 6th edition (2016)

2. Aerodynamics for Engineers-John J. Bertin, Russell M. Cummings, Pearson; 6th edition (2013)

ME 4261: Control Engineering

Credit: 3.00, Contact Hour: 3.00

Introductory concepts of control systems, Mathematical Modelling of Systems, Laplace Transforms, transfer functions, block diagram representation, Block diagram reduction, Time response characteristics, Introduction to stability,

Routh Hurwitz stability criterion, Root locus plots, stability margins, Frequency response analysis: Nyquist stability criterion, Bode plots and stability margins in frequency domain, Basics of control design, the proportional, derivative and integral actions, Design using Root Locus, Design using Bode plots, Effects of zeros, minimum and non-minimum phase systems, State space analysis, Design using State space

Text and Ref books:

1. Modern Control Engineering- Katsuhiko Ogata, Pearson; 5th edition (2009)

2. Control Systems Engineering- Norman S. Nise, Wiley; 7th edition (2015)

ME 4263: Petroleum Engineering

Credit: 3.00, Contact Hour: 3.00

Prospects of hydrocarbon reserves in Bangladesh, Classification of rocks and hydrocarbon deposits and their genesis, geological processes, forming and properties of rock formations, structures, reservoir rock formation, accumulation of petroleum, collection and investigation of seismic data, petro physical and other geophysical data, Example of combination of geological and seismic data to produce 3-dimensional pictures of the internal of the earth.

Systems and methods for drilling and well construction, formation evaluation and reservoir engineering, vertical and direction drilling, analysis of data collected by logging and core sampling in the borehole, methods and procedures for calculating oil and gas volume, and methods for optimized production, well flow calculations, methods for separation of oil and gas, including alternative solutions for oil- and gas field development.

Text and Ref books:

1. Introduction to Petroleum Engineering- John R. Fanchi, Christiansen, Wiley; 1st edition (2016)

2. Introduction To Petroleum Exploration And Engineering-Andrew Clennel Palmer, Wspc (2016)

ME 4265: Applied Statistics

Credit: 3.00, Contact Hour: 3.00

Introduction to elementary statistical methods, applications of statistics in engineering problems, frequency and distribution, central tendency, dispersion, probability, normal distribution, samples and populations, random sampling,

point and interval estimation, hypothesis testing and linear regression and correlation, factor analysis, linear regression, analysis of variance.

Text and Ref books:

1. Applied Statistics and Probability for Engineers- Douglas C. Montgomery, George C. Runger, Wiley; 6th edition (2013)

2. Applied Statistics: Models and Intuition- Arnold I. Barnett, Dynamic Ideas LLC; 1st edition (2015)

ME 4269: Introduction to Nuclear Engineering

Credit: 3.00, Contact Hour: 3.00

Introduction, Historical background, Atomic and nuclear structure, radiation fundamentals, Radiation transport, Radiation damage in materials, Fission chain reaction, Photon interactions with matter, Charged particle interactions with matter, Neutron interactions with matter, Reactor Physics, Reactor Kinetics, Reactor designs, Reactor coolants; Fuel cycle and nuclear waste management, Nuclear Safety, Introduction to nuclear medicine and lessons learned from past accidents.

Text and Ref books:

1. Introduction to Nuclear Engineering- John R. Lamarsh, Anthony J. Baratta, Pearson; 4th edition (2017)

2. Fundamentals of Nuclear Science and Engineering- J. Kenneth Shultis, Richard E. Faw, CRC Press; 3rd edition (2016)

ME 4271: Bio-Engineering

Credit: 3.00, Contact Hour: 3.00

Basic concepts of biomechanics:, methods of mechanics as applied to biological tissues, statics, dynamics and mechanics applied to the human body, including: vectors, moments, equilibrium, kinetics and kinematics, displacement, rotation, acceleration, and deformation, stress and strain, equations of motion, impulse and momentum, and mechanical properties of biological tissues, Introduction to the conservation laws and their application to bioengineering related problems including blood flow in the vascular system and other biological flows, dimensional analysis, definition of system, conservation of mass and energy, and conservation of momentum.

Materials for medical devices including polymers, metals, ceramics, composites, and natural materials, biocompatibility, host reactions to biomaterials, immune response, wound healing, biomaterial implantation and acute inflammation,

thrombosis, infection, tumorigenesis and calcification of biomaterials, testing and degradation of biomaterials, cardiovascular devices, drug delivery, and tissue engineering.

Text and Ref books:

1. Introduction to Biomedical Engineering Technology- Laurence J. Street, CRC Press; 3rd edition (2016)

2. An Introduction to Biomechanics: Solids and Fluids, Analysis and Design- D. Humphrey, Sherry L. O'Rourke, Springer; 2nd edition (2015)

ME 4273: Plastics Process Technology

Credit: 3.00, Contact Hour: 3.00

Introduction to Plastics, basics of thermoplastics, thermosets, homopolymers, copolymers, regrinds, polymer blends, composites and masterbatches, Degradation, Fillers, Additives, properties and processing behavior of thermoplastics, Processing Methods, extrusion, thermoforming, compression, rotational and calendaring processes.

Polymer additives and testing, nucleating agents, impact modifiers, glass and carbon fibers, fillers, Reinforcement of plastics, flame retardants and antioxidants, Tensile, Izod, Flexural, Rowell Hardness, HDT and Flammability tests, Thermoplastics: general properties, processing behaviors and applications of commodity thermoplastics, engineering thermoplastics and high performance thermoplastics, Materials Selection: suitable processing methods, choice of right additives and the cost effectiveness of the selected material.

Text and Ref books:

1. Principles of Polymer Engineering – N. G. McCrum, P. C. Buckley, C. B Bucknall.

2. Polymer Morphology: Principles, Characterization, and Processing-Qipeng Guo, Wiley 1st edition (2016)

ME 4275: Modern Manufacturing Technology

Credit: 3.00, Contact Hour: 3.00

Introduction to modern manufacturing technology, Modern manufacturing process: electro-discharge machining (EDM), electro-chemical machining (ECM), electron-beam machining (EBM), LASER-beam machining (LBM), ultrasonic machining (USM), plasma arc 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.

Text and Ref books:

1. Manufacturing Engineering and Technology – Serope kalpakjian, Steven R. Sahmid, Prentice Hall, 7th edition, (2013).

2. Managing Engineering and Technology-Lucy C. Morse, Daniel L. Babcock, Pearson; 7th edition (2019)

ME 4277: Metal Cutting Process

Credit: 3.00, Contact Hour: 3.00

Theory of metal cutting: mechanism of chip formation, chip breaker, chip-tool contact process, types of chip. Tool materials, tool design and manufacturing, theoretical and experimental determination of cutting forces, Heat phenomenon, Cutting fluid, Tool wear and tool life, Economics of metal cutting, Gear and thread manufacturing processes.

Text and Ref books:

1. Metal Cutting Theory and Practice- David A. Stephenson, John S. Agapiou, CRC Press; 3rd edition (2016)

2. Metal Cutting- E M Trent, Butterworth-Heinemann; 3rd edition (2015)

ME 4279: CAD/CAM

Credit: 3.00, Contact Hour: 3.00

CAD: fundamental concepts, application, benefits, hardware and software; Types of CAD systems; Common 2D CAD software features; Basic 3D CAD features.

CAM: fundamental concepts; Trend of development of numerical control (NC); Principles of NC; Types of NC systems; Types of NC machines; CNC (manual) part programming; CNC part programming using CAM software; Interfacing CAM software with CNC machines; Computer aided machining.

Text and Ref books:

1. CAD/CAM – Principles, Practice and Manufacture Management – Chris McMahen, Jimmie Browne.

2. Computer-Aided Manufacturing- Tien-Chien Chang, Richard A. Wysk, Pearson; 3rd edition (2005)

ME 4291: MEMS Devices - Design and Fabrication

Credit: 3.00, Contact Hour: 3.00

An overview of microelectromechanical devices and technologies, and an introduction to design and modeling Standard microelectronic fabrication technologies; bulk micromachining, surface micromachining, bonding technologies, related fabrication methods, and creating process flows.

Mechanical, thermal, electrical, magnetic, optical, and chemical properties of materials Introduction to lumped modeling of systems and transducers; an overview of system dynamics MEMS examples, energy methods, the thermal energy domain; modeling dissipative processes, Fluids and Transport

Text and Ref Books:

1. Analysis and Design Principles of MEMS Devices- Minhang Bao, Elsevier Science; 1st edition (2005)

2. Fundamentals of Microfabrication and Nanotechnology- Marc J. Madou, CRC Press; 3rd edition (2011)

ME 4293: Material Handling

Credit: 3.00, Contact Hour: 3.00

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 controlled material handling (AGV, ASRS etc.); Description and design of belt, chain, flight, screw, pneumatic and hydraulic conveyors; Operation and selection of industrial truck loads. Packaging: packaging materials, layout for packaging; Testing procedure of packages - vibration test, drop test; Performance limit; Testing machines. Storage and warehousing, Sorting, Automated warehousing.

Text and Ref books:

1. Manufacturing Facilities Design & Material Handling- Matthew P. Stephens, Purdue University Press; 6th edition (2019)

2. World-Class Warehousing and Material Handling- Edward Frazelle, McGraw-Hill Education; 2nd edition (2016)

ME 4295: Mechatronics

Credit: 3.00, Contact Hour: 3.00

Introduction: Definition, organization structure, applications of mechatronics, open and closed loop systems, sensors and transducers, sensor characteristics, classification of sensor, sensors for displacement, position, proximity, velocity, motion, force, torque and tactile sensors, pressure, temperature, light sensors, ultrasonic and range sensors, System Modeling and Control Systems**:** signals, systems and controls, transfer function and block diagram form of systems, time delays, measurement of system performances, and modeling of mechanical, electrical, fluid and thermal systems, control system types, stability analysis, frequency response, P, PI, PID controllers, Fuzzy controllers.

Microcontroller: overview, basic architecture, ADC, timer, clock, PWM, USART/UART, I2C, Data Read/Write from EEPROM, Programming using C, I/O port programming, Interrupt handling, Interfacing with LCD display and Keypad and example projects with Microcontrollers, Recent Topics: Introduction to PLC, Smart sensors and Smart actuators, MEMS and Nanotechnology, Future Trends.

Text and Ref books:

1. Mechatronics: Electronic Control Systems in Mechanical Engineering – W. Bolton, William Bolton, Publisher – Prentice Hall, 6th edition, (2015)

2. Introduction to Mechatronic Design- J. Edward Carryer, Matthew Ohline, Thomas Kenny, Pearson; 1st edition (2010)

ME 4297: Textile Technology

Credit: 3.00, Contact Hour: 3.00

Introduction to textile engineering, fibers and their production, properties and areas of application, yarns and their production, yarn preparation, properties and areas of application, weaving, fabric production, fabric structure, fabric properties and areas of application, warp and weft knitting; fabric production, fabric structure, fabric properties and areas of application, Non-woven fabrics, classification, web formation, wet-laid, dry-laid and polymer-laid fabric production, fabric properties and areas of application, dyeing , finishing, preparatory processes for different textile materials, principles of colouration, fabric testing and analysis, fabric performance, fabric specifications, fabric testing and analysis.

Text and Ref books:

1. Textile Technology: An Introduction-Thomas Gries, Hanser Publications; 2nd edition (2015)

2. Textiles- Sara J Kadolph, Sara B Marck, Pearson; 12th edition (2016)

Chapter-5
Detail Outline of Courses Offered by Other Department to ME

Phy 1109: Physics-I

Credit: 3.00, Contact Hour: 3.00

Pyrometry and X-ray: introduction, Platinum resistance thermometer, optical and radiation pyrometers, production, properties and applications of X-rays in engineering, Atomic Physics: Atomic structure, atom model; nature of electron orbit, orbital energy, crystalline and non-crystalline solids, single crystal and polycrystalline solids, unit cell, crystal systems, cohesive and bonding energy, packing fraction, crystal planes and directions, photoelectric emission and Einstein's photoelectric equation, photovoltaic cells, Compton effect, de-Broglie waves, wave velocity and group velocity.

Nuclear Physics: Introduction; binding energy, isotope, isobar, isotones; concept of compound nucleus, nuclear fission and fusion Process, neutron energies, neutron scattering, neutron diffusion, nuclear cross-sections, chain reaction; radioactivity: radioactive decay, half-life and mean life, neutron life cycle, law of disintegration, successive disintegration.

Electricity and Magnetism: Coulomb's law, magnetic properties of matter; Gauss' law and its application, magneto motive force, magnetic field intensity, permeability, susceptibility, classifications of magnetic materials, capacitors: Capacitance, dielectrics and atomic view, magnetization curves, hysteresis loss, magnetostriction, Hall Effect, magnetic force on a current carrying conductor, Modern Physics: Michelson Morley's experiment, Gallelian Transformation, special theory of relativity, Lorentz transformation, length contraction, time dilation, mass energy relation.

Text and Ref Books:

1. Modern Physics- Raymond A. Serway, Cengage Learning; 3rd edition (2004)

2. Modern Physics- Kenneth S. Krane, Wiley, 3rd edition (2012)

Phy 1207: Physics-II

Credit: 3.00, Contact Hour: 3.00

Waves and Oscillation: introduction, oscillations in physical systems, time period and frequency, harmonic oscillator in one-dimension and its solutions, total energy and average energy, superposition of simple harmonic oscillations, Lissajous figures, damped harmonic oscillations and its solutions, driven and

damped oscillator and its solutions, applications of vibration isolation, spring mass system, calculation of time period of torsional pendulum; damped oscillations, determination of damping co-efficient forced oscillation, wave equation and the transverse waves, solutions of wave equation, velocities in wave motion, resonance, progressive and stationary wave, architectural acoustics, reverberation and Sabine's formula.

Geometrical optics: lens equation, image resolution, spherical aberration, astigmatism, distortion, curvature of image, longitudinal and transverse chromatic aberration achromatic combination of lenses, optical instruments: compound microscope, polarizing microscope, and resolving power of a microscope, camera and photographic techniques, Fiber optics, Physics of LASER, Photonics, electron microscopy and spectroscopy.

Wave Mechanics: introduction to statistical physics, probabilities, quantum statistics, Bose-Einstein statistics, Fermi-Dirac statistics and their applications, fundamental postulates of wave mechanics, Schrodinger's equation, two slit experiment and its paradoxes.

Text and Ref Books:

1. Fundamentals of Physics- Haliday, Resnick, Wiley & Sons, 10th Edition (2013)

2. Concept of Modern Physics- Arther Beiser; McGraw Hill Education; 6th edition (2009)

Phy 1208: Physics Sessional

Credit: 1.50, Contact Hour: 3.00

Sessional based on Phy 1109 and Phy 1207.

Chem 1113: Inorganic Quantitative Analysis

Credit: 3.00, Contact Hour: 3.00

Concepts of atomic structure, Different atom models, Quantum numbers, Electronic configuration, Periodic classification of elements, Periodic properties of elements, Properties and uses of noble gases, Chemical bonding (types, properties, Lewis theory, VBT, MOT), Hybridization and shapes of molecules, Selective organic reactions such as- addition, substitution, oxidation- reduction, alkylation and polymerization, Phase rule, Phase diagram of mono component system.

Solutions and their classification, Unit expressing concentration, Colligative properties of dilute solutions, Thermo-chemistry, Chemical kinetics, Chemical equilibrium, pH and buffer solutions, and Electrical properties of solution.

Text and Ref Books

1. Analytical Chemistry and Quantitative Analysis- David S. Hage, James R. Carr, Pearson; 1st edition (2010)

2. Inorganic Quantitative Analysis –Carroll Wardlaw Griffin, Palala Press (2015)

Chem 1114: Inorganic Quantitative Analysis Sessional

Credit: 1.50, Contact Hour: 3.00

Volumetric analysis: Acid-base titration, Oxidation-reduction titration: Determination of Cu, Fe and Ca content volumetrically.

Chem 1213: Industrial Chemistry

Credit: 3.00, Contact Hour: 3.00

Introduction to glass, classification, raw materials, reaction during manufacturing, constituents of different glasses, their properties and uses. Ceramics and Cement constituents, types and properties, manufacture and uses of ceramic, Corrosion Chemistry: nature and its importance, classifications, dry, wet and electrochemical corrosion, galvanic corrosion, concentration cell corrosion, atmospheric corrosion, passivity of metals, and prevention of corrosion by: protective coatings, varnishes and metallic coatings, cathodic and anodic protection.

Industrial Chemistry: introduction, polymer and plastics: classification, raw materials, bonding, properties of resins, plasticizer, synthesis of bakelite, PVC, polythene, vinyl acetate, cellulose acetate, melamine, etc. and their uses, Natural and synthetic Rubber: importance, latex, crude natural rubber, Gutta-percha, compounding and vulcanization of rubber, properties of synthesis of neoprene rubber, nitrile rubber, silicon rubber and Buna-S rubber, reclaimed rubber. Fibers: types of fibers, raw materials, applications and manufacturing processes of synthetic fibers.

Lubricants: sources, properties, distillation and refining of fuels, cracking processes, refining of mechanical and industrial importance of lubrication, anti-knocking compounds, CNG, LPG, LNG, study of sources of pollution and their remedy, properties and application of carbon and graphite, manufacturing and applications of non- fabricated industrial carbon.

Text and Ref books:

1. Chemical Process Industries– Norris Shreve & Joseph A. Brink, Jr., McGraw-Hill International edition.

2. Design and Corrosion Control – V. R. Pludek., Palgrave Publishing (2014)

Math 1161: Mathematics-I

Credit: 3.00, Contact Hour: 3.00

Limit, continuity and differentiability, successive differentiation of various types of functions, Leibnit'z theorem, Rolle's theorem, Mean Value theorem, expansion in finite and infinite forms, Lagrange's form of remainder, Cauchy's form of remainder (expansion of remainder), expansions of functions differentiation and integration, indeterminate form, Cartesian differentiation, Euler's theorem, tangent and normal, sub tangent and subnormal in Cartesian and polar coordinates, maxima and minima of functions of single variables, curvature, asymptotes.

Definition of integrations, integration by the method of substitution, integration by parts, standard integrals, integration by the method of successive reduction, definite integrals and its use in summing series, Walli's formula, improper integrals, beta function and gamma function, multiple integral and its application, area, volume of solid revolution, area under a plain curve in Cartesian and polar coordinates, area of the region enclosed by two curves in Cartesian and polar coordinates, arc lengths of curves in Cartesian and polar coordinates.

Text and Ref books:

1. Calculus with Differential Equations-Dale Varberg,Edwin J. Purcell, Steve E. Rigdon, Pearson; 9th edition (2006)

2. Calculus 1 - Differentiation and Integration- Dan Hamilton, Hamilton Education Guides (2018)

Math 1265: Mathematics-II

Credit: 3.00, Contact Hour: 3.00

Vector analysis: Definition of vector, Equality of direction ratios and vectors, Addition and multiplication of vectors, Triple products and multiple products, Differentiation of vectors, Gradient of scalar functions, Divergence and curl of point functions, Physical significance of gradient, divergence and curl, integration of vectors (line, surface and volume integrals); Green's, Stoke's and Gauss's theorem and their application.

Matrices: Definition of matrix, algebra of matrices, multiplication of matrices, transpose of a matrix, inverse of matrix, rank and elementary transformation of

matrices, solution of linear equations, linear dependence and independence of vectors, quadratic forms, matrix polynomials, determination of characteristic roots and vectors, null space and nullity of matrix, characteristic subspace of matrix, Transformation of co-ordinates, equation of conics, its reduction to standard forms, pair of straight lines, homogeneous equations of second degree, angle between straight lines, pair of lines joining the origin to the point of intersection of two given curves, circles and system of circles, orthogonal circles, radical axis and its properties, radical centers, coaxial circles and limiting points, equations of parabola, ellipse in Cartesian and polar coordinates, three dimensional system of coordinates, projection, direction cosines, equations of planes and lines, angle between lines and planes, distance from a point to a plane, co-planner lines. Shortest distance between two given straight lines, standard equation of conicoides, sphere and ellipsoid.

Text and Ref books:

1. Vector Analysis- Murray Spiegel, McGraw-Hill Education; 2nd edition (2009)

2. Scalar, Vector, and Matrix Mathematics: Theory, Facts, and Formulas-Dennis S. Bernstein, Princeton University Press (2018)

Math 2165: Mathematics-III

Credit: 3.00, Contact Hour: 3.00

Formulation of Differential Equations. Degree and order of Ordinary differential equations, Solution of first order but higher degree differential equations Solution of first order differential equations by various method Solution of general linear equations of second and higher orders with constant coefficient. Solution of Homogeneous linear equations and its applications. Solution of differential equations by the methods based on the factorization of the operators, Frobenious methods, Bessel's functions, Legendre's polynomials and properties.

Introduction to linear and nonlinear first order equations, standard forms of linear equations of higher order, Equation of second order with variable coefficients. Wave equations, Particular solutions with boundary and initial conditions, Integral surface passing through given curve; Nonlinear PDE of order One (Complete, particular, singular and general integrals), Charpit's Method, Second order PDE and classifications to canonical (standard)-parabolic, elliptic, hyperbolic solution by separation of variables, Linear PDE with constant coefficients.

Text and Ref books:

1. Schaum's Outline of Differential Equations-Richard Bronso, McGraw-Hill Education; 4th edition (2014)

2. Fundamentals of Differential Equations- R. Kent Nagle, Edward B. Saff, Pearson; 9th edition (2017)

Math 2267: Mathematics-IV

Credit: 3.00, Contact Hour: 3.00

Fourier Analysis in real and complex form, Fourier Integral, Fourier transforms and their uses in solving boundary value problems, complex variables, complex number system, general functions of a complex variable, limits and continuity of a function of complex variable and related theorems, complex function, differentiation and the Cauchy-Riemann Equations. Line integral of a complex function, Cauchy's Integral Formula, Liouville's Theorem, Taylor's and Laurent's Theorem, Singular Residues, Cauchy's Residue Theorem.

Harmonic Functions: Definition of harmonics. Laplace's equation in Cartesian, polar cylindrical and spherical co-ordinates. Solutions of these equations together with applications. Gravitational potential due to a ring, Steady-state temperature. Potential inside or outside of a sphere. Properties of harmonic functions, Laplace Transform: Definition, Laplace transforms of some elementary functions, sufficient conditions for existence of Laplace transform, Inverse Laplace transforms, Laplace transforms of derivatives, unit step function, periodic function, some special theorems on Laplace transform, Partial fraction, Solutions of differential equations by Laplace transform, evaluation of improper integral.

Text and Ref books:

1. An Introduction to Laplace Transforms and Fourier Series- P. P. G. Dyke

2. Fourier and Laplace Transforms- R. J. Beerends.

Hum 1259: Communicative English

Credit: 3.00, Contact Hour: 3.00

Introduction, importance and mastering various approaches to learning English; Phonetics – Phonetic systems, correct English pronunciation; Grammatical problems – Grammar and usages; Approaches to communication - communication today, business communication; Methods of Writing - business letter, tenders and quotations, resumes and job letters.

Comprehension, paragraph writing, précis writing, amplification; Report Writing – Purpose of a report, classification of reports, organizing a report, writing short report, preparing complete analytical report, analysis and

illustration of a report, problems in writing reports; journal articles, technical and scientific presentation.

Text and Ref books:

1. Advance learners Degree general English – Chowdhury and Hossain.
2. The most common mistakes in English usage – Thoma's Ellioft Berry

Hum 1260: Technical Report Writing and Presentation

Credit: 0.75, Contact Hour: 3/2

Tutorial Discussion – on a given topic to test the proper use of phonetics, pronunciation grammar, logic and confidence; Public Speaking – Demonstration by teacher for a short specific period, speaking by students (each student minimum twice) on different but easy given topic, well in advance as per a schedule maximum for 3 to 4 minutes for each student; Extempore – Minimum two presentations by each student for a duration of maximum 3 to 4 minutes; Debriefing on public speaking and extempore presentation ; Presentation – On a given professional topic or on a given research paper using power point followed by question and answer session. Group presentation or different given topics by the students using power point.

Text and Ref books:

1. Advance learners Degree general English – Chowdhury and Hossain.
2. Business correspondence and report writing – R. C. Sharma & Krisnamohon.

Hum 1153: Bangla Languages & Literature (বাংলা ভাষা ও সাহিত্য)

Credit: 2.00, Contact Hour: 2.00

প্রথম খন্ড- ভাষা

১. বাংলা ধ্বনি/বাগ্ধ্বনি (Phone/Speech Sound); বর্ণ (Letter); অক্ষর (Syllable)

2. বাংলা ধ্বনির উচ্চারণ স্থান ও রীতি (Point of Articulation & Manner of Articulation)

৩. বাংলা উচ্চারণ-প্রমিত (Standard), আঞ্চলিক (Dialectal), বৈচিত্র (Variation)

৪. অপিনিহিত, অভিশ্রুতি, স্বরসঙ্গতি, শ্বাসাঘাত (Stress accent), স্বরভঙ্গি/ স্বরতরঙ্গ (Intonation)

৫. বাংলা ও ইংরেজির তুলনা

৬. বাংলা লিখন দক্ষতা: সাধু/ চলিত রীতি। বিরাম চিহ্ন প্রয়োগ। প্রমিত বাংলা বানানের নিয়ম (বাংলা একাডেমি)

৭. ব্যবহারিক বাংলা: সংক্ষিপ্ত আলোচনা

একুশে ফেব্রুয়ারি, মুক্তিযুদ্ধ, বাংলাভাষা, বিশ্বায়ন, বাংলার উৎসব, ষড়ঋতু, বাংলা নববর্ষ, আধুনিক তথ্য-প্রযুক্তি, সংস্কৃতি, মানবতা ও নৈতিকতা।

দ্বিতীয় খন্ড-সাহিত্য

কবিতা

১. আবদুল হাকিম- নূরনামা
২. মাইকেল মধুসূধন দত্ত- বঙ্গভাষা
৩. লালন সাঈ- খাঁচার ভেতর অচিন পাখি
৪. রবীন্দ্রনাথ ঠাকুর- নির্ঝরের স্বপ্নভাঙ্গা
৫. কাজী নজরুল ইসলাম- আজ বৃষ্টি-সুখের উল্লাসে
৬. জীবনানন্দ দাশ- রূপসী বাংলা
৭. হাসান হাফিজুর রহমান- অমর একুশে
৮. আলা উদ্দিন আল আজাদ- স্মৃতি স্তম্ভ
৯. শামসুর রাহমান- তোমাকে পাওয়ার জন্য হে স্বাধীনতা
১০. সৈয়দ শামসুল হক-পরিচয়

প্রবন্ধ

১. বঙ্কিম চন্দ্র চট্টোপাধ্যায়- বাঙ্গালা ভাষা
২. রবীন্দ্রনাথ ঠাকুর- সভ্যতার সংকট
৩. হরপ্রসাদ শাস্ত্রী- তৈল
৪. প্রমথ চৌধুরী- যৌবনে দাও রাজটিকা
৫. কাজী নজরুল ইসলাম- বর্তমান বিশ্বসাহিত্য
৬. মুহম্মদ আবদুল হাই- আমাদের বাংলা উচ্চারণ
৭. কবীর চৌধুরী- আমাদের আত্মপরিচয়

ছোট গল্প অন্যান্য রচনা

১. রবীন্দ্রনাথ ঠাকুর- পোস্ট মাস্টার
২. রোকেয়া সাখাওয়াত হোসেন- অবরোধবাসিনী
৩. বিভূতিভূষণ বন্দোপাধ্যায়- পুঁইমাচা
৪. সৈয়দ ওয়ালীউল্লাহ- নয়নচারা
৫. জাহানারা ইমাম- একাত্তরের দিনগুলি
৬. হাসান আজিজুল হক- ঘরগেরস্থি
৭. আখতারুজ্জামান ইলিয়াস- অপঘাত

নাটক

কবর- মুনির চৌধুরী

Hum 1255: Bangladesh Studies (History of Independent)

Credit: 3.00, Contact Hour: 3.00

Ancient period and Muslim period of Bengal, British period, Pakistan period: an overview (1952-1971),

The problem of national integration under Ayub regime, Elite in crisis during Pakistan rule, nation building in the new state, The ideals and philosophy of constitution- making of Bangladesh, Study on the coup and assassination of Bangabandhu Sheikh Mujib, Philosophy and fundamental changes of Zia regime, Constitutional amendments of Bangladesh, Corruption and good governance in Bangladesh, Issues of governance of Bangladesh, Bangladesh economy, Ideas on political and ethnic conflict in Bangladesh, Geographical setting of Bangladesh, environmental challenges of Bangladesh, Bangladesh foreign policy: realities and challenges, Foreign policy-decision-making process in Bangladesh.

Text and Ref books:

1. The Changing Pattern of Bangladesh Foreign Policy: A Comparative Study of Mujib and Zia Regimes- Zaglul Haider (2008), The University Press Limited,Dhaka-1000
2. Bangladesh Studies and Culture- Sumon Das & M.N. Mohabbat, Human Publications.

Hum 2133: Principles of Accounting

Credit: 3.00, Contact Hour: 3.00

A study of accounting as an informational system, fundamental accounting concepts, principles used to analyze and record business transactions, Double-entry book keeping and accounting, accounting equation, measuring and recording business transactions, Journal, ledger, trail balance, preparation of financial statements considering adjusting and closing entries, Financial statements analysis and interpretation, Ratio analysis – tests for profitability, liquidity, solvency and overall measure.

Cost in general: objectives and classifications. Overhead and its allocation, Product costing: Cost sheet under job costing, process costing, costing by products and joint products, Marginal costing, cost-volume-profit analysis, break-even analysis, profitability within the firm. Guidelines for decision-making: Short-run decisions, long run planning and control: Capital budgeting; the master budget, flexible budget and standard cost, variance analysis.

Text and Ref books:

1. Managerial Accounting - Ray; Noreen, Eric Garrison, McGraw-Hill, 10th Edition.
2. Introduction to Management Accounting- Charles T. Horngren, Gary L. Sundem, William O. Stratton, and Jeff Schatzberg; Publisher: Prentice Hall; 14th edition.

Hum 2235: Sociology and Engineering Economics

Credit: 3.00, Contact Hour: 3.00

Scope of sociology, Industrial revolution, Society and population, Social pathology, Nature of social change, sociology of development, Urban ecology, Microeconomics: Definition of economics; Fundamentals of economics; Market and government in a modern economy; Basic elements of supply and demand; Choice and utility; indifference curve technique; Analysis of cost; Short run long run theory of production; Analysis of Market; Optimization and theory of distribution.

Macroeconomics: key concept of macroeconomics; Saving, consumption, investment; National income analysis; Inflation, Unemployment; Fiscal and monetary policy, Development: Theories of developments; Economic problem of developing countries; Planning in Bangladesh.

Text and Ref books:

1. Sociology (4th edition) – Anthony Gidders, Publisher – Excel Media
2. Economics- Paul Samuelson, McGraw-Hill Education; 19th edition (2009)

EEE 1159: Fundamentals of Electrical Engineering

Credit: 3.00, Contact Hour: 3.00

Laws of electric circuit: Ohm's Law, Kirchhoff's voltage and current laws, delta-wye transformation. Electrical networks: network analysis methods of branch and loop currents, method of node pair voltages, Thevenin's and Norton's theorems, Magnetic concepts and units: magnetic field, right hand rule, magnetic flux density, Biot Savart law, magnetic field intensity, measurement of magnetic flux, energy of magnetic field, characteristic of ferromagnetic materials, theory of ferromagnetism, B-H curve, hysteresis loss, eddy current and eddy current loss, total core loss. Introduction to magnetic circuits. Electromagnetic forces: forces upon a current carrying conductor and charged particles moving in a magnetic field. Electromagnetic torque; electric motor. Electromagnetic induction and emf; Lenz's law, BLV rule, elementary a.c. generator.

General concepts and definitions. Instantaneous current, voltage and power, R-, L-, C-, RL-, RC- and RLC- branches, Effective current and voltage: average values, form factor, crest factor, power real and reactive. Introduction to vector algebra. Impedance in polar and Cartesian forms. Sinusoidal single phase circuit analysis. Impedance in series, parallel branches, series-parallel circuits. Network analysis – Thevenin's theorem. Balanced poly phase circuits: three phase, four wire system of generated emfs, three phase, three wire systems, balanced wye loads, balanced delta loads, power in balanced systems, power factor. Balanced three phase circuit analysis and power measurement.

Text and Ref books:

1. Introductory Circuit Analysis – R. L. Boylestad., Pearson; 13th edition (2015)
2. Basic Engineering Circuit Analysis- J. David Irwin, R. Mark Nelms, Wiley; 11th edition (2015)

EEE 1160: Fundamentals of Electrical Engineering Laboratory

Credit: 0.75, Contact Hour: 1.50

Laboratory experiments based on EEE 1159.

CSE 1271: Computer Programming Language

Credit: 3.00, Contact Hour: 3.00

Introduction to computer hardware and its working principle; Programming logic, algorithms, and flowcharts, concept of structured programming; Overview of C and C++ programming languages; C and C++ fundamentals – data types and expressions; Operators, Libraries and keywords; Statements; Arrays and strings; Functions; Control statements; Pointers; Input and output systems, Objective Oriented programming; Introduction to advanced programming. Introduction and familiarization with MATLAB software.

Text and Ref books:

1. Turbo C/C++: The complete reference (2nd edition) – Herber Schildt, Publisher- Osborne McGraw-Hill.
2. C Programming using Turbo C++ (2nd edition) – Robert Lafore, Publisher – Tech media.

CSEE 1272: Computer Programming Language Sessional

Credit: 1.50, Contact Hour: 3.00

Sessional based on CSE 1271.

EEE 2159: Electrical and Electronic Technology

Credit: 3.00, Contact Hour: 3.00

Single phase transformer-equivalent circuit and laboratory testing, introduction to three phase transformers. DC generator: principle, types, performances and characteristics. D C Motor: principles, types of motor, performances, speed control, starters and characteristics. A C Machines: three phase induction motor principles, equivalent circuit. Introduction to synchronous machines and fractional horse power motors. Semiconductor diode, transistor characteristics, equivalent circuits, self-biasing circuits, emitter follower amplifiers, push-pull amplifier. Introduction to silicon controlled rectifier and its application, Oscilloscope, Transducers: strain, temperature, pressure, speed and torque measurements.

Text and Ref books:

1. Electric Machinery Fundamentals- Stephen Chapman, McGraw-Hill Education; 5th edition (2011)
2. Electric Machines and Transformers – Irving L. Kosow., Pearson College Div.

EEE 2160: Electrical and Electronic Technology Laboratory

Credit: 1.00, Contact Hour: 2.00

Laboratory experiments based on EEE 2159.

IPE 4193: Industrial Safety

Credit: 3.00, Contact Hour: 3.00

Evolution of modern safety concept- safety policy - Safety Organization - Safety Committee – budgeting for safety. Safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign Concept of an accident, reportable and non-reportable accidents, reporting to statutory authorities – principles of accident prevention – accident investigation and analysis – records for accidents, departmental accident reports, documentation of accidents – unsafe act and condition – domino sequence – supervisory role – cost of accident.

Machine Guarding, Guarding of hazards, Machine Guarding types and its application, Safety in welding and Gas cutting, Safety in Manual and Mechanical material handling, Safety in use of electricity, Toxicity, TLV, Types of Chemical Hazards, Occupational diseases caused by dust, fumes, gases, smoke and solvent hazards- control measures Fire triangle- Types of fire - first aid firefighting equipment, flammability limit, LPG safety Overview of factories act 1948, OHSAS-18000

Text and Ref Books:

1. Industrial Safety Management- L M. Deshmukh , McGraw Hill Education (2017)
2. Industrial Safety- R. P. Blake, Prentice Hall; 3rd edition (2000).