CHAPTER- III

Academic Ordinance for the Undergraduate Studies

1. Definitions:

1.1 'University' means the Rajshahi University of Engineering & Technology abbreviated as RUET.

1.2 'Syndicate' means Syndicate of RUET.

1.3 'Academic Council' means the Academic Council of the University.

1.4 'Deans Committee' means the Executive Committee of concerned Faculty of the University.

1.5 'Academic Committee' means the Academic Committee for Undergraduate Studies of Department of the University.

1.6 'Vice-Chancellor' means the Vice-Chancellor of the University.

1.7 'Dean' means the Dean of the Faculty of the University.

1.8 'Head of the Department' means the Head of a Department of the University.

1.9 'Central Equivalence Committee' means the Central Equivalence Committee of the University.

1.10 'Degree' means the degree of Bachelor of Science in Engineering or Bachelor of Urban & Regional Planning or Bachelor of Architecture offered by the University.

1.11 'Course System' means pass or fail on course basis.

1.12 'Backlog Courses' means the failed courses after appearing at odd/even semester(s) examination.

1.13 'Short Semester' means a semester for conducting classes and examinations of Backlog course(s) at the end of 4^{th} /5^{th} year Backlog examination result.

2. Faculties:

The University has four Faculties:

(1) Faculty of Civil Engineering (CE)
(2) Faculty of Electrical & Computer Engineering (ECE)
(3) Faculty of Mechanical Engineering (ME)
(4) Faculty of Applied Science & Engineering (ASE)

2.1 Degree Awarding Departments:

The University has the following Degree Awarding Departments under four Faculties:

i) Department of Civil Engineering (CE)
ii) Department of Electrical & Electronic Engineering (EEE)
iii) Department of Mechanical Engineering (ME)
iv) Department of Computer Science & Engineering (CSE)
v) Department of Electronic and Telecommunication Engineering (ETE)

vi) Department of Industrial and Production Engineering (IPE)
vii) Department of Glass & Ceramic Engineering (GCE)
viii) Department of Urban & Regional Planning (URP)
ix) Department of Mechatronics Engineering (MTE)
x) Department of Architecture (ARCH)
xi) Department of Chemical & Food Processing Engineering (CFPE)
xii) Department of Material Science & Engineering (MSE)
xiii) Department of Building Engineering & Construction Management (BECM)
xi) Any other Department to be instituted by the Syndicate on the recommendation of the Academic Council.

2.2 Teaching Departments:

The University has the following teaching departments as defined in the statutes:

i) Department of Civil Engineering
ii) Department of Electrical & Electronic Engineering
iii) Department of Mechanical Engineering
iv) Department of Computer Science & Engineering
v) Department of Electronic and Telecommunication Engineering
vi) Department of Industrial and Production Engineering
vii) Department of Glass & Ceramic Engineering
viii) Department of Urban & Regional Planning
ix) Department of Mechatronics Engineering
x) Department of Architecture
xi) Department of Chemical & Food Processing Engineering (CFPE)
xii) Department of Material Science & Engineering (MSE)
xiii) Department of Building Engineering & Construction Management (BECM)
xiv) Department of Mathematics
xv) Department of Physics
xvi) Department of Chemistry
xvii) Department of Humanities
xviii) Any other Department to be instituted by the Syndicate on the recommendation of the Academic Council.

3. Degrees Offered:

The University offers courses leading to the award of the following degrees:

i) Bachelor of Science in Civil Engineering abbreviated as B.Sc. Engg. (CE)
ii) Bachelor of Science in Electrical & Electronic Engineering abbreviated as B.Sc. Engg. (EEE)
iii) Bachelor of Science in Mechanical Engineering abbreviated as B.Sc. Engg. (ME)

iv) Bachelor of Science in Computer Science & Engineering abbreviated as B.Sc. Engg. (CSE)
v) Bachelor of Science in Electronic & Telecommunication Engineering abbreviated as B.Sc. Engg. (ETE)
vi) Bachelor of Science in Industrial and Production Engineering abbreviated as B.Sc. Engg. (IPE)
vii) Bachelor of Science in Glass & Ceramic Engineering abbreviated as B.Sc. Engg. (GCE)
viii) Bachelor in Urban & Regional Planning abbreviated as BURP.
ix) Bachelor of Science in Mechatronics Engineering abbreviated as B.Sc. Engg. (MTE)
x) Bachelor in Architecture abbreviated as B. ARCH.
xi) Department of Chemical & Food Processing Engineering (CFPE)
xii) Department of Material Science & Engineering (MSE)
xiii) Department of Building Engineering & Construction Management (BECM)
xi) Any other degree that may be awarded by any department on the approval of the syndicate on the recommendation of the Academic council.

4. Student Admission, Equivalence and Admission Transfer:

4.1 The four academic years of study for the Bachelor degree have been designated as 1st year class, 2nd year class, 3rd year class and 4th year class in succeeding higher levels of study. For Architecture, five years of study for the Bachelor degree have been designated as 1st year class, 2nd year class, 3rd year class, 4th year class and 5th year class in succeeding higher levels of study.

Students shall be admitted into the 1st year class.

4.2 The Academic Council will form an Admission Committee in each academic session for admission into 1st year Bachelor Degree class.

4.3 A candidate for admission into the 1st year class must have passed the H.S.C Examination from a Secondary and Higher Secondary Education Board in Bangladesh (after 12 years of schooling) with Physics, Chemistry, Mathematics and English as his/her subjects of Examination in Higher Secondary level or examination recognized as equivalent thereto, and must also fulfill all other requirements as prescribed by the Academic Council on the recommendation of the Admission Committee. In case of confusion regarding the equivalence, the case may be referred to Equivalence Committee.

4.4 All candidates for admission into the courses of Bachelor Degree must be the citizens of Bangladesh. Candidates for all seats except the reserved (Tribal) ones, if any, are selected on the basis of merit. However, all candidates must pass the required level as set by the admission committee. The Academic Council, on the recommendation

of the Admission Committee, frames the rules for admission into the reserved seats.

4.5 No student ordinarily is admitted in the 1st year class after the corresponding classes start or after the call goes out for admission into the next session, whichever is earlier.

4.6 Admission of a newly admitted student in the 1st year class is canceled if he/she fails to attend any class within the first two consecutive cycles after the start of class without prior permission. The date of commencement of classes for the newly admitted students will be announced in advance.

4.7 An Equivalence Committee consisting of at least five members will be formed by the Academic Council in order to consider the equivalence of different public examinations.

4.8 A candidate, seeking admission on transfer from other University, should apply to the Registrar of the University if there is any exchange program with that university. The Registrar will refer the case to the concerned Head of the Department and also to the Equivalence Committee. On receiving the opinions of the Head of the Department and of the Equivalence Committee, the matter will be forwarded to the Academic Council. The Academic Council's decision will be communicated to the Head of the Department and the candidate.

4.9 There is no transfer in the 1st year class. In special cases, students may be admitted into a higher class under clause 4.8.

4.10 Every student being admitted to the University shall be examined by a competent medical officer as prescribed in the admission rules.

5. Method of Course Offering and Instruction:

The undergraduate curricula at RUET are based on course system. The salient features of course system is:

i) Number of theoretical courses and examination papers shall be five in each semester.

ii) Continuous evaluation of student's performance.

iii) The flexibility to allow the student to progress at his/her own pace depending on his/her ability or convenience, subject to the regulations on credit and minimum grade point average (GPA) requirements.

iv) Promotion of teacher-student contact.

6. Academic Calendar:

6.1 The academic year is ordinarily divided into two semesters each having duration of not less than 13 cycles.

6.2 There are final examinations at the end of each semester conducted by the respective degree awarding departments of the University.

6.3 On the approval of the Academic Council an academic schedule for the year will be announced for general notification before the start of the academic year.
The schedule may be prepared according to the following guidelines:

Odd Semester	**Duration**
Classes	13 cycles
Mid-semester recess	1 week
Recess before examination and Semester Final Examination	29 days
Inter-Semester Recess	1 weeks
Even Semester	**Duration**
Classes	13 cycles
Mid-semester recess	1 week
Recess before examination and Semester Final Examination	29 days
Inter-Year Recess, Result publication, and Preparation for next semester	3 weeks
Backlog Examination and Result publication	2 Weeks
Vacation and others	Rest
Total	52 Weeks
Short Semester	**Duration**
Classes and Examinations	10 weeks

7. Duration of Course and Course Structure:

7.1 Bachelor Degree courses (except Architecture) extend over a period of four academic years (8 semesters), each of a normal duration of one calendar year, which is divided as necessary for the purpose of academic program and conduct of examinations. For Bachelor degree in Architecture, the period will be five academic years (10 Semesters).

7.2 The curricula of the Bachelor degree in the different departments are as proposed by the respective Academic and Dean's Committee and approved by the Syndicate on the recommendation of the Academic Council.

7.3 The Academic Committee reviews the curricula as required and put forward suggestions to the Academic Council through Dean's Committee.

7.4 Teaching for the courses is reckoned in credits and the credits allotted to various courses are determined by the Academic Committee with the following guidelines:

Nature of Course	Contact hour	No. of Credit
i) Theory	1 hour/week	1
ii) Tutorial	1 hour/week	1
iii) Independent sessional /design	3/2 hours/week 2 hours/week 3 hours/week and similar	0.75 1 1.5
iv) Project & thesis	3 hours/week and similar	1.5
v) Field work	2-4 weeks of field work	1

7.5 The total number of credits that a student has to complete successfully for the award of Bachelor degree is minimum 160 except for Bachelor in Architecture. The maximum period of candidature is seven years, i.e., 3 years (6 semesters) more than the normal time required to complete the course. For Architecture the minimum credit will be 200.

7.6 The total number of credits per week in a semester shall be as approved curricula.

7.7 The total contact hours for students including lecture, tutorial and sessional is around 25 (35 for Architecture) periods per week, each period being of minimum 50 minutes duration.

7.8 In each degree-awarding department, one of the senior teachers nominated by the Head of the Department acts as Course Coordinator who acts as Member Secretary to the academic committee.

7.9 A course plan for each course, approved by the Course Coordinator, showing details of lectures may be announced at the start of each semester.

7.10 Credits in any theory subject do not exceed 4 and that in sessional subject do not exceed 3.0. For Architecture credits in sessional subject will not exceed 12.0.

8. Course Designation and Numbering System:

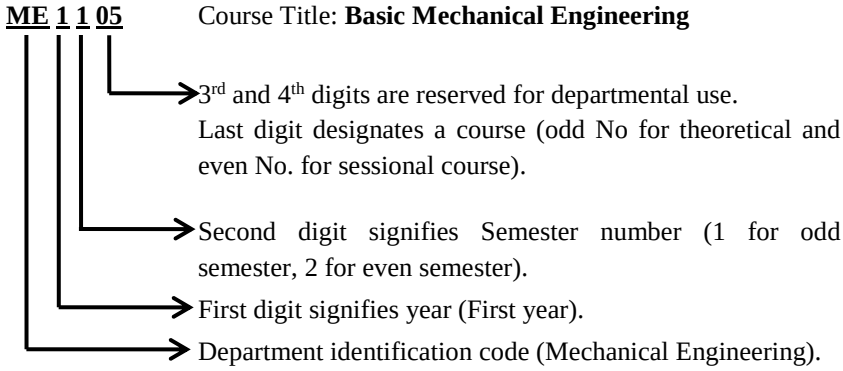
Each course is designated by a two to five letter word (e.g. ME, EEE, Math) identifying the department which offers it following by a four digit number with the following criteria:

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

b) The second digit corresponds to the semester in that year.

c) The 3rd and 4th digits are reserved for departmental use indicating major area.
d) The 4th digit is usually odd for theoretical and even for laboratory or sessional courses.

The course designation system is illustrated by one example as shown below:



N.B.: There will be one blank space after department identification code.
Project/thesis courses shall be designed by the department identification code followed by 4100 and 4200 (Example: ME 4100 and ME 4200).

9. Types of Courses:

The courses included in undergraduate curricula are divided into several groups as follows:

9.1 **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 of the designated core courses for his discipline.

9.2 **Pre-requisite Course:** Some of the core courses are identified as pre-requisite courses. A pre-requisite course is one, which is required to be completed before taking some other course(s). Any such course, on which one or more subsequent courses build up, may be offered in each of the two regular semesters (if possible).

9.3 **Optional Courses:** Apart from the core courses, students have to complete a number of courses which are optional in nature. In those cases, students will have some choices to choose the required number of courses from a specified group/number of courses.

10. Departmental Monitoring Committee and Student Adviser:

10.1 **Department monitoring committee:** Each department constitutes a Departmental Monitoring Committee with two teachers from the respective Department as members, nominated by the Academic Committee and Head of the Department as chairman. This committee monitors and evaluates the performance of the Course System within the Department. The committee may also propose from time to time to the Academic Committee if any changes and modifications needed for upgrading/changing the Undergraduate Curriculum and the Course System.

10.2 **Student Adviser:** One adviser is appointed for a batch of student (around 30) by the Department Monitoring Committee of the concerned Department(s) who advises each student on the courses to be taken by a student. Adviser discusses with the student on his academic program and then decides the nature of courses for which he/she can register. However, it is the student's responsibility to keep contact with his adviser who reviews and eventually approves the student's specific plan of study and checks on subsequent progress. The adviser generally be of the rank of an Assistant Professor or above from the concerned Department(s). However, in case of shortage of teachers, Lecturers may be appointed as adviser.

For a student of second and subsequent semesters, the nature of courses for which he can register will be decided on the basis of his/her academic performance during the previous semester(s). The adviser advises the students to register for the courses during the next semester within the framework of the guidelines in respect of minimum/maximum credit hours limits.

11. Registration Requirements:

Any student who wants to study a course is required to register formally. Being admitted to the University, each student is assigned to a student adviser. The student can register for courses he/she intends to take during a given semester only on the basis of the advice and consent of his/her adviser.

11.1 **Registration Procedure:** Students must register for each class in which they will participate. Each student will fill up his/her Course Registration Form in consultation with and under the guidance of his/her adviser. The original copy of the Course Registration Form(s) will be submitted to the Registrar's Office, and then the requisite number of copies will be distributed to the adviser and Head. The date, time and venue for registration will be announced in advance by the Department's Office. It is absolutely necessary that all students present themselves for registration at the specified time.

11.2 **Limits on the Credit Hours to be taken:** A student must be enrolled for the requisite number of credits as mentioned in article 7.6. A student must enroll for the prescribed sessional courses in the respective semester within the allowed credit limits.

11.3 **Pre-condition for Registration:** A student will be allowed to register in those courses subject to the satisfaction of pre-requisite courses. If a student fails in a pre-requisite course in any semester, the concerned Department Monitoring Committee may allow him/her to register for a course which builds on the pre-requisite course provided his attendance and grades in continuous assessment in the said pre-requisite course is found to be satisfactory.

Registration will be done at the beginning of each semester. Late registration is however, permitted during the second week on payment of a late registration fee. Students having out standing dues to the University or a hall of residence shall not be permitted to register. All students have therefore, to clear their dues and get a clearance or no dues certificate, on the production of which, they will be given necessary Course Registration Forms and complete the course registration procedure. Registration Forms are normally available in the Register's office. An orientation program will be conducted for only the first year students at the beginning of the first semester when they will be handed over the registration package on producing enrollment slip/proof of admission.

11.4 **Registration Deadline:** Student must register for the courses to be taken within 1 (One) cycle from the commencement of each semester and no late registration will be accepted after 2(Two) cycles of classes. Late registration after this date will not be accepted unless the student submits a written appeal to the Registrar through the concerned Head and can document extraordinary circumstances such as medical problems (physically incapacitated and not able to be presented) or some other academic commitments which precluded enrolling prior to the last date of registration.

11.5 **Penalty for Late Registration:** Students who fail to register during the designated dates for registration are charged a late registration fee Tk 500/= per cycle. This extra fee will not be waived whatever be the reason for late registration.

11.6 **Withdrawal from a Semester:** If a student is unable to complete the semester Final Examination due to illness, accident or any other valid reason etc., he/she may apply to the Head of the department. Each Department will decide for total withdrawal from the semester before the start of the semester final examination. He/she may choose not to withdraw any laboratory/sessional/design course if the grade obtained in such a course is 'D' or better. The application must be supported by a medical certificate from any authorized Medical Officer. The Academic Council will take the final decision about such applications. However he/she will not be permitted to the next year class unless he/she completes the required credit for that year.

12. Striking off the Names and Readmission:

12.1 The names of the students shall be struck off and removed from the rolls on the following grounds:

i) Non-payment of University fees and dues within the prescribed period.

ii) Forced to discontinue his/her studies under disciplinary rules.

iii) Withdrawal of names from the rolls of the University on grounds acceptable to the Vice-Chancellor of the University/ nominated authority after having cleared all dues.

iv) Could not earn required credits for graduation as outlined in the respective curriculum and/or fulfill CGPA requirement within the maximum allowed time of 7 academic years. For Architecture maximum allowed time is 8 academic years.

12.2 Every student whose name has been struck off the rolls by exercise of the clauses (ii) of Article 12.1 seeking re-admission after expiry of the period for which he/she was forced to discontinue his/her studies, shall submit an application to the Head of the Department in the prescribed form before the commencement of the session to which he/she seeks re-admission. The Head of the Department shall forward the application to the Registrar of the University with his remarks. In case the readmission is allowed, the student will be required on payment of all dues to get him/her-self admitted no later than one week from the date of permission given by the Registrar. All readmission should preferably be completed before the session starts. The percentage of attendance of the re-admitted students shall be counted from the date of recommendation of the concerned Head of the department.

12.3 No student who has withdrawn his/her name under clause (iii) of Article 12.1 shall be given readmission.

12.4 In case, a student whose name has been struck off the rolls under clause (i) of Article 12.1 seeks readmission within the session in which his/her name was struck off, he/she shall be readmitted on payment of all the arrears fees and dues. But if he/she seeks readmission in any subsequent session, the procedure for his/her readmission will be the same as described under Article 12.2.

12.5 The application of a student for readmission will be considered if he/she applies within two academic sessions from the semester of discontinuance of his/her studies in the University. Other than debarment as punishment under the ordinance related to discipline, a student failing for any other reason whatsoever to become a candidate for a semester final examination in which he/she ought to have had in the usual process of his/her progressive academic activities, shall be considered to have discontinued his/her studies for the relevant

semester together with striking the name off from current roll and two such discontinuance periods will be considered equivalent to that for one academic session. The maximum period of discontinuance under no circumstances is to exceed two academic sessions during a student's period of studies for the degree.

12.6 In case any application for readmission is rejected, the student may appeal to the Academic Council and, in this case, the decision of the Academic Council shall be final.

12.7 A student, whose name has been struck off the rolls by exercise of clause (iv) of Article 12.1, is not eligible to seek readmission.

12.8 After Short semester, if any student fails to complete his/her required courses he/she will take readmission in the final year.

13. Grading System:

The letter grade system shall be used to assess the performance of the student and shall be as follows:

Numerical grade	Letter grade	Grade point
80% or above	A+ (A Plus)	4.0
75% to less than 80%	A (A Regular)	3.75
70% to less than 75%	A- (A Minus)	3.5
65% to less than 70%	B+ (B Plus)	3.25
60% to less than 65%	B (B Regular)	3.0
55% to less than 60%	B- (B Minus)	2.75
50% to less than 55%	C+ (C Plus)	2.5
45% to less than 50%	C (C Regular)	2.25
40% to less than 45%	D	2.0
Less than 40%	F	0
Incomplete	**I**	**-**

A grade 'I' shall be awarded for courses (like project & thesis, design etc.) in the odd semester, which continue through to the even semester.

13.1 **Calculation of GPA and CGPA:** Grade point average (GPA) is the weighted average of the grade points obtained in all the courses passed/completed by a student in a semester. 'F' grades do not count for GPA calculation. GPA of a semester will be calculated as follows:

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

where, n is the total number of courses passed by the student, C_i is the number of credits allotted to a particular course i and G_i is the grade point corresponding to the grade awarded for i-th course.

The overall or Cumulative Grade Point Average (CGPA) gives the cumulative performance of the student from first semester up to any other semester to which it refers and is computed by dividing the total grade points ($\Sigma C_i G_i$) accumulated up to the date by the total credit hours (ΣC_i). Both GPA and CGPA are rounded off to the second place of decimal for reporting.

14. Distribution of Marks:

14.1 **The distribution of marks for a given course is as follows:**

i) **Theory courses:**

Class participation and attendance	08
Class tests	20
Semester Final Examination (3 hours duration)	72
	Total= 100

ii) **Independent sessional/design/field work courses:**

Class participation and attendance	08
Quizzes/viva voce	20
Board Viva (Compulsory)	25
Performance/reports	47
	Total = 100

iii) **Project and thesis (Architecture):**

Class participation and attendance	10
Internal criticisms	40
Viva voce/ Jury	30
Supervisor (Internal Examiner)	20
	Total = 100

iv) **Project and thesis (Other departments):**

Viva voce (conducted by a viva voce committee)	30
Supervisor (internal examiner)	50
External examiner (any other teacher of the department/ Examination committee)	20
	Total = 100

14.2 Basis for awarding marks for class participation and attendance will be as follows:

Attendance	**Marks**
90% and above	8
85% to less than 90%	7
80% to less than 85%	6
70% to less than 80%	5
60% to less than 70%	4
Less than 60%	0

14.3 The students will not be allowed to sit in the semester final examination for failing to attend at least 50% in the classes. The students whose percentage of attendance will fall short of 75% in any

of the theory, sessional courses for which he/she has registered in one academic year shall not be eligible for the award of any type of scholarship/stipend/grant for the following academic session.

15. Class tests:

i) 3 best out of 4 class tests may be taken for awarding grade.

ii) Duration of class tests normally should be 20-30 minutes and materials covered should be what were taught in 2 to 3 previous cycles or most recent classes.

iii) The dates for the class tests shall be fixed by the Head or Course Coordinator and dates shall be announced accordingly.

iv) All class tests shall ordinarily be of equal value. The result of each individual class test shall be posted for information of the students preferably before the next class test is held.

16. Earned Credits:

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

A student, who obtains a 'F' grade in any Core Course in any semester, he/she will have to repeat the course. If a student obtains a 'F' in an Optional Course, he/she may choose to repeat the course or take a substitute course if available.

'F' grades will be considered as backlog courses. 'F' grades will not be counted for GPA calculation but will stay permanently on the Grade Sheet and Transcript.

A student obtaining D grade in a course will be allowed to repeat the course for the purpose of grade improvement if CGPA of the student falls below **2.20**. In such case he/she will be awarded the new grade thus he/she obtains or retains his/her previous grade if he/she fails.

17. Performance Evaluation:

i) The minimum CGPA requirement for obtaining a B.Sc. Engineering/ Bachelor degree is **2.20**. The performance of a student will be evaluated in terms of two indices, viz. Semester grade point average and cumulative grade point average.

ii) Students will be allowed to sit in Backlog examination for maximum 3 courses (in same year) in an academic year. However only 4th year students are allowed to choose 3 courses from his/her Backlog course(s).

18. Honors, VC's List and University gold medal:

18.1 **Honors:** Candidates for Bachelor's degree will be awarded the degree with honors if their CGPA is 3.75 or above and will be called as First Class with Honors.

18.2 **Class:** Candidates having CGPA 3.00 or above and less than 3.75 will be called as First Class and Candidates having CGPA **2.20** or above and less than 3.00 will be called as Second Class.

18.3 **VC's List:** In recognition of excellent performance, the names of students who maintain good standing with the University obtaining SGPA of 3.75 or above in two regular semesters in each academic year may be published in the VC's List in each department. Students who have received F grade in any course during any of the two regular semesters will not be considered for VC's List in that year.

18.4 **University Gold Medal:** If a student can show extraordinary brilliance and obtains all A or better grades in all the courses he/she attended and fulfills the credit requirement for graduation will be honored by awarding University gold medal in a special function/convocation.

19. Registration for the Second & Subsequent Semesters:

A student is normally required to register courses according to the approved curricula in each semester. After odd semester final examination, Students will normally register courses in even semester.

After Even semester final examination, students provisionally register courses for the odd semester in next academic year.

20. Measures for Helping Academically weak Students:

The following provisions are made in order to help academically weak students to enable them to complete their studies within the maximum period of seven years. Adviser will keep special contact for all such students whose Cumulative grade point averages (CGPA) are less than **2.20** at the end of a semester.

21. Backlog Examination:

i) There will be Backlog Examination after the publication of result of Even semester examination.

ii) 'F' grade(s) obtained after semester examination will be considered as backlog course(s).

iii) Students are allowed to sit for maximum 3 backlog courses in odd and/or even semester(s).

iv) Class test marks of Backlog courses in odd/even semester(s) will be counted for Backlog examination.

v) Maximum B (B regular) grade will be counted in Backlog examination.

Backlog Courses: The course(s) which a student registered in a Semester but after Semester examination he/she obtained 'F' grade in that course(s).

22. Short Semester Examination:

The Short Semester Examination on only backlog courses may be conducted for the students who have participated in their 4(four)/5(Five) year degree course (up to 4^{th} /5^{th} year backlog examination) and have a shortage of maximum 5 (Five) incomplete courses including sessional, project and thesis to obtain Bachelor degree. The short semester examination will be arranged in a convenient time by the Head of the Department within 10 weeks of the publication of results of the final year backlog examination. The evaluation system will be the similar as regular semester. The students willing to appear at the short semester examination have to apply to the Head of the Department and with his permission must register within 7(seven) working days of publication of final year Backlog examination results. A student who has failed in the short semester examination will need to register backlog course(s) in the regular semester. Student(s) will be allowed to register for short semester only one time in his academic life. Maximum grade B+ (B plus) will be counted in short semester examination.

23. Minimum Earned Credit and GPA Requirements for Obtaining Degree:

Minimum credit requirements for the award of Bachelor Degree will be recommended by the respective Academic Committee to the Academic Council. The minimum CGPA requirements for obtaining a Bachelor Degree are 2.20.

24. Time Limits for Completion of Bachelor's Degree:

A student must complete his/her studies within a maximum period of seven years for 4 year bachelor degree and eight years for 5 year bachelor degree.

25. Industrial/Professional Training Requirements:

Depending on each Department's own requirement a student may have to complete a prescribed number of days for industrial/professional training as mentioned in the course curricula.

26. Application for Graduation and Award of Degree:

A student who has fulfilled all the academic requirements for bachelor's degree will have to apply to the Registrar/VC through his/her Adviser for graduation. Provisional degree will be awarded on

completion of Credit and GPA requirements. Such provisional degrees will be confirmed by the academic council.

27. Inclusion of repeaters from the present system to the new course system:

Repeater students will be included in the course system of curricula as and when such situation will arise. Equivalence of Courses and Grades (if required) will be done by Academic Council with recommendation by the respective Academic and Dean Committee.

28. Absence during Semester:

A student should not be absent from quizzes, tests etc. during the semester. Such absence will naturally lead to reduction in points/marks, which count towards the final grade. Absence in semester final examination will result in 'F' grade and that course will not be counted as backlog course.

A student who has been absent for short period, up to a maximum of three weeks due to illness, should approach the course teacher(s) or the course coordinator(s) for a make-up quizzes or assignments immediately on returning to the classes. Such request should be supported by medical certificate from University medical officer. The medical certificate issued by a registered medical practitioner (with the registration number shown explicitly or the certificates) will also be acceptable only in those cases where the student has valid reason for his/her absence from the University.

Conduct of Examination:

1. Dean of the respective Faculty will announce the date of final examinations with recommendation from the respective heads of the departments at least 1(one) week before the end of the semester classes.
2. Board viva will be held at 13th cycle as convenient by the department.
3. There will be an Examination Committee for each examination in every department as:

Sl No.	Name	Remarks
1.	Head	Chairman
2.	3 (Three) Teachers within the University not below the rank of Assistant Professor	Members
3.	1(One) Teacher from outside the University (Not below the rank of Associate Professor)	External Member

For 4th year backlog and short semester examination committee no. of internal members will be 4.

4. Odd, Even, Backlog and Short Semesters will be treated as separate examinations.
5. Head of the department will put forward the proposal of formation of the examination committee to respective Dean of the Faculty. Dean will place this proposal to the Dean's executive committee for recommendation to the Academic Council's approval.
6. Chairman of the Examination committee will propose the name of the Paper Setters and Examiners from the panel of Paper setters and Examiners to the Vice-chancellor. Vice-Chancellor will appoint the examiners. Two Paper Setters and Examiners will be appointed for each course.
7. Examination Committee will moderate the questions for semester final, backlog and short semester examinations.
8. Chairman of the Examination committee will arrange to prepare question typing and printing (as required). The persons involved for preparation of question papers will be kept among the members of the respective examination committee.
9. Printed Questions will be sent to Dean in sealed envelope signed by the Chairman of the Examination committee and the person involved with question preparation at least 1(one) day before the examination.
10. Dean will keep the questions and will open and distribute the questions to the invigilators before the examination(s).
11. Results of Even semesters must be published before the start of next academic year.
12. Backlog examination must be completed within 2nd cycle of the odd semester.
13. After examinations all answer scripts will be submitted to Dean's office by the invigilators.
14. Examiners, who will perform invigilation duty, must collect the answer script from the Dean's office after the examinations on same day. All other examiners will collect the answer script from Dean's office on next office day.

Script Evaluation:

1. There will be two sections in the questions and answer script. Each examiner will evaluate one section.
2. Examiners will send four copies of mark sheet along with marked answer script to the Chairman of Examination committee.
3. Chairman of the examination committee will send the answer script with mark sheet and questions to the scrutinizers for scrutiny.
4. Vice-Chancellor will appoint two Scrutinizers on recommendation from the Chairman of the examination committee.
5. Vice-Chancellor will appoint three tabulators/Data Entry Teachers on recommendation from the chairman of the examination committee.

Advisor(s) or other teacher (as required) may be the Tabulators/ Data entry teachers for a particular series and will continue to do so until that series will pass away. However the appointment will be on annual basis.

6. Chairman of the examination committee will provide the three copies of scrutinized mark sheets to the tabulators/Data Entry Teachers.
7. Chairman of the examination committee will arrange examination committee meeting for result finalization.
8. Tabulation will be done at a secured place under the supervision of the chairman of the examination committee.
9. Proper security measure is required to be taken.
10. Chairman of examination committee will send the three copies of prepared result along with one copy of scrutinized mark sheet to the Controller of Examination.
11. Controller of examination will publish the result after the approval of the Vice-Chancellor.
12. Grade sheets will be prepared and checked by the tabulators.

Special Instructions:

1. Students will not be allowed to enter the examination hall after half an hour from the start of the final examination(s).
2. Students will not be allowed to leave the exam hall before completion of one hour from the start of examination.
3. Students are not allowed to keep any electronic device unless it is officially permitted.
4. Students normally will not be allowed to go outside the exam hall during examination.
5. Students will be under Ordinance related to discipline for any unfair means as laid out.

Effectiveness: This ordinance, Instruction and procedure will be effective for student entry session 2013-2014 and so on. In case of any discrepancy Academic council will take necessary actions.

CHAPTER- IV

Course Structure for the Undergraduate Studies (Prerequisite Courses)

Course No.	Course Title	Prerequisite Course No.	Course Title
Math 1221	Vector, Matrix and Integral Calculus	Math 1121	Differential Calculus and Geometry
ME 2100	Computer Aided Drawing	ME 1100	Mechanical Engineering Drawing
Math 2121	Differential Equation	Math 1221	Vector, Matrix and Integral Calculus
EEE 2281	Electrical Machine and Electronics	EEE 1281	Electrical Circuits
Math 2221	Complex Variable and Harmonic Analysis	Math 2121	Differential Equation
ME 2101	Thermodynamics	ME 1101	Basic Mechanical Engineering
ME 2203	Engineering Mechanics-II	ME 2103	Engineering Mechanics-I
ME 3215	Mechatronic System	ME 3115	Instrumentation and Control
Math 3121	Numerical Analysis and Statistics	Math 2221	Complex variable and Harmonic Analysis
ME 3201	Heat Transfer-II	ME 3101	Heat Transfer-I
ME 3209	Design of Machine Elements-II	ME 3109	Design of Machine Elements-I
ME 3203	Engineering Mechanics-III	ME 2203	Engineering Mechanics-II
ME 3105	Fluid Mechanics-II	ME 2105	Fluid Mechanics-I
ME 4201	Applied Thermodynamics-II	ME 4101	Applied Thermodynamics-I
ME 4205	Fluid Machinery	ME 3105	Fluid Mechanics-II
ME 4207	Machine Tool and Tool Design	ME 2107	Production Process

Summary of Courses for the Undergraduate Studies

1st Year Odd Semester

SL. No.	Course No.	Course Title	Contact hours/ Week	Credits
Theory Courses				
1.	Chem 1121	Chemistry	3.00	3.00
2.	Phy 1121	Physics	3.00	3.00
3.	Hum 1121	Economics and Sociology	3.00	3.00
4.	Math 1121	Differential Calculus and Geometry	3.00	3.00
5.	ME 1101	Basic Mechanical Engineering	3.00	3.00
Sessional Courses				
6.	Chem 1122	Chemistry Sessional	1.50	0.75
7.	Phy 1122	Physics Sessional	1.50	0.75
8.	ME 1102	Basic Mechanical Engineering Sessional	1.50	0.75
9.	ME 1100	Mechanical Engineering Drawing	3.00	1.50
10.	MES 1108	Shop Practice	3.00	1.50
Total			**25.50**	**20.25**

1st Year Even Semester

SL. No.	Course No.	Course Title	Contact Hours/ Week	Credits
Theory Courses				
1.	Hum 1221	Technical English	3.00	3.00
2.	Math 1221	Vector, Matrix and Integral Calculus	3.00	3.00
3.	CSE 1281	Computer and Programming Language	3.00	3.00
4.	EEE 1281	Electrical Circuits	3.00	3.00
5.	ME 1207	Production Process	3.00	3.00
Sessional Courses				
6.	Hum 1222	Technical English Sessional	2.00	1.00
7.	CSE 1282	Computer and Programming Language Sessional	3.00	1.50
8.	EEE 1282	Electrical Circuits Sessional	1.50	0.75
9.	ME 1208	Production Process Sessional	3.00	1.50
Total			**24.50**	**19.75**

2nd Year Odd Semester

SL. No.	Course No.	Course Title	Contact Hours/ Week	Credits
Theory Courses				
1.	Hum 2121	Accounting and Industrial law	3.00	3.00
2.	Math 2121	Differential Equation, Complex variable and harmonic Analysis	4.00	4.00
3.	ME 2101	Thermodynamics	3.00	3.00
4.	ME 2103	Engineering Mechanics-I	3.00	3.00
5.	ME 2105	Fluid Mechanics-I	3.00	3.00
Sessional Courses				
6.	ME 2102	Thermodynamics Sessional	3.00	1.50
7.	ME 2106	Fluid Mechanics-I Sessional	3.00	1.50
8.	ME 2100	Computer Aided Drawing	3.00	1.50
Total			**25.00**	**20.50**

2nd Year Even Semester

SL. No.	Course No.	Course Title	Contact Hours/ Week	Credits
Theory Courses				
1.	Math 2221	Numerical Analysis and statistics	3.00	3.00
2.	EEE 2281	Electrical Machines and Electronics	3.00	3.00
3.	ME 2203	Engineering Mechanics-II	3.00	3.00
4.	ME 2207	Measurement, Quality Control and Materials Handling	3.00	3.00
5.	ME 2209	Mechanics of Solids	3.00	3.00
Sessional Courses				
6.	EEE 2282	Electrical Machines and Electronics Sessional	3.00	1.50
7.	Math 2222	Numerical Analysis and statistics Sessional	1.50	0.75
8.	ME 2204	Engineering Mechanics-II Sessional	1.50	0.75
9.	ME 2208	Measurement. Quality Control and Materials Handling Sessional	1.50	0.75
10.	ME 2210	Mechanics of Solids Sessional	3.00	1.50
Total			**25.50**	**20.25**

3rd Year Odd Semester

SL. No.	Course No.	Course Title	Contact Hours/ Week	Credits
Theory Courses				
1.	ME 3101	Heat Transfer-I	3.00	3.00
2.	ME 3105	Fluid Mechanics-II	3.00	3.00
3.	ME 3109	Design of Machine Elements-I	3.00	3.00
4.	ME 3115	Instrumentation and Control	3.00	3.00
5.	ME 3119	Engineering Materials and Metallurgy	4.00	4.00
Sessional Courses				
6.	ME 3106	Fluid Mechanics-II Sessional	1.50	0.75
7.	ME 3110	Design of Machine Elements-I Sessional	1.50	0.75
8.	ME 3116	Instrumentation and Control Sessional	1.50	0.75
9.	ME 3120	Engineering Materials and Metallurgy Sessional	1.50	0.75
Total			**22.00**	**19.00**

3rd Year Even Semester

SL. No.	Course No.	Course Title	Contact Hours/ Week	Credits
Theory Courses				
1.	ME 3201	Heat Transfer-II	3.00	3.00
2.	ME 3203	Engineering Mechanics-III	3.00	3.00
3.	ME 3209	Design of Machine Elements-II	3.00	3.00
4.	ME 3221	Energy Engineering & Technology	3.00	3.00
5.	ME 3215	Mechatronic Systems	3.00	3.00
Sessional Courses				
6.	ME 3202	Heat Transfer-II Sessional	3.00	1.50
7.	ME 3204	Engineering Mechanics-III Sessional	1.50	0.75
8.	ME 3210	Design of Machine Elements-II Sessional	3.00	1.50
9.	ME 3200	Case Study in Mechanical Engineering	2.00	1.00
Total			**24.50**	**19.75**

4th Year Odd Semester

SL. No.	Course No.	Course Title	Contact hours/ Week	Credits
Theory Courses				
1.	ME 4101	Applied Thermodymics-I	3.00	3.00
2.	ME 4111	Refrigeration and Mechanical Equipment in Buildings	3.00	3.00
3.	ME 4117	Production Planning and Control	3.00	3.00
4.	ME 4121	Power Plant Engineering	3.00	3.00
5.	ME 4113	Optional-I	3.00	3.00
Sessional Courses				
6.	ME 4102	Applied Thermodynamics-I Sessional	1.50	0.75
7.	ME 4112	Refrigeration and Mechanical Equipment in Buildings Sessional	1.50	0.75
8.	ME 4100	Project and Thesis	3.00	1.50
9.	ME 4110	Seminar	2.00	1.00
10.	ME 4120	Industrial Training	4 weeks	1.00
Total			**23.00**	**20.00**

4th Year Even Semester

Sl. No.	Course No.	Course Title	Contact hours/ Week	Credits
Theory Courses				
1.	ME 4201	Applied Thermodynamics-II	3.00	3.00
2.	ME 4205	Fluid Machinery	3.00	3.00
3.	ME 4207	Machine Tool and Tool Design	3.00	3.00
4.	ME 4217	Industrial Management	3.00	3.00
5.	ME 4213	Optional-II	3.00	3.00
Sessional Courses				
6.	ME 4206	Fluid Machinery Sessional	1.50	0.75
7.	ME 4208	Machine Tool and Tool Design Sessional	1.50	0.75
8.	ME 4200	Project and Thesis	6.00	3.00
9.	ME 4210	Seminar	2.00	1.00
Total			**26.00**	**20.50**

Optional Courses Offered in the Undergraduate Studies

Optional-I		Optional-II	
Course No.	**Course Title**	**Course No.**	**Course Title**
ME 4113(a)	Computer Aided Design	ME 4213 (a)	Automobile Engineering
ME 4113 (b)	Energy Auditing	ME 4213 (b)	Intelligent Control Engineering
ME 4113 (c)	Nuclear Engineering	ME 4213 (c)	Aerodynamics
ME 4113 (d)	Polymer Processing	ME 4213 (d)	Solar Energy
ME 4113 (e)	Operation Research	ME 4213 (e)	Managerial Economics
ME 4113 (f)	Machine Dynamics	ME 4213 (f)	Noise and Vibration
ME 4113 (g)	Robotics	ME 4213 (g)	Mechanical Behavior of Materials
ME 4113 (h)	Bio Mechanics	ME 4213 (h)	Computational Fluid Dynamics
ME 4113 (i)	Tribology	ME 4213 (i)	Bio Transport
ME 4113 (j)	Bio Statistics	ME 4213 (j)	Railway Engineering

Summary of the Courses of undergraduate Studies at a glance

SL. No.	Type of Courses	Total Credits	Credit in %
1.	Core Courses of Mechanical Engineering	113.00	70.63
2.	Allied Engineering Courses	12.75	07.97
3.	Basic Sciences	21.25	13.28
4.	Humanities	13.00	08.12
Total		**160.00**	**100.00**

CHAPTER- V
Detail Syllabus for the Undergraduate Studies

Courses of the 1st Year B.Sc. Engineering

Odd Semester

SL. No.	Course No.	Course Title	Contact hours/ Week	Credits
Theory Courses				
1.	Chem 1121	Chemistry	3.00	3.00
2.	Phy 1121	Physics	3.00	3.00
3.	Hum 1121	Economics and Sociology	3.00	3.00
4.	Math 1121	Differential Calculus and Geometry	3.00	3.00
5.	ME 1101	Basic Mechanical Engineering	3.00	3.00
Sessional Courses				
6.	Chem 1122	Chemistry Sessional	1.50	0.75
7.	Phy 1122	Physics Sessional	1.50	0.75
8.	ME 1102	Basic Mechanical Engineering Sessional	1.50	0.75
9.	ME 1100	Mechanical Engineering Drawing	3.00	1.50
10.	MES 1108	Shop Practice	3.00	1.50
Total			**25.50**	**20.25**

Even Semester

SL. No.	Course No.	Course Title	Contact Hours/ Week	Credits
Theory Courses				
1.	Hum 1221	Technical English	3.00	3.00
2.	Math 1221	Vector, Matrix and Integral Calculus	3.00	3.00
3.	CSE 1281	Computer and Programming Language	3.00	3.00
4.	EEE 1281	Electrical Circuits	3.00	3.00
5.	ME 1207	Production Process	3.00	3.00
Sessional Courses				
6.	Hum 1222	Technical English Sessional	2.00	1.00
7.	CSE 1282	Computer and Programming Language Sessional	3.00	1.50
8.	EEE 1282	Electrical Circuits Sessional	1.50	0.75
9.	ME 1208	Production Process Sessional	3.00	1.50
Total			**24.50**	**19.75**

Detail Syllabus of 1st Year Odd Semester B.Sc. Engineering

Chem 1121 (Chemistry)

Lecture: 3.00 hrs /week ***No. of credit: 3.00***

Inorganic and Physical Chemistry: Atomic structure; Chemical bonds: Thermo-chemistry; Properties and uses of noble gases; Different types of solutions and their composition/concentrations; Colligative properties of dilute solutions; Classification of colloids; Methods of preparation and purification of colloidal solutions, properties of colloids; Electrolysis; theories of electrolytic dissociation; Debye-Huckle theory; transport number.
Corrosion: Cost and importance of corrosion; electrochemical and thermodynamic principles of corrosion; different types of corrosion, methods of corrosion prevention, prevention by design improvement; inhibitors, cathodic protection, anodic protection.

Industrial Chemistry: Raw materials and production technology and applications of cement, glass, ceramic, fertilizer and sugar; crude oil and its refining processes. Concepts of Sources of Pollution and Their Remedy;

Chem 1122 (Chemistry Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Chemistry

Phy 1121 (Physics)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Optics: Lens equation, Optical instruments; Compound microscope and resolving power of a microscope, camera and photographic techniques, image resolution, Depth of field view, Fiber optics, Physics of LASER, Photonics.
Atomic Physics: Atomic structure, atom model; nature of electron orbit, orbital energy, origin of spectral lines; photoelectric effect, law of photoelectric emission, Einstein's photoelectric equation, photovoltaic cell; Compton effect, de Broglie waves, wave velocity and group velocity.
Nuclear Physics: Introduction, characteristics of nuclear force, nuclear binding energy, isotope, isobar, isotones; concept of compound nucleus, nuclear fission and fusion Process, chain Reaction; radioactivity: radioactive decay, half-life and mean life, law of disintegration, successive disintegration.
Magnetism: Law of electromagnetic induction, Amperes law and its application; Magnetic properties of matter; magneto motive force, magnetic field intensity, permeability, susceptibility, classifications of magnetic materials, magnetization curves, hysteresis loss, magnetostriction, Hall Effect, magnetic force on a current carrying conductor

Phy 1122 (Physics Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Physics

Hum 1121 (Economics and Sociology)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Economics:
Fundamental Concept of Economics: Definition of economics, economics and engineering; microeconomics and macroeconomics; theories: application of economic theories to the problems of developing countries; marginal analysis, demand and supply; elasticity; price system; market and equilibrium; money; inflation; concept of inflation, causes, consequences and

remedies; price index number; consumer price index; laws of returns; economics and diseconomies; theory of production: production function; small scale production and large scale production, productivity types, equilibrium of firm.

Gross National Product (GNP) and National Income: Concepts, measurements and importance of national income in the modern economics; economic growth and development: national income relationship; economic planning; development problems in Bangladesh; the role of the state in economic activity, market and government failures.

Sociology:

Definition**,** relationship with other social sciences, subject matter, scope; social system- family, marriage, economic, political & recreational institutions; role of Engineers in society, urban community, urban ecology, rural and urban power structure. Relationship between culture and civilization.

Social Problems: Social problems as the outcome of industrial revolution, unemployed delinquency and crime; effects of change in science & technology on society, social crime, cyber-crime; deviant behavior; Ethics, Human-Rights, Social and value dimensions of technology, case studies in Ethics and Sociology.

Math 1121 (Differential Calculus and Geometry)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Differential Calculus: Limit, continuity, differentiation and successive differentiation of various type of functions, Leibnitz's theorem, expansion of function, Rolle's theorem, mean value theorem, Taylor's series, partial differentiation, determination of maximum and minimum values of functions and their applications, indeterminate forms, L'Hospital rule, curvature. Application of differential calculus to solve practical problems in Mechanical Engineering.

Two Dimensional Coordinate Geometry: Coordinate geometry of two dimensions, change of axes, pair of straight line, general equation of second degree, circle, parabola, ellipse.

Three Dimensional Coordinate Geometry: Coordinate geometry of three dimensions, system of coordinates, distance between two points, section formula, projection, direction cosines, equations of planes and lines.

ME 1101 (Basic Mechanical Engineering)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Energy: Energy cycle of the earth, forms and sources of energy, conventional and renewable energy; energy conservation and management.

Pure Substance: Properties of water and steam; P-V-T behavior of simple compressible substances; phase rule; thermodynamic property tables and charts; ideal and real gases; equations of state.
Basic Mechanical Devices/Systems: Introduction to steam, gas and water turbines with their accessories; internal combustion engines, automobiles; introduction to pumps, blowers and compressors; refrigeration and air conditioning systems.
Mixture of Gases and Vapors: Mixture of ideal gases; properties of ideal gas mixtures; mixtures of an ideal gas and a vapor (Air-water); dew point**;** specific and relative humidity; use of psychometric chart.
Fundamental Concept of Thermodynamics: Basic concepts and definitions; thermodynamic systems, property and state, thermodynamic process and cycle.
Study of Steam Generating Unit: Introduction, operation of modern steam boilers, accessories and mountings; performance study of steam generator.

ME 1102 (Basic Mechanical Engineering Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Basic Mechanical Engineering

ME 1100 (Mechanical Engineering Drawing)

Sessional: 3.00 hrs /week ***No. of Credit: 1.50***

The Graphic Language: Introduction to pictorial drawing, lettering, theory of projection, orthographic projection, first and third angle projection; drawing equipment & use of instruments, size description, scale, dimensioning rules; multi view representation and conventional practices.
Mechanical Engineering Drawing: Orthographic projection problems; multi view projection problems; auxiliary views; oblique projection; perspective views; isometric drawing; sectional views; geometrical construction; development of surfaces and intersection of solids.

MES 1108 (Shop Practice)

Sessional: 3.00 hrs /week ***No. of Credit: 1.50***

Welding Shop: Acquaintance with tools and appliances used in welding and sheet metal shop; electric arc welding; gas welding; gas cutting; soldering and brazing practices; welding defects; simple exercise on sheet metal work.
Wood Shop: Acquaintance with hand and machine tools used in woodworking. Identification of soft, hard and modified woods; sawing, planning and chiseling practice, making simple wood patterns that will be used in foundry shop.

Detail Syllabus of 1st Year Even Semester B.Sc. Engineering

Hum 1221 (Technical English)

Lecture: 3.00 hrs /week ***No of Credit: 3.00***

Grammar: Properties of English grammar, correction. Construction of sentences, English phonetics, Different types of clauses and phrases
Vocabulary: Scientific terms, phrases and idioms, group verb.
Reading Comprehension: Techniques of reading, skimming, scanning, SQ3R technique
Writing: Formal letter, resume, paragraph, report writing, tender and schedule, APA style sheet, email writing. Commercial correspondence and tenders, amplification, précis writing
Modern Literature: Short stories.

Hum 1222 (Technical English Sessional)

Lecture: 2 hrs/week ***No of Credit: 1.00***

Reading: Different techniques
Writing: Different techniques.
Listening: Monologue, conversation (formal and informal), telephoning and direction; note taking skills.
Speaking: Basic conversation, job interview, seminar and paper presentation; formal speech, telephoning, difference between British and American English.

Math 1221 (Vector, Matrix and Integral Calculus)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Vector Analysis: Linear dependence and independence of vectors, vector geometry, differentiation and integration of vectors with respect to a parameter, line, surface and volume integrations, gradient of a scalar function, divergence and curl of a vector and its physical significance, conservative system, Green's theorem, Gauss's divergence theorem, Stoke's theorem and their applications in physical problems.
Matrices: Different types of matrices, ranks, adjoint and inverse, elementary transformation. Determination of eigen value and eigen vectors, Solution of system of linear equations by matrix methods.
Integral Calculus: Review of elementary techniques (integration by the method of substitution, integration by parts, successive reduction, and standard integrals), improper integrals, beta, gamma and error function, differentiate inside integral, definite integrals, multiple integrals, area, surface area and volume of solids of revolution.

Application of these mathematical tools for solving Mechanical Engineering problems.

CSE 1281 (Computer and Programming Language)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Computer: Main parts like I/O devices, Memory unit and CPU. Primary and secondary storage devices, different memory types. Introduction to Number System, Overview of DOS, Windows, Linux, MAC, UNIX operating systems, Essential general purpose packages for word processing, spreadsheet analysis etc.

Programming Language: Concept of Algorithms and Flow chart, Assembly level language and Machine level language, high level language, Compiler, interpreter, Source and Object programs. Introduction to C/C++ Language, program construction and data types, I/O statements, Expressions, Decision making, Loops, Function and its Calling procedure, Recursion, Arrays and pointer, structure abdominal, Object oriented programming Application of computer programming for solving Mechanical Engineering problems.

CSE 1282 (Computer and Programming Language Sessional)

Sessional: 3.00 hrs /week ***No. of Credit: 1.50***

Sessional based on Computer and Programming Language

EEE 1281 (Electrical Circuits)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

DC Circuits: Kirchhoff's laws, node voltage and mesh current methods, Delta-star and star-delta conversion, Superposition principle, Thevenin's and Norton's theorems.

AC Circuits: Single phase EMF generation, average and effective values of sinusoids, solution of R,L,C series circuits, the j operator, complex-impedances, phasor diagram, power factor, solution of parallel and series, parallel circuits, power factor correction. Three phase EMF generation, delta and wye connections, line and phase quantities, solution of three phase circuits, balanced polyphase systems.

Magnetic Circuits: Ampere's circuital law, B-H curve, solution of magnetic circuits, hysteresis and eddy current losses, relays, applications of magnetic force, resonance.

EEE 1282 (Electrical Circuits Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Electrical Circuits.

ME 1207 (Production Process)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Casting: Patterns and allowance; molding tools and operation; sand molds casting; other casting processes; shell mold, plaster mold, lost wax casting, centrifugal casting, permanent mold casting, die casting, continuous casting. casting design, casting defects and remedies.

Chip-less Metal Forming Process: Different types of hot and cold working process; rolling, cold drawing, deep drawing, forging, extrusion, stamping, shearing, bending and press works; different forming processes of non-metals: plastics, ceramics and non-metallic composite materials.

Tool Geometry: Cutting force analysis; force and power estimation, relations among speed, feed, depth of cut and power input; metal cutting dynamometers; tool wear, tool life and machinability; economics of metal cutting.

Chip Formation Process: Types of chips; chips breakers; tool materials; friction between tool and chip; cutting fluid and its action; surface finish.

Metal Removing Process: Introduction to turning, drilling, shaping, planning, milling, broaching, grinding, precision and non-precision finishing processes.

Welding: Arc, Gas, TIG, MIG, resistance, thermit and other special types; electrodes and their uses; causes and remedies of common welding troubles; brazing and soldering processes; welding symbols.

Unconventional Machining Processes: EDM, ECM, VSM, AJM, USM, Laser.

ME 1208 (Production Process Sessional)

Sessional: 3.00 hrs/week ***No. of Credit: 1.50***

Introduction to Foundry Shops: Acquaintance with tool and appliances used in foundry and machine shops; molding sand and its preparation; making mold for ferrous and non-ferrous casting; use of core boxes; casting of metals.

Introduction to Basic Machine Tools: Acquaintance with tool and appliances used in machine shops. Study of lathe machine, shaper machine, milling machine, drilling machine and grinding machines and their operation.

Introduction to Safety Measures: Introduction to the principles of working, construction, operation, types of cutting tools, selection of cutting speed and feeds etc. regarding basic machine tools.

Courses of the 2nd Year B.Sc. Engineering

Odd Semester

SL. No.	Course No.	Course Title	Contact Hours/ Week	Credits
Theory Courses				
1.	Hum 2121	Accounting and Industrial law	3.00	3.00
2.	Math 2121	Differential Equation, Complex variable and harmonic Analysis	4.00	4.00
3.	ME 2101	Thermodynamics	3.00	3.00
4.	ME 2103	Engineering Mechanics-I	3.00	3.00
5.	ME 2105	Fluid Mechanics-I	3.00	3.00
Sessional Courses				
6.	ME 2102	Thermodynamics Sessional	3.00	1.50
7.	ME 2106	Fluid Mechanics-I Sessional	3.00	1.50
8.	ME 2100	Computer Aided Drawing	3.00	1.50
Total			**25.00**	**20.50**

Even Semester

SL. No.	Course No.	Course Title	Contact Hours/ Week	Credits
Theory Courses				
1.	Math 2221	Numerical Analysis and statistics	3.00	3.00
2.	EEE 2281	Electrical Machines and Electronics	3.00	3.00
3.	ME 2203	Engineering Mechanics-II	3.00	3.00
4.	ME 2207	Measurement, Quality Control and Materials Handling	3.00	3.00
5.	ME 2209	Mechanics of Solids	3.00	3.00
Sessional Courses				
6.	EEE 2282	Electrical Machines and Electronics Sessional	3.00	1.50
7.	Math 2222	Numerical Analysis and statistics Sessional	1.50	0.75
8.	ME 2204	Engineering Mechanics-II Sessional	1.50	0.75
9.	ME 2208	Measurement. Quality Control and Materials Handling Sessional	1.50	0.75
10.	ME 2210	Mechanics of Solids Sessional	3.00	1.50
Total			**25.50**	**20.25**

Detail Syllabus of 2nd Year Odd Semester B.Sc. Engineering

Hum 2121 (Accounting and Industrial Law)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Accounting:

Financial accounting: Introduction, double entry system; transaction, accounts and its classification; journal, cash book, ledger, trial balance and financial statement.

Cost Accounting: Definition, classification of cost, cost statement, overhead costing, operating costing and relevant costing; financial and economic evaluation of a project; accounting for depreciation and income taxes.

Industrial Law:

Law of Contract: Definition, essential elements of contract, void and voidable agreement, rules regarding offer, acceptance, and consideration; methods of termination of contract.

Company Act: General principles of company law relating to formation; management and winding-up.

Labor Code 2006: Factory-definition, rules regarding employment of women, child, & adult, safety act including fire safety, benefits and privileges of employees. Payment & deduction rules of wages.

Trade Union Act: Definition, legal status of a registered trade union, rules of registration, cancellation of registration, rights and privileges of a registered trade union, collective bargaining process, unfair labor practice on part of both the employees and employers, penalties for unfair labor practice, industrial disputes, lockout, boycott, go-slow, strike, illegal retrenchments, layoff, methods of settlement of industrial disputes.

Math 2121 (Differential Equation, Complex variable and Harmonic Analysis)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Differential equation: First order differential equations-exact, linear and Bernoulli's form, second order differential equations with constant coefficients, general linear differential equations with constant coefficients, Second order equations with variable coefficient; Frobenius methods, Bessel's function and Legendre's polynomials, Application of Bessel's function especially in heat transfer and mechanics.

Partial Differential Equations: First order linear and non-linear equations, standard forms; Solutions of Heat flow and wave equations (One-

dimensional).

Complex variable: Introduction, Cauchy's integral theorem; zeros and poles, contour integration; conformal mapping, Simple application to fluid dynamics.

Harmonic Analysis: Periodic function, Fourier series, Fourier transformations and Fourier integrals and its applications to boundary value problems; harmonic functions, Laplace equations, Laplace transformation to algebraic and trigonometric functions, Inverse Laplace transformation. Application of Laplace Transformation in mechanical systems analysis.

ME 2101 (Thermodynamics)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Laws of Thermodynamics: First law of thermodynamics and its corollaries, first law applied to open and closed system; second law of thermodynamics and its corollaries; statement of third law of thermodynamics; Zeroth law, thermal equilibrium; reversibility, irreversibility, enthalpy, entropy and internal energy.

Thermodynamic Cycles: Air standard power cycles, air standard refrigeration cycles, PV and TS diagrams.

Heat Engines, Refrigeration and Air Conditioning Systems: Diesel engine and petrol engine; two and four stroke engines; operations; valve timing diagram; Concept and application of refrigeration, different refrigeration methods, refrigerants, vapor-compression refrigeration system and heat pump; Concept and classification of air conditioning, and its applications.

Fuels: Introduction to solid, liquid and gaseous fuels; conventional and alternate fuels; fuel compositions, fuel properties; proximate and ultimate analysis of fuel.

Introduction to Combustion Phenomena: Stoichiometry, combustion processes; combustion chemistry and determination of products of combustion.

ME 2102 (Thermodynamics Sessional)

Sessional: 3.00 hrs /week ***No. of Credit: 1.50***

Sessional based on Thermodynamics

ME 2103 (Engineering Mechanics-I)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Statics: State of equilibrium, force equilibrium in space, couple, transmissibility of forces and force couple system, wrench; different types of friction; method of virtual work and applications; equilibrium positions of composite bodies; analysis of forces in trusses and frames.

Distributed Forces: Centroids of lines, areas and volumes; moments 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.

ME 2105 (Fluid Mechanics-I)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Fundamental Concept: Concept of fluid as a continuum, fluid classification and fluid properties.

Fluid Statics: Pressure variation in static incompressible fluids; manometers; hydrostatic forces on plane and curved surfaces; Buoyant force; stability of floating and submerged bodies.

Fluid Flow Concepts and Basic Equations: Types of fluid flow; stream line, streak line and stream tube; relation between system approach and control volume approach; continuity, momentum and energy equation; special forms of energy and momentum equations and their applications.

Fluid Measurement: Pressure, velocity and flow measurement devices.

Dimensional analysis: Its application in various flow problems.

Irrotational Flows: Stream function; circulation; vorticity; velocity potentials; continuity equation and divergence of velocity field; stokes theorem; Rankin body, Source-Sink pair, Doublet; Kutta Joukowski conditions; Magnus effect.

ME 2106 (Fluid Mechanics-I Sessional)

Sessional: 3.00 hrs /week ***No. of Credit: 1.50***

Sessional based on Fluid Mechanics-I

ME 2100 (Computer Aided Drawing)

Sessional: 3.00 hrs /week ***No. of Credit: 1.50***

Computer Aided Drawing: Use of interactive menu-driven software for preparation of line drawings, graphic coordinate system; commands for draw, erase, move, rotate mirror, hatch etc., blocks and layers; dimensional drawing files, saving, editing, and plotting.

Production Drawing: Machine drawing, study of part drawing, study of assembly drawing, preparing complete working drawing (detail and assembly) from explodes pictorial and actual machines. Dimensioning with tolerances, notes etc. representation of conventional features (threads, fasteners, gear, spring, their specification) and drawing; introduction to solid works.

Detail Syllabus of 2nd Year Even Semester B.Sc. Engineering

Math 2221 (Numerical Analysis and Statistics)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Numerical Analysis: Interpolation with equal and unequal intervals, central difference formulae, trapezoidal and Simpson's rule; solution of algebraic and transcendental equations; Bisection and Regula falsi method, initial approximation and convergence criteria of iteration method, Newton-Raphson method, solution of simultaneous linear algebraic equations, Gauss elimination method, Gauss Jordan method, Jacobi method, Gauss Seidal method.

Numerical Solution of Ordinary and Partial Differential Equations: Euler's and Runge-Kutta method; finite difference method.

Application of Numerical Analysis in Mechanical Engineering problems

Statistics: Review of central tendency and dispersion; moments, skewness and kurtosis; correlation and regression; elementary probability and probability distributions (e.g. Binomial Poison and Normal distributions).

Math 2222 (Numerical Analysis and Statistics Sessional)

Sessional: 1.50 hrs /week ***No. of credit: 0.75***

Numerical solution of problems in Mechanical Engineering with Computer Programming

EEE 2281 (Electrical Machines and Electronics)

Lecture: ***3.00 hrs /week*** ***No. of Credit 3.00***

Transformers: Single phase and three phases; open and short-circuit tests.

Electrical Machines:

DC machines: DC generator and motors; speed control and applications of DC motor.

AC Machines: Synchronous and asynchronous machines; speed control and applications; starting of motors.

Introduction to Semiconductor Devices: Diode, transistors, FET, amplifiers and their applications. Introduction to silicon controlled rectifier and its application; oscilloscope; logic circuits; A/D and D/A conversion.

EEE 2282 (Electrical Machines and Electronics Sessional)

Sessional: ***3.00 hrs /week*** ***No. of Credit: 1.50***

Sessional based on Electrical Machine and Electronics.

ME 2203 (Engineering Mechanics-II)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Kinematics of Particles: Rectilinear and curvilinear motion of particles; motion of several particles; components of velocity and acceleration; motion

relative to frame in translation; tangential, normal, radial and transverse components.

Kinetics of Particles: Newton's second law of motion; linear and angular momentum; radial and transverse component of motion; motion under a central force; two-body problem; satellite motion; equation of orbit; cycle time; orbit change.

Kinematics of Rigid Bodies: Translation; rotation; general plane motion; motion about a fixed point and general motion; absolute velocity and acceleration; relative velocity and acceleration; Coriolis acceleration; mechanism-velocity and acceleration analysis; angular acceleration due to precession; gyroscopic motion and couple-principles and applications.

Kinetics of Rigid Bodies: Plane motion of rigid bodies; Angular momentum and D'Alembert's principle; inertial force and inertia torque; Center of percussion; combined rolling and sliding.

Work, Energy, Impulse and Momentum: Work and kinetic energy; conservative force systems; Work done by a conservative force; potential energy; Work due to friction force in sliding and rolling, principle of conservation of momentum; direct and oblique impact; angular impulse and angular momentum; impulse and momentum of rigid bodies.

ME 2204 (Engineering Mechanics-II Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Engineering Mechanics-II

ME 2207 (Measurement, Quality Control and Materials Handling)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Measurement: Basic terms of Measurement, Interchangeability and tolerances, Gauging and limit gauge; Modern instruments for checking flatness and alignment; LASER Interferometry, Modern methods of gear measurement and surface finish, Digital Measurement Equipment, Non Destructive Testing (NDT) methods

Quality Control: Introduction to Quality Control, Statistical measures of Quality Control; estimation hypothesis testing, sampling theory, acceptance sampling plan-single, double, sequential, rectifying inspection plans, control charts; X, R, C charts; regression analysis, Introduction to software tools for Quality Control, concept of quality circle; QA, TQM and TQC.

Materials Handling: Classification of conveying equipment; operation principles of different conveyors, computer controlled material handling system (AGV, ASRS, Robots etc.).

Packaging: Packaging materials, packaging symbols, load testing procedure of packages.

ME 2208 (Measurement, Quality Control and Materials Handling Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Measurement, Quality Control and Materials Handling

ME 2209 (Mechanics of Solids)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Simple Stress and Strain: Introduction, various types of stresses; tensile, compressive, shearing, bearing and thermal stresses, stress–strain diagram, Hook's law, Poisson's ratio, biaxial and tri-axial deformations, statically indeterminate members, stresses in thin walled pressure vessels.

Beams: Shear force and bending moment diagrams; various types of stresses in beams; Flexure formula; Deflection of beams: reinforced concrete beams; integration and area moment methods.

Columns: Euler's formula, Intermediate column formulas, the Secant formula, eccentrically loaded column.

Torsion formula: Derivation of torsional stress, Shear flow, Helical springs

Combined stresses: Principle stress, Mohr's Circle, Introduction to experimental stress analysis techniques, Strain energy; Failure theories.

ME 2210 (Mechanics of Solids Sessional)

Sessional: 3.00 hrs /week ***No. of Credit: 1.50***

Sessional based on Mechanics of Solids

Courses of the 3rd Year B.Sc. Engineering

Odd Semester

SL. No.	Course No.	Course Title	Contact Hours/ Week	Credits
Theory Courses				
1.	ME 3101	Heat Transfer-I	3.00	3.00
2.	ME 3105	Fluid Mechanics-II	3.00	3.00
3.	ME 3109	Design of Machine Elements-I	3.00	3.00
4.	ME 3115	Instrumentation and Control	3.00	3.00
5.	ME 3119	Engineering Materials and Metallurgy	4.00	4.00
Sessional Courses				
6.	ME 3106	Fluid Mechanics-II Sessional	1.50	0.75
7.	ME 3110	Design of Machine Elements-I Sessional	1.50	0.75
8.	ME 3116	Instrumentation and Control Sessional	1.50	0.75
9.	ME 3120	Engineering Materials and Metallurgy Sessional	1.50	0.75

Total			22.00	19.00

Even Semester

SL. No.	Course No.	Course Title	Contact Hours/ Week	Credits
Theory Courses				
1.	ME 3201	Heat Transfer-II	3.00	3.00
2.	ME 3203	Engineering Mechanics-III	3.00	3.00
3.	ME 3209	Design of Machine Elements-II	3.00	3.00
4.	ME 3221	Energy Engineering & Technology	3.00	3.00
5.	ME 3215	Mechatronic Systems	3.00	3.00
Sessional Courses				
6.	ME 3202	Heat Transfer-II Sessional	3.00	1.50
7.	ME 3204	Engineering Mechanics-III Sessional	1.50	0.75
8.	ME 3210	Design of Machine Elements-II Sessional	3.00	1.50
9.	ME 3200	Case Study in Mechanical Engineering	2.00	1.00
Total			**24.50**	**19.75**

Detail Syllabus of 3rd Year Odd Semester B.Sc. Engineering

ME 3101 (Heat Transfer-I)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Introduction: Basic modes of heat transfer; thermal properties of materials.
Conduction Heat Transfer: General conduction equation for one, two and three dimensional steady state situation; steady state conduction in different geometry and composite structures for one dimensional situation; electrical analogy; heat transfer from extended surfaces; transient heat conduction in one dimension; multidimensional transient heat conduction by superposition methods; analytical and numerical solutions or methods.
Radiation Heat Transfer: Radiation fundamentals -- properties and laws; electromagnetic wave spectrum and thermal radiation; intensity of radiation, radiation exchange between surfaces, shape factor-analysis; radiation exchange in enclosures; gas radiation; radiation shield; solar radiation and its prospects in Bangladesh.

ME 3105 (Fluid Mechanics-II)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Viscous Flows: Viscous flow between parallel flat plates; velocity distribution for fixed or moving horizontal and inclined plates; Hagen-Poiseulle equation; frictional losses in pipes and fittings.
Boundary Layer Flow: Boundary layer equations; momentum integral estimates; laminar flat plate boundary layer-Blasius equation; displacement and momentum thickness; boundary layer with pressure gradient; flow separation; turbulent flat plate boundary layer. Introduction to Nevier-Stocks Equation
Open Channel Flow: Introduction to open channel flow; best hydraulic channel cross-sections; hydraulic jump; specific energy; Froude number and its significance in channel flow; critical depth.
Fundamental Relations of Compressible Flow: Speed of sound wave, stagnation states for the flow of an ideal gas; flow through converging diverging nozzles; normal shock waves; flight of bodies through compressible fluid.

ME 3106 (Fluid Mechanics-II Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Fluid Mechanics-II

ME 3123 (Design of Machine Elements-I)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Engineering Design: Introduction, design process, feasibility study, design productions.
Detail Design: Material specification, factor of safety, standard specification and design equations.
Design Practices: Stress analysis, design of simple machine elements, variable load and stress concentration, design for fatigue strength, shock and impact, combined stresses, pressure vessels, shaft design, column design, design of screw fasteners and connections, rivet joints, welded joints, springs.

ME 3124 (Design of Machine Elements-I Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Group wise projects on Designing Machine Elements-I

ME 3115 (Instrumentation and Control)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Instrumentation: Classification of measuring instrument, characteristics of instrument, sensitivity and resolution of instrument, measurement system errors, electromechanical and electronic meters and their uses, pressure sensor, temperature sensor, optical sensor, flow sensor, strain gauge sensor, ultrasonic sensor and speed sensor; analog and digital signal processing, data

acquisition and processing techniques, Data logging and Display.

Control System: Introduction, Classification of control system, System modeling, Block diagram, Transfer function, Transient and steady state response, Frequency response analysis, Root locus method, Stability analysis, different types of controllers, compensation techniques, introduction to digital control and fuzzy logic, Fluidics-principles and applications.

ME 3116 (Instrumentation and Control Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Instrumentation and Control Sessional

ME 3119 (Engineering Material and Metallurgy)

Lecture: 4.00 hrs /week ***No. of Credit: 4.00***

Introduction: Historical perspective, Concept of engineering material and metallurgy, classification of materials.
Atomic Bonding & Crystal Structure: Atomic structure, space lattice, atomic bonding in solids, structure of crystalline solids, crystal growth, crystal system, imperfection in solids.
Phase diagrams: Phase equilibrium, binary phase diagrams, Fe-C System, phase transformations, Fe-C alloys.
Application and processing of metal alloys: Types of metal alloys, fabrication of metals, thermal processing of metals.
Ceramics: Classification of ceramics, structure and properties of ceramics, application of ceramics, fabrication and processing of ceramics.
Polymers: Type of polymers, polymer structures, characteristics of polymers, processing of polymers.
Composites: Introduction, particle reinforced composites, fiber reinforced composites, structural composites.

ME 3120 (Engineering Material and Metallurgy Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Engineering Material and Metallurgy

Detail Syllabus of 3rd Year Even Semester B.Sc. Engineering

ME 3201 (Heat Transfer-II)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Convection Heat Transfer: Mechanism of convective heat transfer, momentum and energy equations; concept of thermal boundary layers; forced and free convection; dimensionless numbers; fully developed flows and boundary layer developments in tubes or ducts over flat plates natural convection around vertical plate and cylinder; combined heat transfer.

Heat Transfer with Change of Phase: Condensation, drop wise and film condensation; Boiling heat transfer; evaporation and boiling; mechanism and heat transfer correlation process of bubble growth and bubble dynamics; heat pipe.
Mass Transfer: Introduction; co-efficient of mass transfer; Fick's law of diffusion in gases, liquids and solids; simultaneous heat and mass transfer phenomena; analogy between heat and mass transfer.
Heat Exchangers: Types, overall heat transfer co-efficient; exchanger effectiveness, LMTD and effectiveness NTU method; heat transfer enhancement technique; fouling and scaling; heat exchanger applications**.**

ME 3202 (Heat Transfer-II Sessional)

Sessional: 3.00 hrs /week ***No. of Credit: 1.50***

Sessional based on Heat Transfer-II

ME 3203 (Engineering Mechanics-III)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Mechanisms: Links, pair, degrees of freedom.

Mechanics of Machinery: Inertia and kinetic energy of rotating and reciprocating parts, turning moment diagram; fluctuating energy and speed; flywheel; dynamometer; 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; law of gearing and toothed gearing; types of gear and gear trains; study of cams and cam followers; study of governors.
Vibration: 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 of shaft, transverse vibration of shafts, Pendulum treated by energy method, undamped free vibrations with two degrees of freedom, torsional oscillation of shaft with multi rotors; sources of vibration, vibration isolation and control, force mobility and transmissibility, vibration measuring instruments, elastic suspension of machinery for isolation of vibration; case study for vibration in machines and engines.

ME 3204 (Engineering Mechanics-III Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Engineering Mechanics-III

ME 3209 (Design of Machine Elements-II)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Design Practice: Design of keys and coupling, design of belts, rope and chain drives, design of journal and rolling contact bearing, design of spur, helical, bevel and worm gearing; brakes and clutches, design with composite

materials, modeling of assembly and motion analysis/animation, conceptual design examples and mechanical engineering design process, including selection and applications of mechanisms.

ME 3210 (Design of Machine Elements-II Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Group wise projects on Designing Machine Elements-II

ME 3221 (Energy Engineering & Technology)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Energy sources: Current status of non-renewable and renewable sources, present consumption and demand scenario for Bangladesh and the world.

Non-renewable Energy: **Coal:** Formation, classification and exploration; **Oil:** Formation, characteristics; potential, basic properties and grading; **Natural gas:** Formation, Exploration; oil shale and tar sands; **Nuclear resources:** Types, prospects, limitations and uses.

Renewable Energy: **Solar energy:** Generation, solar radiation; Solar thermal conversion: solar heating, cooling and desalination; Solar photovoltaic: basic operation, semi-conductor devices, electrical characteristics and generation of electrical energy; **Biomass energy:** Concept of biomass and bio fuels, characteristics; Bio-chemical conversion: biogas production with its operating parameters; types of digesters; Ethanol production; Thermo-chemical conversion**:** preparation of feedstock, incineration, pyrolysis, gasification, carbonization, densification, briquetting; Modern use of biomass: processing for oils and fats, bio-diesel, gasohol; **Wind Energy:** Basics of wind generation, wind measurement, wind turbines; aerodynamic behavior of turbine blades, power coefficient, thrust coefficient, overall efficiency, overall power output. **Hydropower:** basic concepts; geothermal energy, OTEC.

Energy efficiency: Efficiency of conversion systems in current use, matching of energy sources to application of hybrid and stored energy system, waste heat rejection and utilization.

Environmental impact: Aspects of air and water pollutions, and waste disposal problems arising from conversion systems.

ME 3215 (Mechatronic Systems)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Introduction: Definition, Organization structure, Scope and Applications, different types of sensors and their principle of operations, proximity sensor, selection of sensors.

Signal Conditioning: Op-Amp, filtering, multiplexers, data acquisition, DSP.

Actuation Systems: Pneumatic and hydraulic actuation system, mechanical and electrical actuation system.

Microprocessor: Microprocessor systems, microcontroller basics and programming.

Interfacing and Communication Systems: Interfacing, serial

communication interfacing, digital communications, networks, protocols of communication.

Automation: NC and CNC systems, PLC basic structure and programming, overview of SCADA and DCS systems.

ME 3200 (Case Study in Mechanical Engineering)

Training: 2.00 hrs /week ***No. of Credit: 1.00***

The students will be assigned to specific supervisor to conduct their project; the students will submit a project report at the end of the semester.

Courses of the 4th Year B.Sc. Engineering

Odd Semester

SL. No.	Course No.	Course Title	Conduct Hours/ Week	Credits
Theory Courses				
1.	ME 4101	Applied Thermodynamics-I	3.00	3.00
2.	ME 4111	Refrigeration and Mechanical Equipment in Buildings	3.00	3.00
3.	ME 4117	Production Planning and Control	3.00	3.00
4.	ME 4121	Power Plant Engineering	3.00	3.00
5.	ME 4113	Optional-I	3.00	3.00
Sessional Courses				
6.	ME 4102	Applied Thermodynamics-I Sessional	1.50	0.75
7.	ME 4112	Refrigeration and Mechanical Equipment in Buildings Sessional	1.50	0.75
8.	ME 4100	Project and Thesis	3.00	1.50
9.	ME 4110	Seminar	2.00	1.00
10.	ME 4120	Industrial Training	4 weeks	1.00
Total			**23.00**	**20.00**

Even Semester

Sl. No.	Course No.	Course Title	Conduct Hours/ Week	Credits
Theory Courses				
1.	ME 4201	Applied Thermodynamics-II	3.00	3.00
2.	ME 4205	Fluid Machinery	3.00	3.00
3.	ME 4207	Machine Tool and Tool Design	3.00	3.00
4.	ME 4217	Industrial Management	3.00	3.00
5.	ME 4213	Optional-II	3.00	3.00
Sessional Courses				
6.	ME 4206	Fluid Machinery Sessional	1.50	0.75

7.	ME 4208	Machine Tool and Tool Design Sessional	1.50	0.75
8.	ME 4200	Project and Thesis	6.00	3.00
9.	ME 4210	Seminar	2.00	1.00
Total			**26.00**	**20.50**

Detail Syllabus of 4th Year Odd Semester B.Sc. Engineering

ME 4101 (Applied Thermodynamics-I)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Internal Combustion Engines: Engine types, CI and SI engine, combustion process, pre-ignition, Ignition-delay, detonation and diesel knock; fuel requirements and fuels ratings-Octane and Cetane ratings; carburation and fuel injection; excess air ratio and equivalence ratio; scavenging and supercharging of IC engines; lubrication and engine cooling- methods, requirements and calculations; combustion chamber design and their influence on engine performance; factors limiting the performance of IC engines; engine emission and control. Modern technologies associated with IC engines.

Modern Engines: Introduction to Stirling engine, free piston engine, Wankel engine, Dual Fuel engine operations with their applications.

Gas Power Cycle: Introduction to gas turbine and its principle of operation; gas turbine cycles-with inter-cooling, regeneration and reheating.

Thrust Propulsion: Jet propulsion, turbojet, turbo propeller, ramjet, rocket propulsion, propellant and its criteria, estimation of fuel consumption and efficiency.

ME 4102 (Applied Thermodynamics-I Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Applied Thermodynamics-I

ME 4111 (Refrigeration and Mechanical Equipment in Buildings)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Refrigeration Systems: Analysis of vapor-compression refrigeration system and its modifications, Absorption refrigeration, Air-cycle refrigeration, Low-temperature refrigeration, Multi-pressure systems of refrigeration. Refrigeration equipment: Defrost mechanism and automatic controls used in commercial refrigeration systems, Heat-flow problems in condensers and evaporators. Manufacture of water ice and dry ice.

Air Conditioning Systems: Concept of HVAC systems, comfort data, cooling and heating load calculation of various applications, Air distribution system and duct design, Air conditioning equipment, Air purification, Installation of units, Charging, Leak detection, wiring diagram and service; Trouble shooting.

Life Safety Systems: Passive and active fire protection, fire resistance and spread fire ratings, types and key components of building fire extinguishing,

sprinkler, and standpipe systems, fire detection systems, and fire alarm systems, building fire protection system design and detailing information.

Conveying Systems: Types of conveying systems that move people and freight vertically and horizontally (elevators, escalators, and walkways), applications for building conveying systems, conveying system design and detailing information.

ME 4112 (Refrigeration and Mechanical Equipment in Buildings Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Refrigeration and Mechanical Equipment in Buildings

ME 4117 (Production Planning and Control)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Introduction: Functions of production planning and control; plant/facility location: location factor; analysis of industrial facilities location. Plant layout: objectives; types of layout; criteria of successful layout.

Forecasting: Forecasting, methods and their applications

Inventory Control: Classification of inventories; economic order quantity; reorder point; safety stock; economic production quantity; inventory control under conditions of uncertainty; other inventory control systems, min-max, two bin, perpetual inventory record and ABC analysis, Zero inventory.

Scheduling: Objectives of scheduling; aggregate scheduling; scheduling single machine and multiple jobs; multi-machine models; network scheduling, MRP, MRPII, JIT, CPM, PERT techniques; arrow diagrams; coping with variance and unbalance in production MPS.

E-Manufacturing: Definition, EM-Functions and application.

Work Study: Introduction to lean manufacturing; Methods study techniques; Different tools of Method study analysis; motion study; micro motion study; principles of motion economy; Work measurement; objectives, time study; selected time, normal time, standard time, allowance; rating factor, stop watch time study work sampling.

Ergonomics: Introduction, ergonomics for workplace and product design; physical and environmental factors in ergonomics; introduction to cybernetics.

ME 4121 (Power Plant Engineering)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Introduction: Types of power plants and its modern trend, field survey of power plants in Bangladesh, gas plant.

Variable Load Problems: Principle of optimization, its application to power system planning, design and technical operation.

Power Plant Economics: Theory of tariffs; instrumentation in power plants, selection of power plants; advantages, disadvantages and comparisons of different types of power plants.

Diesel Electric Power Plant: Scope, arrangements, air fuel system, cooling system and lubrication system; starting methods.
Steam Power Plant: Introduction, principle of operation, steam turbine and its performance, stage efficiency; installation of steam power plant; fuel handling and burning system**.**
Hydroelectric power plant: Types of operation, site selection, turbine selection, seasonal and intermittent plants, components of the plant, efficiency.
Gas Turbine Power Plant: Scope, installation, governing and maintenance.
Nuclear Power Plant: Scope, plant layout, types of reactors, fuels, waste disposal and safety.
Hybrid power Plant: Concept, solar/wind hybrid system, diesel/wind hybrid system, solar/biomass hybrid system.
Power Plant Accessories: Draft systems and chimney design; water-cooling systems, water conditioning and industrial water treatment.
Electrical Transmission and Distribution: Basic concept, types of transmission and distribution system, major electrical equipment in power plants, smart grid. **Field visits in power plants**.

ME 4100 (Project and Thesis)

Sessional: 3.00 hrs /week ***No. of Credit: 1.50***

The students will start their project work effectively on the basis of its progress in previous semester. They will stand their research idea practically and will complete experimental set-up /fabrication, also do some trial runs.

ME 4110 (Seminar)

Sessional: 2.00 hrs /week ***No. of Credit: 1.00***

Every student will present their research progress in front of an evaluation board at least twice through the semester. They will gather new idea/ suggestions from the audience and will revise their work accordingly.

ME 4120 (Industrial Training)

Sessional: 4.00 weeks ***No. of Credit: 1.00***

To be arranged in any suitable time in/before Fourth Year Odd Semester

Detail Syllabus of 4th Year Even Semester B.Sc. Engineering

ME 4201 (Applied Thermodynamics-II)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Vapor Power Cycles: Introduction Carnot and Rankine cycles; Applied reheat and regenerative cycles; binary vapor cycles; economizer and air-preheater, steam cycles for nuclear power plants.
Combined Cycles: Basic concepts, coupling of two different power cycles, Cogeneration system: backpressure and extraction turbines.
Direct Energy Conversion: Electro-chemical effects and fuel cells, reversible cells, ideal fuel cells and other fuel cells; Thermo-ionic emission and conversion: electrode configuration; practical consideration; Thermoelectric power generation and properties of thermoelectric materials; MHD power generation system.
Fusion Plasma Generation: Nuclear fusion reaction; plasma generation, plasma confinement; pinch effect; fusion breeder; environmental and safety aspects.

ME 4205 (Fluid Machinery)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Detailed Study of Fluid Machinery: Rotodynamic and positive displacement machines; Euler equation for turbo-machines; impulse and reaction turbines; centrifugal and axial flow pumps; operation of submersible pumps, reciprocating pumps; compressors (with thermo-dynamic aspects);
Performance Study: Performance and characteristics of turbines, pumps and compressors; Design of pumps; System analysis and selection of fluid machine.
Dimensional Analysis and Similitude: Dimensional analysis applied fluid machinery; specific speed, unit power, unit speed, and unit discharge; principle of similitude applied to the design of fluid machinery.
Hydraulic Transmissions: Fluid coupling and torque converter with their applications.

ME 4232 (Fluid Machinery Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Fluid Machinery

ME 4207 (Machine Tool and Tool Design)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Locating and Clamping: Purpose of work-piece location; degree of freedom; fundamental locating arrangements; clamping devices and forces.
Tooling: Types of tools; jigs and fixtures; general tool design principles and their applications.
Dies: Progressive and compound dies; design of cutting, forming and drawing dies; punch design.

Design of Power Transmission System: Mechanical, Electrical, Hydraulic and Pneumatic drive in machine tools, basic considerations; speed range, gearbox design.

Machine Tool Guides: Guide material, guide wear, effect of temperature and lubrication, error elimination.

Detailed Study of Basic Machine Tools: Lathe machines; milling machines; shaping machines, planning machine; drilling machine; boring machine; hobbing machine; grinding machine; broaching, lapping and honing machine with their operations.

Structure of Bed, Tables and Columns: Classification, design principles, sources of machine tools vibration and its elimination.

ME 4208 (Machine Tools Sessional)

Sessional: 1.50 hrs /week ***No. of Credit: 0.75***

Sessional based on Machine Tool and Tool design

ME 4217 (Industrial Management)

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

Management and Organization: Definitions of management, management functions, organization fundamentals, organization structures, span of control, motivation and leadership.

Business: Single proprietorship; partnership; joint stock company; corporation; private and public sector; business collusion's and combinations; share, bond, loan; share market; mortgage; bankruptcy liquidation and procurement.

Financial Planning: Classification of capital: capital procurement; financial and economic analysis of cost pattern; cash flow analysis; break-even analysis; depreciation; depreciation calculation estimation of life of an engineering asset; replacement of plant machinery.

Budgeting: Types of expenditure; controllable and non-controllable expenditure; flexible budgets; budget revision; zero based budgets; cost control through budgeting.

Human Resource Management: Functions of HRM; recruitment and development; Job evaluation; techniques of evaluation; merit rating.

Wage and Salary Administration: Salary and wages; wage incentive plans; fringe benefit , labor relations; collective bargaining, strike; lockout; grievance arbitration.

Marketing: Purchasing policies: purchasing procedures; purchasing problems; salvage department; Sales forecasting; distribution channels; concept of marketing; advertising, branding and sales promotion.

Research and Development: Technological change; process of innovation; importance of R & D; research cost and risks; patent and royalty; industrial espionage; product life cycle; development of a product; creativity.

ME 4200 (Project and Thesis)

Sessional: 6.00 hrs/week ***No. of Credit: 3.00***

The students will take data using the experimental set-up that was completed in previous semester. They will also conduct performance study of the system and will make conclusion on their research project; the students will also submit a project report for evaluation at the end of the semester.

ME 4210 (Seminar)

Sessional: 2.00 hrs /week ***No. of Credit: 1.00***

Every student will present their research progress in front of an evaluation board at least twice through the semester. They will gather new idea/ suggestions from the audience and will revise their work accordingly.
The students will present their project work in front of an examination board at the end of semester final examination.

Detail Syllabus of the Optional Courses for Undergraduate Studies

Optional-I

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

ME 4113 (a) (Computer Aided Design)

Methodology of interactive, graphical, engineering design, concepts of discretization optimization, simulation in CAD. Concepts of algorithm developments in CAD. Application of different types of data structures in CAD.
Concepts of engineering graphics and differential geometry in CAD, Design of curves and surface, Application of geometrical design in conveyor systems, sheet metal design, tool design, die design, design of pump and impeller rotor surface.
Design of volumes: Evolution of integral properties of volumes. Derivation of NC codes from solid design and its graphic representation, Intersection of surfaces and interference of volumes, Application of CAD in mechanism design, piping systems lay out design, heat exchanger design, Design of mechanical components.

ME 4113 (b) (Energy Auditing)

Notions of energy conservation and efficiency, analysis of systems employed to provide energy services, integrated approach to energy auditing, assessing the elements of system optimization, examples of typical applications (steam generation and distribution, process or comfort cooling, pumping and compressed air).

ME 4113 (c) (Nuclear Engineering)

Radioactivity: alpha-, beta- and gamma- rays, Radioactive Decay, Units of radioactivity, Interaction of gamma rays, neutrons and charged particles with matter, The detection and measurement of radiation, The basis of the theory of radioactive disintegration, the disintegration constant, radioactive decay, Half-life and Mean Life.

Nuclear Reaction: Possible type of nuclear interactions, Microscopic cross-section and macroscopic cross-section, nuclear fission and fusion.

Nuclear Power Development: Early history of nuclear energy, Worldwide development of nuclear power, difference between PWR and BWR, safety features of VVER (Russian PWR, which the Bangladesh Govt. is going to establish at Ruppur site), fast breeder reactor, Bangladesh TRIGA research reactor, National program of nuclear power development with emphasis on Bangladesh, IAEA rules and regulations.

Nuclear Reactor Accidents: Historical overview of reactor accidents, the Three Mile Island accident, the Chernobyl and Fukushima accidents, other accidents.

Nuclear Power Generation: Basics of nuclear power generation, Design, analysis and fabrication of nuclear powers systems, Energy conversion in nuclear power systems, thermal and structural analysis of reactor core and plant components, corrosion in nuclear power systems: structural metals in nuclear power plants, operation and maintenance of nuclear power plant, Reactor Controls, Rector Coolants and Radioactive waste disposal,

Nuclear Fuel Cycle and Waste Management: Components of Nuclear Fuel Cycle (NFC), types of NFC, components of NFC with diagram, differences between closed and open NFCs, classification of radioactive wastes, types of wastes associated with PWR operations.

Water Management of Nuclear Power Plant: Different types of cooling systems, once through, Wet cooling tower, Dry cooling tower etc.

ME 4113 (d) (Polymer Processing)

Introduction to polymeric materials, Mechanical and physical properties and limitations of applications, Testing of properties**,** Identification of common plastics, Fillers, Additives, Mixing & compounding, Mills: Internal and continuous, Polymer processing operations such as Extrusion, compression molding, Transfer molding, Injection molding, blow molding and reaction injection molding. Design of products with plastics, Machining, fitting and

welding of plastics, Reinforcement of plastics, Calendaring and laminating, Instrumentation and control.

ME 4213 (e) (Operations Research)

Introduction: Origin and development of O.R., Art of modeling, assumptions, scope, limitations and application of O.R. techniques.
Linear Programming Models: Mathematical formulation, graphical solution, simplex and duel simplex methods, types of solutions, duality, interpretation of the duel problem and post optimality analysis.
Transportation and Assignment Models:
Decision and Game Theory: Non-linear, integer programming, simulation, dynamic programming, queuing theory and markov chains.

ME 4113 (f) (Machine Dynamics)

Kinematics of Particles and Rigid Bodies: Rotation Matrix, Euler and Cardan angles, Holonomic and Non-holonomic constraints
Kinetics of Point Masses and Rigid Bodies: Momentum and Angular Momentum, Newton's and Euler's Law, Work-Energy Principles, Lagrange's Equation of Motion, State Space Representation.
Vibration of Linear System: Equation of Motion of Single Degree of Freedom, Free Vibration, Damping, Forced Vibrations from Harmonic and General Periodic Excitation, Excitation by impacts, Excitation by Forces with Arbitrary Time Function, Isolation of Vibrations.
Vibration of Multi Degrees of Freedom System: Equations of Motion, Free Undamped Vibrations, Eigenvalue Problem, Natural Frequencies, Mode Shapes, Modal Matrix, Orthogonality of Modes, Forced Vibrations, Active Damping, Smart Structures.

ME 4113 (g) (Robotics)

Introduction to robotics; Definitions; Plane, rotational and spatial motion with applications to manipulators; Geometric configurations: structural elements, linkages, arms and grippers; Kinematics of manipulators; Motion characteristics, trajectories, dynamics and control of manipulators; Actuators and sensors for manipulators; Application of industrial robots and programming, teleoperator, mobile robots and applications.

ME 4113 (h) (Bio Mechanics)

Introduction to Mechanics: Principles of Mechanics, Vector mechanics, Mechanics of motion - Newton's laws of motion, Kinetics, Kinematics of motion, Fluid mechanics – Euler equations and Navier Stoke's equations, Viscoelasticity, Constitutive equations, Stress transformations, Strain energy function.

Bio-fluid Mechanics: Introduction, viscosity and capillary viscometer, Rheological properties of blood, laminar flow, Couette flow and Hagen-poiseuille equation, turbulent flow. Cardiovascular system - biological and mechanical valves development, artificial heart valves testing of valves, Structure, functions, material properties and modeling of Blood vessels.
Bio-solid Mechanics: Hard Tissues: Bone structure & composition mechanical properties of bone, cortical and cancellous bones, viscoelastic properties, Maxwell & Voight models – anisotropy. Soft Tissues: Structure, functions, material properties and modeling of Soft Tissues: Cartilage, Tendon, Ligament, Muscle.
Biomechanics of Joints and Implants: Skeletal joints, forces and stresses in human joints, Analysis of rigid bodies in equilibrium, free body diagrams, types of joint, biomechanical analysis of elbow, shoulder, spinal column, hip knee and ankle. Design of orthopedic implant, specifications for a prosthetic joint, biocompatibility, requirement of a biomaterial, characteristics of different types of biomaterials, manufacturing process of implants, fixation of implants.
Modeling and Ergonomics: Introduction to Finite Element Analysis, Analysis of bio mechanical systems using Finite element methods, Graphical design. Ergonomics- Gait analysis, Design of work station, Sports biomechanics, Injury mechanics

ME 4113 (i) (Tribology)

Introduction: Tribological consideration in design.
Tribological Elements: Sliding Bearing, Journal Bearings, Rolling contact bearing, Piston, piston ring liner etc.
Types of wear and their Mechanism: Wear in lubricated contact – Film lubrication
Lubrication: Basic equations of the theory of lubrication, calculation of oil flow rate; Methods of lubrication; Types of industrial lubricants and their standard grades; Boundary, hydrostatic and hydrodynamic lubrication.
Elements of contact Mechanics: Thermal effects in surface contact, Contact between rough surface. Friction, Lubrication and wear in Clutches, Brakes, Pneumatic Tyres, Mechanical Seals, drives etc. Sliding Bearings: Thrust bearings, Journal Bearings, – Application, selection, modern developments. Rolling Contact Bearings: Bearing materials, Trouble-shooting and Bearing Problems.

ME 4113 (j) (Bio Statistics)

Statistical methodology in designing, analyzing, interpreting, and presenting biological experiments and observations. We will cover descriptive statistics, elements of experimental design, probability, hypothesis testing and statistical inference, analysis of variance, correlation, regression techniques, and non-

parametric statistical methods. Throughout the course the application of statistical techniques within a biological context will be emphasized, using data from laboratory and field studies.

Optional II

Lecture: 3.00 hrs /week ***No. of Credit: 3.00***

ME 4213 (a) (Automobile Engineering)

Fundamentals: Introduction, components of automobile, Automotive engines: Types and construction, performance study

Automotive Engine Systems: Automotive fuel systems for SI and CI engines, ignition systems, alternative fuels, lubrication systems, cooling systems, exhaust systems, circuits--- their details.

Electrical Systems and Equipment: Storage battery and its construction, cranking motor and generators, lighting, regulators, indicators, ignition system, electrical safety devices and accessories, electrical and electronic control systems.

Power Transmission and Chassis: Clutch, gear, differential and final drive, manual and automatic transmission system and their geometry.

Safety Devices and Controls: Types and functions, modern development of economy speed and fuel economy, emissions, pollution and controls, braking system.

ME 4213 (b) (Intelligent Control Engineering)

Sampling & holding, z-transform, representation of digital system, solution properties, eigenvectors, structural decomposition, controllability/ observability, stabilizability/ detectability; Optimal control Method (LQR), LQG/ Kalman Filtering, Robust control and adaptive control approaches, internal stability, parameter estimation. Introduction to fuzzy logic and its control structure.

ME 4213 (c) (Aerodynamics)

Inviscid incompressible flow to include potential function, stream function, circulation and basic flows; Kutta Joukowski theorem; Aerofoil theory and wing theory, Drag, aircraft propulsion and propeller; Static performance problem; special performance problem; Introduction to stability and control, Longitudinal stability and control; Lateral and directional stability and control.

ME 4213 (d) (Solar Energy)

Sun earth relationships, solar radiation and its measurement, solar radiation climatology; thermal processes in solar and flat-plate collectors; concentrating collectors; applications of solar thermal energy; photoelectric

effect in semiconductor p-n junctions, solar photovoltaic components and systems, design of photovoltaic systems for electrification and water pumping; applications of photovoltaic solar energy; storage systems for solar energy; recent advances in solar energy applications

ME 4213 (e) (Managerial Economics)

Introduction, Forecasting consumer demand, Regression analysis, Production and cost analysis, Market structure, optimal pricing and production decisions, Market economy, sensitivity analysis, capital budgeting and project decisions.

ME 4213 (f) (Noise and Vibration)

Sound waves: Sound sources; sound transmission through wall and structures; acoustics of large and small rooms; mechanism of sound absorption; design of silencer.

Vibration isolation: Vibrational elements, problem classification, Harmonic motion, Free vibration of undamped single DOF systems, Rayleigh's Energy Method, stability, Free vibration of viscously damped SDOF systems, Free vibration of damped SDOF systems with Coulomb and hysteretic damping, Harmonically forced SDOF systems, Harmonic motion of the base, rotating unbalance, Forced vibrations of Coulomb-damped and hysteresis-damped SDOF systems, self-excited vibrations, Periodically forced vibrations, Non-periodically forced vibrations, Response spectrum, Laplace transforms, Free vibration of 2 DOF systems, Forced vibration of 2 DOF systems, Equations of motion for MDOF systems, Equations of motion for MDOF systems, Eigenvalue problem for free vibration of MDOF, Forced vibrations of MDOF systems using modal analysis, Forced vibrations of viscously damped MDOF systems, Longitudinal and torsional vibrations of bars, Nonlinear vibration.

ME 4213 (g) (Mechanical Behavior of Materials)

Fatigue: Fatigue failure; types of fatigue with fixed and varying amplitude, Combined stress fatigue properties; Notch sensitivity, factors influencing fatigue strength; fatigue tests, Utilization of fatigue properties in design.

Creep: Creep-stress-time -temp. Relation for simple tension and combined stresses, Recovery creep and relaxation, Testing techniques, Creep in tension, bending, torsion and buckling.

Fracture: Basic modes of fracture, Theories of linear elastic fracture mechanics, Griffith theory of brittle fracture, irwin's theory of fracture in elastic plastic materials, stress intensity factors; fracture toughness testing, Interpretation of test data.

ME 4213 (h) Computational Fluid Dynamics)

Introduction to floating point arithmetic. Introduction to numerical methods for Euler and Navier-Stokes equations with emphasis on error analysis,

consistency, accuracy and stability. Modified equation nalysis (dispersion vs. dissipation) and Von Neumann stability analysis. Finite difference methods, finite volume and spectral element methods. Explicit vs. implicit time stepping methods. Solution of systems of linear algebraic systems. Higher-order vs. higher resolution methods.Computation of turbulent flows. Compressible flows with highresolution shock-capturing methods (e.g. PPM, MUSCL, WENO). Theory of Riemann problems and weak solutions for hyperbolic equations.

ME 4213 (i) (Bio Transport)

Transport phenomena: Physical, rheological and transport properties, Continuum concepts, Conservation principles, modes of heat and mass transfer in biological systems and bio-materials, Capillary flow, Bio-heat equations , transport in porous media, role and application of transport in bio-systems.

Modelling of transport phenomena: Porous media model, Multiphase flow model, Multi-scale modelling, and Mechanical deformation model, Coupled heat and mass transport in deformable materials.

ME 4213 (j) (Railway Engineering)

Introduction: Introduction and history of modern railway. History and present condition of railway system in Bangladesh

Cars and Locomotives: Major Components Common to Cars and Locomotives Types of Traction, Nomenclature of Steam Locomotives, Classification of Locomotives, Preventive Maintenance of Locomotives, Rolling Stock, Brake Systems, Maintenance of Coaches and Wagons, Design Features of Modern Coaching and Goods Stock

Equipment at Railway Stations: Platforms, Foot Over Bridges and Subways, Cranes, Weigh Bridge, Loading Gauge, End Loading Ramps, Locomotive Sheds, Ash pits, Water Columns, Turntable, Triangles, Traverser, Carriage Washing Platforms, Buffer Stop, Scotch Block, Derailing Switch, and Sand Hump, Fouling Mark .

Signaling and Communications: Objectives of Signaling, Classification of Signals, Fixed Signals, Stop Signals, Signaling Systems, Mechanical Signaling System, Electrical Signaling System, Systems for Controlling Train Movement, Interlocking, Modern Signaling and Communication systems.

Train Resistance and Tractive Power: Resistance Due to Friction, Resistance Due to Wave Action, Resistance Due to Wind, Resistance Due to Gradient, Resistance Due to Curvature, Resistance Due to Starting and Accelerating, Tractive Effort of a Locomotive, Hauling Power of a Locomotive

Modernization of Railways and High Speed Trains: Modernization of Railways, Effect of High-speed Track, MAGLEV transportation, Superconducting MAGLEV, Vehicle Performance on Track, High-speed Ground Transportation System, Ballast less Track.

Ways and Transportation Systems: Component of permanen**t** way-sleepers, ballast, fixtures and fastening, track geometry point and crossing, track junction, statistics and yards, Railway bridges and tunnels.

CHAPTER- VI
Academic Ordinance for Postgraduate Studies

1. Definitions

a. '**University**' means Rajshahi University of Engineering & Technology abbreviated as RUET.
b. '**Syndicate**' means the Syndicate of the University.
c. '**Academic Council**' means the Academic Council of the University.
d. 'CASR' means the Committee for Advanced Studies and Research of the University.
e. '**PGAC**' means the Post Graduate Academic Committee in a degree awarding department of the University.
f. '**DSC**' means the Doctoral Scrutiny Committee.

2. Degrees Offered

The postgraduate degrees to be offered under this ordinance are as follows:

2.1 Master of Science in

i) Civil Engineering abbreviated as M. Sc. Engg. (CE).
ii) Electrical & Electronic Engineering abbreviated as M.Sc.Engg. (EEE).
iii) Mechanical Engineering abbreviated as M.Sc. Engg. (ME).
iv) Computer Science and Engineering abbreviated as M.ScEngg. (CSE)
v) Industrial and Production Engineering abbreviated as M.ScEngg. (IPE)

2.2 Master of Engineering in

i) Civil Engineering abbreviated as M. Engg. (CE).
ii) Electrical & Electronic Engineering abbreviated as M. Engg. (EEE).
iii) Mechanical Engineering abbreviated as M. Engg. (ME).
iv) Computer Science and Engineering abbreviated as M. Engg. (CSE)
v) Industrail and Production Engineering abbreviated as M. Engg. (IPE)

2.3 Master of Philosophy in

i) Mathematics abbreviated as M. Phil (Math)
ii) Physics abbreviated as M. Phil (Phy)
iii) Chemistry abbreviated as M. Phil (Chem)

2.4 Doctor of Philosophy

The degree of Doctor of Philosophy abbreviated as Ph. D. shall be offered by the following departments:

i) Department of Civil Engineering
ii) Department of Electrical & Electronic Engineering
iii) Department of Mechanical Engineering
iv) Department of Computer Science and Engineering

v) Department of Industrial and Production Engineering
vi) Department of Mathematics
vii) Department of Physics
viii) Department of Chemistry

2.5 The above postgraduate degrees may also be offered by other departments / disciplines of the University approved by the syndicate on the recommendation of the Academic Council.

3. Admission requirements

3.1 (a) For admission to the postgraduate courses offered by the engineering faculties, a candidate must have a minimum GPA of 4.0 in the scale of 5.0 or its equivalent in the pre-university examinations.

(b) For admission to the postgraduate courses offered by the faculty of Applied Science & Engineering, a candidate must have a minimum GPA of 3.5 in the scale of 5.0 or its equivalent in the pre-university examinations.

3.2 For admission to the courses leading to the award of the Degree of M. Sc. Engg./M. Engg. in any branch of engineering, a candidate must have a B. Sc. Engg. or an equivalent degree from any recognized University/ Institute in the relevant/ related field with a minimum CGPA of 3.0 in the scale of 4.0 or its equivalent.

3.3 For admission to the courses leading to the award of M. Phil degree in any branch of Science, a candidate must have an M. Sc. or equivalent degree from any recognized University/ Institute in the relevant/related field with a minimum CGPA of 3.0 in the scale of 4.0 or its equivalent in all levels of the University/Institute.

3.4 For admission to the courses leading to the award ofPh. D. degree in any branch, a candidate must have an M. Sc. Engg./M. Engg./M. Phil or an equivalent degree in the relevant branch from any recognized University/Institution with a minimum CGPA of 3.25 in the scale of 4.0 or its equivalent and must fulfill the conditions of Art. 3.1 and Art.3.2 (for the Engineering faculties)/3.3 (for the faculty of Applied Science & Engineering).

3.5 If a student in M. Sc. Engg. and M. Phil program of this University shows an excellent progress and promise in thesis work, he/she may be allowed to get admission into the Ph.D. program, on recommendation of the supervisor(s), after the successful completion of their M. Sc. Engg./M. Phil degree. In such a case, the students are not required to sit for the admission test.

3.6 If the supervisor(s) is satisfied with his/her research work, a student in M. Phil program of this University may be transferred to the Ph.D. program on recommendation of the supervisor(s), relevant PGAC,

CASR, with the approval of the academic council, by retrospective registration using the prescribed form. But for such transfer, the student must complete the course work requirements for a PhD student and publish at least one paper in a referred/reputed Journal. In case of such a transfer, the students shall normally apply for transfer by the end of his/her 4th semester.

4. Admission Procedure

4.1 Applications for admission to the above courses shall be invited through regular means of advertisement and shall be received through prescribed application form.

4.2 There shall be an admission Committee in each department as constituted by the respective PGAC. The admission committee will scrutinize the applications.

4.3 The eligible applicants may be required to appear at a written and/or oral test conducted by the admission committee. The committee, on the basis of the admission test result, will approve a list of prospective postgraduate students for admission into the postgraduate program of the concerned department.

4.4 Full time teachers of RUET, who applied for admission into postgraduate program of this University, are not required to sit for the admission test. All of them shall be selected for postgraduate program of this University.

4.5 Every selected candidate for the postgraduate programs hall have to get himself/herself admitted/registered to the University within the prescribed time limit on payment of prescribed fees and other dues.

4.8 Eligibility for the admission of foreign students in the aforementioned postgraduate programs shall be examined by the equivalence committee.

4.9 On the recommendation of the appropriate PGAC, the rules for admission into postgraduate courses of the University may be amended from time to time by the Academic council through CASR.

5. Academic Regulations

5.1 (a) For full time students, the minimum duration of the M.Sc. Engg./M. Engg. andM. Phil courses shall be three and four semesters, respectively. However, a candidate must complete all requirements for the M.Sc. Engg./M. Engg./M. Phil degree within five academic years from the date of his/her first admission.

(b) For part time students, the minimum duration of the M.Sc. Engg./M. Engg. and M. Phil courses shall be four and five semesters, respectively. However, a candidate must complete all requirements for

the M.Sc. Engg./M. Engg./M. Phil degree within five academic years from the date of his/her first admission.

5.2 (a) For full time students, the minimum duration of the Ph. D. course shall be six semesters. However, a student must complete all the requirements for the Ph. D. degree within seven academic years from the date of his/her first admission.

(b) For part time students, the minimum duration of the Ph. D. course shall be eight semesters. However, a student must complete all the requirements for the Ph. D. degree within seven academic years from the date of his/her first admission.

5.3 There shall be two semesters, namely odd and even, in one academic year. Normally, oddsemester will start in April and the even in October.

5.4 The courses to be offered in a semester shall be determined by the respective department.

5.5 Academic progress shall be measured in terms of credit hours earned by a student. One credit hour for theory course shall normally require one hour of class attendance per week in a semester. While one credit hour for thesis, project and laboratory classes should normally require three hours of work per week in a semester.

5.6 Status of a student

5.6.1 There shall be two categories of students, namely -

(i) Full time: A full time student shall not ordinarily be a full time/part time employee of any organization. However, the employees of any organizionsation may be admitted as full time students only if he/she is on leave or deputation from his/her employer. A full time student may be awarded teaching/research assistantship in this University.

(ii) Part Time: Students serving in different organization may be admitted as part time students with a written consent from their employer. A part time Ph. D. student shall have to take leave from his/her employer, at least two semesters (not exceeding one Calendar year) for the program; and he/she must join the program with the approved leave not later than the beginning of their fourth semester.

5.6.2 The Head of the department may allow a student to switch from part time to full time or vice versa on recommendation of the supervisor (if any). However, prior approval of the employer is required for such a change.

5.6.3 The concerned PGACmay permit a postgraduate student to withdraw his/her name from the program for a total period of five academic years for Ph. D. course and three academic years for M.Sc. Engg./M. Engg./M. Phil course on the recommendation of the supervisor (if any)/advisor. Such withdrawal period will be assessed as academic

exmption and will be ignored for the calculation of total academic years spent by the student to complete the course.

5.7 Course Registration

5.7.1 Each registered student to the postgraduate program shall be assigned by the respective PGAC, an adviser from the teachers of the department, not below the rank of an Assistant Professor having Ph. D. degree.

5.7.2 Every student in the postgraduate program shall have to register the course(s) of the current semester within the prescribed time limit on payment of prescribed fees and other dues. Prior to each registration for any semester, the Adviser/Supervisor (as appointed by Articles 9/11 of this Ordinance) shall check and approve the student's schedule for course(s), prerequisites (if any) and the total credit hours.

5.7.3 A full time M.Sc. Engg./M. Engg./M. Phil student must register a minimum of 12 credit hours and a maximum of 15 credit hours of the theory course per semester. However, a Ph. D. student may register a minimum of 9 credit hours of the theory course per semester.

5.7.4 A part time M.Sc. Engg./M. Phil/Ph. D. student must register a maximum of 6 credit hours of the theory course per semester. However, a part time M. Engg. student may register a maximum of 9 credit hours of the theory course per semester.

5.7.5 On the approval of the supervisor, the concerned Head and the course teacher(s), postgraduate students may be allowed to register theory courses offered by any other departments of this University as per the following table:

Degree	Maximum allowable Theory Course	Maximum allowable Credit hours
M. ScEngg	2	6
M. Engg	4	12
M. Phil	3	9
Ph. D	1	3

5.8 Credit Transfer

After the first semester the respective PGAC may consider a student's application to transfer the credits earned elsewhere if the following conditions are fulfilled:

i) The credits should be earned from a recognized University or Institution.

ii) A maximum of 50% Credit-Hours in course work may be transferred.

iii) Credits earned before five academic years from the date of application will not be considered.

iv) Only B+ or higher grades will be considered.

5.9 Requirements for Continuation of a Program

5.9.1 If F grade is obtained in three or more subjects by a student, he/she shall not be allowed to continue the program.

5.9.2 If at the end of the 1st semester, the GPA falls below 2.5 (including C grades) he/she shall not be allowed to continue the program.

5.9.3 If a Ph. D. student fails to qualify the comprehensive examination (Art. 10) in two chances, he/she shall not be allowed to continue the program.

5.10 Minimum Credit Hour Requirements for the Degree

Minimum requirements of the theory and thesis/project credit hours to be earned by a student for different degrees are as outlined in the following table:

Degree	Theory	Thesis	Project	Total
M. ScEngg	18	18	-	36
M. Engg	30	-	6	36
M. Phil	24	24	-	48
Ph. D	9	45	-	54

6. Grading System

6.1 Letter grade system will be applied in assessment of the performance of a student in semester examination. Numerical markingmay be made in answer scripts but all final gradings to be reported to the Head of the department in prescribed form, shall be in the letter grade as outlined below:

Marks obtained	Grades	Description	Grade Points
90% and above	A+	Excellent	4.0
80% to below 90%	A	Very good	3.5
70% to below 80%	B+	Good	3.0
60% to below 70%	B	Average	2.5
50% to below 60%	C	Pass	2.0
Below 50%	F	Fail	0.0
	I	Incomplete	
	S	Satisfactory	
	U	Unsatisfactory	

6.1.1 Courses in which the student gets F grades shall not be counted towards credit hour requirements and for the calculation of Grade Point Average (GPA).

6.1.2 A student shall get I grade in a course if he/she is unable to complete the course due to any unavoidable circumstances. The student has to complete the course within the next two consecutive semesters; otherwise, he/she will get F grade in that course.

6.1.3 Satisfactory (S) and unsatisfactory (U) grade shall be used only as final grade for thesis/ project and non-credit courses.

6.2 **Calculation of GPA and CGPA**

Grade Point Average (GPA) is the weighted average in a semester and is calculated as

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

where n is the number of courses completed by the student in a semester with grades not less than C, Ci is the credit hour in a particular course and Gi is the grade point corresponding to the grade obtained by the student in that course.

A Cumulative Grade Point Average (CGPA) shall also be computed at the end of second and subsequent semesters. CGPA gives the cumulative performance of the student; and is computed by taking n in the above equation as the total number of courses completed by the student from first semester up to any other semester to which it refers.

Both GPA and CGPA will be rounded off to the second place of decimal for reporting.

7. Conduct of Examination of Theory Courses

7.1 In addition to class tests, assignments and/or examination during the semester as may be given by the teachers(s) concerned, there shall be a written examination at the end of the semester for each of the courses offered in that semester. The dates of such examinations will be announced by the Head of the respective department at least two weeks before the commencement of the examinations. The final grade in a subject shall be based on the performance in all tests, assignments and/or examinations.

7.2 The respective teacher(s) of each theory course offered in a semester will be the paper setter and script examiner for the semester examination.

7.3 The respective course teacher will submit the final grades obtained by the student(s) in his/her course in a prescribed form to the Head of the department and will also submit a copy of the same to the Controller of Examination of the University.

7.4 The Controller of Examination shall keep up-to-date record of all the grades obtained by a student in individual Academic Record Card and shall announce the same at the end of each semester. Students may

collect a copy of transcript from the Controller of Examination at the end of the program, on payment of prescribed fees. However, the copy of the Academic Record Card may be given to the students, on payment of prescribed fees.

8. Qualifying Requirements

8.1 The qualifying requirement of the postgraduate degree is that a student must earn minimum CGPA of 3.0for M. Sc. Engg/ M. Engg./M. Phil and 3.25 for Ph. D.

8.2 The C grade(s) up to a maximum of two subjects may be ignored for calculation of CGPA at the written request of the student provided that he/she has fulfilled the total course credit hour requirement with the required minimum CGPA in the remaining subjects.

8.3 In addition to successful completion of course work every student shall submit a thesis on his/her research work or a report on his/her project work fulfilling the requirements as detailed in Articles 5.10.

8.4 M.Sc. Engg/ M. Phil students must have a conference/journal paper from his/her thesis work.

8.5 Ph. D. students must have atleast three conference papers and must have atleast two publications from his/her thesiswork in a refferedJournal.

9. Thesis/Project for M.Sc. Engineering/M. Engg./M. Phil degree

9.1 Research work for a thesis/project shall be carried out under the supervision of a full time teacher of the department, not below the rank of Assistant Professor having Ph. D. degree. PGAC of the department will recommend the supervisor for a student in the middle of first semester. A co-supervisor (if necessary) from within or outside the department/University may also be recommended. The appointment of the supervisor and co-supervisor (if any), and the tentative research proposal of thesis/project written under the guidance of the supervisor(s)shall be approved by the CASR on recommendation of PGAC at the end of first semester of a full time and at the end of second semester of a part time student. Accordingly, the student will have to register his/her thesis course in the following semester.

9.2 If any change in research proposal of thesis/project, the supervisor and co-supervisor (if any) is unavoidable it should be approved by the CASR on recommendation of PGAC. In such a case, if the student fails to complete the program within the specified time limit as outlined in Art. 5.1, the student may get an extension for not more than a semester.

9.3 The research work must be carried out in this University. In special circumstances it may be carried out at a place(s) recommended by the supervisor in consultation with the Head of the department and approved by the CASR.

9.4 A seminar shall have to be presented by M. Sc. Engg/ M. Phil student on the progress of his/her research work, within the next semester after completion of course work. The Head of the department will keep a record of it and send a copy of the same to the Vice-Chancellor in prescribed form.

9.5 Every student shall submit to the Head of the department, through his/her supervisor a required number of printed copiesof his/her thesis/project report in the approved format on or before a date to be fixed by the supervisor in consultation with the Head of the department concerned.

9.6 The student shall certify that the research work has been done by him/her and that the same work has not been submitted elsewhere for any degree or award (except for publication).

9.7 The thesis/project should demonstrate an evidence of satisfactory knowledge in the field of research undertaken by the student and must be an original contribution to engineering/science and worth of publication.

9.8 Every student submitting a thesis/project report in partial fulfillment of the requirement of a degree shall be required to appear at an oral examination, on a date or dates fixed by the supervisor in consultation with the Head of the department concerned and must satisfy the examiners that he/she is capable of intelligently applying the results of this research to the solution of problem, of undertaking independent work, and also afford evidence of satisfactory knowledge related to the theory and technique used in his/her research work.

9.9 Examination Committee for M. Sc. Engg./M. Phil thesis: The supervisor, in consultation with the Head of the department shall propose to the Vice-Chancellor for the approval of Academic council a panel of examiners for thesis and oral examination, usually one month before the date of thesis examination. The Examination Committee shall be constituted as follows:

Supervisor	**Chairman**	
Co-Supervisor	Member	
Dean of the faculty	Member	
Head of the department	Member	
One external member from outside the department /University	External member	Two alternate names should be proposed.
One or two members from within or outside the department, not below the rank of Assistant Professor, having research experience.	Member	Three alternate names should be proposed.

9.10 Examination Committee for M. Engg. Project: The supervisor, in consultation with the Head of the department shall propose to the Vice-Chancellor for the approval of Academic council a panel of examiners for project and oral examination, usually one month before the date of project examination. The examination committee shall be constituted as follows:

Supervisor	Chairman	
Co-Supervisor	Member	
Dean of the faculty	Member	
Head of the department	Member	
One external member from outside the department/University	External member	Two alternate names should be proposed.
One or two member from within or outside the department, not below the rank of Assistant Professor, having research experience.	Member	Three alternate names should be proposed.

9.11 If an examiner is unable to accept the appointment or has to relinquish his appointment before/during the examination, the Vice-Chancellor may appoint another examiner in his place in consultation with the Head of the department and the supervisor, without, further reference to the PGAC, subject to the approval of Academic Council.

9.12 The Head of the department will arrange to keep a record of the thesis/project examination in his possession and send a copy of the report to the Vice-Chancellor/Controller of Examination in prescribed format, along with the comments of the thesis examiners. In this report he will also confirm that the student has completed the courses and other requirements (if any) for the award of the degree.

10. Comprehensive Examination for Ph.D. Student

10.1 Every Ph.D. Student shall appear at a comprehensive examination, ordinarily held soon after the completion of the course requirements. The PGAC will form an examination committee named Doctoral scrutiny Committee (DSC) through CASR approved by the academic council and will be constituted as follows:

Supervisor	Chairman	
Co-Supervisor	Member	
Dean of the faculty	Member	
Head of the department	Member	
One expert member with Ph. D. degree in the relevant field from outside the University	Expert member	Two alternate names should be proposed by the supervisor

Two members from within or outside the department, not below the rank of Assistant Professor having Ph. D. degree	Member	Three alternate names should be proposed by the supervisor

The date and time of the comprehensive examination shall be fixed by the PGAC on the request of the supervisor.

10.2 The comprehensive examination shall comprise a written examination and/or an oral examination to test the knowledge of the student related to the subject(s) of his research and allied fields. If a student fails to qualify in a comprehensive examination, he shall be given one more chance to appear in the examination as scheduled by the PGAC. The Head of the department will send a report of the comprehensive examination in prescribed form, to the Vice-Chancellor.

11. Thesis for Ph. D. students

11.1 Research work for a thesis shall be carried out under the supervision of a full time teacher, having Ph. D. degree, of the department, not below the rank of Assistant Professor. PGAC of the department will recommend the supervisor for a student in the middle of the first semester. A co-supervisor (if necessary) from within or sutside the department/University may also be recommended. The appointment of the supervisor, co-supervisor (if any), and the title of thesis shall be approved by the CASR on recommendation of PGAC at the end of first semester of a full time and at the end of second semester of a part time student. Accordingly, the student will have to register his/her thesis course in the following semester.

11.2 If any change in research proposal of the thesis, the supervisor and co-supervisor (if any) is unavoidable it should be approved by the CASR on recommendation of PGAC. In such a case, if the student fails to complete the program within the specified time limit as outlined in Art. 5.2, the student may get an extension for not more than one academic year.

11.3 The Research work must be carried out in this University. In special circumstances it may be carried out at a place (s) recommended by the supervisor in consultation with the Head of the department and approved by the CASR.

11.4 A seminar shall have to be presented by the student after passing the comprehensive examination. The seminar will show the evidences that the research work selected by the student is compatible towards the award of a Ph. D degree as will be evaluated by the DSC. The Head of the department will keep a record of it and send a report to the Vice-Chancellor in prescribed form.

11.5 Open seminar: Before submitting the thesis, the student will present the research work in open seminar, showing the achievements in the research towards the award of Ph.D. degree as will be evaluated by the DSC. The Head of the department will keep a record of it and send a report to the Vice-Chancellor in prescribed form.

11.6 Every student shall submit required number of printed copies of synopsis and Thesis in prescribed format to the Head of the department, through his/her supervisor for distribution among the members of the examination committee and the experts.

11.7 The student shall certify that the research work has been done by him/her and that the work has not been submitted elsewhere for degree or award (except publication).

11.8 The supervisor, in consultation with the Head of the department, will propose a panel of 6 experts in the related field of research from outside the department/University, at least 3 from outside the country, to the Vice-Chancellor.

11.9 The Vice-Chancellor will send the copy of the synopsis to any two experts from the panel of whom one from outside the country, seeking their consent to be external examiner for the thesis. On receipt of their positive consent, the authorized person will send the copies of the thesis to them for evaluation and written opinion in the prescribed form.

11.10 Copies of the experts' reports may be given to the student through the supervisor, if there are any further queries to be cleared or questions to be answered by the student. Such answers should be directly sent to the expert concerned and final report should be collected.

11.11 On receipt of favorable experts' report, the supervisor in consultation with Head of the department shall propose to the Vice-Chancellor, for the approval of Academic Council, a panel of examiners for thesis and oral examination, usually one month before the date of thesis examination. The Examination Committee approved by CASR shall be constituted with the following members as described below:

Supervisor	Chairman
Other members of DSC	Members
One external member from outside the University.	External Member

11.12 Every student submitting a thesis in partial fulfillment of the requirement of a Ph.D. degree shall be required to appear at an oral examination, on a date or dates fixed by the supervisor in consultation with Head of the department and must satisfy the examiners that he/she is capable of intelligently applying the results of this research to the solution of problems, of undertaking independent work, and also afford

evidence of satisfactory knowledge related to the theory and technique used in his/her research work.

11.13 The thesis should demonstrate and evidence of satisfactory knowledge in the field of research undertaken by the student and must be an original contribution to engineering/science and worthy of publication. In support of this the student should have at least two publications in Journal of International standard.

11.14 If an examiner is unable to accept the appointment or has to relinquish his appointment before/during the examination, the Vice-Chancellor may appoint another examiner in his/her place from the panel, subject to the approval of academic council.

11.15 A student who has been transferred to the Ph.D. program from the M. Phil program may be awarded M. Phil degree, on recommendation of the supervisor, if the student fails to qualify for the award of the Ph.D. degree. In that case the student must have to fulfil all the requirements for the said degree.

11.16 The Head of the department will arrange to keep a record of the thesis examination in his possession and send a copy of the report to the Vice-Chancellor/Controller of Examination in prescribed format, along with the comments (if any) of the members of the examination committee. In this report he will also confirm that the student has completed the course and other requirements (if any) for the award of the degree.

12. Cancellation of Studentship

i) Non-payment of dues within prescribed period.

ii) Failing to proceed with the program as prescribed by Art. 5.9 of this ordinance.

iii) Forced to discontinue his/her studies under disciplinary rules.

13. Academic Fees

Academic fees will be prescribed by the appropriate authority of this University from time to time.

14. Effectiveness of this Ordinance

This ordinance will be effective from the batch of Postgraduate student admitted after the date of approval of this ordinance by the Syndicate.

CHAPTER-VII

Courses Offered and Detail Syllabus for the Postgraduate Studies

Courses Offered For Post Graduate Studies

Course No.	Course Title	Contact hours/ Week	Credits
ME 6000 (a)	Thesis (Ph.D)	-	45
ME 6000 (b)	Thesis (M.Sc. Engg.)	-	18
ME 6000 (c)	Project (M. Engg.)	-	06

Engineering Mathematics

Course No.	Course Title	Contact hours/ Week	Credits
ME 6001	Mathematical Methods in Engineering	03	03
ME 6003	Advanced Numerical Analysis	03	03
ME 6005	Finite Elements in Engineering	03	03
ME 6007	Numerical Fluid Flow and Heat Transfer	03	03

Thermal Engineering

Course No.	Course Title	Contact hours/ Week	Credits
ME 6101	Classical Thermodynamics	03	03
ME 6103	Advanced Thermodynamics	03	03
ME 6105	Advanced IC Engines	03	03
ME 6107	Combustion in IC Engines	03	03
ME 6109	Fuels and Combustion	03	03
ME 6111	Simulation of IC Engine Processes	03	03
ME 6113	Alternative Fuels for Engines	03	03

Heat Transfer

Course No.	Course Title	Contact hours/ Week	Credits
ME 6201	Advanced Conduction and Radiation	03	03
ME 6203	Advanced Convective Heat & Mass Transfer	03	03
ME 6205	Boiling and Condensation Heat Transfer	03	03
ME 6207	Thermal Environmental Engineering	03	03

Energy and Environmental Engineering

Course No.	Course Title	Contact hours/ Week	Credits
ME 6301	Energy Engineering	03	03
ME 6303	Solar Energy Engineering	03	03
ME 6305	Renewable Energy Technology	03	03
ME 6307	Waste Utilization & Energy Production	03	03
ME 6309	Aerosol Technology	03	03
ME 6311	Automotive Air Pollution & Control	03	03
ME 6313	Advanced Nuclear Engineering	03	03

Fluid Engineering

Course No.	Course Title	Contact hours/ Week	Credits
ME 6401	Advanced Fluid Mechanics	03	03
ME 6403	Mechanics of Viscous Fluid	03	03
ME 6405	Fluid Dynamics	03	03
ME 6407	Advanced Fluidics	03	03
ME 6409	Computational Fluid Dynamics	03	03

Management & Production Engineering

Course No.	Course Title	Contact hours/ Week	Credits
ME 6501	Principles of Engineering Production	03	03
ME 6503	Advanced Machine Tools	03	03
ME 6505	Modern Manufacturing Process	03	03
ME 6507	Welding & Other Joining Process	03	03

ME 6509	Statistical Quality Control	03	03
ME 6511	Advanced Operation Research	03	03
ME 6513	Advanced Industrial Management	03	03

Dynamics, Control and Mechatronics Engineering

Course No.	Course Title	Contact hours/ Week	Credits
ME 6601	Advanced Control Theory and Automation	03	03
ME 6603	Applied Mechatronics	03	03
ME 6605	Advanced Vibration Engineering	03	03
ME 6607	Vibration of Continuous Systems	03	03
ME 6609	Robotics and Intelligent Systems	03	03
ME 6611	Machine Vision and Application	03	03
ME 6613	Bio- Medical Engineering	03	03
ME 6615	Magnetic Levitation and Magnetic Suspension	03	03

Mechanics and Design Engineering

Course No.	Course Title	Contact hours/ Week	Credits
ME 6701	Finite Element Method in Engineering Mechanics	03	03
ME 6703	Advanced Solid Mechanics	03	03
ME 6705	Theory of Elasticity	03	03
ME 6707	Theory of Plasticity	03	03
ME-6709	Ultrasonic Mechanics	03	03

Materials Engineering

Course No.	Course Title	Contact hours/ Week	Credits
ME 6801	Advanced Mechanics of Materials	03	03
ME 6803	Advanced Materials Technology	03	03
ME 6805	Advanced Evaluation of Engineering	03	03

	Materials		
ME 6807	Mechanical Behavior of Engineering Materials	03	03
ME 6809	Applied Materials and Surface Modification	03	03
ME 6811	Advanced Ceramic Technology	03	03
ME 6813	Mechanics of Composite Materials	03	03
ME 6815	Advanced Polymer Technology	03	03

Note : A student must pass 01(one) course as compulsory from Engineering Mathematics group and at least 02 (two) courses related to the area of his/her research work. The students are not allowed to register more than one course offered by other Departments in the Faculty of Mechanical Engineering during his/her entire postgraduate program.

Detail Syllabus of the Postgraduate Studies

Engineering Mathematics

ME 6001 (Mathematical Methods in Engineering)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Review of ordinary differential equations, Ordinary and singular points, Frobenius methods and special functions, Fourier series, Sturm–Liouville problem, Orthogonal functions.
Differentiation under integral sign, Change of variable and inversion of the order of integration.
Laplace transforms and its uses in physical systems.
Vector calculus, surface and volume integrals, curvilinear coordinates. Complex variables, contour integration, conformal transformation. Elementary partial differential equations.
Classical methods of optimization of a function of several variables with constraints, Calculus of variation, introduction to integral equation.

ME 6003 (Advanced Numerical Analysis)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Solution of non- linear equations: iterative process, localization of the roots, initial approximation and convergence criteria, relaxation and conjugate gradient method for system equation, Newton's method.
Partial differential equation: stability and convergence of numerical methods, finite difference and finite element method for solving partial differential equations.

ME 6005 (Finite Elements in Engineering)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Introduction to finite elements and finite element methods, the design of elements for plane stress and plane strain, 2D problems using constant, strain triangles, axisymmetric solids subjected to axisymmetric loading, dynamic consideration, Hamilton's principle, the development of finite element program.

ME 6007 (Numerical Fluid Flow and Heat Transfer)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Introduction, governing differential equations, nature of coordinates, nature of numerical methods, discretization equations, Consistency and stability of the method, basic rules, steady and unsteady conduction (1D, 2D, 3D), steady convection and diffusion (1D, 2D, 3D), false diffusion flow, field calculations, linearization, irregular geometry, special topics, application to fluid flow and heat transfer problems.

Thermal Engineering

ME 6101 (Classical Thermodynamics)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Fundamentals of classical thermodynamics, first and second law, concept of properties, reversible and irreversible processes, entropy and other characteristic functions, Maxwell's relations, equation of state and generalized co-ordinates, equilibrium and stability.

ME 6103 (Advanced Thermodynamics)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Different laws of thermodynamics, availability & energy analysis of thermodynamic systems, interpretation of entropy, general thermodynamic relations, properties of pure substance at different phases, equations of state and properties of gas mixtures, thermodynamics of magnetism and magneto caloric effect.

Chemical thermodynamics (reactive system): combustion reactions, enthalpy and entropy of formation, heat of fraction, adiabatic flame temperature, irreversibility in combustion process, chemical equilibrium of ideal gases.

ME 6105 (Advanced IC Engines)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Thermodynamics of fuel-air cycle, actual cycle, Fuels for use in SI engine, rating of SI engines' fuels, carburetor and carburetion, petrol injection systems, normal and abnormal combustion in SI engines, detonations, stratification and lean mixture, operations and performance characteristics of engine, suitability of fuels for CI engines, ratings of fuels, fuels additives, theory of combustion and other working processes, heat release rate calculations.
Modern engine technology: hybrid vehicles, electric vehicles, fuel cell vehicles, solar energy for vehicles propulsion.

ME 6107 (Combustion in IC Engines)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Overview of combustion processes in SI and CI engines, delay period, engine knock, and effect of operating parameters on knocking, knock reduction, fuel requirements and ratings, alternative fuels, carburetion and fuel injection, combustion chamber design, engine cooling, pollution generation in CI and SI engines and its remedies in different ways.

ME 6109 (Fuels and Combustion)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Fuels and classification of fuels; merits & demerits of different kinds of fuel, determination of fuel properties, physics, chemistry and thermodynamics of combustion processes, pollution generation and its environmental effects.
Laminar and turbulent premixed and diffusion flames, determination of flame velocity and length.
Empirical correlation. Flammability limits and flame stability.
Combustion of solid and liquid fuels, diffusion and kinetically controlled combustion, combustion applications.

ME 6111 (Simulation of IC Engine Processes)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Heat of reaction, adiabatic flame temperature, numerical solution for the flame temperature, isentropic changes of state, gas turbine cycle, four stroke IC engines, two stroke IC engines, rockets, free piston engines, chemical equilibrium.

ME 6113 (Alternative Fuels For Engines)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Sources, properties, applications, Natural gas: physical forms, supply, storage and dispensing systems, Safety standards, dedicated and retrofitted engines, Bi-fuel and dual fuel engines, engine performance. CNG conversion systems for automobiles, liquefied petroleum gas: supply and dispensing systems, safety standards, Biogas: production and dispensing systems, Digester design parameters: effect on production rate and fuel quality, potential of alcohols, bio-diesel, vegetable oil and hydrogen as fuel for internal combustion engines.

Heat Transfer

ME 6201 (Advanced Conduction and Radiation)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Conduction: steady and unsteady problems and their solutions in Cartesian, cylindrical and spherical coordinates (1D, 2D, 3D), use of separation of variables, Laplace transform, numerical and approximate analytical methods, problems involving change of phase.
Radiation: thermal radiation and radiation properties, radiative interchange among black and Grey surfaces separated by non-absorbing media, shape factors, absorption factors, application and solutions of the equations of radiant interchange, cavities, enclosures, radiation from gases, vapors and flames, combined conduction and radiation.

ME 6203 (Advanced Convective Heat & Mass Transfer)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Review of conservation equations, convection boundary layers and its significance, Free & forced convection heat transfer in laminar and turbulent flow, mixed convection; combined convection and radiation, boiling and condensation, molecular diffusion in fluids.
Mass transfer: Convective mass transfer, mass transfer coefficient, mass transfer at fluid surfaces, diffusion in solids, transport equations, mass transfer across interface, Heat and mass transfer in separated flows & Heat pipe.

ME 6205 (Boiling and Condensation Heat Transfer)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Introduction: Boiling-Pool and forced convection, sub-cooled and saturated; fundamentals of two phase flow, mathematical and empirical methods,

hydrodynamic instability; enhanced boiling heat transfer, estimation methods; burnout; condensation- modes, gas phase heat and mass transfer, film wise condensation on horizontal and inclined tubes and surfaces; condensation promoters.

ME 6207 (Thermal Environmental Engineering)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Refrigerant: Mechanical vapor compression refrigeration systems and details of their components, absorption refrigeration system and cycle analysis, miscellaneous refrigeration processes, Cryogenics, refrigeration applications with special reference to food preservation.
Psychometric: direct contact transfer processes between moist air and water including evaporative cooling; Heating and cooling of moist air by extended surfaces; condensation of vapor within walls; heat transmission in buildings and solar radiation effects upon structures; air conditioning applications; air conveying and distribution systems.

Energy and Environmental Engineering

ME 6301 (Energy Engineering)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

World energy resources and energy demand, Energy use in different sectors and its future trend, General survey of energy conversion systems, Level of extraction and efficiency of conversion, Energy management and conservation.
Environmental aspects of energy use, economics of energy utilization.

ME 6303 (Solar Energy Engineering)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Nature and availability of solar radiation, Radiation estimations and measuring instruments. Materials for solar energy utilization, Radioactive properties and thermal transport properties. Non-concentrating and concentrating collectors & their design techniques and performance estimation. Solar components and Solar system operational characteristics. Practical applications of solar energy, Special solar devices for developing countries including solar desalination, solar storage system, solar photo-voltaic and solar water pumping.

ME 6305 (Renewable Energy Technology)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Prospects of renewable energy, Characteristics of renewable energy sources and their differences compared to fossil fuels. Technological basis for harnessing renewable energy sources.
Solar-derived renewable energy: Solar thermal energy, Photovoltaic, Wind energy, Biomass, Hydropower, Wave energy, Ocean thermal energy Conversion.
Non-solar derived renewable energy: Tidal energy, Geo-thermal energy, Renewable Hydrogen.
Main components of different renewable energy systems, Comparisons of different renewable energy technologies and selection of the most appropriate based on local conditions.

ME 6307 (Waste Utilization and Energy Production)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Sources of waste generation; Nature and composition of available wastes; Traditional uses of wastes and their prospects for energy recovery.
Current technology for energy production: Physical process: Briquetting; Thermo chemical process: Incineration, Pyrolysis and Gasification; Biological Process: production of bio-diesel, bio-ethanol and bio-gas.
Social, economic and environmental factors for waste to energy conversion; Cost analysis, Case studies.

ME 6309 (Aerosol Technology)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Introduction, properties of gases, uniform particle motion, particle size statistics, acceleration and curvilinear particle motion, adhesion of particles, Brownian motion and diffusion, thermal and other radiometric forces, filtration, measurement of concentration, respiratory deposition, coagulation, condensation and evaporation, electrical properties, optical properties, bulk motion of aerosols, dust explosion, microscopic measurement of particle size, production of test aerosols.

ME 6311 (Automotive Air Pollution Control)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Pollutants from diesel and gasoline engine: causes of formation of UHC, NOx, CO, PM, and odor from diesel and gasoline engine, comparison of diesel and gasoline emissions.
Methods of controlling diesel and gasoline engine emissions.
Effects of different engine parameters on emission and their optimization.

Fuel modification: Alternative fuel and additive for diesel and gasoline engine.
Exhaust after treatment: Particulate trap, Three-way catalyst, oxidation catalyst, EGR, reduction catalyst, thermal reactor. Emission of modern engines: Hybrid vehicles, electric vehicles, fuel cell vehicles, solar energy for vehicle propulsion.

ME 6313 (Advanced Nuclear Engineering)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

An introduction to nuclear power in the global landscape, Underpinning core nuclear engineering – including reactor physics, nuclear chemical engineering and the fuel cycle, nuclear materials, nuclear thermal hydraulics, safety, waste management and decommissioning, and modeling approaches used in the nuclear industry, Mathematical and Numerical Methods in Nuclear Engineering, Nuclear Radiation Detection and Analytical Tools, Nuclear and Computational Sciences, Structure and Material of Nuclear Reactor, Plasma Physics and Nuclear Fusion Reactors, Nuclear engineering in the wider industrial, policy, and technical context (e.g. future reactor designs)

Fluid Engineering

ME 6401 (Advanced Fluid Mechanics)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Continuum, fluid, deformation rate and rotation tensor, forces on fluids, equations of continuity, momentum and energy, Navier-Stokes equations, Linearised N-S equations, lubrication theory, creeping flows, boundary layer, Karman's integral theorem, similar and approximate solutions.

ME 6403 (Mechanics of Viscous Fluid)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Governing equations of motion for viscous fluid, boundary layer analysis for laminar and turbulent flow. Turbulence, Reynolds's equations, hypotheses, transition, flow through pipes, boundary layer, boundary layer control, jets, wakes and separated flows, drag on bodies.

ME 6405 (Fluid Dynamics)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Continuum concept, control volume equation, ideal fluid flow and hydraulic singularities, Navier-Stokes equation and their application, concept of

compressible fluid flow, one dimensional and isentropic flow, normal shock, flow with friction and heat transfer, boundary layer theory and applications.

ME 6407 (Advanced Fluidics)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Introduction, characteristics and classification of fluid power generators, fluid motors and kinematics of fluid cylinders, basic circuit components and their symbols, Symbols development, fluid power circuit and their design, intensifiers and accumulators, heat in fluid power systems, three-way and four way valve analysis, pneumatics in industry.
Compressor installation practice, steady analysis of pneumatic components, pressure regulators, analysis of spherical, conical and butterfly valves, pneumatic actuators fluidics, wall attachment devices, proportional and vortex amplifiers, bio-medical applications of fluidics.

ME 6409 (Computational Fluid Dynamics)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Equations of motion, Discretization, Solution algorithm, Parabolic and parabolic-elliptic flows, Turbulent flows calculation, Handling of irregular geometry.

Management & Production Engineering

ME 6501 (Principles of Engineering Production)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Fundamentals of materials and their properties, effective stress and strain, yield conditions, plastic deformation, shape and yield surface, mechanics of chip formation, 3D machining operations, buildup edge formation, Tool wear: crater and wear land, tool wear geometry, mathematical derivation of crater and wear land growth, tool life and machinability.

ME 6503 (Advanced Machine Tools)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Review of structural and functional characteristics of machine tools, machine tools for production of gears, precision machine tools, automatic machines and transfer lines, design of machine tools for static and dynamic rigidity, economics in the design and selection of machine tools, NC machine tools.

ME 6505 (Modern Manufacturing Processes)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Theory and application of machining by abrasive jet, ultrasonic, water jet, abrasive flow, thermal assistance, total form machining and low stress grinding, electro-chemical machining and grinding, polishing, sharpening, honing, turning, electrochemical-discharge grinding, electro stream and shape tube electrolytic machining, chemical and thermo-chemical machining, thermal energy methods in material processing by electro-discharge, LASER and electron beam, plasma arc and ion beam, physical vapor deposition, chemical vapor deposition and plasma spraying, high energy rate forming and electro-forming.

ME 6507 (Welding and Other Joining Processes)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Introduction to metal joining processes, heat sources for joining of metals, metallurgy of welding, heat treatment, residual stresses and stress relief methods, welding processes: process parameters, selection and control, welding equipment, metal transfer and heat flow in different welding processes, joint design and design of weldments, adhesive bonding, brazing and soldering of metals, welding defects: causes and remedies, destructive and non-destructive inspection of welds, recent trends in joining of materials.

ME 6509 (Statistical Quality Control)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Economics of quality control, control charts: X and R chars, rational sub-grouping, theory of probability, control charts for attributes, acceptance sampling, acceptance sampling by attributes, acceptance sampling by variables, acceptance inspection for continuous production, life testing and reliability.

ME 6511 (Advanced Operation Research)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Duality theory of linear programming, some techniques in non-linear programming, Markovian multistage decision processes, games theory, sequencing theory, replacement theory, simulation techniques, search techniques, large scale systems, geometric programming, pseudo-Boolean methods in operations research, scheduling theory.

ME 6513 (Advanced Industrial Management)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Modern management theories: scientific management, modern operational management theory, behavioral science, recent management thoughts, management analysis, planning: nature of plans, types and steps of plans, planning process, strategies and policies: nature and purpose, strategic planning process, effective implementation.
Decision-Making: importance and limitations, development of alternative, evaluation and selection of alternatives, decision-making under uncertainties, controlling: basic and critical control processes, feed-back systems, feed forward control, effective control requirements, return of investment control, direct and preventive control, Operational management: productivity problems, planning operations, controlling operations, research concept, linear programming, other tools and techniques. Management and society: external environment, social responsibility, ethics in managing comparative management, international management, MIS.

Dynamics, Control and Mechatronics Engineering

ME 6601 (Advanced Control Theory and Automation)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Control Theory: introduction, classification of control systems, block diagram, system modeling, transfer function, stability, graphical methods of design by root locus, Nyquist diagram, bode plots, gain margin, controllers.
Digital control theory: sampling, sampling theorem, Z transform, digital control of a motor.
Automation: principles of automation, programmable logic controllers (PLCs), applications of control and automation.

ME 6603 (Applied Mechatronics)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Overview of Mechatronics systems, concepts and components and applications, sensors, transducers and actuators, system modeling, system responses, transfer functions and open and closed-loop controllers, feedback controller, interfacing, data processing and communications, microprocessors, programmable logic controllers and digital signal processor, industrial automation, case studies.

ME 6605 (Advanced Vibration Engineering)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Single and multiple degree of freedom of systems, transient vibrations, vibration of shafts, resonance, Stability analysis, application of Lagrange's equations, sources and types of vibrations, force mobility and transmissibility, vibration troubles, energy methods, parametric excitation, basic noise theory, measuring shock, passive, semi-active and active noise and vibration control and isolation, noise pollution, its control and its application in industry, physiological effects of vibration and noise.

ME 6607 (Vibration of Continuous Systems)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Review of vibration of discrete systems with single and multi degree freedom, Hamilton's principle, Lagrange's equations, longitudinal vibration of bars, lateral vibration of straight and curved beams, vibration of membranes and plates, free and forced vibration, effect of damping, approximate methods, wave motion in continuous systems.

ME 6609 (Robotics and Intelligent Systems)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Robotics: Introduction, types, main components, co-ordinates and transformations, kinematics, dynamics, sensors and actuators, control, mobile robots.

Intelligent Systems**:** Systems & intelligent systems, different paradigms and architectures of intelligent systems, introduction to AI, knowledge representation, machine learning algorithms.

ME 6611 (Machine Vision and Application)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Introduction, Components of machine vision system, sensors for image acquisition, image processing steps- filtering, edge detection, image segmentation, image analysis techniques, stereovision, color image processing.

Object recognition, smart camera: part inspection, defect detection, bar –code reading, OCR, bio-metric applications (face, finger print, iris recognition), robot vision: robot guidance, automated picking, surveillance.

ME 6613 (Bio-Medical Engineering)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Biomaterials, Biomechanics, Medical and Surgical Practice, Medical Implant and Device Design, Tissue Engineering, Biotransport, Computational Methods in Engineering Analysis/ Advanced Finite Element Methods, Mechanobiology.

ME 6615 (Magnetic Levitation and Magnetic Suspension)
Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Introduction and application of bearingless motors.
Analysis of magnetic circuits: Analysis of permanent magnet circuits, simple magnetic circuits, analysis, electromagnetic force, non linearity, flux density reluctance, MMF, flux linkage
Radial magnetic bearing: Structure and principle of radial magnetic bearing, current, MMF, magnetic circuit, magnetic force analysis, Force and current relationship, linearization, displacement-force factor, block diagram of radial magnetic bearing
Controller requirement of magnetic bearing: Instability of magnetic suspension, feedback controller configuration and design, Parameters and response, external force suppression and displacements, integral controller
Simple representation of magnetic bearing: Force and current relationship, linearization, displacement-force factor, block diagram of radial magnetic bearing
Maglev systems: Structure, characteristics, history of Maglev systems, low speed magnetically levitated train. Propulsion, levitation, electromagnetic force generation, feedback control system, high speed train, propulsion, electric power supply, magnetic levitation, Shanghai maglev.
Applications of magnetic suspension and magnetic levitation: Water power plant with magnetic bearing, some other applications of Maglev systems.

Mechanics and Design Engineering

ME 6701 (Finite Element Methods in Engineering Mechanics)
Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Introduction to finite element method, relation to other methods, solution of problems in structural mechanics using two dimensional elements, plane stress, plane strain, axisymmetric stress analysis, three dimensional stress analysis using tetrahedral and prismatic elements, shell analysis.
Solution of large scale systems, completeness and convergence studies in finite element approximation, application to the analysis of mechanical linkage, turbines, nuclear reactors, composite structure and machine tools.

ME 6703 (Advanced Solid Mechanics)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Instruction to Cartesian tensors, analysis of stress and strain, theory of constitutive equation with special emphasis on elasticity, plasticity and visco-elasticity, solution of problems to illustrate the effects of elasticity, thermo-elasticity.

ME 6705 (Theory of Elasticity)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Analysis of stress and strain, invariants, equilibrium, compatibility and constitutive equations, plane stress, plane strain and generalized plane stress, stress function, applications, complex potential in two dimensional and axi symmetric problems, use of variation methods, anisotropic elasticity, finite deformation elasticity.

ME 6707 (Theory of Plasticity)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Introduction to Cartesian tensors, analysis of stress and strain, phenomenology of plasticity, yield surface and generalized stress, deformation and flow theories, theory of plastic constitutive equation, bending and torsion of bars and tubes, axisymmetric and spherically symmetric problems, slipline theory and its application to extrusion problems, drawing and indentation, phenomenology of dynamic plasticity, wave propagation in plastic materials, application problems of high rate forming and performance.

ME 6709 (Ultrasonic Mechanics)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Introduction to ultrasonic and ultrasonic mechanics.
Ultrasonic wave propagation: Elastic medium, Deformation and strain of elastic medium, Dynamics of ultrasonic wave propagation, wave velocity (longitudinal, transverse), surface acoustic wave (saw). Piezoelectric effect and its effect on ultrasonic wave propagation. Piezoelectric materials, piezoelectric constitutive relations, inverse piezoelectric effect, electromechanical coupling factor.
Equivalent circuit model of ultrasonic wave propagation, Ultrasonic Devices: Ultrasonic transducer, Ultrasonic motor, Gyro sensor, ultrasonic drill, ultrasonic welder.

Materials Engineering

ME 6801 (Advanced Mechanics of Materials)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Analysis of stress and strain, constitutive relations, failure theories, torsion of non- circular sections, plane stress and plane strain problems, viscous-elasticity, structure and mechanical behavior of polymers, behavior of unidirectional composite and orthotropic lamina, failure theories for fiber composites.

ME 6803 (Advanced Materials Technology)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Deformation, failure modes, selection of materials, heat treatment of metals and alloys surface treatment of materials, conventional and ionic surface hardening of ferrous alloys, metals, spraying, phosphating, coating of tools, cladding, vapor deposition, electroplating, anodizing.

ME 6805 (Advanced Evaluation of Engineering Materials)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Material defects, Nondestructive testing: radiographic testing, ultrasonic testing, dye penetrate, eddy current, magnetic particle flaw detection, Stress-strain measurement: strain gauges, photo elasticity, X-ray stress measurement, Magnetic Barkhausen measurement principle.

ME 6807 (Mechanical Behavior of Engineering Materials)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Deformation, elastic behavior, plastic behavior, creep and creep rupture, fatigue fracture, brittle fracture, ductile fracture.

ME 6809 (Applied Materials and Surface Modification Technology)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Advanced Materials: advanced materials and its classification, engineering requirements and properties of materials, ferrous and non-ferrous materials, materials for high and low temperature service, identification of metals and alloys, plastic and composite materials.

Surface Modification: classification of surface engineering techniques and review of conventional methods. Advanced surface engineering techniques: Laser and ion beam modification techniques, PVD techniques, vacuum deposition processes, spray techniques including plasma and flame spraying and related processes. Hard ceramic coating, degradation of surfaces, chemistry and physics of surfaces, types, mechanisms and theories of wear and friction, wear resistant materials and coatings.

ME 6811 (Advanced Ceramics Technology)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Engineering Ceramics: definition and scope of engineering ceramics, atomic bonding and crystal structure; phase equilibrium and phase equilibrium diagrams. Processing of high performance ceramics; physical, mechanical and thermal properties of engineering ceramics, toughening mechanisms, industrial applications of engineering ceramics as tool materials, surface barrier coatings, bio-ceramics, dental ceramics etc.
Electronic ceramics: crystal chemistry of ceramics, effects of crystal defects and impurities on electronic properties of ceramics, processing, structure and properties of ceramic insulators, ceramic materials for piezoelectric, ferroelectric and magnetic applications; ceramic sensors.

ME 6813 (Mechanics of Composite Materials)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Composite materials and their characteristics, stiffness of unidirectional composites, transformation of stress and strain, off-axis stiffness of unidirectional composites, in-plane stiffness of symmetrical laminates, flexural stiffness of symmetric sandwich laminates, behavior of general laminates, strength of composite materials and their modes of failure, micromechanics, functionally graded materials (FGM).

ME 6815 (Advanced Polymer Technology)

Lecture: 3.00 hrs/week ***No. of Credit: 3.00***

Basic concepts of polymer science: Basic concepts in polymer science, various polymerization mechanisms, polymerization techniques and molecular weight. Various methods of determining of MW and MWD such as ebulliometry, cryoscopy, osmometry, GPC, ultracentrifugation, light scattering, chemical methods, fractionation methods etc.
Polymers and their properties: Commodity thermoplastics. Fibers. elastomers. Thermosers. Engineering Polymers. Specialty polymers. Polymer blends.
Polymer processing: Extrusion: Extruder and extrusion dies. Basic consideration on mixing. Single screw and twin screw extruders. Injection moulding: The gate, runner, and mould. Control of pressure, temperature and time.
Environmental considerations: Polymers as a replacement to traditional natural resources, energy conservation due to plastics, biodegradability, plastic waste and management of plastic waste in the environment-recycling **,** incineration and biodegradation. Green chemistry; new methods of production of polymers, new feedstock alternative to petroleum, alternative technologies for eco-friendly plastics, role of biopolymer and biodegradable polymers.

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