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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