CHAPTER 1

INTRODUCTION TO ME DEPARTMENT

1.1 General Information

The necessity of establishing a technical institute for Bangladesh Armed Forces was felt in the late eighties. In the absence of such an institution, officers of Bangladesh Armed Forces had been graduating from Bangladesh University of Engineering and Technology (BUET), Bangladesh Institute of Technology (BIT) and other foreign institutions of science and technology. With a view to meet the increasing demand for the development and dissemination of engineering and technological knowhow, Bangladesh Armed Forces established the Military Institute of Science and Technology (MIST) that promises to provide facilities for higher technical education both for the officers of Bangladesh Armed Forces and for civil students from home and abroad. The motto of MIST is Technology for Advancement. Founded on 19 April 1998, MIST started its journey on 31 January 1999 by offering a four-year Bachelor degree on civil engineering fields. Bachelor course on Mechanical Engineering started its journey on February 2003. To cope up with the national demand currently MIST has twelve departments offering a four year Bachelor degree.

1.2 Department Mechanical Engineering

1.2.1 Introduction

In view of global necessity, it is clear that postgraduate degree in mechanical engineering will play an important role in future demand of highly professionals in this field. The national and international requirement of professionals of mechanical engineers is increasing day by day for the developing and developed countries. From this perspective, it is of vital importance to offer high quality education to the next generation of mechanical engineers.

The post graduate programs in mechanical engineering offers students deep knowledge and functional skills in most fields of relevance for mechanical technology. Upon completion, students will be well prepared for future positions within the advanced professional arena, or in a Mechanical technology research environment.

1.2.2 Vision and Mission of ME Department

Vision: To be an internationally recognized center of excellence offering a study program of high quality teaching, research, industry-related consultancy and outreach activities with national relevance, innovation and creativity in the field of Mechanical Engineering.

Mission: To produce engineers and researchers with sound knowledge on fundamentals of traditional, modern and emerging areas of Mechanical Engineering together with innovative design abilities and managerial skills, which are essential to achieve sustainable national development.

1.2.3 Facilities of the Department

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

(1) Thermodynamics Lab

(2) Fluid Mechanics Lab

(3) Heat Transfer Lab

(4) Material & Production Process Lab

(5) Applied Thermodynamics (Heat Engine) Lab

(6) Applied Mechanics Lab

(7) Machine Tools Lab

(8) Measurement & Quality Control lab

(9) Fluid Machinery Lab

(10) Instrumentation and Control Lab

(11) Automobile Lab

(12) Heat Engine Lab

(13) Workshop

In addition to above laboratories, ME students will have the access to the laboratories/workshops held in Physics, Chemistry, Electrical Engineering, Civil Engineering ad Naval Architecture and Marine Engineering departments too during their project, thesis and research works.

CHAPTER 2

RULES AND REGULATIONS FOR MASTERS DEGREE

Degrees Offered

The Masters degrees to be offered under the Post-Graduation Ordinance of MIST in ME Department are as follows:

2.1.1	**Master of Science in**	
Mechanical Engineering, Abbreviated as		M.Sc. Engg. (ME)
2.1.2	**Master of Engineering in**	
Mechanical Engineering, Abbreviated as		M. Engg. (ME)

2.1 Program Objectives:

The students will acquire the following attributes on achieving the post-graduation degree:

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

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

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

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

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

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

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

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

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

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

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

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

2.2 Learning Outcome

Learning outcome of each course is provided in the course profile.

2.2 Admission Requirements/ Generic Skills

2.3.1 For admission to the courses leading to a Master's degree (M.Sc. Engg. / M. Engg.) an applicant:

(a) Must have a minimum GPA of 4.00 out of 5.00 or a first division or equivalent in S. S. C and H. S. C or in equivalent examinations;

(b) Must have obtained a B.Sc. Engg. Degree in Mechanical Engineering or related equivalent engineering degree from any UGC recognized university/institution. The duration of B. Sc. Engg. or equivalent degree program should be of minimum four (04) years, and the applicant must have at least 55% marks or a minimum GPA of 2.75 out of 4.0 or its equivalent in the under-graduation programme;

(c) In case of different grading system, the GPA of all the above examinations should be evaluated by the MIST Equivalence Committee.

(d) In case of difference in the under-graduation degree, the applicant may require to undertake prerequisite theory course(s) as allocated by the BPGS of ME department to achieve the equivalency amongst the candidates.

2.3.2 For admission to the courses leading to the degree of M.Sc. Engg. /M.Engg. in any branch, an applicant must have obtained a B.Sc. Engg. Degree in the relevant branch or an equivalent degree from any UGC recognized institution. For the case of non-relevant degree of a department, the candidate may be required to undertake prerequisite courses as determined by the BPGS of that department.

2.3.3 For any course requiring any prerequisite knowledge, will be mentioned in that respective course profile.

2.4 Curriculum/ Skill Mapping

Curriculum/ Skill Mapping will be presented for each course in the course profile.

2.5 Curriculum Structure

The courses offered by the Department for both Masters and PhD Programs are generally divided in the following divisions.

a. Division of Fluid Mechanics
b. Division of Thermal Engineering
c. Division of Applied Mechanics
d. Division of Automotive Engineering

The following courses are offered by the Department for both Masters and PhD Programs. Each term only some of the courses (typically 6-9) are offered from the different divisions.

Course No.	Course Title	Credit Hours	Remarks
General Courses			
ME 6000	Thesis (M. Sc. Engg.)	18	
	Project (M. Engg)	6	
	Thesis (Ph. D.)	45	
ME 6001*	Seminar	Non credit	
ME 6003	Engineering Problem	3	
ME 6007*	Research Methods for Engineers	Non credit	It will be mandatory for all students and will be regarded as a non-credit course
ME 6183	Finite Element Methods	3	
ME 6185*	Advanced Numerical Analysis	3	
ME 6401	Advanced Mechatronics	3	
ME 6245	Fire safety and Engineering	3	
EECE 6906	Advanced Electrical, Electronics and Communication Engineering in Military	3	Only for military students
AE 6108	Advanced Weapon Engineering	3	Only for military students

Division of Fluid Mechanics			
ME 6123	Mechanics of Inviscid Incompressible Fluid	3	
ME 6125	Mechanics of Viscous Fluid	3	
ME 6127	Mechanics of Inviscid Compressible Flow	3	
ME 6129	Turbulence	3	
ME 6131	Wind Power	3	
ME 6133	Wind Turbines	3	
ME 6135	Advanced Aerodynamics	3	
ME 6189	Computational Fluid Dynamics	3	
Division of Thermal Engineering			
ME 6101	Classical Thermodynamics	3	
ME 6103	Statistical Thermodynamics	3	
ME 6111	Solar Energy	3	
ME 6113	Energy Engineering	3	
ME 6143	Advanced Conduction and Radiation Heat	3	
ME 6145	Advanced Convection Heat Transfer	3	
ME 6147	Design of Heat Transfer Equipment	3	
ME 6151	Boiling and Condensation Heat Transfer	3	
ME 6153	Inverse Heat Transfer Problems	3	
ME 6155	Heat Transfer Enhancement	3	
ME 6157	Alternative Fuels for Engines	3	
ME 6161	Thermal Environmental Engineering	3	
ME 6163	Combustion Engineering	3	
Division of Applied Mechanics			
ME 6005	Tribology	3	
ME 6171	Advanced Dynamics	3	
ME 6173	Mechanical Vibrations	3	
ME 6175	Applied Elasticity	3	
ME 6177	Theory of Plates and Shells	3	
ME 6179	Elastic Stability of Structures	3	
ME 6181	Experimental Stress Analysis	3	
ME 6191	Engineering Acoustics and Noise Control	3	
ME 6193	Variational Methods in Structural Mechanics	3	
ME 6201	Mechanical Behaviour of Engineering Materials	3	
ME 6203	Structure and Properties of Engineering	3	
ME 6205	Theory of Plasticity	3	
ME 6209	Mechanics of Composite Materials	3	
ME 6211	Smart Materials	3	
ME 6301	Surface Engineering	3	
ME 6213	Fracture Mechanics	3	
Division of Automotive Engineering			

ME 6231	Computational Engineering for Automobile Applications	3	
ME 6233	Vehicle Power-Train Technologies	3	
ME 6235	Automotive Materials and Processes	3	
ME 6237	Automotive Systems and Control	3	
ME 6239	Advanced CAE for Automotive Applications	3	
ME 6241	Intelligent Materials and Processes	3	
ME 6243	Automotive Electronics	3	
ME 6251	Advanced Automobile Engineering	3	Only for Military students

2.6 Course Schedule

All students must complete at least two courses (6 credit) in his/ her respected area of research. The regulations for registering courses and forming different committees are as follows:

2.6.1 Admission and Registration Procedures

2.6.1.1 Applications for admission to the above programs shall be invited through regular means of advertisement and shall be received by the Admission officer.

2.6.1.2 Before being finally selected for admission, an applicant may be required to appear at an oral and/or written test by a Selection Committee as constituted by the concerned department. Every selected applicant, unless he/she has already been registered, shall get himself/herself registered with Bangladesh University of Professionals (BUP).

2.6.1.3 After admission each student shall be assigned, by the Head of the department, an Adviser from among the teachers of the Department not below the rank of an Associate Professor/Instructor Class A. In advance of each enrolment and registration, the Adviser shall check and approve his/her student's schedule for subjects, pre-requisites as recommended by the Selection Committee and the total hours. The student is expected to consult his/her Adviser on all academic matters but, it is the responsibility of the individual student to see that his/her schedule conforms to the academic regulations. If no advisor is assigned, then the student will contact with the Postgraduate Program Coordinator or Head of the department for all academic matters.

2.6.1.4 Every registered student shall get himself/herself enrolled on payment of prescribed fees and other dues as per MIST and BUP rules before commencement of each semester.

2.6.1.5 On the recommendation of the Board of Post Graduate Studies (BPGS) and Committee for Advanced Studies and Research (CASR), the rules for admission into the post graduate studies shall be framed from time to time by the Academic Council. CASR on its own may, if it deems fit, recommend such rules for admission for approval of the Academic Council. The composition of BPGS and CASR is mentioned in next section.

2.6.1.6 No late registration will be allowed after two weeks of designated dates of registration. Late registration after this date may only be accepted for thesis/project if the student submits a written appeal to the Dean, MIST through the concerned Head and can document extenuating circumstances such as medical problems (physically incapacitated and not able to be presented) from the Medical Officer (MO) of the Institute or some other academic commitments which precluded registration prior to the last date of registration. Students will be charged a late registration fee of Tk. 1000.00 (One thousand) only. This extra fee will not be waived whatever be the reason for late registration.

2.6.1.7 If a student is unable to complete the final examination of a semester due to serious illness or serious accident or official commitment he/she may apply to the Dean, MIST in a prescribed form through Head/Director of the Department for total withdrawal from the semester within a week after the end of the semester final examination. The application must be supported by a medical certificate from the MO, or relevant Official documents. The Academic Council will take the final decision about such application on the recommendation of the relevant BPGS.

2.6.2. Supervisor

2.6.2.1 Criteria of supervisor selection

On admission and fulfillment of other requirements as mentioned in this ordinance, the Head or Postgraduate Program Coordinator of the relevant department will suggest a Supervisor for the student after completion of at least 60% theory courses with minimum required CGPA (for MSc: 3.00 and for MEngg: 2.75) following the format as given in Annexure-1. Without taking supervisor a student is not allowed to register credit hours for thesis/project. The criteria of supervisor are as follows:

2.6.2.1.1 He/She must have a PhD degree in a relevant discipline from any public university of Bangladesh/renowned foreign university.

2.6.2.1.2 Scrutinising of the PhD degree has to be done through a committee as comprised below before selection as a supervisor:
- Head of the concern department
- One teacher from MIST
- One external member

2.6.2.1.3 He/She should have at least 01 years of postgraduate teaching and supervising experience or 02 years of research experience from any public university or from national/internationally renowned research organization.

2.6.2.1.4 Any person who has online PhD will not be appointed as supervisor.

2.6.2.1.5 Any person who fulfills above criteria and preferably has 02 publications in reputed peer reviewed journals as a First/Corresponding author will be appointed as a supervisor.

2.6.2.1.6 The institute may outsource supervisors primarily from public university on fulfillment of above criteria. However, a retired teacher of public university presently serving in any other organization/university may be permitted to supervise on fulfillment of above criteria.

2.6.2.1.7 The BPGS will look into the fulfillment of the above criteria before appointing supervisors. Approval of CASR for appointing supervisor must be taken.

2.6.2.1.8 If supervisor is selected outside of this institute, CASR through BPGS may decide whether a co-supervisor from MIST is required or not.

2.6.2.1.9 If co-supervisor is required for a particular thesis work, the co-supervisor preferably should have a PhD degree from reputed university, however, a faculty member holding MSc (with thesis) degree can work as a co-supervisor.

2.6.2.1.10 For MEngg projects a faculty member holding MSc (with thesis) degree with at least 02 years of teaching and/or research experience may be permitted to supervise.

2.6.2.1.11 A supervisor/co-supervisor shall not take more than 12 (twelve) students (maximum 6 as supervisor and remaining 6 as co-supervisor) of two programs ie Masters and PhD at a time. However, in any cases he/she will not allow to take more than 2 (two) PhD students at a time.

2.6.2.1.12 Any change of supervisor/co-supervisor shall have to be recommended by the CASR through BPGS. In such case, written consent of both present and proposed supervisor/co-supervisor has to be produced.

2.6.2.2 Charter of Duties of a Supervisor

The supervisor is expected to do the following:

2.6.2.2.1 Supervise the research work of the M. Sc. Engg./M.Engg. researcher.

2.6.2.2.2 Supervise the research for the duration of researcher's candidacy, which may include a period of extension to the researcher's submission deadline and may also include supervision during a period of resubmission.

2.6.2.2.3 Ensure face-to-face meeting with the Researcher's at least once in a month.

2.6.2.2.4 Ensure communication with Researcher at least once in a week by any means (i.e., telephone, email etc.)

2.6.2.2.5 Submit Research Progress Report to the Head of the respective department covering duration of three calendar months as specified in the Academic Calendar.

2.6.2.2.6 Examine the thesis as a member of Board of Examiners.

2.6.2.2.7 Attend the oral examination of the researcher for defense.

2.6.2.2.8 Maintain a comprehensive file of relevant documents, emails, correspondence etc. relating to supervision of the candidate.

2.6.2.2.9 If under any emergency circumstance such as going abroad for higher studies etc. he/she must inform the Dean/Head of the department at least one month prior to the discontinuation.

2.6.3 Academic Requirements and Regulations

2.6.3.1 The minimum duration of the M.Sc.Engg./M.Engg. program shall be three semesters. A student for the Master's degree program must complete all the requirements for the degree within five academic years from the date of the first admission in the respective programme.

2.6.3.2 Academic progress shall be measured in terms of Credit hours earned by a student. One Credit hour subject shall normally require 14 hours of lecture for one semester (14 weeks); while one Credit hour for thesis/project work should normally require 42 hours of research work for one semester. The number of Credit hours for each subject shall be as specified in the syllabus of the respective department.

2.6.3.3 A student must complete a minimum of **36 credit hours** of which **18 credit hours** shall be assigned for a thesis for M.Sc.Engg. and **6 credit hours** as project work for M.Engg. Students can register thesis/project after completion of at least 12 credit hours theory courses.

2.6.3.3.1 Students are allowed to take more credit courses than minimum requirement for the calculation of GPA. The extra course should help the student to increase his/her CGPA than minimum requirement, and also in case Supervisor wants him/her to take addition courses related to his/her thesis work. However, the students need to take written permission for the extra courses from Supervisor and Head of the concern department. This has to be reported to the Controller of Examination of BUP through Controller of Examination of MIST.

2.6.3.3.2 The best grades among all the completed courses will be considered for CGPA calculation.

2.6.3.4 There shall be two categories of students, namely, full-time students and part-time students.

2.6.3.4.1 A student may enroll as a part-time student. Students, serving in different organizations, may also be admitted as part time students with the written consent of the employer. A part time student may be assigned a maximum of 9 credit hours of course including thesis work in any semester.

2.6.3.4.2 Full-time students must register for a minimum of 12 credit hours and a maximum of 15 credit hours per semester. A full-time student shall not be allowed to be in the employment of any organization (even as a part-time employee). However, they may be employed as Teaching/Research Assistant at MIST. If a full time student becomes an employee (full time or part time) of any other organization in the middle of a semester, he/she may, with the approval of the Head of the Department and his/her Employer, be allowed to continue as a full time student for that semester only.

2.6.3.4.3 A student may be allowed to switch from part-time to full-time or vice versa on the recommendation of the respective BPGS before the commencement of a semester.

2.6.3.5 The subjects of study in the different Departments/Institutes shall be as recommended by the respective BPGS and the Faculty and approved by CASR. The BPGS may review the curriculum from time to time and recommend any changes as may be considered necessary. At least 60% of the theory courses have to be completed from their major field of study.

A student on the recommendation of the BPGS and as approved by the CASR may be allowed to transfer a maximum of 9.0 credits of the courses (relevant to the field of study) completed by the student at a recognized institution provided that the courses were not taken earlier than five calendar years from the date of his/her first enrolment in the respective programme at MIST and that the student obtained a minimum GPA of 3.0 out of 4.0 or its equivalent in such courses and that the courses are equivalent to the approved courses of MIST.

2.6.4 Grading system

2.6.4.1 Final grades for courses shall be recorded as follows:

Grade	Merit description	Grade points
A (Plus)	Excellent	4.00
A	Very good	3.50
B (Plus)	Good	3.00
B	Average	2.6.30
C	Pass	2.00
F	Fail	0.00
S	Satisfactory	--
U	Unsatisfactory	--
W	Withdrawn	--
X	In Progress (for thesis)	--
I	Incomplete/Discontinued (for thesis)	--

Note: For the students who are already enrolled; the previously approved grading system will be followed till his/her completion of the degree.

2.6.4.2 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).

2.6.4.2.1 The C grades, up to a maximum of two courses, may be ignored for calculation of GPA at the written request of the student to the Head of the Department on the recommendation of the supervisor / program coordinator, provided that the student has fulfilled the total course credit hour requirement in the remaining subjects with a minimum CGPA of 3.00 (for M.Sc. Engg.) and 2.75 (for M.Engg.).

2.6.4.2.2 When a course is repeated for improvement, better grade shall be counted for calculation of GPA.

2.6.4.2.3 Performance in all the subjects excluding all the F grades shall be reflected in the transcript.

2.6.4.3 Grade "I" is given only when a student is unable to sit for the examination of a course at the end of the semester because of circumstances beyond his/her control. He/She must apply to the Head of the Department within one month after the examination to get an "I" grade in that course. It must be completed as soon as possible whenever the course is offered, otherwise, the "I" becomes an "F" grade. He/She may, however, be allowed to register without further payment of tuition fees for that course. If the course is not offered within next one year, the student can complete the course requirement by taking similar alternative course which should be approved by the BPGS.

2.6.4.4 Satisfactory or Unsatisfactory used only as final grades for thesis/project and non-credit courses. An "X" grade shall be recorded for thesis in progress. If, however, thesis is discontinued an "I" grade shall be recorded.

2.6.4.5 Students may enroll for non-credit course(s) termed as audit/research course(s) on recommendation of his/her thesis / project Supervisor and Head of the Department. However, his grades in audit/research course(s) will not be counted for calculating his CGPA.

2.6.4.6 A student shall withdraw officially from a course within two working weeks of the commencement of the semester or else his grade in that course shall be recorded as F unless he/she is eligible to get a grade of "I". A student may be permitted to withdraw and change his/her course within the specified period with the approval of his/her Adviser, Head of the Department and the respective teacher(s) concerned. (In that case his / her grade in the courses registered shall be recorded as 'W' in his Academic Record but shall not be reflected in the transcript.)

2.6.4.7 Numerical markings may be made in answer scripts, tests etc., but all final grading to be reported to the Controller of Examinations (BUP) shall be in the letter grade system as detailed below:

90% and above	:	A (Plus)
80% to below 90%	:	A
70% to below 80%	:	B (Plus)
60% to below 70%	:	B
50% to below 60%	:	C
Below 50%	:	F

2.6.5 Research Proposal

All students must submit a research proposal following the format given in Annexure-3 (for M.Sc. Engg.) or Annexure-5 (for M.Engg.) to the BPGS of the respective department which shall examine the proposal and recommend it for the approval of the CASR. In special circumstances the BPGS may recommend to CASR for approval of any subsequent changes in the research proposal.

2.6.6 Conduct of Examination

2.6.6.1 In addition to tests, assignments and/ or examinations during the semester as may be given by the teacher(s) concerned, there shall be a written examination and / or other tests for each of the subjects offered in a semester at the end of that semester, the dates of which shall be announced by the Exam Section, MIST as advised by Dean at least two weeks before the commencement of the examination. The final grade in a subject shall be based on the performance in all tests, assignments and examinations.

2.6.6.2 The Exam Section and BUP shall keep up to date record of all the grades obtained by a student in individual Academic Record Card. Grades shall be announced by the Controller of Examinations at the end of each semester. In addition, each student is entitled to one official transcript of the University record at the completion of his academic programme from the office of the Controller of Examinations on production of statement of clearance from all departments' offices.

2.6.6.3 The Head /BPGS of a department shall recommend the names of the paper setters and examiners for the semester examinations at least four weeks before the date of commencement of the examination to the Controller of Exam of MIST for approval.

2.6.7 Qualifying Requirements

The following are the qualifying requirements for the degree of M.Sc. Engg./M. Engg:

2.6.7.1 To qualify for the degree a student must earn a minimum grade point of 3.00 for M.Sc. Engg and 2.75 for M.Engg based on the weighted average of grade points (GP) in his/her course work.

2.6.7.2 Two courses may be repeated for improvement with the prior approval of the Head of the Department on the recommendation of the Supervisor/Program Coordinator. Such approval shall be reported to the BPGS.

2.6.7.3 A student obtaining "F" grade in a course may be allowed to repeat the course with the prior approval of Head of the Department on the recommendation of the Supervisor / Advisor. Such approval shall be reported to the BPGS.

2.6.7.4 A student is allowed to switch from M.Sc. Engg. to M.Engg. if his/her CGPA falls below the minimum requirement of the M.Sc. Engg. degree. This has to be approved by the respective BPGS on the written request from the student.

2.6.7.5 A student shall not be allowed to continue the programme if he/she obtains a total of three "F" grades in one or more than one subjects, during the whole course of his/her studies.

2.6.7.6 If at the end of the second or any subsequent semester (for full time students) and third or any subsequent semester (for part time students), the cumulative GPA falls below 3.00 for a M.Sc. Engg. student and 2.75 for a M.Engg. student he/she shall not be allowed to continue in the programme.

2.6.8 Thesis

2.6.8.1 A M.Sc. Engg. student finally shall submit a thesis on his/her research work fulfilling the other requirements mentioning in this Ordinance.

2.6.8.2 Research work for the thesis shall be carried out under the supervision of a Supervisor and a Co-supervisor (if required).

2.6.8.3 If any change is necessary of the approved thesis (title, content, cost, Supervisor, Co-supervisor etc.), it shall be approved by the CASR on recommendation of the relevant BPGS.

2.6.8.4 The research work must be carried out in MIST or at a place(s) recommended by the BPGS. The work schedule and financial involvement should be mentioned in the research proposal for carrying out the research work.

2.6.8.5 At the end of the student's research work, the student shall submit a thesis which must be an original contribution to engineering/sciences and worthy of publication.

2.6.8.6 The thesis submitted for the fulfillment of the degree of M.Sc. Engg. shall be written in English. The student must follow the Thesis writing guideline attached to this ordinance.

2.6.8.7 The student shall certify that the research work was done by him/her and that this work has not been submitted elsewhere for the award of any other diploma or degree (except for publication).

2.6.9 Examination of Thesis

2.6.9.1 Examination Board

2.6.9.1.1 An Examination Board for every student for thesis and oral examination shall be approved by the CASR through BPGS on recommendation of the thesis Supervisor in consultation with the Head of the Department. The Board shall consist of at least four members including the Supervisor as the Chairman and the Head of the Department as an Ex-officio and following the format as given in Annexure-4. The Board shall also include one or more external examiner(s).

The Examination Board shall be constituted as follows:		
(i)	Supervisor	Chairman
(ii)	Co-supervisor (if any)	Member
(iii)	Head of the Department (Ex-officio)	Member
(iv)	One or more members from within the Department/Institute	Member
(v)	One or more external member from any other reputed National/International Institutes/Universities/Organizations	Member (External)

If any member holds two portfolios (i.e., Head of a Department becomes Supervisor), then one additional internal member can be included in the board. In any case if Head of a department is

unable to act as an Ex-officio, then the Faculty Dean will act as an Ex-officio. In case of non-availability of an internal member in related field, one additional external member can be included in the board from any reputed public university.

2.6.9.1.2 All the members of the Thesis Examination Board should be PhD holder and should have expertise on the same field of study of the student. They should have experience of supervision and/or thesis examination of Masters Candidates.

2.6.9.1.3 If the external examiner is appointed from outside the country a copy of the thesis should be sent for his/her evaluation and his/her written opinions are to be placed before the Examination Board.

2.6.9.1.4 If any examiner is unable to accept the appointment or has to relinquish his/her appointment before the examination, Commandant, MIST shall appoint another examiner in his/her place, on suggestion from the Supervisor in consultation with the Head of the department. This appointment will be reported to the CASR.

2.6.9.2 Thesis Examination

2.6.9.2.1 Every student submitting a thesis in partial fulfillment of the requirements of a degree, shall be required to appear at an oral examination, on a date fixed by the Supervisor in

consultation with the 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.

2.6.9.2.2 Every student shall submit to the Head of the Department, through his/her Supervisor, required number of type written soft bound copies of his/her thesis in the approved format (as given in Annexure-7) on or before a date to be fixed by the Supervisor in consultation with the Head of the Department along with transcript of the course work and copy/copies of published article.

2.6.9.2.3 After necessary scrutiny, the Head will forward the thesis with other documents (transcripts, published articles) to the member of the Examination Board.

2.6.9.2.4 The M.Sc. Engg. Thesis shall be examined by all members of the Examination Board. After examination of the thesis, all members shall send their reports within 2 weeks after receiving the soft bound thesis in a sealed envelope to the Head of the concerned department and a copy to the Controller of Examination of MIST.

2.6.9.2.5 On the basis of positive opinions from majority of the examiners except Supervisor and Co-supervisor that satisfies the thesis is standard and justified for Oral Examination, the Ex-officio of the Thesis Examination Board in consultation with the Supervisor shall arrange an Oral Examination for the M.Sc. Engg. student to defend his/her Thesis.

2.6.9.2.6 If any external examiner is appointed from outside the country, he/she shall be invited for attending the Oral Examination. In case, he/she is unable to attend the oral examination, the oral examination shall be arranged in absence of him/her, provided he/she gives his/her consent to do so.

2.6.9.2.7 On the basis of the negative opinions from majority of the examiners except Supervisor and Co-supervisor that do not satisfy the thesis as standard, the Thesis Examination Board shall decide either to reject the thesis or may recommend to allow the student to resubmit the thesis after necessary revision and modification as suggested by the examiners within 6 (six) months from the date of supply of comments of examiner. In such case, further registration will not be necessary. The Ex-officio of the thesis Examination Board shall report their decision to the Controller of Examinations of this Institute.

2.6.9.2.8 In case equal numbers of examiners are in favour and against, the Ex-officio will propose and get approval from CASR for a third external examiner on the relevant field and take his opinion whether the student will be allowed for Oral examination or reject/resubmit the thesis. For unavoidable circumstances, Commandant may give approval of the third external examiner which has to be post facto approved in the next CASR meeting.

2.6.9.2.9 In case, the student is unable to satisfy the Oral examination even the thesis is adjudged adequate, the Thesis Examination Board may recommend that the M.Sc. Engg. student may be permitted to appear at another oral examination on a date to be fixed by the Supervisor in consultation with the Head of the Department.

2.6.9.2.10 After successful Oral examination and necessary corrections recommended by the thesis Examination Board, every candidate will submit necessary copies of hard bound thesis following the template to the concern persons/department.

2.6.9.2.11 The Thesis Examination Board will forward the results of the M.Sc. Engg. student to Controller of Examinations of MIST. The results will be send to the Controller of Examination of BUP for approval and then the degree will be awarded.

2.6.10 Project

2.6.10.1 A M.Engg student finally shall submit a project report on his/her research work fulfilling the other requirements mentioning in this Ordinance.

2.6.10.2 Research work for the report shall be carried out under the supervision of a Supervisor.

2.6.10.3 If any change is necessary of the approved project (title, content, cost, Supervisor etc.), it shall be approved by the CASR on recommendation of the relevant BPGS.

2.6.10.4 The research work must be carried out in MIST or at a place(s) recommended by the BPGS. The work schedule and financial involvement should be mentioned in the research proposal for carrying out research work.

2.6.10.5 At the end of the student's research work, the student shall submit a project report which must be an original contribution to engineering/sciences.

2.6.10.6 The report submitted for the fulfillment of the degree of M.Engg. shall be written in English. The student must follow the writing guideline attached to this ordinance.

2.6.10.7 The student shall certify that the research work was done by him/her and that this work has not been submitted elsewhere for the award of any other diploma or degree (except for publication).

2.6.11 Examination Board-Project

2.6.11.1 An Examination Board for every student for his/her project and oral examination shall be approved by the CASR on recommendation of the thesis Supervisor in consultation with the Head of the Department. The Board shall consist of at least three members including the Supervisor as the Chairman following the format as given in Annexure-6. The Supervisor shall act as the Chairman and propose the other board members.

The Examination Board shall be constituted as follows:

(i)	Supervisor	Chairman
(ii)	One or two member from within the Department/Institute	Member
(iii)	One external member from any other reputed National Institutes/Universities/Organizations	Member (External)

If any member holds two portfolios (i.e., Head of a Department becomes Supervisor), then one additional internal member can be included in the board. In case of non-availability of an internal member in related field, one additional external member can be included in the board from any reputed public university.

2.6.11.2 All the members of the Project Examination Board should be at least Masters degree holder and have expertise on the same field of study of the student. They should have experience of supervision and/or thesis examination of Masters Students.

2.6.11.3 If any examiner is unable to accept the appointment or has to relinquish his/her appointment before the examination the BPGS shall appoint another examiner in his/her place on the recommendation of his/her supervisor. This modification will be reported to the CASR.

2.6.11.4 Every student shall submit to the Head of the Department, through his/her Supervisor, required number of type written soft bound copies of his/her project report in the approved format (as given in Annexure-7) on or before a date to be fixed by the Supervisor concerned in consultation with the Head of the Department along with transcript of the course work and copy/copies of published article (if any).

2.6.11.5 After necessary scrutiny, the Head will forward the project report with other documents to the members of the Examination Board at least 2 weeks before the oral examination. The report shall be examined by all members of the Examination Board.

2.6.11.6 Every student submitting a project report in partial fulfillment of the requirements of a degree, must be required to appear at an oral examination, on a date or dates fixed by the Supervisor concerned in consultation with the Head of the Department and must satisfy the examiners that he/she has gained satisfactory knowledge related to the project work.

2.6.11.7 In case a student fails to satisfy the Examination Board by project report and /or oral examination, the student shall be given one more chance to resubmit the project report and/or appear in another oral examination as recommended by the Board.

2.6.11.8 After successful Oral examination and necessary corrections recommended by the Project Examination Board, every candidate will submit necessary copies of hard bound project report following the template given in Annexure-7.

2.6.11.9 The Project Examination Board will forward the results of the M.Engg student to Controller of Examinations of MIST through Graduate Course Coordinator. The results will be send to the Controller of Examination of BUP for approval and then degree will be awarded.

2.6.12 Striking off and Removal of Names

2.6.12.1 The name of the student shall be struck off and / or removed from the rolls of the

Institute on the following grounds:

(i) Non-payment of dues within prescribed period. Post graduate students residing in the halls of residence shall be subject to the same conditions as allowed in the Policies Relating to the Hall of Residence and Discipline.

(ii) Failing to make satisfactory progress in his/her programme as reported by the supervisor through the BPGS and approved by CASR.

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

(iv) Withdrawn officially from the Master Degree Programme.

2.6.13 Academic fees

Items of Academic fees shall be as per MIST policy, and these fees shall be reviewed and recommended from time to time by the Governing Body of MIST

ANNEXURE – 1

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY, DHAKA
OFFICE OF THE MEMBER SECRETARY OF THE COMMITTEE FOR ADVANCED STUDIES AND RESEARCH

Application for the **Approval of Supervisor and/or Co-Supervisor** for Ph.D./ M.Phil./ M.Sc.Engg./ M.Engg. Thesis/Project

(All the items/sub-items of the following list that are applicable to ones must be mentioned and filled in properly)

Date of Application:

1. **Name of the Student:** **Status:** Full Time/ Part Time
   Roll No: **Session:** Apr.20…./Oct.20.....
2. **Present Address:**
   Email: Tel No:
3. **Name of the Department:**
   Program (Ph.D./M.Phil./M.Sc.Engg./M.Engg.): Division (if any):
4. **Session of First Enrolment in the Program:**
5. **Name of the Supervisor:** Affiliation:

Email: Tel No:

6. **Name of the Co-Supervisor** (if any)**:** Affiliation:
7. **List of Courses so far Completed with Course No, Course Title, Credit Hour, Grade, Grade Point and CGPA:***(To be verified and signed by the Program Coordinator)*

Sl. No	Course No	Course Title	Credit	Grade	Grade Point	CGPA

Signature of the Program Coordinator
Date:

8. **Number of Postgraduate Students Working with the Supervisor at Present:**

Ph.D.: M.Phil./ M.Sc.Engg.: M.Engg.:

9. **BPGS Reference**: Date of BPGS Meeting:

Signature of the Student
Date:

Signature of the Supervisor
Date:

Signature of the Co-Supervisor
Date:

Signature of the Head of the Dept.
Date:

ANNEXURE – 2

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY, DHAKA
OFFICE OF THE MEMBER SECRETARY OF THE COMMITTEE FOR ADVANCED STUDIES AND RESEARCH
Application for the **Approval of Doctoral Committee**

(All the items/sub-items of the following list that are applicable to ones must be mentioned and filled in properly)

Date of Application:

1. **Name of the Student:** **Status**: Full Time / Part Time

   Roll No: Session: Apr. 20…. / Oct. 20….

2. **Present Address:**

   Email: Tel No:

3. **Name of the Department:**

   Program (Ph.D./M.Phil./M.Sc.Engg./M.Engg.): Division (if any):

4. **Session of First Enrolment in the PhD Program:**

5. **Appointment of Supervisor & Co-supervisor Approved by CASR** (if any)**:**

Meeting No: Date:

6. **Name of the Supervisor**: Affiliation:

Email: Tel No:

7. **Name of the Co-supervisor (if any):** Affiliation:

8. **Tentative Title of Thesis:**

9. BPGS Reference: Date of BPGS Meeting:

Signature of the Student:

Date:

To be filled in by the Head of the Department and Supervisor

10. Proposed Doctoral Committee:

(i)	**Name:** Designation: Affiliation:	(Supervisor)	**Chairman**
(ii)	**Name:** Designation: Affiliation:	(Co-Supervisor, if any)	**Member**
(iii)	**Name** (Head of the Dept.)**:** Designation: Affiliation:	(Ex-Officio)	**Member**
(iv)	**Name:** Designation: Affiliation:		**Member**
(v)	**Name:** Designation: Affiliation:		**Member**
(vi)	**Name:** Designation: Affiliation:		**Member**
(vii)	**Name:** Designation: Affiliation:		**Member**

Signature of the Supervisor:

Date:

Signature of the Head of the Dept.:

Date:

ANNEXURE – 3

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY, DHAKA
OFFICE OF THE MEMBER SECRETARY OF THE COMMITTEE FOR ADVANCED STUDIES AND RESEARCH

Application for the **Approval of Ph.D. Thesis Proposal**

(All the items/sub-items of the following list that are applicable to ones must be mentioned and filled in properly)

Date of Application:

1. **Name of the Student:** **Status:** Full Time/ Part Time
   Roll No: **Session:** Apr. 20…. / Oct. 20….
2. **Present Address:**
   Email: Tel No:
3. **Name of the Department:**
   Program (Ph.D./M.Phil./M.Sc.Engg./M.Engg.): Division (if any):
4. **Session of First Enrolment in the Program:**
5. **Name of the Supervisor:**

Affiliation:

Email: Tel No:

6. **Name of the Co-Supervisor** (if any)**:** Affiliation:
7. **Thesis Title** (IN BLOCK LETTER)**:**
8. **Background and Present State of the Problem:** *(Not more than 150 words)*

Please mention only those activities which have been carried out in different places as reported in publications. Please support your information by citing the relevant references. Keep your description within 150 words.

9. Objectives with Specific Aims and Possible Outcome: *(Not more than 150 words)*

Please list the objectives and the possible outcomes using short sentences. If you are writing one or two paragraphs for describing the objectives and the outcomes please limit yourself within 150 words.

10. **Outline of Methodology/Experimental Design:** *(Not more than 200 words)*

Outline the approach and the sequence of activities in not more than 200 works to describe how the work will be carried out.

11. **References:**

Give only the references which you have indicated as number style (i.e., [1] or [1-3] etc.) in the item 8 (background and present state of the problem). While giving the references you must mention clearly the name of author(s), title of the paper/book/dissertation, name of the journal/proceeding/publisher/university, vol. no., year of publication etc. in chronological order.

12. List of Courses so far Completed with Course No, Course Title, Credit Hour, Grade, Grade Point and CGPA: *(To be verified and signed by the Program Coordinator)*

Sl. No.	Course No	Course Title	Credit	Grade	Grade Point	CGPA

Signature of the Program Coordinator:

Date:

13. Cost Estimate: (*Break-ups can be provided in separate sheets, if required*)

Sl. No.	Items	Cost (Tk.)
1	Cost of Material (breakup needed)	
2	Field Works / Cost of Experimental Setup (if applicable)	
3	Conveyance / Data Collection (with breakup)	
4	Typing, Drafting, Binding and Paper etc.	
Total Amount:		

14. Justification of having Co-Supervisor:

Co-Supervisor(s) are acceptable only if the supervisor can justify that the work requires considerable knowledge of a discipline other than his own field of work.

15. Appointment of Supervisor and Co-Supervisor Approved by CASR:

Meeting No: Date: Reference No:

16. Appointment of Doctoral Committee Approved by CASR:

Meeting No: Date: Reference No:

17. Doctoral Committee:

Sl. No.	Name of the Committee members with affiliation
1	Chairman (Supervisor):
2	Member (Co-supervisor, if any):
3	Member-1(Ex-officio): Head,
4	Member-2:
5	Member-3:
6	Member-4:

18. Result of the Candidacy Examination: (*Photocopy of result should be enclosed*)

Satisfactory/ Unsatisfactory Date:

19. BPGS Reference: Date of BPGS Meeting:

	Names and Signatures of the Members of the Doctoral Committee (5 to 7 Members)	
---------- Signature of the Supervisor: Date:	1	
---------- Signature of the Supervisor: Date:	2	
	3	
---------- Signature of the Supervisor: Date:	4	
	5	
---------- Signature of the Head of the Dept: Date:	6	
	7	

ANNEXURE – 4

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY, DHAKA
OFFICE OF THE MEMBER SECRETARY OF THE COMMITTEE FOR ADVANCED STUDIES AND RESEARCH

Application for the **Approval of Board of Examination for the Ph.D./M.Phil./M.Sc.Engg.**

Degree
(All the items/sub-items of the following list that are applicable to ones must be mentioned and filled in properly)

Date of Application:

1. **Name of the Student:** **Status**: Full Time/ Part Time
   Roll No: **Session**: Apr. 20…./ Oct. 20….
2. **Present Address:**
   Email: Tel No:
3. **Name of the Department:**
   Program (Ph.D./M.Phil./M.Sc.Engg.): Division (if any):
4. **Session of First Enrolment in the Program:**
5. **Title of the Thesis as Approved by CASR** (if any)**:**
6. **Thesis Proposal Approved by CASR** (if any)**:**
   Meeting No: Date: Reference No:
7. **Doctoral Committee Approved by CASR:**
   Meeting No: Date: Reference No:
8. **BPGS Reference:** Date of BPGS Meeting:
9. **List of Courses so far Completed with Course No, Course Title, Credit Hour, Grade, Grade Point and GPA:** *(To be verified and signed by the Program Coordinator)*

Sl. No.	Course No	Course Title	Credit	Grade	Grade Point	CGPA

Signature of the Program Coordinator:

Date:

10. **Name of the Thesis Supervisor:**

11. **Name of the Co-Supervisor** (if any)**:**

12. **Time Extension** (if any) **Approved by the CASR:**

Meeting No.: Date: Reference No:

Signature of the Student

Date:

To be Filled in by the Head of the Department/Supervisor

13. **Expected Date of Examination:** Date:

14. **Suggested Board of Examiners:**

(i) Name:

Designation:

Affiliation:

(ii) Name:

Designation:

Affiliation:

(iii) Name (Head of the Dept.)**:** Designation:

Affiliation:

(iv) Name:

Designation:

Affiliation:

(v) Name:

Designation:

Affiliation:

Signature of the Supervisor:

(Supervisor) **Chairman**

(Co-Supervisor, if any) **Member**

(Ex-Officio) **Member**

Member (Internal)

Member (External)

Signature of the Head of the Dept.:

Date:

ANNEXURE – 5

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY, DHAKA
OFFICE OF THE MEMBER SECRETARY OFmTHE COMMITTEE FOR ADVANCED STUDIES AND RESEARCH

Application for the **Approval of M.Engg. Project Proposal**

(All the items/sub-items of the following list that are applicable to ones must be mentioned and filled in properly)

Date of Application:

1. **Name of the Student:** **Status:** Full Time/ Part Time

   Roll No: **Session:** Apr. 20…. / Oct. 20….

2. **Present Address:**

   Email: Tel No:

3. **Name of the Department:**

4. **Session of First Enrolment in the Program:**

5. **Name of the Supervisor:**

Affiliation:

Email: Tel No:

6. **Project Title:** (IN BLOCK LETTERS)

7. **Total Cost of the Project:** Tk. (In words)**:**

8. BPGS Reference: Date of BPGS Meeting:

9. **Project Proposal:** *(Not more than 200 words)*

Please describe briefly background, specific objective, methodology and possible outcome of the project in not more than 200 words.

Signature of the Student:

Date:

Signature of the Supervisor:

Date:

Signature of the Head of the Dept.:

Date:

ANNEXURE – 6

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY, DHAKA
OFFICE OF THE MEMBER SECRETARY OF THE COMMITTEE FORADVANCED STUDIES AND RESEARCH

Application for the **Approval of Board of Examination for the M.Engg. Degree**

(All the items/sub-items of the following list that are applicable to ones must be mentioned and filled in properly)

Date of Application:

1. **Name of the Student:** **Status:** Full Time/ Part Time
   Roll No: **Session**: Apr. 20…. / Oct. 20….
2. **Present Address:**
   Email: Tel No:

3. **Name of the Department**:

4. **Session of First Enrolment in the Program**:

5. **Name of the Supervisor**: Affiliation:

6. **Title of the Project**:

7. **Project Proposal Approved by CASR:**

   Meeting No: Date: Reference No:

8. **Approved Time Extension (if any) up to**:

   CASR Meeting No: Date: Reference No:

9. **BPGS Reference**: Date of BPGS Meeting:

10. **List of Courses so far Completed with Course No, Course Title, Credit Hour, Grade, Grade Point and CGPA:** *(To be verified and signed by the Program Coordinator)*

Sl. No	Course No	Course Title	Credit	Grade	Grade Point	CGPA

Signature of the Student:
Date:

Signature of the Program Coordinator:
Date:

To be Filled in by the Head of the Department/Supervisor

11. Expected Date of Examination:

12. Suggested Board of Examiners:

(i)	**Name:** Designation: Affiliation:	(Supervisor)	**Chairman**
(ii)	**Name** (Head of the Dept.)**:** Designation: Affiliation:	(Ex-Officio)	**Member**
(iii)	**Name:** Designation: Affiliation:		**Member**
(iv)	**Name:** Designation: Affiliation:		**Member**

Signature of the Supervisor:

Date:

Signature of the Head of the Dept.:

Date:

ANNEXURE – 7 (Thesis Format)

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

General Guidelines on Format of Thesis Submitted for Examination or Final

Submission
1. General Information

A Master's thesis must make some contribution to knowledge and not be mere collation of existing material. A PhD thesis must make a significant contribution to the knowledge of the subject concerned or provide evidence of originality either by the discovery of new facts or by the exercising of independent critical ability.

Work which has been submitted for another degree, or for which a degree has already been conferred by this Institute or any other university, may not be submitted again as a thesis but you are not precluded from incorporating part of such work provided that, in the thesis, you clearly indicate the part of the work which has been so incorporated.

Furthermore, please note that any work carried out before your enrolment in the University cannot be used for submission in a thesis examination, unless you have obtained approval from your supervisor and the Faculty.

The thesis must be written in English unless otherwise specified. Before submission of the thesis, you should seek consent from copyright owners for the inclusion of any third party proprietary/confidential intellectual property in the thesis.

Politically and commercially-sensitive information; or proprietary/confidential information which is not critical to the thesis and for which consent is not granted, should be excluded from the thesis. If necessary, such information could be included as appendices instead.

Most thesis authors experience major difficulties with tense in their documents. Many theses become a muddled mixture of past, present and future tense. To alleviate this problem, a simple solution is to treat the thesis as a historical document which will be read many years from the date of publication. The following grammatical procedure can then be adopted:

All general discussions and all discussions of experiments, equipment, etc. are written in the past tense (e.g., "*The test-tubes were acquired from a standard batch that was available at the time of experimentation...*").

References to mathematical formulae are written in the present tense (e.g., "*Equation 7.2 highlights the relationship between...*").

References to objects (sections, tables, diagrams, etc.) in the thesis are in the present tense (e.g., "*Section 2.9 contains a discussion on...*").

References to future work are also written in the past tense (e.g., "*It was determined that future developments could lead to an increase in...*").

2. Thesis Title

The title has to be approved from the CASR after having recommendation from BPGS. If

the thesis title differs significantly from the original approved title, the candidate must request for a change of title using the prescribed application form and take necessary approval from the CASR.

3. General Formatting

Page Size	Each copy of the thesis must be printed on A4 size (8.27" x 11.69") paper (offset paper with minimum weight should be 80 gm) with white background and black colour font for the text.
Print Quality	Clear, clean and sharp copies are required. In the case of photocopies, no fading, extraneous marks or gray background should appear.
Margins	The top, bottom and right margins should be 25 mm from the edge of the paper and left margin should be 35 mm from the edge of the paper. A right justified margin is acceptable which must be consistent throughout the thesis.
Font	The font size for the main text should be 11 to 12 points. The same font type and size should be used for the entire thesis (with possible exception for figures and appendices). Do not choose a font that is difficult to read. The following fonts are acceptable: Times Roman and Helvetica.
Line Spacing	The text should be double-spaced throughout with the following exceptions: Captions for Figures/Tables: should be single-spaced List of Figures/Tables: should be single-spaced and double-spaced between entries Footnotes: should be single-spaced
Page Numbering	All pages except the title page must be paginated. The page numbers must appear at the bottom centre of the page. The position of the page numbers should not change even on pages with landscape mode illustrations. All material preceding the thesis proper (introductory sections starting from acknowledgements to summary) may have a separate sequence of numbering, preferably in roman numerals beginning with i. Plates, maps, plans, diagrams, tables, etc., should also be given a separate sequence of numbering. The main body of the thesis should be numbered in arabic numerals from 1 onwards. The numbering must be consecutive throughout the thesis and should include all maps, diagrams, photographs, etc. Published material submitted with the thesis whether bound in with the thesis or not, should not be included in the pagination but must maintain the same margins, font type and size. For a thesis which consists of more than one volume, one numbering sequence should be used, for example, if volume I ends at p.200, volume II should begin with p.201.

Footnotes	Footnotes should appear at the bottom of each page for easy reference and not at the end of the chapter.
Printing	The thesis should be printed in single sided format.

4. Sequence of Content

The content of the thesis should be in the following order:
Title page

A blank page
Approval page Declaration page Summary

Acknowledgements Table of Contents List of Tables
List of Figures

List of Illustrations List of Symbols

Main body of thesis

Bibliography or references Appendices

A blank page

5. Title Page

The title page should contain the following information in BLOCK LETTERS not exceeding 16 points:

Thesis title

Candidate's name (with qualification(s) in brackets)

The words: "**A THESIS SUBMITTED FOR THE DEGREE OF** <NAME OF DEGREE>"

Department: **DEPARTMENT OF** <NAME OF DEPARTMENT>

Name of Institute/University: **MILITARY INSTITUTE OF SCIENCE AND**

TECHNOLOGY

Year of first submission of thesis: If the thesis is resubmitted in a subsequent year, the year of submission to be indicated on the title page should remain as year of first submission.

Sample of the Title Page:

A MODELING STUDY OF WASTEWATER

TREATMENT PLANT

Rafi Rahman

(*BSc Engg., MIST*)

A THESIS SUBMITTED

FOR THE DEGREE OF MASTER OF ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING
MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

2019

6. Declaration Page

The words on this page should be of a font size of 12 points. The following should be stated:

"*Declaration*

I hereby declare that this thesis is my original work and it has been written by me in its entirety. I have duly acknowledged all the sources of information which have been used in the thesis. This thesis has also not been submitted for any degree in any university previously."

Candidate should sign at the bottom of the page with the candidate's name and the date indicated.

Sample of the Declaration Page:

DECLARATION

I hereby declare that this thesis is my Original work and it has been written by me in its entirety. I have duly acknowledged all the sources of information which have been used in the thesis.

This thesis has also not been submitted for any degree in any university previously.

_____

Rafi Rahman

1 April 2019

7. Summary

The thesis must contain a summary of not more than 500 words written in the English Language in each copy of the thesis. The summary should be a miniature version of the thesis and should contain summary of the results, conclusions and main arguments presented in the thesis.

8. Photographs, Illustrations and Other Attachments

Photographic and other illustrations should be securely mounted using double-faced tape. Photograph album pockets or slits in the page are not adequate. In no circumstances should 'cellophane tape' or a similar material be used for any purpose in a copy of the thesis. All copies of the thesis should contain original photographs.

Subsidiary papers and other loose material should be bound in wherever possible. If this is not possible, an adequately guarded pocket for each material should be provided at the end of the thesis. Any such loose material (and corrigenda sheets, if not bound in) should bear the candidate's name, initials and degree.

9. Approval Page

The approval page has to be included in the hard bound final copy of the thesis.

Sample of the Approval Page:

The thesis titled …… …… Submitted by ……. Roll No: ……. Session: …… has been accepted as satisfactory in partial fulfillment of the requirement for the degree of …….. on……

Board of Examiners

1.	(Signature) Name of the supervisor Designation & Address	Chairman
2.	(Signature) Name of the supervisor Designation & Address	Member
3.	(Signature) Name of the supervisor Designation & Address	**Member**
4.	(Signature) Name of the supervisor Designation & Address	**Member (Ex-officio)**
5.	(Signature) Name of the supervisor Designation & Address	**Member (External)**

10. Main Bodies

1. CHAPTER TITLES SHOULD BE CENTERED BOLD 14 POINT Text in the chapter titles should be in upper case.

1.1 Secondary Headings Should be Flash Left 12 Point Bold

The first letter in each word of the secondary heading should be capitalized.

1.1.1 Third level headings should be flush left 12 point bold

Only the first letter of the first word of the third level heading should be capitalized

In the case of the paragraph starting left justified, there should be a spacing between the paragraphs. Otherwise, the paragraphs may be indented by a consistent amount.

The font, point size, positioning, numbering and referencing of equation:

The typeface for equations will be 12 point Times New Roman and are to be numbered sequentially by chapters (right justified). Reference for equation numbers in the text should be enclosed in parenthesis, such as (5.2).

The layout and numbering of figures and tables and their captions:

Figures should be centered between the left and right margin with their captions centered below the figure in point size 12 Times New Roman single spaced. Figures should be consecutively numbered per chapter. The word Figure may be abbreviated as "Fig". Tables should be centered between the left and right margin with their captions

(12 point Times New Roman) centered above the table. Tables should be consecutively numbered per chapter. Main heading and number of Figures and Tables should be bold.

Part B gives an overview of different chapters of a thesis.

11. References

A numbered list of references must be provided at the end of the thesis, before any appendices. The list should be numbered either in the order of citation in the text, or in alphabetical order, and there should be only one reference per reference number. Each reference number should be enclosed in square brackets. Samples are shown below:
Books:

[1] Brognakke, C. (1984), "Flame Propagation and Heat Transfer Effets in Spark Ignition Engines", In J. C. Hillard and G. S. Springer (eds.), Fuel Economy in Road Vehicles Powered by Spark Ignition Engines, chap 5, pp 183-224, Pienum Press, New York.

[2] Farrelly, D. (1966), "*The book of bamboo*", Thames and Hudson Ltd., London.

Journals/Periodicals:

[3] Benson, R. S., Garg, R. D. and Woolatt, D. (1964), "A Numerical Solution of Unsteady Flow Problems", *Journal of Mechanical Engineering*, vol. 6, pp. 117-144.

Articles from published conference proceedings:

[4] Nichols, M. A., Siegel, H. J. and Nation, W. G. (1990), "Minimizing memory requirements for partitionable SIMD/SPMD machines", *Proceedings of the International conference on Parallel Processing*, pp. 84-91.

Papers presented at conferences (unpublished):

[5] Ebehard, D. and Voges, E. (1984), "Digital single sideband detection for interferometric sensors", *presented at 2nd International conference on Optical Fiber Sensors*, Stuttgart, Germany.

Reports:

[6] GOB (1993), National housing policy 1993. Government of Bangladesh, Ministry of Housing and Public Works, Dhaka, Bangladesh.

Thesis:

[7] Rahman, M. A. (1998), "The structure of Turbulent Mixing Layers", *M. Sc. Engg. Thesis*, Department of Mechanical Engineering, BUET, Bangladesh, pp. 198.

12. Appendices

Appendices should contain supplementary material that the author considers necessary to the interpretation of the text itself. Long tables, essential raw data, detailed reports or computer are generally more appropriately included in an appendix. Appendices should not be longer that the body of the thesis and normally would be considerably shorter. If there is more than one appendix, the appendices should be numbered in sequence using Arabic numerals. Appendices should be numbered as A-1, A-2, … B-1, B-2… etc. for respective appendix.

13. Thesis Cover and Spine

The front cover and spine of the thesis should contain only the following information in BLOCK LETTERS. The font size on the cover should not exceed 16 points:

<table>
<tr>
<td>Thesis Cover:

• Thesis Title
• Candidate's Name
• Name of Institute
• Year of first submission</td>
<td>Thesis Spine:

Thesis Title (or an abbreviated title)
Candidate's Name
Year of first submission</td>
</tr>
<tr>
<td>Sample of Thesis Cover:

A MODELING STUDY OF WASTEWATER TREATMENT PLANT

RAFI RAHMAN

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY

2019</td>
<td>Sample of Thesis Spine

A MODELLING STUDY OF RAFI RAHMAN 2019
WASTEWATER TREATMENT PLANT</td>
</tr>
</table>

14. Type of Cover/Binding

For submission of your thesis for examination/re-examination, the thesis should be bound with soft cover (light blue with black lettering not exceeding 16 points) using saddle-stitch or perfect binding (spiral or ring-back binding is not acceptable).

For final submission the thesis/project report should be sewn and bound in strong, waterproof material. Color of the binding material for various degrees will be as follows. The Lettering in all cases will be in golden color.

PhD:	Black
M.Sc./M.Phil:	Dark Blue
M..Engg.:	Blue

Format of the thesis

Chapter 1 - Introduction (Thesis Body)	This is the most crucial chapter in the thesis and the one which requires the most careful consideration. The reader must be introduced, in a step by step fashion, to the purpose of the project, concepts and ideas related to the project and the structure of the following sections of the thesis. This section should endeavour to treat technical issues in a ***qualitative*** manner so that the reader can clearly understand the task at hand, without reference to other texts or periodicals. Formal page numbering for the body of the thesis begins in this section. Pages should preferably be numbered in a simple sequential order and should be chapter independent (ie: page numbers such as 1.2, 2.7 are not appropriate).
Chapters 2..N (Thesis Body)	This is the portion of the thesis in which literature surveys are discussed, research and development techniques are explained, theories, models and systems formulated and results evaluated. In general, the body of the thesis should be free from long, complex calculations, routine mathematical proofs, program code or large volumes of raw data. Page numbering continues on from the introductory chapter.
Chapter N+1 Conclusions and Recommendations for Further Work	This should draw together the main findings of the research program, together with findings of literature surveys carried out at the beginning and the end of the research program. Recommendations should also be made for future research in related areas. Page numbering should be a continuation from the previous section.
References	A listing of all references from which data has been abstracted for the purposes of the thesis. Preferably, the references should be listed in the order in which they are referred to in the body of the thesis. Page numbering is a continuation of previous sections.
Appendices	Appendices are used to store important calculations, proofs, tables or code which would interrupt the flow of qualitative descriptions in the body of the thesis. Each appendix has its own page numbering scheme. For example, Appendix A would have numbers A-1, A-2, etc. Appendix X would have numbers X-1, X-2, etc.
Index	This is generally an optional section in which common words or phrases, occurring in the body of the thesis are referenced to

	page numbers. Modern word-processors make the task of compiling an index considerably easier and hence authors may wish to include them. Page numbering can be a continuation of the Appendix Format.

\
Thesis Complexity by Chapter

Complexity	***Chapter***	***Function***
Lay-reader		Abstract
Lay-reader	1	Introduction
	2	Literature Review
Expert	3	Methodology and Implementation
	4	Experimental Procedures for Methodology Assessment
	5	Experimental Results and Observations
	6	Broad Context Discussion of Results and Relevance
Lay-reader	7	Conclusions and Recommendations for Further Work
-	-	References
-	-	Appendices

MILITARY INSTITUTE OF SCIENCE AND TECHNOLOGY, DHAKA

OFFICE OF THE MEMBER SECRETARY OF

THE COMMITTEE FOR ADVANCED STUDIES AND RESEARCH
Progress Report of a Postgraduate Student for Ph.D./M.Phil./M.Sc.Engg./M.Engg. Degree

(All the items/sub-items of the following list that are applicable to ones must be mentioned and filled in properly)

Part I: To be Completed by the Student:

1. **Name of the Student:** **Status:** Full Tim / Part Time
   Roll No: Session: Apr. 20…. / Oct. 20….
2. **Present Address:**
   Email: Tel No:
3. **Name of the Department:**
   Program (Ph.D./M.Phil./M.Sc.Engg./M.Engg.): Division (if any):
4. **Session of First Enrolment in the Program:**
5. **Name of Supervisor:**
6. **Title of the Thesis** (if approved by CASR)**:**
7. **Expected Date of Completion of Degree**:
8. **List of Courses so far Completed with Course No, Course Title, Credit Hour, Grade, Grade Point and GPA:** *(To be verified and signed by the Program Coordinator)*

Sl. No.	Course No	Course Title	Credit	Grade	Grade Point	GPA

Signature of the Program Coordinator

Date:

9. **Research Activities and Findings** *(within 200 words)***:**

10. **Publications (***List complete citations for all papers published and manuscripts in press or in preparation)***:**

Part II: To be Completed by the Supervisor:

11. **Comments by the Supervisor** *(Please provide a brief evaluation of the student's performance)***:**

12. Rating of Student's Performance by the Supervisor: (circle one)

Progress is excellent *Progress is satisfactory* *Progress is unsatisfactory*

---------- Signature of the Supervisor

Date:

---------- Signature of the Head of the Dept.

Date

2.7 Teaching Strategy

In class lecture, Research paper review, Literature review, Case study of different technical problems in relevant areas, Design problems, Economic and Environmental considerations, Effective data management procedure, Individual and Group projects and presentations etc.

The course instructor has the freedom to select any of the above mentioned process to conduct his instruction in class or he may use any justifiable teaching method to conduct his lecture in class.

2.8 Assessment strategy

Assessment Method	Percentage
Continuous assessment via class performance, class test, assignment, presentation, project, term paper, in class discussion etc.	**50%**
Final Exam	**50%**

Grading system followed in MIST is mentioned in section 2.6.4

CHAPTER 3

COURSE PROFILE FOR THE MASTERS DEGREE PROGRAMMES

3.1 Detailed Syllabus of Post Graduate Courses

The detailed syllabus of the courses listed in paragraph 2.5 is enumerated in this section by serial.

GENERAL COURSES

Course Title: Thesis

Course Code: ME 6000

Level: Post-graduation program

Credit Hour: 18 for M.Sc. Engineering and 45 for PhD degree

Contact Hour: As required and specified by the supervisor and concerned committee/board.

Objective: This credit courses will enable the students to be an individual researcher.

Rationale: Compulsory course for M.Sc. Engineering and PhD degree based on advanced level of research in line with theoretical courses undertaken and fields under the guidance of assigned supervisor or doctoral committee to undertake innovation and development in science and technology for the well-being of mankind.

Course Content: As defined and specified by supervisor and concerned board.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Address a physical and scientific problem for in depth study;
2. Utilize mathematical models or experimental means developed for scientific researches;
3. Develop new mathematical models or experimental means for further researches;

Teaching-learning Strategy: Research papers review, Literature review, Laboratory works, Field visits, Industry evaluation etc.

Assessment Strategy: As convenient by supervisor and concerned board/committee.

Linkage of LO with Assessment Methods & their Weights:

As convenient by supervisor and concerned board/committee.

Mapping of Course LO and Program Outcomes (PO):

Will remain flexible for supervisor

Reference Books:

1. As advised by supervisor/co-supervisor/board.

Grading system: As per approved grading scale of MIST

Course Title: Project

Course Code: ME 6000

Level: Post-graduation program

Credit Hour: 6 for M. Engineering

Contact Hour: As required and specified by the supervisor and concerned committee/board.

Objective: A student will learn to apply his knowledge to create a mechanical system to solve a specific problem.

Rationale: Compulsory course for M. Engineering on advanced level of research in line with theoretical courses undertaken and fields under the guidance of assigned supervisor to undertake innovation and development in science and technology for the well-being of mankind.

Course Content: As defined and specified by supervisor and concerned board.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

4. Address a physical and scientific problem for in depth study;
5. Utilize mathematical models or experimental means developed for scientific researches;
6. Develop new mathematical models or experimental means for further researches;

Teaching-learning Strategy: Research papers review, Literature review, Laboratory works, Field visits, Industry evaluation etc.

Assessment Strategy: As convenient by supervisor and concerned board/committee.

Linkage of LO with Assessment Methods & their Weights:

As convenient by supervisor and concerned board/committee.

Mapping of Course LO and Program Outcomes (PO):

Will remain flexible for supervisor

Reference Books:

2. As advised by supervisor/co-supervisor/board.

Grading system: As per approved grading scale of MIST

Course Title: Seminar

Course Code: ME 6001

Level: Post-graduation program

Credit Hour: Non-Credit course. But the thesis/project course will include the credit requirement of seminar for M.Sc. Engineering, M. Engineering and PhD degree.

Contact Hour: As specified by the supervisor and BPGS of ME Dept.

Objective: Students will learn to read scientific articles and present technical presentation.

Rationale: Compulsory course for for M.Sc. Engineering, M. Engineering and PhD degree based on ongoing advanced level of research in line with theoretical courses undertaken and fields under the guidance of assigned supervisor or BPGS of ME Dept.

Course Content: As defined and specified by supervisor and concerned board.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Present research works and review of research papers to the audience;
2. Interact with similar researchers;
3. Apply the research tools for further research.

Teaching-learning Strategy: Presentation and discussions.

Assessment Strategy: As convenient by supervisor and BPGS of ME Dept.

Linkage of LO with Assessment Methods & their Weights:

As decided by supervisor and concerned board/committee.

Mapping of Course LO and Program Outcomes (PO):

Will remain flexible for supervisor

Reference Books:

1. As advised by supervisor/co-supervisor/board.

Grading system: As per approved grading scale of MIST

Course Title: Engineering Problems

Course Code: ME 6003

Level: Post-graduation program

Credit Hour: 3

Contact Hour: As required and specified by the supervisor and concerned committee/board.

Objective: Students will explore different engineering problems and develop skills to solve those problems.

Rationale: Theoretical course encouraging guided reading and discussion about current engineering problems.

Course Content: As defined and specified by instructor.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Address a physical and scientific problem for in depth study;
2. Utilize mathematical models or experimental means developed for scientific researches;
3. Develop new mathematical models or experimental means for further researches;

Teaching-learning Strategy: Research papers review, Literature review, Laboratory works, Field visits, Industry evaluation etc.

Assessment Strategy: As convenient by supervisor and concerned board/committee.

Linkage of LO with Assessment Methods & their Weights:

As decided by supervisor and concerned board/committee.

Mapping of Course LO and Program Outcomes (PO):

Will remain flexible for supervisor

Reference Books:

1. As advised by supervisor/co-supervisor/board.

Grading system: As per approved grading scale of MIST

Course Title: Research Methods for Engineers

Course Code: ME 6007

Level: Post-graduation program

Credit Hour: 0

Contact Hour: 3 (per week)

Rationale: Theoretical course to understand the formal procedure to conduct a research, ethics and guideline should be followed during research.

Objective: Students will learn the basic norms for conducting scientific research.

Course Content: As defined and specified by instructor.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Understanding of the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the specific discipline.
2. Application of systematic approaches to the conduct and management of engineering projects.
3. Ethical conduct and professional accountability.
4. Effective oral and written communication in professional and lay domains.
5. Professional use and management of information

Teaching-learning Strategy: Research papers review, Literature review, Case study of ethical issues in different research lab, effective data management procedure etc.

Assessment Strategy: As decided by instructor.

Linkage of LO with Assessment Methods & their Weights:

As decided by instructor.

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2				x								
LO 3								x				
LO 4										x		
LO 5										x		

Reference Books:

1. As advised by supervisor/co-supervisor/board.

Grading system: As per approved grading scale of MIST

Course Title: Finite Element Methods

Course Code: ME 6183

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Students will learn finite element methods and its implication to solve different engineering problems.

Rationale: Theoretical course based on advanced level of mathematics to analyses of complex mechanical system using the finite element method.

Course Content: Overview of standard computational approaches; Variational and residual methods; Finite element modelling: Discretization schemes, Elements and shape functions, Derivation of element matrices and vectors, Assembly of element matrices and vectors, solution of finite element equations; Design of elements: Plane problems of elasticity, Three-dimensional and axisymmetric elements, Plate, shell and vibrating elements; Complete finite element solution of engineering problems.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Have sound mathematical background on finite element method
2. Convert a physical problem into a mathematical model.
3. Discretize the model appropriately and solve it.
4. Critically analyze the result to ensure correctness and further postprocessing.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Problem solving using finite element method etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x										
LO 3					x							
LO 4				x								

Reference Books:

1. An Introduction to finite element method. – J.N. Reddy
2. A First Course in the Finite Element Method - Daryl L. Logan;
3. Finite Element Analysis - S.S. Bhavikatti
4. Introduction to Finite Elements in Engineering - Tirupathi R. Chandrupatla, Ashok D. Belegundu.

Grading system: As per approved grading scale of MIST

Course Title: Advanced Numerical Analysis

Course Code: ME 6185

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Students will learn numerical analysis technique for engineering research.

Rationale: Theoretical course based on advanced level of mathematics to analyses of complex mechanical system using the numerical technique like finite difference method.

Course Content: Numerical computing and approximations; Numerical differentiation and Integration; Numerical solution of ordinary differential equations: Initial-value problems of linear and nonlinear system of equations, Shooting method, Boundary-value problems; Multi-segment method of solving unstable system of equations; Finite-difference technique of solving differential equations; Solution of linear Elliptic, Parabolic and Hyperbolic partial-differential equations: Engineering problems in Cartesian, cylindrical and spherical coordinate systems; finite-difference solution of non-linear partial-differential equations.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Have sound mathematical background on numerical computing method
2. Convert a physical problem into a mathematical model.
3. Solve initial value and boundary value problem.
4. Solve systems expressed by linear elliptic, parabolic and hyperbolic or nonlinear partial

differential equation.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Problem solving using numerical method etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-4	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x										
LO 3					x							
LO 4					x							

Reference Books:

1. Advanced Engineering Mathematics – P. V. Oneil;
2. Applied Numerical Analysis – G. Wheatley;
3. Theoretical Numerical Analysis - Introduction to Advanced Techniques – Peter Linz.
4. Numerical Methods for Engineers – Steven C. Chapra, Raymond P. Canale

Grading system: As per approved grading scale of MIST

Course Title: Advanced Mechatronics

Course Code: ME 6401

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Students will learn about advanced technique for electromechanical sensing and actuation.

Rationale: Theoretical course based on advanced electromechanical systems for sensing, actuation and control.

Course Content: Mechatronics systems overview; Sensors, transducers and actuators; System responses, transfer functions and closed loop controllers; Signals, interfacing, data processing and communications; Microprocessors and programmable logic controllers; Machine vision, industrial automation and robotics; Case studies.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge about the development and research direction in sensing, actuation and control.
2. Develop innovative solution to an automation problem.
3. Describe mechanical design within the context of intelligent solution and assess the interaction between sensing and actuation in designing intelligent mechanical system.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Problem solving using numerical method etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 2-3	Case study /Presentation/Oral examination	30%	
LO 1-3	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x										
LO 3		x			x							

Reference Books:

1. Mechatronics handbook - Robert H Bishop

2. Fundamentals of Robootics analysis and control - Robert J Schilling
3. Mechatronics System Design - Devdas Shetty
4. PIC micro controller and embedded systems - Mazidi and Mckinlay

Grading system: As per approved grading scale of MIST

Course Title: Fire Safety Engineering

Course Code: ME

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: The students will learn fire safety equipment design in tall buildings.

Rationale: Theoretical course based on advanced systems and equipment's used for firefighting in different areas.

Course Content: Theory of combustion, active and passive fire fighting systems, chemical fire fighting, ventilation system for fire fighting, fire fighting equipment and safety gears, respiratory system in fire fighting, automatic fire fighting system, fire hydrant system design, fire fighting system design of tall buildings and industrial areas.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge about the dynamics of combustion and propagation of fire.
2. Demonstrate knowledge about different existing firefighting technique.
3. Design fire hydrant system following national standards.
4. Design and analyze firefighting system of tall buildings and industrial areas.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 3	Class test/Assignment	15%	
LO 3, 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3			x		x							
LO 4			x		x	x						

Reference Books:

1. Fire Dynamics - Gregory E. Gorbett, James L. Pharr, and Scott Rockwell
2. Fire Suppression and Detection Systems - John L. Bryan
3. Fire Protection Systems - A. Maurice Jones
4. Engineering Guide: Fire Safety for Very Tall Buildings - Valerie Necka

Grading system: As per approved grading scale of MIST

Course Title: Advanced Electrical, Electronics and Communication Engineering in Military

Course Code: ME

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Students will learn different electrical and communication technique used in military communications.

Rationale: Theoretical course on advanced electrical and communication technology used in different militaries around the world.

Course Content: Advanced trends in dc and ac motors, dc generator, alternator and transformers. Analog and mixed signal IC design for wireless communications. Electronic vehicle control, drive and diagnoses system, PLC and microprocessor-based control system. Advanced technologies for electro-medical equipment; advanced wired and wireless communication system and trends in Military communications, high data rate analog and digital modulation techniques for Military communication system. Fiber optic and free-space optical (FSO) communications and their applications in military. Modern battle field surveillance system (IR, TI and LASER technology), control and stabilization technology, Electronic protections, support and counter measures (EP, ESM and ECM).

Remark: Both the instructor and students for this course will be from military.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on advancement and current state of motor, generator, alternator and generator technology.
2. Demonstrate knowledge on advanced communication system used in militaries around the world
3. Demonstrate knowledge on modern battlefield surveillance equipment
4. Design PLC and microprocessor based control system for military application.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3	x											
LO 4		x			x							

Reference Books:

1. Advanced Electrical and Electronics Engineering, Vol. 2 – Jian Lee
2. Electronic and Radio Engineeringm - F.E. Terman
3. Introduction to Programmable Logic Controllers - Glen Mazur and William J. Weindorf
4. Microcontroller programming - Julio Sanchez
5. Fiber Optic Communications: Fundamentals and Applications- M. Jamal Deen and Shiva Kumar

Grading system: As per approved grading scale of MIST

Course Title: Advanced Weapon Engineering

Course Code: ME

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Students will learn about small weapon design and guided weapon system.

Rationale: Theoretical course on different design and inspection procedure of light weapons.

Course Content: Weapon classification; light weapons/small arms: small arms theory and design, advanced trends in small arms, material selection and surface treatment, ballistics, firing and operating mechanism, sighting system and safety; gun system; design, barrel material and thermodynamics, breech system, recoil system, control system; guided weapon system: air frames, control, guidance, propulsion and warheads, weapon inspection/performance evaluation; working principles of various types of RADAR used in weapon system.

Remark: Both the instructor and students for this course will be from military.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge weapon classification and current trend of small weapon used by different military of advanced world.
2. Design and modify small arms in terms of material, ballistics, control, safety etc.
3. Demonstrate knowledge on guided weapon system.
4. Evaluate the performance of different gun system.
5. Demonstrate knowledge on RADAR system used in weapon system

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4-5	Case study /Presentation/Oral examination	30%	
LO 1-5	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x		x									
LO 3	x											
LO 4				x								
LO5	x											

Reference Books:

1. Small Arms: General Design - M. A. Toomey
2. Advances in Missile Guidance, Control, and Estimation
3. Guided Weapons - J. F. Rouse
4. Radar technology - Eli Brookner

Grading system: As per approved grading scale of MIST

Fluid Mechanics Courses

Course Title: Mechanics of Inviscid Incompressible Fluid

Course Code: ME 6123

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Students will learn to apply potential flow theory to solve different flow problem.

Rationale: Theoretical course based on fluid kinetics and potential flow theory to solve different practical flow problem.

Course Content: Kinematics of a fluid medium, complex variables, the fundamental hydrodynamic equations for an ideal fluid; The simplest cases of motion of an ideal fluid; Vortex motion of an ideal fluid; The plane motion of a body in an ideal fluid; The three-dimensional motion of a body in an ideal fluid, Potential flow theory and its application.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate advanced knowledge on the fluid kinetics.
2. Convert a practical flow problem into mathematical model using potential flow theory.
3. Analyze and solve a practical problem using knowledge of potential flow theory.
4. Demonstrate and apply complex variable method to solve engineering problems

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 3	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x	x		x								
LO 3			x									
LO 4	x	x										

Reference Books:

1. Advanced Fluid Mechanics - W.P. Graebel
2. Introduction to Fluid Mechanics - Fox and McDonald's
3. Inviscid Incompressible Flow - J.S. Marshall
4. Incompressible Flow - Panton
5. Fluid Mechanics - F.M. White

Grading system: As per approved grading scale of MIST

Course Title: Mechanics of Viscous Fluid

Course Code: ME 6125

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn application of Navier-Stokes equation to analyze different flow problem.

Rationale: Theoretical course based on flow equation of viscous fluid and its application to solve pipe flow, channel flow, flow over submerged body problem.

Course Content: Equations of motion for viscous fluid; energy equations; laminar flow of viscous fluids and its application; Boundary layer analysis for laminar and turbulent flow; Theories of turbulence; Jets, wakes and separated flows.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate advanced knowledge governing equations of viscous fluid flow.
2. Demonstrate knowledge on boundary layer analysis.
3. Analyze and solve different real flow over body problem.
4. Analyze laminar and turbulent flow used in different engineering problems.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 3-4	Class test/Assignment	15%	
LO 3-4	Case study /Presentation/Oral examination	30%	

LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3		x	x									
LO 4		x	x									

Reference Books:

1. Advanced Fluid Mechanics - W.P. Graebel
2. Introduction to Fluid Mechanics - Fox and McDonald's
3. Fluid Mechanics - F.M. White

Grading system: As per approved grading scale of MIST

Course Title: Mechanics of Inviscid Compressible Flow

Course Code: ME 6127

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about shock wave theory and its applictions.

Rationale: Theoretical course on shock wave dynamics to understand the generation and behavior of shock wave.

Course Content: Shock waves; Analysis of subsonic, supersonic and hypersonic flow fields, characteristic method and perturbation technique; Compressible flow in closed conduit.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Formulate and solve problems in one -dimensional steady compressible flow including: isentropic nozzle flow, constant area flow with friction (Fanno flow) and constant area flow with heat transfer (Rayleigh flow).
2. Derive the conditions for the change in pressure, density and temperature for flow

through a normal shock.
3. Determine the strength of oblique shock waves on wedge shaped bodies and concave corners.
4. Determine the change in flow conditions through a Prandtl-Meyer expansion wave.
5. Apply shock dynamics to analyze and solve high speed flight problems.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-4	Class test/Assignment	15%	
LO 5	Case study /Presentation/Oral examination	30%	
LO 1-5	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x	x	x									
LO 2	x			x								
LO 3	x			x								
LO 4	x			x								
LO 5		x										

Reference Books:

1. Applied Gas Dynamics - E. Rathakrishnan
2. Gas Dynamics - James E. A. John
3. Shock Wave Dynamics: Derivatives and Related Topics - George Emanuel

Grading system: As per approved grading scale of MIST

Course Title: Turbulence

Course Code: ME 6129

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about Turbulent flow and its physical application.

Rationale: Theoretical course on turbulent flow and its different types with application in different engineering problem and measurement of turbulence.

Course Content: Introduction to Origin of Turbulence, Equations for Reynolds stresses, Estimation of Reynolds stresses for different boundary conditions, Homogeneous and Isotropic Turbulence, Correlations between Turbulence Qualities, Integral Scale of Turbulence, Taylor's one-dimensional Energy spectrum, Hot Wire techniques in the measurement of Turbulent Flows.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate a good understanding of turbulence and the turbulent flow of liquids and gases (fluids).
2. Demonstrate understanding of turbulent flow cases.
3. Perform and analyze turbulence modelling. Eddy viscosity, mixing-length, Reynolds stress models.
4. Demonstrate turbulence measurement using Hot Wire technique

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 3	Class test/Assignment	15%	
LO 3	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3			x									
LO 4					x							

Reference Books:

1. Turbulent Flows - Pope Stephen B
2. Turbulent Flow - R J Garde
3. CFD Module: Turbulent Flow Modeling (Multiphysics Modeling) - Mehrzad Tabatabaian
4. Tackling Turbulent Flows in Engineering - Anupam Dewan

Grading system: As per approved grading scale of MIST

Course Title: Wind Power

Course Code: ME 6131

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about wind energy and wind machines.

Rationale: Theoretical course on wind power potential and application to solve sustainable energy problems.

Course Content: General introduction, wind energy assessment, wind site selection characteristics, site survey; Theory of power systems, Aerodynamics, turbulence, wind shear, drag and lifting translators; Wind machine fundamentals, machine characteristics, performance, system design for generation of electricity and water pumping, structural system, storage device.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Describe, understand, and analyze energy production systems employing wind power technologies
2. Comprehend and apply, at an advanced level, the engineering fundamentals of wind power systems
3. Use computational fluid dynamics (CFD) methods and specialist tools to design and analyze wind power systems
4. Critically review wind power system proposals, designs, and/or R&D activities. Demonstrate understanding of turbulent flow cases.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 4	Class test/Assignment	15%	
LO 3-4	Case study /Presentation/Oral examination	30%	
LO 2-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3			x		x							
LO 4				x		x	x					

Reference Books:

1. Wind energy explained, Theory Design and Application - J. F. Manwell
2. Wind Energy Basics: A Guide to Small and Micro Wind Systems - Paul Gipe

Grading system: As per approved grading scale of MIST

Course Title: Wind Turbines

Course Code: ME 6133

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about different wind turbine and blade design.

Rationale: Theoretical course on wind turbine, its design criteria and performance for renewable energy generation.

Course Content: Introduction, General Aerodynamics, Classification of Wind turbines, Theories of Wind turbines, Centrifugal force effect, blade tip effect and other effects on turbine performance; Aerodynamic design of wind turbines, constant and variable speed design, structural analysis, vibration and stress analysis; control system, safety system.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate deep understand on wind turbine theories and aerodynamics of wind turbine.
2. Analyze different factors that contribute in turbine performance and design required modification for optimal performance
3. Use computational fluid dynamics (CFD) methods and specialist tools to design and analyze wind turbine system.
4. Critically review wind turbine system proposals, designs, and/or R&D activities. Demonstrate understanding of safety and control features of wind turbine.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 4	Class test/Assignment	15%	
LO 3-4	Case study /Presentation/Oral examination	30%	
LO 2-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3			x		x							
LO 4				x		x	x					

Reference Books:

1. Introduction to Wind Turbine Aerodynamics - A. P. Schaffarczyk
2. Wind Turbine Engineering Design - David M. Eggleston, Forrest S. Stoddard
3. Wind Power Generation and Wind Turbine Design - Wei Tong
4. Wind Turbine Technology: Principles and Design - Muyiwa Adaramola

Grading system: As per approved grading scale of MIST

Course Title: Advanced Aerodynamics

Course Code: ME 6135

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about aerofoil theory.

Rationale: Theoretical course on aerodynamics to understand and improve the design of aviation machines.

Course Content: Introduction to incompressible inviscid flow; Vortex motion; Lifting line theory; induced velocity; Aerofoil theory; Joukowaskis transformation; Theories of propulsion; Axial momentum, Blade element, Cascade and vortex; Aerodynamic characteristics of aerofoils; Shock waves.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Identify the restrictions of the different numerical methods applied in aerodynamic design, and be able to select the most suitable numerical method for a given aerodynamics problem
2. Apply coupled viscous-inviscid strategies to analyze viscous flow past an airfoil, deciding appropriate parameters to model transition, and assessing the validity of the solution
3. Apply computational methods to solve a variety of fluid dynamics problems of aeronautical significance
4. Apply potential flow theory to simplify the solution technique in different aerodynamic problems
5. Select appropriate design parameters for subsonic and high-speed aerodynamic design.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2, 4	Class test/Assignment	15%	
LO 3, 5	Case study /Presentation/Oral examination	30%	
LO 1-5	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x	x										
LO 2		x										
LO 3			x		x							
LO 4			x									
LO 5				x								

Reference Books:

1. Fundamentals of Aerodynamics - John D Anderson

2. Hypersonic and High-Temperature Gas Dynamics, Second Edition - John D Anderson.
3. Computational Fluid Dynamics - John D Anderson.

Grading system: As per approved grading scale of MIST

Course Title: Computational Fluid Dynamics

Course Code: ME 6189

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about the application of CFD technique to solve flow problems.

Rationale: Advanced mathematical and computational course on fluid dynamics to model different flow problems to better analysis and design.

Course Content: Equations of motion, Discretisation, Solution algorithm, Parabolic and parabolic-elliptic flows, Turbulent flows calculation, Modelling of irregular geometry. Modelling of irregular geometry; construction of geometry, mesh generation, numerical solution and flow visualization.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Describe the major theories, approaches and methodologies used in CFD
2. Apply CFD methods (e.g. boundary conditions, turbulence modelling etc.) in commercial CFD codes and describe the limitations on accuracy
3. Apply CFD analysis to real engineering designs

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 1-2	Class test/Assignment	15%	
LO 2-3	Case study /Presentation/Oral examination	30%	
LO 1-2	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x			x							
LO 3		x	x		x							

Reference Books:

1. Computational Fluid Dynamics - John D Anderson.
2. An Introduction to Computational Fluid Dynamics: The Finite Volume Method - H. K. Versteeg and W. Malalasekera
3. Computational Fluid Dynamics: A Practical Approach - Chaoqun Liu, Guan Heng Yeoh, and Jiyuan Tu

Grading system: As per approved grading scale of MIST

Thermal Engineering Courses

Course Title: Classical Thermodynamics

Course Code: ME 6101

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about different theories and their applications in different complex thermodynamic problem.

Rationale: Theoretical course on advanced studies on classical thermodynamics for better understanding of thermodynamic processes.

Course Content: Fundamentals of classical thermodynamic, first and second laws; First law analysis of reactive system. Thermodynamic potentials, chemical and phase equilibrium, phase transitions, and thermodynamic properties of solids, liquids, and gases. Reversible and irreversible processes, entropy and other characteristic functions. Maxwell's relations. Equation of state and generalized co-ordinates; Equilibrium and stability.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate a clear understanding of the laws of thermodynamics
2. Analyze engineering processed involving phase transition to make the process more efficient.
3. Design and apply improved thermodynamics cycles to practical processes.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 1-2	Class test/Assignment	15%	
LO 3	Case study /Presentation/Oral examination	30%	
LO 1-3	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x										

LO 3		x	x									

Reference Books:

1. Fundamentals of Engineering Thermodynamics - E.Rathakrishnan.
2. Engineering Thermodynamics - P.K.Nag.
3. Thermodynamics: An Engineering Approach by Micheal A. Boles and Yunus A.Cengel

Grading system: As per approved grading scale of MIST

Course Title: Statistical Thermodynamics

Course Code: ME 6103

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about statistical approach to solve thermodynamic problem.

Rationale: Theoretical course on statistical thermodynamics for understanding thermodynamics process in microscopic view point.

Course Content: Kinetic theory of gases; Thermodynamic theory of radiation; Maxwell-Boltzman distribution, equipartition theorem; Mean free path; Bose-Einstein and Fermi-Dirac statistics; Entropy transport properties; Fluctuation. Thermodynamics of noise.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Discuss the physical interpretation and justify the use of different ensembles and superpositions as well as calculate thermodynamic properties in model systems
2. Justify and interpret interaction potentials as well as calculate thermodynamic properties using corresponding configuration integrals for different model systems
3. Apply concepts of statistical mechanics to explain different types of phase transitions

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 1-2	Class test/Assignment	15%	
LO 3	Case study /Presentation/Oral examination	30%	
LO 1-3	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x										
LO 3		x	x									

Reference Books:

1. Elements of statistical thermodynamics - Leonard Kollender Nash.
2. An Introduction to Statistical Thermodynamics - Terrell Hill
3. Classical and Statistical Thermodynamics - Ashley H. Carter

Grading system: As per approved grading scale of MIST

Course Title: Solar Energy

Course Code: ME 6111

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn the potential and use of solar energy.

Rationale: Theoretical course on solar energy to create a in depth understanding of different processes and devices for using solar energy and their design.

Course Content: Energy demand and conventional sources; Alternative sources; Solar energy, solar radiation extra-terrestrial and terrestrial; measurements, data and estimation; Direct utilization of solar energy, collection devices, storage; Solar cell, Solar water heaters, solar stills, solar refrigeration and other special topics.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Explain the technical and physical principles of solar cells and solar collectors, measure and evaluate different solar energy technologies through knowledge of the physical function of the devices,
2. Calculate the required size of solar cell systems and solar collectors from a given power need by using appropriate software,
3. Make critical comparisons of different solar energy systems,
4. Communicate technological, environmental and socio-economic issues around solar energy in a concise and an accessible way to a target group with basic technical skills.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 1-2	Class test/Assignment	15%	
LO 3	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x	x									
LO 3						x						
LO4						x	x					

Reference Books:

1. Handbook of Solar Energy: Theory, Analysis and Applications - Arvind Tiwari, G. N. Tiwari, and Shyam.
2. Solar Energy Engineering: Processes and Systems - Soteris Kalogirou
3. Solar Cells: Materials, Manufacture and Operation - Augustin McEvoy L. Castaner Tom Markvart

Grading system: As per approved grading scale of MIST

Course Title: Energy Engineering

Course Code: ME 6113

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about energy sources and its effective use.

Rationale: Theoretical course on energy sources to create a in depth understanding of different energy sources, consumption, future trend.

Course Content: Sources of energy, Energy consumption patterns: Life-cycle cost calculations; Energy demand forecasting. Energy conversion methods. Energy use in industry, residential, commercial, and transport sector and its future trend; Energy efficiency; Energy management and conservation; Impacts of energy utilization on Environment.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Discuss and compare various types of energy resources and the principles for converting from one form to another
2. Analyze and evaluate energy use over the lifecycle of a product or project
3. Collect data from thermodynamic systems and evaluate the performance of the system
4. Evaluate the global considerations of energy production, management and conservation including the environmental and economic impact of common

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 1-2	Class test/Assignment	15%	
LO 3-4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2							x					
LO 3				x								
LO4							x					

Reference Books:

1. Handbook of energy engineering - Albert Thumann, D. Paul Mehta
2. Renewable Energy Engineering - Janaka Ekanayake, Nicholas Jenkins
3. Wind Energy Engineering, Second Edition - Pramod Jain

Grading system: As per approved grading scale of MIST

Course Title: Advanced Conduction and Radiation Heat Transfer

Course Code: ME 6143

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about conduction and radiation heat transfer in different engineering processes.

Rationale: Theoretical course on conduction and radiation mode of heat transfer and their application in different engineering problem.

Course Content: Steady and unsteady state conduction, solutions by analytical, numerical and analogue methods, Thermal radiation processes and evaluation of heat exchange by different methods.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge of the mechanisms of conduction and radiation heat transfer
2. To quantify steady and transient temperature in important engineering problems often encountered
3. Demonstrate mechanisms of radiative transport in enclosures, absorbing, emitting and scattering media as well as the interaction of thermal radiation with other modes of heat transfer.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 2-3	Case study /Presentation/Oral examination	30%	
LO 1-3	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x										

LO 3	x	x										

Reference Books:

1. Heat Transfer: Basics and Practice - Thomas Wetzel, Peter Böckh
2. Thermal Radiation Heat Transfer 6th Edition - John R. Howell, M. Pinar Mengüç, Robert Siegel
3. Advanced Heat Transfer - Greg F. Naterer

Grading system: As per approved grading scale of MIST

Course Title: Advanced Convection Heat Transfer

Course Code: ME 6145

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about convection heat transfer and its application in different engineering process.

Rationale: Theoretical course on convection heat transfer and its application in different engineering problem.

Course Content: Convection fundamentals. Forced convection, natural convection, transport equations, differential similarity, Heat transfer in fully developed pipe and channel flow, pipe entrance flow, laminar boundary layers, and turbulent boundary layers. Transport in rarefied gases. Condensation and evaporation, convective mass transfer. General introduction to heat transfer in complex flows.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge in convective heat transport equation and assess their importance by an order of magnitude analysis.
2. Analyze classical external and internal convective flows using differential and integral solution techniques.
3. Demonstrate in depth knowledge in different condensation and evaporation process encountered in engineering applications.
4. Demonstrate understanding of complex flow heat transfer

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 2-4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x										
LO 3	x	x										
LO4	x											

Reference Books:

1. Convective Boiling and Condensation - John G. Collier, John R. Thome
2. Heat Transfer in Condensation and Boiling - K. Stephan
3. Advanced Heat Transfer - Greg F. Naterer

Grading system: As per approved grading scale of MIST

Course Title: Design of Heat Transfer Equipment

Course Code: ME 6147

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn to design and develop different heat transfer equipment.

Rationale: Theoretical design and analysis of heat transferring device like heat exchanger, using knowledge of forced and free convection and boiling heat transfer.

Course Content: Forced convection, natural convection, heat exchange theories; Application to the design of heat transfer devices; Different types of heat exchangers, analysis and design.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate good understanding of free and forced convection heat transfer
2. Design and analysis of heat exchanger for optimal performance.
3. Modification of existing design to improve the performance of heat exchangers

commonly used industries.
4. Compare different heat exchangers to play a decision-making role in selecting heat exchanger.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2			x									
LO 3			x									
LO4	x			x								

Reference Books:

1. Fundamentals of Heat Exchanger Design - R. K. Shah
2. Heat Exchangers: Selection, Rating, and Thermal Design, Third Edition - Anchasa Pramuanjaroenkij, Hongtan Liu, and S. Kakaç
3. Advanced Heat Transfer - Greg F. Naterer
4. Heat Transfer Equipment Design - R. K. Shah, Eleswarapu Chinna Subbarao, R. A. Mashelkar

Grading system: As per approved grading scale of MIST

Course Title: Boiling and Condensation Heat Transfer

Course Code: ME 6151

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about the fundamentals of boiling and condensation.

Rationale: Theoretical course on boiling and condensation heat transfer to generate an in depth understanding in this two phase heat transfer mechanism.

Course Content: Introduction to pool boiling, different boiling regime; fundamentals of two-phase flow, mathematical and empirical methods of studying boiling, hydrodynamic instability; enhanced boiling heat transfer, estimation methods; burnout; condensation- modes, gas phase heat and mass transfer, filmwise condensation on horizontal and inclined tubes and surfaces; condensation promoters.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate good understanding of different regimes of boiling to safely operate any device using boiling heat transfer
2. Analyze the performance of existing devices to improve the boiling heat transfer performance.
3. Design and study boiling and condensation on different surfaces for improved heat transfer
4. Design new devices to improve the heat transfer in different engineering applications.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2	Class test/Assignment	15%	
LO 3-4	Case study /Presentation/Oral examination	30%	
LO 1-3	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x										
LO 3			x									
LO4			x									

Reference Books:

1. Convective Boiling and Condensation - John G. Collier, John R. Thome
2. Heat transfer in condensation and boiling - Karl Stephan
3. Advanced Heat Transfer - Greg F. Naterer

4. Boiling heat transfer and two-phase flow - L S Tong, Y S Tang

Grading system: As per approved grading scale of MIST

Course Title: Inverse Heat Transfer Problems

Course Code: ME 6153

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about inverse heat transfer problem.

Rationale: Theoretical course on inverse heat transfer to numerically solve heat transfer problem arising in engineering and research environment.

Course Content: Statements and use of inverse problems in studying heat transfer processes. Analysis of statements and solution methods for IHTPs. Analytical forms of boundary inverse heat conduction problems. Solutions of boundary IHCPs by direct numerical methods and by Laplace transform techniques.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge to formulate and analyze ill posed inverse heat transfer problems and apply inverse heat transfer techniques to solve them.
2. Demonstrate basic mathematical principles on which inverse heat transfer techniques are based on.
3. Solve and analyze optimization problem appear in thermal industry.
4. Analyze and solve boundary inverse heat transfer problem using numerical methods.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2	Class test/Assignment	15%	
LO 3-4	Case study /Presentation/Oral examination	30%	
LO 1-3	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x										
LO 3		x										
LO4		x			x							

Reference Books:

1. Inverse Heat Transfer Problems - Alifanov, Oleg M
2. Inverse Heat Conduction: Ill-Posed Problems - James V. Beck, Ben Blackwell, Charles R. St. Clair, Jr.
3. Advanced Heat Transfer - Greg F. Naterer
4. Inverse Heat Transfer: Fundamentals and Applications - M. Necat Ozisik

Grading system: As per approved grading scale of MIST

Course Title: Heat Transfer Enhancement

Course Code: ME 6155

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about different techniques and procedure to increase heat transfer in a system.

Rationale: Theoretical course on different processes and modifications to enhance heat transfer in different heat transferring devices to improve their performance.

Course Content: Concept of enhanced heat transfer surfaces; Its application; Performance evaluation criteria, Extended plate and Fin surfaces; Internally finned tubes and annuli; Insert devices; Externally finned tubes; Integral roughness; Enhancement by additives for gases and liquids; Enhancement in magnetic and electric fields; Swirling and flow structures in enhanced surfaces; Fouling on enhanced surfaces; Application in two-phase systems; Boiling and condensation; Enhancement rate in laminar and turbulent flows; Enhanced heat transfer correlations and estimation.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on different modification and processes to enhance heat transfer.
2. Design new devices with enhanced heat transfer capability.
3. Demonstrate knowledge on different advanced heat transfer enhancement process.
4. Estimate different enhancement process using existing correlations.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 3-4	Class test/Assignment	15%	
LO 2	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x	x									
LO 3	x											
LO4		x										

Reference Books:

1. Advances in Heat Transfer Enhancement - Saha, S.K., Tiwari, M., Sundén, B., Wu, Z
2. Heat Transfer Enhancement Techniques. with Special Attention to Passive Methods of Heat Transfer Enhancement - Chakole M M.

Grading system: As per approved grading scale of MIST

Course Title: Alternative Fuels for Engines

Course Code: ME 6157

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about different alternative fuel sources and their performance.

Rationale: Theoretical course on different alternative fuels that is used or can be used to reduce dependency on fossil fuel and better engine performance.

Course Content: Alternative fuels: 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 oils and Hydrogen as fuel for internal combustion engines.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge understands the preparation, properties and applications of synthetic fuels from renewable sources and from unconventional sources of liquid and gaseous hydrocarbons.
2. Demonstrate knowledge on production, storage and use of hydrogen, biofuel production from biomass and waste.
3. Demonstrate knowledge on conversion system of automobiles for using CNG and other form of alternative fuels.
4. Study and compare the potential of different novel alternative fuel source with environmental and economic impact.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3	x											
LO4				x		x	x					

Reference Books:

1. Prospects of Alternative Transportation Fuels - Singh, A.P., Agarwal, R.A., Agarwal, A.K., Dhar, A., Shukla, M.K.
2. Alternative Fuels: The Future of Hydrogen - Michael Hordeski.

3. Alternative Fuels for Transportation

Grading system: As per approved grading scale of MIST

Course Title: Thermal Environmental Engineering

Course Code: ME 6161

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about the thermal activities in environment.

Rationale: Theoretical course on advanced refrigeration and air condition methods, system design and performance evaluation.

Course Content: Mechanical vapor compression refrigeration systems and details of their components; Refrigerant flow controls; Refrigerant piping and accessories; Absorption refrigeration system and cycle analysis; Miscellaneous refrigeration processes; Refrigeration applications to food preservation; Defrost methods; Electric motors and controls; Heat 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.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on different types of refrigeration and air conditioning process.
2. Design of systems for different applications of refrigeration.
3. Study and implement and deforestation in devices, motor control for optimal performance.
4. Study and design air conditioning and distribution system.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2	Class test/Assignment	15%	
LO 3-4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x										
LO 3		x										
LO4		x										

Reference Books:

1. HVAC Systems Design Handbook, Fifth Edition - Roger W. Haines, Michael E. Myers.
2. Air Conditioning System Design - Roger Legg.
3. Refrigeration and Air-Conditioning - R.K. Rajput

Grading system: As per approved grading scale of MIST

Course Title: Combustion Engineering

Course Code: ME 6163

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about different combustion processes in engines.

Rationale: Theoretical course on combustion process in engines.

Course Content: Fuels, Thermodynamics and Chemical Kinetics of Combustion. Flames, Gas-fired furnace combustion, Premixed charge engine combustion, Conservation equations for multi-component reacting flows; propagation of laminar premixed flames and detonation, Detonation of gaseous mixtures. Spray formation and droplet behavior, Oil-fired furnace combustion, Gas turbine spray combustion, Direct injection engine combustion, Detonation of liquid-gaseous mixtures. Solid fuel combustion mechanism, Fixed-bed combustion, Suspension burning, Fluidized bed combustion.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on the ongoing role of combustion, both of fossil and bio-fuels, in providing a more sustainable energy source for society, and the environmental challenges to be met to achieve this.
2. Demonstrate in depth knowledge on premixed flame, spray formation, direct injection etc. fuel supply system.
3. Demonstrate knowledge on solid fuel combustion and other form of non-conventional fuel combustion.

4. Design and analysis of combustion process for better combustion and exhaust quality.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3	x											
LO4		x										

Reference Books:

1. Combustion engineering - Gary L. Borman, Kenneth W. Ragland.
2. An Introduction to Combustion: Concepts and Applications - Stephen R. Turns.
3. Advanced Direct Injection Combustion Engine Technologies and Development: Gasoline and Gas Engines

Grading system: As per approved grading scale of MIST

Course Title: Radiative Heat Transfer

Course Code: ME 6165

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about advanced radiation heat transfer.

Rationale: Theoretical course on radiation heat transfer.

Course Content: The fundamentals of thermal radiation heat transfer; blackbody radiation laws; radiative properties of non-black surfaces; analysis of radiative exchange between surfaces and in enclosures; combined radiation, conduction, and convection; radiative transfer in absorbing, emitting, and scattering media. Advanced material for students with interests in heat transfer, as applied in high-temperature energy conversion systems.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on radiation heat transfer from gray and black body, radiation laws, radiation heat transfer from surface to enclosure.
2. Demonstrate and study radiation heat transfer coupled with conduction and convection.
3. Demonstrate high temperature energy conversion system.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 2-3	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x						x			x		
LO 2	x											
LO 3	x					x						
LO4	x									x		

Reference Books:

1. Thermal Radiation Heat Transfer, 5th Edition - John R. Howell, M. Pinar Menguc, Robert Siegel.
2. Essentials of Radiation Heat Transfer - C. Balaji.
3. Analytical Heat Transfer - Je-Chin Han

Grading system: As per approved grading scale of MIST

Course Title: Advanced Heat Conduction

Course Code: ME 6167

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about advanced application of conduction heat transfer.

Rationale: Theoretical course on radiation heat transfer.

Course Content: Physical description of heat conduction in solids, liquids, and gases. The heat diffusion equation and its solution using analytical and numerical techniques. Data and microscopic models for the thermal conductivity of solids, liquids, and gases, and for the thermal resistance at solid-solid and solid-liquid boundaries. Introduction to the kinetic theory of heat transport, focusing on applications for composite materials, semiconductor devices, micromachined sensors and actuators, and rarefied gases.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on physical understanding of heat conduction in different materials, heat diffusion equation.
2. Demonstrate and analyze conduction using analytical and numerical methods.
3. Design thermal systems with solid-solid and solid liquid boundary used in different engineering applications.
4. Demonstrate knowledge in kinetic theory of heat conduction and apply it to different devices.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x				x							
LO 3			x									
LO4	x											

Reference Books:

1. Heat Transfer: Basics and Practice - Thomas Wetzel, Peter Böckh
2. Thermal Radiation Heat Transfer 6th Edition - John R. Howell, M. Pinar Mengüç, Robert Siegel
3. Advanced Heat Transfer - Greg F. Naterer

Grading system: As per approved grading scale of MIST

Applied Mechanics Courses

Course Title: Tribology

Course Code: ME 6007

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about contact surface and its engineering applications.

Rationale: Theoretical course on tribology to understand the mechanics of in contact surfaces, friction and wear and different lubrication technique to increase the life time of machineries.

Course Content: Fundamentals of tribology; Engineering surfaces - characterization and statistical description of engineering surfaces; Mechanics of contact - Hertz theory and GW model; Friction and wear; Thermal effects in sliding contact. Lubrication and lubricants; Rheology of lubricants; Regimes of lubrication; Theory and application of hydrodynamic lubrication; Boundary friction and extreme pressure lubrication. Elasto-hydrodynamic lubrication (EHL) theory; Rolling element bearings; Nanotribology.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on surface degradation mechanisms for materials lifetime, mechanics of solid elastic and elastoplastic contacts.
2. Analyze and compare different types of lubrication: boundary, solid-film, hydrodynamic, and hydrostatic lubrication.
3. Design tribological surfaces and troubleshoot tribology problems.
4. Apply knowledge of tribology in minimizing energy consumption, extending product life, and protecting the environment.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x	x										
LO 3			x									
LO4						x	x					

Reference Books:

1. Fundamentals of Tribology - Homer Rahnejat, R. Gohar
2. Friction, wear, lubrication - K. C. Ludema
3. Fluid Film Lubrication - Andras Z. Szeri
4. Tribology for Engineers: A Practical Guide - J Paulo Davim

Grading system: As per approved grading scale of MIST

Course Title: Advanced Dynamics

Course Code: ME 6171

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about advanced dynamic systems.

Rationale: Theoretical course on advanced dynamics systems for better understanding and control of the system.

Course Content: Generalized coordinates, Constraints, Virtual displacement, Virtual work; Lagrange's equations; Kane’s method; Small oscillation; Dynamics of rigid bodies in three dimensions; Gyroscopic motion; Introduction to Hamiltonian mechanics.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on the position, velocity, angular velocity, acceleration, and angular acceleration vectors associated with three-dimensional rigid body motion.
2. Formulate and solve kinematics problems for mechanical devices with constraints.
3. Generate and solve the dynamic equations of motion for systems of rigid bodies using Newtonian dynamics.
4. Demonstrate different aspect of Hamiltonian mechanics.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x	x										
LO 3		x										
LO4	x											

Reference Books:

1. Advanced Dynamics - Donald T. Greenwood
2. Advanced Dynamics of Mechanical Systems - Federico Cheli, Giorgio Diana
3. Advanced dynamics for engineers - Bruce J. Torby

Grading system: As per approved grading scale of MIST

Course Title: Mechanical Vibrations

Course Code: ME 6173

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about vibration and its control in engineering applications.

Rationale: Theoretical course on vibration to clearly understand the reasons of vibration in engineering devices and the ways to isolate the vibration.

Course Content: Single degree of freedom system; Coupled two mass systems. Energy methods. Forced vibrations. Different types of damping. Polar plots. Vibration isolation. Vibration absorbers. Effects of couple modes. Multi-degree of freedom systems. Shock loading. Normal modes of continuous systems. Non-linear systems.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Develop mathematical model of dynamic systems with single degree of freedom,
2. Develop mathematical model of dynamic systems with multiple degrees of freedom,
3. Calculate natural frequency and period of simple vibrating mechanical systems,
4. Obtain the analytical solution for system's time response,
5. Deal with engineering systems involving vibration isolation and rotating imbalance.
6. Demonstrate good understanding of shock loading and non-linear systems.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 2-4	Class test/Assignment	15%	
LO 5-6	Case study /Presentation/Oral examination	30%	
LO 1-6	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3		x										
LO4		x										
LO5				x								
LO6	x											

Reference Books:

1. Mechanical vibrations - William T Thomson
2. Engineering vibrations - William J. Bottega
3. Fundamentals of Vibrations - Leonard Meirovitch

Grading system: As per approved grading scale of MIST

Course Title: Applied Elasticity

Course Code: ME 6175

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about stress strain theory in 3D coordinate system.

Rationale: Theoretical course on elastic properties of materials to design and study machine members using advanced theories of elasticity.

Course Content: Three-dimensional stress and strain analysis, governing equations; Plane elasticity, Stress functions; Stress concentrations; St. Venant's principle; Concentrated and line loads; Superposition principle; Torsion of prismatic bars; Energy methods for solution; Thermoelasticity. Principle of stationary potential energy. The reciprocal theorem of Maxwell and Beth.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Apply linear elasticity in the design and analysis of structures such as beams, plates, shells and sandwich composites
2. Apply hyper elasticity to determine the response of elastomer-based objects,
3. Analyze the structural sections subjected to torsion,
4. Design and analyze devices considering stress concentration, different types of concentrated and line load commonly found in engineering applications,
5. Demonstrate good understanding of energy method, reciprocal theorem of Maxwell and Beth for designing purposes.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 5	Class participation and observation	5%	
LO 1-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-6	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1		x										
LO 2		x										
LO 3		x										
LO4			x									
LO5	x											

Reference Books:

1. Advanced Mechanics of Materials and Applied Elasticity (5^{th} edition) - Ansel C. Ugural, Saul K. Fenster
2. Applied Elasticity and Plasticity - Mumtaz Kassir
3. Applied Elasticity - J D Renton

Grading system: As per approved grading scale of MIST

Course Title: Theory of Plates and Shells

Course Code: ME 6177

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about plate and shell theory and their application in design.

Rationale: Theoretical course on plate and shell to have in depth knowledge about the behavior of these members under different loading condition.

Course Content: Classical theory of plates; Large deflection theory of plates; Membrane theory of shells; Bending theory of shells applied to shells of revolutions and cylindrical shells.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate clear understanding of the mechanics of plate and shell structure used in engineering application.
2. Design and analyze plate structure with large deflection
3. Design machine elements with shell structure under bending and other types of load.
4. Critically analyze the safety of different existing structure having shell and plate elements.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2			x									
LO 3			x									
LO4				x								

Reference Books:

1. Theory and design of plate and shell structures - Maan H Jawad
2. Theory and Analysis of Elastic Plates and Shells - J. N. Reddy
3. Plates and Shells: Theory and Analysis, Fourth Edition - A. C. Ugural

Grading system: As per approved grading scale of MIST

Course Title: Elastic Stability of Structures

Course Code: ME 6179

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about the determination of elastic stability of a structure.

Rationale: Theoretical course on the stability of elastic members under various loading condition.

Course Content: General stability theory: Discrete and continuous systems. Introduction to calculus of variation. Approximate methods. Buckling of column frames, flexure elements, plates and shells.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate clear understanding of the theory of structural stability and nonlinear structural behavior, discrete and continuous system.
2. Demonstrate clear understanding of the techniques to analyze geometrically perfect and

imperfect systems for structural stability
3. Demonstrate clear understanding of different techniques to classify post-buckling phenomena.
4. In depth knowledge in variational calculus and approximate methods.
5. Design and analyze column, flexure elements under bucking load.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-3	Class participation and observation	5%	
LO 4	Class test/Assignment	15%	
LO 5	Case study /Presentation/Oral examination	30%	
LO 1-5	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3	x											
LO4	x											
LO5			x									

Reference Books:
1. A general theory of elastic stability - Michael Thompson
2. Theory of elastic stability - Stephen Timoshenko
3. Theory of Elastic Stability: Analysis and Sensitivity - A. Godoy

Grading system: As per approved grading scale of MIST

Course Title: Experimental Stress Analysis

Course Code: ME 6181

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about different experimental technique to measure stress in engineering devices.

Rationale: Theoretical course on different technique used in measuring and analyzing engineering stress in machine members.

Course Content: Resistance strain gauges and associated circuits; Strain gauge rosettes. Semiconductor strain gauges. Other electrical, mechanical, pneumatic, and optical strain measuring devices. Recording of dynamic strain measurements. Stress probing. Residual stress. Principles of photoelasticity. Isoclinic and isochromatic fringes. Compensation techniques. Stress freezing Oblique incidence and scattered light methods, Photoelastic coating techniques. Brittle lacquer technique. Analysis of experimental results.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate clear understanding concept of stress and strain and different techniques used in measuring strain in industry.
2. Install and use different types of strain gauge for measurement and analysis.
3. Demonstrate clear understanding of the principles of photoelasticity, isoclinic and isochromatic firnges.
4. Use photoelasticity as a measuring tool.
5. Analyze and comment on the condition of a structure from the experimental data.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1, 3	Class participation and observation	5%	
LO 2, 4	Class test/Assignment	15%	
LO 5	Case study /Presentation/Oral examination	30%	
LO 1-5	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2					x							
LO 3	x											
LO4					x							
LO5				x								

Reference Books:

1. Experimental Stress Analysis - Jindal U C
2. Experimental Stress Analysis for Materials and Structures: Stress Analysis Models for Developing Design Methodologies - Alessandro Freddi
3. Modern Experimental Stress Analysis: Completing the Solution of Partially Specified Problems - James F. Doyle
4. Interference-optical Methods of Solid Mechanics - Igor A. Razumovsky

Grading system: As per approved grading scale of MIST

Course Title: Engineering Acoustics and Noise Control

Course Code: ME 6191

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about acoustics and noise control in engineering systems.

Rationale: Theoretical course on the generation, propagation and attenuation of noise in different systems.

Course Content: Origin of sound; Wave equation and its solution in gases and liquids; Reflection and transmission of plane waves; Wave equation and its solution in solids; Energy methods: relation between wave theory and energy-based methods; Sound generation and propagation mechanisms; Sound field characterization. Sound propagation in ducts; Silencers: Principles and design of silencers. Systemic approach to noise control: Noise control at source; Noise control along path; Noise control at the receiver. Sound control materials: absorber, barrier and damper. Flow induced noise and vibration in pipes: Noise generation, transmission and radiation; Noise control techniques. Noise measurement: Equipment and procedure, impedance, power, intensity, directivity, microphones, sound intensity probes, sound level meters, sound dose meters, frequency analyzers.Human response to noise: Hearing mechanism; Hearing loss and protection, OSHA standards; Noise regulations.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge of the fundamental assumptions related to the derivation of the wave equation and 1D and 3D solution of wave equation.
2. Demonstrate knowledge on energy methods: relation between wave theory and energy-based methods.
3. Design silencer and analyze or compare among the performances of existing silencers.
4. Demonstrate knowledge on noise generation and transmission through pipes and ducts and their attenuation method.
5. Use noise measuring instruments.
6. Demonstrate good understanding and application of OSHA standard.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 3,4	Class test/Assignment	15%	
LO 5-6	Case study /Presentation/Oral examination	30%	
LO 1-6	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3		x										
LO4	x											
LO5					x							
LO6	x											

Reference Books:

1. Engineering Acoustics: An Introduction to Noise Control - Michael Moser
2. Active Control of Sound - Paul A. Nelson, S. J. Elliott
3. Acoustic design and noise control - Michael Rettinger

Grading system: As per approved grading scale of MIST

Course Title: Variational Methods in Structural Mechanics

Course Code: ME 6193

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about variational methods.

Rationale: Theoretical course on variational methods for analyzing structural members for safe and efficient design.

Course Content: General concept and principles of statics: system configuration and coordinates, work and energy, principle of virtual work, complementary work and complementary energy, principle of virtual complementary work, strain energy, potential energy. Principles of solid continuum mechanics: state of stress and strain, constitutive relations for materials, compatibility and equilibrium conditions, formulation of problems for stress analysis. Principles of variational calculus, concept of functional and its variation, Delta operator, Euler-Lagrange equations; Direct methods of variational calculus: Castigliano's theorem, stationary total potential energy method, Least-squares method, Rayleigh-Ritz method, Collocation method, Galerkin's method; Application of variational methods to beam problems, torsion problems and plate problems; Application of variational methods to finite element formulation for stress analysis of structural components.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge of principle of statics, virtual work, complementary work and complementary energy, strain energy and potential energy.
2. Formulate mathematical problem based on real machine members and subsequent stress analysis.
3. Design and analysis beam, torsional member for engineering application.
4. Apply finite element tools using variational methods for structural analysis.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-3	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2			x									
LO 3			x									
LO4	x				x							

Reference Books:

1. Energy Principles and Variational Methods in Applied Mechanics 3rd Edition - J. N. Reddy
2. Basic Variational Principles of Structural Mechanics Theory and Applications - Vladimir Slivker
3. The Finite Element Method for Solid and Structural Mechanics - O.C. Zienkiewicz, R.L. Taylor, David Fox

Grading system: As per approved grading scale of MIST

Course Title: Mechanical behaviour of Engineering Materials

Course Code: ME 6201

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn to select engineering materials based on their behavior.

Rationale: Theoretical course to understand the mechanical behavior of different materials under different loading condition for optimal and safe design and application.

Course Content: Deformation, elastic behaviour, plastic behaviour, elasto-plastic behaviour, non-linearly elastic material behavior, creep and creep rupture; fatigue fracture, brittle fracture, ductile fracture.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on elastic, plastic, viscoelastic behavior of different engineering materials.
2. Demonstrate knowledge on different failure criteria of materials.
3. Demonstrate transition of mechanical properties of materials under different loading condition.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 2-3	Case study /Presentation/Oral examination	30%	
LO 1-3	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3	x											

Reference Books:

1. The science and engineering of materials - Donald Askeland
2. Materials Selection in Mechanical Design - Michael F. Ashby
3. Fundamentals of Materials Science and Engineering - William Callister

Grading system: As per approved grading scale of MIST

Course Title: Structure and Properties of Engineering Materials

Course Code: ME 6203

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about atomic structure and properties of engineering materials.

Rationale: Theoretical course to understand the structural and metallurgical properties of engineering materials for optimal and safe design and application.

Course Content: Atomic forces, atomic bonding, diffusion, dislocation, motion of dislocation, kinetics of dislocation, mechanical behaviour of single crystal, mechanical behaviour of polycrystals: Strain hardening, alloy hardening, solution hardening; Precipitation hardening, cracks, nucleation and propagation, Plastic wave propagation.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on fundamental construction of materials.
2. Demonstrate knowledge on crystallographic orientation and their physical implication on mechanical properties.
3. Demonstrate knowledge on different metallurgical process used to modify crystallographic structure of materials to modify their behavior.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 2-3	Case study /Presentation/Oral examination	30%	
LO 1-3	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3	x											

Reference Books:

4. The science and engineering of materials - Donald Askeland
5. Materials Selection in Mechanical Design - Michael F. Ashby
6. Fundamentals of Materials Science and Engineering - William Callister

Grading system: As per approved grading scale of MIST

Course Title: Theory of Plasticity

Course Code: ME 6205

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about the properties of materials in plastic zone.

Rationale: Theoretical course to understand the plastic deformation of materials under different loading condition.

Course Content: Phenomenological nature, stress analysis, strain analysis, yield criteria of metals, stress-strain relations, strain hardening characteristics, plasticity conditions, deformation equations, buckling, necking, some methods of solving forming problems, extrusions, drawing, slip-line solution.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on stress- strain analysis, relation, plasticity of materials.
2. Demonstrate knowledge on deformation equation and their different solution technique.
3. Demonstrate knowledge on different plastic deformation process like extrusion, drawing, buckling etc.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 2-3	Case study /Presentation/Oral examination	30%	
LO 1-3	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3	x											

Reference Books:

1. The science and engineering of materials - Donald Askeland
2. The mathematical theory of plasticity - Rodney Hill
3. Foundations of the theory of plasticity - L. M Kachanov

Grading system: As per approved grading scale of MIST

Course Title: Mechanics of Composite Materials

Course Code: ME 6209

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about the fundamentals of composite materials.

Rationale: Theoretical course on composite materials, their characteristics, mechanical behavior, different types of commonly used composites and modes of failure.

Course Content: Composite materials and their characteristics; Micromechanics; Transformation of stress and strain; Off-axis stiffness of unidirectional composites; Macro mechanical behavior of laminates; Sandwich structures; Strength of composite materials and their modes of failure; Bending, buckling, and vibration of laminates. Functionally graded materials (FGM).

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Understand the specifics of mechanical behavior of layered composites compared to isotropic materials.
2. Apply constitutive equations of composite materials and understand mechanical behavior at micro, macro and meso level.
3. Determine stresses and strains in composites.
4. Apply failure criteria and critically evaluate the results.
5. Demonstrate knowledge on functionally graded materials.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4-5	Case study /Presentation/Oral examination	30%	
LO 1-5	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12

LO 1	x											
LO 2		x										
LO 3		x										
LO4				x								
LO5	x											

Reference Books:

1. Introduction to Composite Materials Design - Ever J. Barbero
2. Composite Materials: Science and Engineering - Krishan Chawla
3. Finite element analysis of composite materials - Ever J. Barbero

Grading system: As per approved grading scale of MIST

Course Title: Smart Materials

Course Code: ME 6211

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about different smart materials and their applications.

Rationale: Theoretical course on smart materials to understand their types properties and application in engineering field.

Course Content: Review of mechanical behavior of conventional engineering materials, Residual stresses, Hysteresis under loading-unloading cycles; Introduction to smart materials and theory of their functional characteristics: Shape memory alloy, Shape memory effect and super elasticity, piezoelectric materials, magnetorheological fluid and electrorheological fluid; Behavior and applications of smart materials.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate a clear understand of conventional engineering materials as well as smart materials and their differences.
2. Demonstrate in depth knowledge in different smart materials like shape memory alloy, piezoelectric materials, magnetorheological fluid etc. and their behavior.
3. Select smart materials for specific engineering applications.
4. Judge the appropriate application of smart materials with respect to the feasibility of their fabrication and implementation, and to the economic aspects.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3			x									
LO4											x	

Reference Books:

1. Smart materials and structures - Mukesh V. Gandhi
2. Smart materials and technologies - Michelle Addington
3. Smart Materials for Advanced Environmental Applications - Peng Wang

Grading system: As per approved grading scale of MIST

Course Title: Fracture Mechanics

Course Code: ME 6213

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about fracture theories.

Rationale: Theoretical course on surface engineering for modifying the surface to attain some desired surface properties, surface coatings and its characterization.

Course Content: Introduction and overview; Linear elastic fracture mechanics (LEFM): modes of fracture failure, stress concentration and singularities, stress intensity factor, stability of crack propagation; Elasto-plastic fracture mechanics: crack tip plasticity, small scale yielding, experimental methods for fracture toughness (KIC) determination, J-integral; R-curves; Fatigue crack growth; Micro mechanisms of failure; Post mortem failure analysis.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on correctly applying fracture mechanics to predict brittle fracture. Identify and describe the basic fracture and fatigue mechanisms
2. Apply linear Elastic Fracture Mechanics on brittle materials.
3. Apply experimental techniques to determine the critical values of parameters at crack tip.
4. Demonstrate an understanding of J- integral and R- curves.
5. Demonstrate an understanding of micro mechanism of crack growth.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4-5	Case study /Presentation/Oral examination	30%	
LO 1-5	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x										
LO 3					x							
LO4	x											
LO5	x											

Reference Books:

1. Elementary engineering fracture mechanics - David Broek
2. Analytical Fracture Mechanics - David J. Unger
3. Fracture Mechanics: Fundamentals and Applications - Surjya Kumar Maiti

Grading system: As per approved grading scale of MIST

Course Title: Surface Engineering

Course Code: ME 6301

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about surface properties and their applications.

Rationale: Theoretical course on surface engineering for modifying the surface to attain some desired surface properties, surface coatings and its characterization.

Course Content: Mechanical properties of surface and its relevance to tribology; Surface characteristics of engineering material; Surface interaction with environment and its degradation; Review of conventional methods to improve the quality of surfaces; Coating materials; Surface coating techniques: Thermal spraying, Chemical vapor deposition (CVD), Physical vapor deposition (PVD) and Miscellaneous Techniques; Characterization of mechanical properties of coating.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate an understanding of different forms and mechanisms of surface degradation due to wear, oxidation, corrosion, tribocorrosion, fatigue and creep.
2. Demonstrate knowledge of different types of surface protection against wear, oxidation, and corrosion.
3. Demonstrate an understanding of different methods of coating deposition, chemical vapor deposition thermal spraying, physical vapor deposition etc.
4. Demonstrate an understanding of some basic chemical, mechanical, tribological, and biological properties of coatings.
5. Demonstrate an understanding of different methods of surface and coating characterization using modern analytical techniques

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 3-4	Class test/Assignment	15%	
LO 5	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3	x											
LO4	x											
LO5					x							

Reference Books:

1. Introduction to Surface Engineering - P. A. Dearnleyi
2. Advanced Surface Coatings: a Handbook of Surface Engineering – A. Matthews
3. Introduction to Surface Engineering and Functionally Engineered Materials - Peter Martin

Grading system: As per approved grading scale of MIST

Automotive Engineering Courses

Course Title: Computational Engineering for Automobile Applications

Course Code: ME 6231

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about application of computational methods in automotive system desing.

Rationale: Theoretical course on the application of computational methods in automobile design and manufacturing process.

Course Content: Virtual Analysis of Automotive Structures: Basics of CAE techniques utilized for automotive structural analysis and virtual product development, Potential and limitations of different finite element analysis techniques in solving problems related to automotive structures. Practical applications of the finite element method to automotive structures.

Automotive Applications of Computational Fluid Dynamics: Computational fluid dynamics (CFD) and numerical heat transfer (NHT) modelling technology and their application in the design and optimisation of automotive bodies and components. Fundamental theories, approaches and methodologies used in CFD and use of commercial CFD software package.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge of solving simple mechanical and automotive engineering problems using mathematical and numerical techniques.
2. Model simple structures using the Finite Element Method (FEM)
3. Model simple engineering systems using Computational Fluid Dynamics (CFD).
4. Analyze and evaluate models obtained from CAE automotive applications.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1,4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2					x							
LO 3					x							
LO4			x									

Reference Books:

1. Computational Intelligence in Automotive Applications - Prokhorov, Danil
2. Computational Engineering - Günter Hofstetter

Grading system: As per approved grading scale of MIST

Course Title: Vehicle Power-Train Technologies

Course Code: ME 6233

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about power train used in automotive vehicles.

Rationale: Theoretical course on vehicle power train and whole manufacturing process.

Course Content: Logistics and supply chain management in the global automotive industry, Advanced automotive manufacturing technologies, Lean manufacturing, Methodological design and analysis of automotive industrial systems, Process planning (flow, analysis, stabilisation and optimisation), Process modelling and simulation, Management and control of processes Manufacturing engineering software tools, Virtual plant layout, Research skills.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge of global automobile industry with global demand and supply chain management.
2. Analyze different advanced manufacturing technologies used in automotive industry.
3. Design a manufacturing process chain for an automotive industry.
4. Use advanced simulation software and tools for management and controlling automotive manufacturing process.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2		x										
LO 3			x									
LO4					x							

Reference Books:

1. Vehicle Powertrain Systems - David Crolla, Behrooz Mashadi
2. Advanced Hybrid Vehicle Powertrain Technology

Grading system: As per approved grading scale of MIST

Course Title: Automotive Materials and Processes

Course Code: ME 6235

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about different materials selection and use in automotive parts manufacturing.

Rationale: Theoretical course on the different materials and process used in automobile design and manufacturing.

Course Content: Lightweight materials: High strength steels, Aluminum and Magnesium Alloys, Plastics and Composites. Processes: Pressing and Forming, Joining, Composite manufacture. Specialist applications: Coatings, Catalysts and Brakes. Design for light-weighting.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on different conventional and advanced materials used in automotive manufacturing.
2. Demonstrate knowledge on different manufacturing technique and advanced tools used in automotive industries.
3. Select advanced materials for specific automobile components and applications
4. Apply life cycle analysis to the selection of advanced materials.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3			x									
LO4							x					

Reference Books:

1. Materials for Automobile Bodies 2nd Edition - Geoffrey Davies
2. Advanced Materials in Automotive Engineering - Jason Rowe

Grading system: As per approved grading scale of MIST

Course Title: Automotive Systems and Control

Course Code: ME 6237

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about automotive system and control desing.

Rationale: Theoretical course on different systems and control systems used in automobile for safe and efficient use.

Course Content: Introduction to the automobile and its primary chassis and tyre systems operating in a highway system under driver control. Tyre behavior and modelling: overview of tyre construction; the tyre / road contact patch and tyre forces; rolling resistance; longitudinal force / slip ratio characteristics; lateral force / slip angle characteristics; the friction ellipse; influence of normal load and camber angle. Chassis behaviour and modelling: brake force apportioning; stability and the friction ellipse; antilock braking; traction control; split- effects; steering and handling; stability control; ride quality and suspension control. Drivers as feedback controllers: longitudinal acceleration control; yaw rate control; lateral positioning; path planning / tracking. Intelligent vehicle/highway systems: e.g. adaptive cruise control and automatic lane keeping; automatic vehicle following and convoys.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on automobile chassis and tyre system for control of automobile during operation.
2. Modeling of chassis and tyre system.
3. Demonstrate understanding of braking force and control during braking.
4. Demonstrate knowledge on advanced vehicle control like adaptive cruise control, lane keeping, self-driven car technology.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12

LO 1	x											
LO 2			x									
LO 3	x											
LO4	x											

Reference Books:

1. Automotive Control Systems - A. Galip Ulsoy, Huei Peng, and Melih Çakmakci
2. Introduction to Hybrid Vehicle System Modeling and Control - Wei Liu
3. Automotive Chassis Systems - James D. Halderman
4. Automotive Brake Systems - James D. Halderman

Grading system: As per approved grading scale of MIST

Course Title: Advanced CAE for Automotive Applications

Course Code: ME 6239

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about computer aided engineering for automotive design and analysis.

Rationale: Theoretical course on the application of CAE in designing and performance improvement of automotive system.

Course Content: Automotive CAE NVH Analysis: Advanced NVH CAE structural modelling and analysis technology applied to relevant automotive applications. Improvement NVH performance of the car body. Automotive CAE Crash Analysis: Numerical modelling of advanced non-linear automotive applications. Practical problems related to automotive structures, static and dynamic analysis, large deformations and crash simulation. Crash analysis and simulations.

Automotive CAE Concept Modelling. Automotive Trimmed Body (T/Body) CAE Modelling Method.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on CAE NVH analysis tools for structural modeling and analysis.
2. Numerically model the structure, automotive systems for improvement in car body design.
3. Simulation of car crash and subsequent analysis.
4. Demonstrate knowledge on CAE concept modeling, trimmed body modeling for better performance.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2	Class test/Assignment	15%	
LO 3	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x				x							
LO 2					x							
LO 3					x							
LO4	x											

Reference Books:

1. Design Theory and Methods using CAD/CAE: The Computer Aided Engineering Design Series - Kuang-Hua Chang
2. CAE Design and Failure Analysis of Automotive Composites - Srikanth Pilla, Charles Lu

Grading system: As per approved grading scale of MIST

Course Title: Intelligent Materials and Processes

Course Code: ME 6241

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about smart materials application in automotive industry.

Rationale: Theoretical course on the advanced materials and processes for sustainable development.

Course Content: Materials, advanced materials and processes. Sensing and actuation integration into materials. State-of-the-art in integrative materials, novel manufacturing techniques and signal processing developments, Design-For-Manufacturing, and environmental issues with regard to material selection and degradation.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on multifunctional advanced materials.
2. Design or improve the performance of an engineering structure by adding functionalities such as sensing and actuation.
3. Analyze creatively and critically issues in materials-based manufacturing
4. Demonstrate knowledge on material degradation and its impact on environment to design ecofriendly systems.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2			x									
LO 3				x								
LO4	x						x					

Reference Books:

1. Smart Materials - Mel Schwartz
2. Materials and Process Selection for Engineering Design - Mahmoud M. Farag

Grading system: As per approved grading scale of MIST

Course Title: Automotive Electronics

Course Code: ME 6243

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about electronic systems used in automobiles.

Rationale: Theoretical course on the advanced materials and processes for sustainable development.

Course Content: Advanced Semiconductor Fundamentals, Microelectronics Fabrication, Fundamentals of Carrier Transport, PN-Junction Diodes, Schottky Diodes, Bipolar Junction Transistors, Field Effect Devices, Advanced MOS Devices, Thyristors, Optoelectronic Devices, Sensor and Actuators, Surface Acoustic Wave Devices, Bulk Acoustic Wave Devices, Micro-electromechanical Systems, Nano-electromechanical Devices, Microelectronic Circuit Design, Analysis and Design of Analog Integrated Circuits. Fundamentals of Signal Processing Devices including Delay Lines, Filters, Oscillators, Switches. Practice of automotive system application via the platform of MATLAB and SIMULINK..

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on different electronics devices and circuits used in automobiles.
2. Demonstrate knowledge on different sensors and actuators used in automobiles.
3. Analyze and design analog integrated circuits.
4. Model and simulate complex electronic automotive systems using modern numerical analysis and simulation tools

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1-2	Class participation and observation	5%	
LO 3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3			x									
LO4					x							

Reference Books:

1. Automotive Mechatronics: Automotive Networking, Driving Stability Systems, Electronics - Konrad Reif
2. Automotive Mechatronics: Operational and Practical Issues - Fijalkowski, B. T.

Grading system: As per approved grading scale of MIST

Course Title: Advanced Automobile Engineering

Course Code: ME

Level: Post-graduation program

Credit Hour: 3

Contact Hour: 3 (per week)

Objective: Student will learn about different design characteristics of military vehicles.

Rationale: Theoretical course on the advanced engineering of military vehicles

Course Content: Military Vehicle: design characteristics, vehicle material selection, vehicle aerodynamics. Military Vehicle propulsion: engine technology and performance analysis, transmission system. Military Vehicle dynamics: improved automotive fuel system, lubrication and cooling system, braking, suspension, tire/track and steering system. Emission effects and control; advanced electrical automotive drives and instruments; hybrid power and automobile technology; evaluation of vehicle performance, vehicle safety system and vehicle tracking system. Vehicle electronics, sensors and imaging, signal processing and communications. Electromagnetic shielding of military vehicle..

Remark: Both the instructor and students for this course will be from military.

Learning Outcomes (LO): On successful completion of this course unit, students should be able to:

1. Demonstrate knowledge on military vehicle design (requirements and guidelines)
2. Demonstrate knowledge on military vehicle subsystems.
3. Demonstrate advanced tracking and control system used in military vehicles.
4. Demonstrate knowledge on inspecting and maintenance of military vehicles.

Teaching-learning Strategy: Class lectures, Case studies, Research papers review, Practical problem solution etc.

Assessment Strategy: Class tests, Assignments, Presentation and Final exam.

Linkage of LO with Assessment Methods & their Weights:

Learning Outcome	Assessment Methods	Weightage	Remarks
LO 1	Class participation and observation	5%	
LO 2-3	Class test/Assignment	15%	
LO 4	Case study /Presentation/Oral examination	30%	
LO 1-4	Final Examination	50%	
Total		**100%**	

Mapping of Course LO and Program Outcomes (PO):

Learning Outcomes (LOs) of this course	Program Outcomes											
	1	2	3	4	5	6	7	8	9	10	11	12
LO 1	x											
LO 2	x											
LO 3	x											
LO4	x											

Reference Books:

1. Materials and Process Selection for Engineering Design - Mahmoud M. Farag
2. Automotive Mechatronics: Operational and Practical Issues - Fijalkowski, B. T.
3. Automotive Control Systems - A. Galip Ulsoy, Huei Peng, and Melih Çakmakci
4. Introduction to Hybrid Vehicle System Modeling and Control - Wei Liu
5. Automotive Chassis Systems - James D. Halderman
6. Automotive Brake Systems - James D. Halderman

Grading system: As per approved grading scale of MIST