Curriculum

Undergraduate
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Department of Mechanical Engineering

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## Ordinance for Semester System for Bachelor Degree

(This ordinance will replace other ordinances/resolutions etc. on the issues described here. However, it will not affect ordinances/resolutions on issues not mentioned here.)

### 1. Student Admission

**1.1. Undergraduate Admission:**
The admission committee of the university will conduct the admission process for the Bachelor's degree as per the rules. The student will enroll in the first semester of an academic year in individual disciplines of different schools. The admission of foreign students will be subjected to the verification of academic records as per the university rule.

**1.2. Student Status, Student Level and Level of courses:**
Every student has to maintain her/his student status by enrolling, paying tuition fees, and doing the registration for required credits every successive semester following the requirements (Section-4). For smooth operation of semester system and bookkeeping purpose: (1) a student's level will be expressed by her/his year and semester, and (2) courses of 1st year, 2nd Year, 3rd Year and 4th Year will be termed respectively as 100 level, 200 level, 300 level and 400 level courses.

**1.3. Re-Admission:**
(1) A student will be eligible for re-admission in the first year first semester of the subsequent session if s/he was present in at least 25% of the classes of her/his core and elective courses of the same semester.
(2) A student has to take re-admission if her/his student status is not maintained or one or more semesters have annulled because of disciplinary action taken against him/her. In the case of semester annulment, the student has to re-admit the same level of semester. The level (Year and Semester) of re-admitter will be determined by his/ her completed credits.

The re-admitted students will always be assigned the original Registration number.

**1.4. Student's Advisor:**
After admission, every batch of the students will be assigned to a student advisor nominated by the respective discipline to guide them during their study under the semester system. Advisors will always be accessible to the students and ready to mentor them in academic activities, career planning and if necessary, personal issues. There will be a prescribed guideline for the advisors to follow.

### 2. Academic Calendar

**2.1. Number of Semesters:**
There will be two semesters in an academic year. The first semester of the year will start on 1st January and end on 30th June, the Second semester will begin on 1st July and end on 31st December. The roster of the final examination dates and other academic deadlines will be announced at the beginning of each semester.

**2.2. Duration of Semesters:**
The duration of each semester will be as follows:



| | |
|---|---|
| Classes | 14 weeks |
| Recess before final Examination | 2 weeks |
| Final Examination | 4 weeks |
| Total | 20 weeks |

These 20 (twenty) weeks may not be continuous in order to accommodate various holidays and the recess before the final examination. The final grading will be completed within one month of the beginning of the semester.

### 3. Course Pattern

The entire Bachelor's degree program has covered through a set of theoretical, practical, project, viva and seminar courses. At the beginning of every academic session, a short description of courses will be published by the curriculum committee of each discipline.

**3.1. Course Development:**

**3.1.1. Core, Elective and General Education Courses:**
The Curriculum Committee of the discipline duly formed by the respective Dean will develop all the courses of the curriculum for every session. These courses include the Core, General Education, and Elective courses needed for the program of the discipline. The General Education courses will be developed with the close cooperation of the respective discipline concerned, considering the necessity of the program. If for any of the disciplines, the needed General Education courses are not running/operating in the University then the Curriculum Committee of that discipline will develop all the necessary/relevant courses for the program. Finally, the curriculum has to be approved by the respective school and the Academic Council.

**3.1.2. Curriculum:**
**(a) Core, Elective and General Education Courses:** The Curriculum Committee will select and approve the courses from Core/Elective courses of the discipline as well as General Education courses designed/offered by the other disciplines for completing the full curriculum. The Curriculum committee will also select a group of courses as the core courses. In that instance, without completing all of these core courses, a student will not be considered for graduation even if s/he completed the credits required for the degree. Also, the committee may assign a prerequisite for any course if deemed necessary.
**(b) Second Major Courses:** The curriculum committee will select a set of courses of 28-36 credits from the core and elective courses for a second major degree.

**3.1.3. Course Instruction:**
At the beginning of every semester, the course instructor has to prepare a detailed course plan and submit it to the head of the discipline to make it available for the students. The course plan should have information about the suggested textbooks, topics per week and corresponding course learning outcomes (Cos) covered, teaching and learning strategies, assessment strategies, number and approximate dates of term-test examinations, quizzes, presentations, and mandatory office hours reserved for the students of the course offered. If not otherwise mentioned, the medium of instruction is always English.

### 3.2. Course Identification System:

Each course is specified/designated by a three-letter symbol for discipline/school abbreviation (if not otherwise mentioned) followed by a four-digit International Standard Classification of Education (ISCED) code and a four-digit number to characterize that course. To avoid confusion, any new or modified courses should never be specified/designated by reusing a discontinued course number.

### 3.2.1. Discipline Identification:

The three-letter symbol will identify a discipline/institute/school offering the course as follows. If the same course is offered to more than one discipline/institute, if necessary, an extra letter shown in the list may be used after the four digits to specify the department receiving the General Education course.

| | | | |
|---|---|---|---|
| **School of Applied Sciences and Technology:** | | | |
| 1. | ARC | Architecture | A |
| 2. | CEP | Chemical Engineering and Polymer Science | B |
| 3. | CEE | Civil and Environmental Engineering | C |
| 4. | CSE | Computer Science and Engineering | D |
| 5. | EEE | Electrical and Electronic Engineering | E |
| 6. | FET | Food Engineering and Tea Technology | F |
| 7. | IPE | Industrial and Production Engineering | G |
| 8. | MEE | Mechanical Engineering | Q |
| 9. | PME | Petroleum and Mining Engineering | H |
| **School of Life Sciences** | | | |
| 10. | BMB | Biochemistry and Molecular Biology | I |
| 11. | GEB | Genetic Engineering and Biotechnology | J |
| **School of Physical Sciences:** | | | |
| 12. | CHE | Chemistry | K |
| 13. | GEE | Geography and Environment | L |
| 14. | MAT | Mathematics | M |
| 15. | PHY | Physics | N |
| 16. | STA | Statistics | O |
| 17. | OCG | Oceanography | S |
| **School of Social Sciences** | | | |
| 18. | ANP | Anthropology | a |
| 19. | BNG | Bangla | b |
| 20. | ECO | Economics | c |
| 21. | ENG | English | d |
| 22. | PSS | Political Studies | e |
| 23. | PAD | Public Administration | f |
| 24. | SCW | Social Work | g |
| 25. | SOC | Sociology | h |
| **School of Agriculture and Mineral Science** | | | |
| 26. | FES | Forestry and Environmental Science | P |
| **School of Management and Business Administration** | | | |
| 27. | BUS | Business Administration | i |
| **Institute of Information and Communication Technology** | | | |
| 28. | SWE | Software Engineering | W |



### 3.2.2. Course Number:

Following the BNQF (Bangladesh National Qualifications Framework) guidelines, an ISCED Code will be assigned to each course (offered by the discipline/institute/school) immediately after the three-letter code of the specified course.

**(a) First Digit:** The first digit of the four-digit number, after the ISCED Code, will correspond to the year (level) intended for the course recipient.

**(b) Second Digit:** The second digit of the four-digit number, after the ISCED Code, will correspond to the semester intended for the course recipient.

**(c) Third Digit:** A discipline should use the numbers 0 and 1 for the third digit to identify allied General Education courses. The digits 2-9 are reserved for Core and Elective courses to identify the different areas within a discipline/institute.

**(d) Fourth Digit:** The fourth digit of the four-digit numbers (after the ISCED Code) will identify a course within a particular discipline/institute/school. This digit may be sequential to indicate the follow-up courses. If possible, fourth digit may be even for identifying the laboratory/sessional courses of the discipline/institute/school.

### 3.2.3. Course Title and Credit:

Every course will have a short representative course title and a number indicating the total credit as well as reference to prerequisite courses if any.

### 3.2.4. Theory and Lab/Sessional Course:

If a single course has both Theory and Laboratory/sessional part, then the course must be split by Theory and Lab/Sessional courses, and both should have separate course numbers. A student will not be allowed to register for the Lab/Sessional course without registering or completing the corresponding Theory course. Completion of both the Theory and the corresponding Lab/Sessional courses is mandatory for graduation.

### 3.3. Assignment of Credits:

### 3.3.1. Theoretical:

One lecture of 1 (One) hour duration per week or 14 (Fourteen) lectures in total per semester will be considered as one credit.

### 3.3.2. Laboratory/Sessional Classes:

Within the (laboratory/sessional) classroom of the discipline/institute minimum two contact hours of a laboratory/sessional class per week (or 28 contact hours in total) per semester will be considered as one credit. The minimum – maximum credits of the

lab/sessional courses will be specified by/ limited to 1-3 credits. The other laboratory/sessional courses (like the design studio, field practicum, etc.) will be designed, and the credits will be determined/specified based on the necessity by the discipline/institute.

**3.3.3. Seminar, Projects, Fieldwork, Thesis, Viva etc.:**
Will be assigned by the respective discipline/institute.

**3.4. Classification of the Courses:**
The Bachelor's degree courses will be classified into several groups, and the curriculum committee will finalize the curriculum by selecting courses from the groups shown below.

**3.4.1. Core and Elective Courses:**
Every student has to take the courses specified/marked as core courses of the program offered by the discipline/institute. The percentage of the core and elective courses shall be at most 75% of the total credits so designed by the respective discipline/institute.

**3.4.2. General Education Courses:**
Every student is required to take General Education courses developed by the Curriculum Committee of the discipline/institute. The General Education courses shall be at least 25% of the total credits offered by the respective discipline/institute. If any General Education course is specified/declared as a mandatory course in the curriculum, a student is required to take that course to graduate.

**3.4.3. Non-credit Courses:**
The credit of these courses will be added to the total credits if passed but will have no effect on the CGPA as there will be no grades for these courses.

**3.4.4. Non-credit Course for BNCC:**
The credit of these courses will be added to the total credits if passed and its grade will be separately shown but will have no effect on the CGPA.

## 4. Admission in semesters and Course Registration

**4.1. Requirements for Admission and Course Registration:**
For admissions to higher semester (2nd to 10th) and course registration following requisites and steps have to be strictly maintained:
Completion of 100 level courses is mandatory for student's admission in semester of 300 level courses.

(1) Completion of 200 level courses is required for admission in semester of 400 level courses.
(2) A student having incomplete 100 level courses shall be allowed for admission in her/his next available semester of 100-200 level courses until s/he completes all of 100 level courses.
(3) A student having incomplete 200 level courses shall be allowed for admission in her/his next available semester of 200-300 level courses until s/he completes all of 200 level courses.



(4) Once a student reaches to 8th/10th semester of 4/5 years' program s/he will be kept at this level, if necessary, till the specified last semester of the undergraduate program for completion of credit requirement of graduation.

Every admission/course registration of a student will be counted and adjusted from the total number of semesters of the program to determine her/his remaining period of study. Student advisors of all disciplines will advise every student about her/his courses for registration and monitor her/his performances. Accordingly, a student has to register for her/his courses and pay necessary dues within the first 4 (Four) weeks of every semester (2 more weeks for late registration). A student will not be allowed to appear in the examination if her/his semester and examination fee is not fully paid off. Foreign student must have valid Visa/residential permit to appear in the examination and that has to be checked by the student advisor and the head of the discipline/institute.

**4.2. Minimum and Maximum Credit:**
A student, if s/he is not a clearing graduate, will not be allowed to register for more than 30 credits per semester.

**4.2.1. Course registration for clearing graduate:**
For course registration of a clearing graduate (8th/10th and subsequent semesters), however, the condition(s) for maximum and minimum credits is/are relaxed.

**4.3. Incomplete Courses:**
If a student has an incomplete course(s), s/he has to register such an incomplete course(s) from preceding semesters before registering courses from current or successive semesters. If an incomplete course is not available or offered in the running semesters, the student shall take such course(s) when it is available or offered.

**4.4. Course Withdrawal:**
A student can withdraw a course by a written application to the Controller of Examinations through the Head/Director of the discipline/institute two weeks before the examination start. The Controller of Examinations will send the revised registration list(s) to the disciplines before the commencement of semester final examination. There will be no record in transcript if the course is withdrawn.

**4.5. Course Repetition:**
If a student has to repeat a failed or incomplete course and that course is not available/offered any more, the discipline may allow him/her to take an equivalent course from the current curriculum. For clearing graduates, if any incomplete course is not available/offered in the running semester, the discipline may suggest a suitable/equivalent course to complete the credit requirement so required for the degree.

## 5. Graduation Criteria

**5.1. Major Degree**

**5.1.1. Total Credits:**
For graduation, a student must complete all of the offered courses prescribed by the curriculum committee for her/his session. In general, the minimum requirements for

graduation from the disciplines of different Schools and Institute are as in the following table:

| Schools/Institute | Disciplines | Program duration (in year) | Minimum credits |
|---|---|---|---|
| Physical Sciences | All disciplines | 4 | 140 |
| Social Sciences | | | |
| Management and Business Administration | | | |
| Applied Sciences and Technology | Architecture | 5 | 200 |
| | Other disciplines | 4 | 160 |
| Institute of Information and Communication Technology | Software Engineering | 4 | 160 |
| Life Sciences | All disciplines | 4 | 160 |
| Agriculture and Mineral Sciences | | | |

Student must complete all the core and prerequisite (if assigned in curriculum) as well as all the registered courses for graduation.

**5.1.2. Total Years:**
A regular student is expected to complete her/his graduation in 8/10 semesters for 4/5 (four/five) years' program of the disciplines/institute. If necessary, s/he will be given 4 (four) extra semesters (in consecutive 2 (two) years) in addition to 8/10 (eight/ten) semesters of the program to complete the credit-requirement of the degree. In very special cases, that is, if a student completed her/his 80% or more of the credits and intended through application to complete the remaining credits then the discipline may send a detailed report to the respective Dean for further steps. Then, based on the report and Dean's opinion, Academic Council may allow 2 (two) extra semesters as the special semesters for completing the credit-requirement of the degree as irregular students. In the case of Institute, the director will send the report through the governing body to the academic council. The regular examination year will be specified/identified by the session and the end-month (June or December) of the semester in which the student graduates.

**5.1.3. Break in study:**
In very special cases, if a student does not register and remains absent continuously for 2-4 (two to four) semesters within her/his 12/14 semesters of 4/5 years' program, then s/he may apply for readmission as an irregular student. Her/his application will be considered only once provided that s/he has already completed 80% or more of the credits for which s/he was supposed to register and sit in the examination before the beginning of her/his break of study. The concerned discipline will analyze the application and send its well-judged recommendation to the Dean within the 1st month of the running semester. The Academic council, based on the recommendation of the discipline and the opinion of the Dean, may allow the applicant for admission as an irregular student. Such student has to complete the required credits within her/his remaining number of semesters.



In the certificate, grade sheet and transcript of all irregular students, the word "irregular" will be mentioned.

**5.2. Second Major Degree**

**5.2.1. Total Credits:**
A student will be eligible for a second major degree if s/he completes an extra 28-36 credits requirement stipulated by the program offering discipline.

**5.2.2. Total Semesters:**
A student must complete the credit-requirement of second major degree within her/his 8 (eight) regular and 4 (four) extra semesters.

**5.2.3. Requirement of Second Major Degree:**
A student will not be given a second major degree if s/he fails to complete her/his regular major degree.

**5.2.4. Registration Criteria:**
An offering discipline will decide on the number of seats for the second major, enrollment criteria, and get it approved from the Academic council. Students willing to get a second major have to apply to the offering discipline for enrollment, and the concerned discipline will enroll them as per the admission criteria.

**5.2.5. Class routine:**
After enrollment, a regular student may start taking the second major courses starting from her/his 3rd semester. The class routine will be arranged to accommodate the student's need.

**5.2.6. Certificate and Mark sheet:**
A Student completing the requirement will be given an additional standard certificate and mark sheet for her/his second major degree.

## 6. Examination System

A student will be evaluated continuously under the semester-course system. For theoretical classes, students have to be assessed by class participation, assignments, quizzes, term-test examinations, topic-based report writing/presentation, and semester-end final examination. For laboratory/sessional work, s/he will be assessed by observation at work, viva-voce during laboratory/sessional works, from her/his written reports and grades of examinations designed by the respective course teacher and the examination committee.

**6.1. Distribution of Marks:**
The marks of a given course will be as follows:

| | | |
|---|---|---|
| 1. | Class Attendance | 10% |
| 2. | Class performance (Quizzes, MCQ, fill in the gap, report writing/ presentation/ Assignments) | 10% |
| 3. | Term-Test Examinations | 20% |
| 4. | Final Examination (25% is the pass mark for the final examination) | 60% |

**6.1.1. Class participation:**
The marks for class participation will be as follows:

| Attendance (Percentage) | ≥ 95 | 90 – < 95 | 85 – < 90 | 80 – < 85 | 75 – < 80 | 70 – < 75 | 65 – < 70 | 60 – < 65 | 50 – < 60 |
|---|---|---|---|---|---|---|---|---|---|
| Marks | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 0 |

A student will not be allowed to appear the final examination of a course if her/his class attendance in that course is less than 50%.

**6.1.2. Term-Test:**
There should be at least two Term-Tests for every theory course. The course teacher may decide the marks distribution between term-tests. The answer script must be shown to the students as it is essential to their learning process.

**6.1.3. Final Examination:**
After the 16th week since the beginning of the semester, the final examination will be conducted as per the Semester Examination Ordinance.

**(a) Duration of the Final Examination:** There will be a 3-hour final examination for every course of 3-4 (three-four) credits, and the courses less than 3 (three) credits will have a final examination for 2 (two) hours duration.

**(b) Evaluation of answer scripts of final examination:** The school of disciplines may follow any one of the following answer script evaluation systems.

**(1) Single Examiner system, SES:** The students will have two answer scripts to answer a separate set of questions during the final examination. Two examiners will grade the two answer scripts separately, and their given marks will be added together (examinee wise) for determining the Final Mark.

**(2) Double Examiner system, DES:** The students will have a single answer script to answer questions during the final examination. The answer scripts will be evaluated by two examiners separately. For determining the Final Mark: (1) If the difference of two marks of the examiners is less than 20%, then these two marks will be averaged, and (2) If the difference of two marks of the examiners is 20% or more, the corresponding/concerned answer scripts will be examined by a third examiner and then the closer (by smaller difference) otherwise higher two marks of the three examiners will be averaged. Furthermore, if the total marks of two examiners differ by 15% or more in the case of 50% or more answer scripts of a course, then the whole set of answer scripts will be examined by the third examiner. The examination committee will propose the name for appointing the third examiner(s) (not any member of the examination committee) to the respective Dean. The Dean will authenticate/approve the name and send it to the Controller of Examinations for book-keeping and to take the approval of the Vice-Chancellor.

The system of answer script evaluation of the school has to be approved by the Academic Council.



## 7. Grading System

**7.1. Letter Grade and Grade Point:**
Letter Grade and corresponding Grade-Point for a course will be awarded from the roundup marks of individual courses as follows:

| Numerical Grade | Letter Grade | Grade Point |
|---|---|---|
| 80% and above | A+ | 4.00 |
| 75% to less than 80% | A | 3.75 |
| 70% to less than 75% | A- | 3.50 |
| 65% to less than 70% | B+ | 3.25 |
| 60% to less than 65% | B | 3.00 |
| 55% to less than 60% | B- | 2.75 |
| 50% to less than 55% | C+ | 2.50 |
| 45% to less than 50% | C | 2.25 |
| 40% to less than 45% | C- | 2.00 |
| Less than 40% | F | 0.00 |

**7.2. Calculation of Grades**

**7.2.1. GPA:**
Grade Point Average (GPA) is the weighted average of the grade points obtained in all the courses completed by a student in a semester.

**7.2.2. CGPA:**
Cumulative Grade Point Average (CGPA) of major and second major degrees will be calculated separately by the weighted average of all courses of the previous semesters along with that of the current/present semester. For the calculation of the final CGPA of clearing graduates, if the third digit after the decimal point is nonzero then its previous, that is, the second digit will be incremented by one. A student, if applicable, will also receive a separate CGPA for her/his Second Major courses.

**7.2.3. F Grades:**
A student will be given an "F" grade if s/he fails or remains absent in the final examination of a registered course. If a student obtains an "F" grade, her/his grade will not be counted for GPA and s/he will have to repeat the course. An "F" grade will be in her/his record, and s/he will not be eligible for distinction, award, and scholarship of the university.

**7.2.4. Course Improvement:**
A student will be allowed only once to improve maximum of 2 (two) theory courses for which s/he has obtained a B- grade or less in the previous level by registering in the semesters of the immediate next level. Such course grade improvement opportunity shall be given only for 100- 300 level courses. If the course grade does not improve then the previous course grade will sustain in grade count. In the case of the course grade

improvement, this will be cited/noted in the concerned transcripts beside the grade count as “Improvement.”

## 8. Distinction

**8.1. Distinction:**
Candidates for 4/5 years’ programs will be awarded the degree with Distinction if her/his overall CGPA is 3.75 or above. However, a candidate/student will not be considered for Distinction and any kind of Awards if s/he has any one of the following:

(a) s/he is not a regular student,
(b) s/he has semester drop or incomplete courses in any semester,
(c) s/he has an “F” grade in any course,
(d) s/he has upgraded her/his GPA through improvement,
(e) s/he is addicted to drugs,
(f) disciplinary action(s) is taken against her/him.

## 9. Certificate of Practical Skill

For extraordinary and remarkable contribution in establishing lab(s)/new lab set ups, instrument making, developing software/algorithm/apps/device/technology/technique, designing research tools, etc., student (involved) will be awarded a certificate of excellence in practical skill based on the decisions of the discipline by the respective Dean.



## Examination Ordinance for Semester System for Bachelor Degree

(This ordinance will replace other ordinances/resolutions etc. on the issues described here; however, it will not affect ordinances/resolutions on issues not mentioned here.)

## 1. Examinations and Results

University authorities will administer and publish the results of Bachelor's degree examinations. Every examination will be identified by University Semester Number (USN).

## 2. Final Examination Dates, Rosters, and Registrations

**2.1. Data Base Update:**
At the beginning (within the first 4 weeks) of every semester, the office of the registrar will update the valid list of students who have paid the tuition and got admitted to that semester. They will make necessary corrections to the available list of the teachers. The office of the controller of examinations will update the information of courses offered from the curriculum/syllabus in that semester identified by the USN.

**2.2. Examination dates:**
The period/schedule for the final examination will be fixed/determined by the Academic Council according to the Semester System Ordinance (2.1 and 2.2). The fixed examination period/schedule cannot be changed or shifted without the prior approval of the Academic Council. However, in very special cases, the Vice-Chancellor may make decisions on the examination dates, but such an action must be reported to the next meeting of the Academic Council.

**2.3. Examination Rosters:**
The examination rosters and centers will be prepared and selected by the respective disciplines before 3 (three) weeks of the beginning of the semester examination. The Head of the Discipline will notify the examinees and send the exam routines to the other relevant heads of the disciplines and the Controller of the Examinations.

**2.4. Course registration:**
A student will be allowed to register her/his courses during the first 4 (four) weeks of the semester either by using the internet-based system or by completing the prescribed forms. A student may be allowed to register within the next 2 (two) weeks with a late registration fee. The controller of examinations will make sure the registering students have paid the tuition and the examination fees and send each discipline the detailed registration list along with students admit cards at least 1 (one) week before the start of the semester final examination. The controller of examinations will send an updated list in case of a student register late. In case a student withdraws any course (Semester System Ordinance 4.4) 2 (two) weeks before the examination starts, the controller of examinations will send an updated list to the concerned discipline immediately so that it can be used during the result processing.

## 3. Examination Committee

**3.1. Formation:**
A committee consisting of all the teachers headed by the Head of the discipline will propose examination committees for all existing semesters to the respective Dean within 4 (four) weeks of the semester start. It is not necessary to form separate committees for students having incomplete courses at a particular level; the committee of the nearest level of the same year will be responsible to process the result of the students. But, for the clearing graduates, 4th year 2nd semester (5th year 2nd semester for architecture) committee of immediate past will process the results of left out students of 4th year 2nd semester (5th year 2nd semester for architecture) while 4th year 2nd (5th year 2nd semester for architecture) semester is not running.

**3.2. Members:**
The examination committees for different semesters will be comprised of the following members:
**Chairman:** A teacher not below the rank of Professor of the discipline. In absence of Professor of the discipline, an Associate Professor/Head of the discipline. Head of the Discipline will be the Chairman of the terminal semesters.
**Internal Members:** 4 (four) teachers of the discipline.
**External members:** One teacher/expert (not below the rank of professor or equivalent) of the Major field from other university/organization and one teacher from each of the disciplines offering the general education courses.
The respective Deans will ratify the list of the examination committees and send to the registrar for approval from the Academic Council.

**3.3. Responsibilities:**
The Examination Committee will be responsible for the moderation of question papers. External members from the disciplines offering the general education courses will be especially responsible for the moderation of the respective courses and, if necessary, for typing and printing the corresponding question papers. The chairman, internal members, and the external member of the major field will be responsible for conducting the viva-voce examination where applicable.
The Chairman and the internal members of the examination committee will be responsible for the preparation of all question papers, coding and decoding answer scripts (if applicable), detailed results for every course, and the final tabulation.

**3.4. Change of Committee Members:**
If for some genuine reason either the chairman or a member of the examination committee is needed to be changed, then the committee consisting of all the teachers headed by the Head of the discipline will send the nomination/proposal/recommendation to the respective Dean. The Dean will authenticate/approve the change and send it to the Controller of Examinations for book-keeping and to take the approval of the Vice-Chancellor.

## 4. Pre-Examination Preparation

The discipline must formulate a uniform policy to ensure equal opportunities to all the existing faculties to maintain the propriety of the participatory examination system. The Head of the Discipline will give that policy to all the examination committees to follow.



**4.1.** The head of the discipline will make sure about the correct status of students, i.e., s/he is in the proper session and semester to write the exam and will also update the database with the information provided by the examination committee.

**4.2.** The Chairman and the internal members of the examination committee will make the list for:

- Question setters, internal examiners (Course teacher when available) and external examiners (within or outside the university) for the theoretical courses.
- Examiners for the laboratory/sessional courses, seminars, field works, monographs, term papers, theses, projects etc.
- Tabulators and scrutinizers (where applicable) from among the committee members.

The examination committee will send the list to the respective Dean for appointing examiners, tabulators, and scrutinizers (where applicable) before 8 (eight) weeks of the beginning of the semester final examination. The Dean will endorse the said appointment and send the list to the Controller of Examinations. The Controller of Examinations will do the needful for taking administrative approval of the Vice-Chancellor. The Controller of Examinations will then send out the appointment letters to the examiners subject to the approval of the Vice-Chancellor.

**4.3.** The Chairman of the examination committee will receive all the manuscripts of question papers. If anyone of the manuscript is not received within the stipulated time, the committee will suggest an alternative question setter and send it to the Dean for the appointment. The Dean will ratify the said appointment and send it to the Controller of Examinations. The Controller of Examinations will take approval of the Vice-Chancellor. The Controller of Examinations will then send out the appointment letters to the examiners subject to the approval of the Vice Chancellor.

**4.4.** After receiving all the manuscripts of question papers, the examination committee will moderate the questions and will be responsible for security, typing, printing, and photocopying of the question papers. If for unforeseeable reasons, the external member of the Examination Committee is unable to show up during the moderation of the question papers, then the examination committee may recommend a senior teacher of the relevant field outside the discipline to be the external member, and the Controller of Examinations will get it approved by the Vice-Chancellor.

**4.5.** The Controller of Examinations will be responsible for printing and supplying blank (main and extra) answer scripts, mark-sheets, and other relevant forms to the concerned disciplines.

**4.6.** The Controller of Examinations will send out the required blank (main and extra) answer scripts, mark sheets, envelopes, blank forms, instruction sheets, etc. as per the requisition of the head of the discipline well before the examination starts.

## 5. Conducting Final Examination

Discipline will not be allowed to conduct the semester final examination without publishing the results of previous semesters.

**5.1.** Before the semester final examination, the head of the discipline will assign the duties to the chief invigilator and invigilators. The chief invigilator will collect the question papers from the respective chairman of the examination committee before the examination starts. He will be responsible to conduct the examination with the help of invigilators as per the university rule (155th AC). The conduct of examination involves: (a) the distribution of answer scripts and question papers, (b) collecting signatures of the students on the attendance sheet, (c) collecting the answer scripts after the examination, (d) sorting the answer scripts, (e) completing the course wise top-sheet, and (f) returning the packet of the answer scripts to the chairman (on the same day or within the next working day) of the examination committee.

**5.2.** As per semester ordinance, the school may follow any one of the following systems:

- **Single Examiner System (SES):** Students will be answering a separate set of questions in two separates A and B answer scripts.
- **Double Examiner System (DES):** Students will be answering all questions in one single answer script.

The invigilators, accordingly, will ready separate packets for the regular and drop students.

**5.3.** Upon receiving the answer script from the chief invigilator, the chairman of the examination committee will deliver

- the two packets of the answer scripts (A and B) to the respective examiners under the single examiner system, SES.
- the packet of single answer scripts to the internal examiner under the double examiner system, DES.

It should be done within the next 3 (three) days since the examination of the concerned course has taken place. The chairman will make sure every packet has (a) top-sheet, (b) question paper, (c) blank mark sheet, (d) special envelopes, and (e) detailed instructions on the grading procedure.

**5.4.** In case a packet of answer scripts needs to be sent to an examiner outside the university, the chairman will send it to the office of the Controller of Examinations for reaching it to the proper destination. The Controller of Examinations will then send the packet along with the (1) top sheet. (2) question paper, (3) blank mark sheet, (4) special envelopes, and (5) detailed instructions on the grading procedure to the external examiner within 3 (three) working days requesting the examiner to return the examined scripts within 15 days.

**5.5.** If any student is apprehended for unfair means during the examination, then (a) the chief invigilator in case of the Final Examination and (b) the course teacher for the term test/practical examination will take the necessary steps to inform the Controller of Examinations as per the examination rule (155th AC). A separate disciplinary committee set up only for examination related misconduct will make a quick decision and inform the student. The Examination disciplinary committee shall be constituted as stated below:

| | |
|---|---|
| Vice Chancellor | Chairman |
| All Deans | Member |
| Director of Institute (offering undergraduate/graduate program) | Member |



| | |
|---|---|
| One member of the Syndicate nominated by the Vice Chancellor | Member |
| Director of students counselling and guidance (DSCG) | Member |
| Proctor | Member |
| Controller of Examinations | Member Secretary |

**5.6.** The nominated member shall hold office for a term of two years. The committee will dispose of all the issues within the 15 (fifteen) working days after the last exam of that semester has taken place, and the decision(s) has/have to be reported to the Syndicate. If a student comes down with a contagious disease during the Final Examination, then s/he may apply to the Controller of Examination through the Head of the discipline to write the examinations in sickbed/sickbay. The Controller of Examinations will arrange the Examination under the guidance of the physician of the medical center.

## 6. Processing of the Result

### 6.1. Theory Courses: (If school follow Single Examiner System, SES)

**6.1.1.** The processing of the result starts at the end of the classes when the course teacher makes 3 (three) copies of the mark-sheets showing (a) the total number of attendance of each student, (b) the marks from Term-test, and (c) the marks from continuous assessments (assignments, quiz, report writing, and presentation). S/he will display one copy on the noticeboard, send one sealed copy to the Controller of Examinations, and one copy to the Chairman of the Examination Committee responsible for processing the result of that course
before the beginning of the semester examination. The course teacher shall enter the attendance, class performances, and total marks of continuous assessments using the software so approved for result processing.

**6.1.2.** Two examiners will examine scripts A and B separately, grade the answer scripts properly making legible marks on the answer scripts, and put on the Marks on the mark-sheet within 12 (twelve) working days after the examination of the specified course. S/he will enter all the Marks using the software, send the original mark-sheet in a sealed envelope, and the packet of answer scripts to the Chairman of the Examination Committee and one copy of the same in a sealed envelope to the Controller of Examinations.

**6.1.3.** If an examiner is from outside the university, s/he will grade the answer scripts within 15 (fifteen) days of receipt of the packet. S/he will send one copy of the mark-sheet in a sealed envelope and the packet of answer scripts to the Controller of Examinations and one copy of the same in a sealed envelope to the chairman of the Examination Committee. Upon receipt of the packet of the answer scripts the controller of examinations will send the packet to the chairman of the examination committee for scrutiny. The chairman and the tabulators of the examination committee will enter the marks of the external examiners using the software for result processing.

**6.1.4.** Upon receipt of the answer scripts and mark-sheets from the two examiners, the Chairman of the examinations committee will distribute the two packets of answer scripts A and B to the two scrutinizers. The scrutinizers will go through the answer

scripts carefully (to see whether each of the answers has properly graded or not) and put on the marks from the answer scripts on a blank mark-sheet and prepare a report whenever discrepancies are visible/or found. S/he will send one copy of the mark-sheet in a sealed envelope along with the report and the packet of the answer scripts to the Chairman of the Examination Committee and one copy of the detailed mark sheet in a sealed envelope to the Controller of Examinations. The committee will tally the mark-sheets received from the examiners, respective scrutinizers, and judge the report. The committee, if discrepancies are reported, will take necessary steps to resolve it. The Chairman and Tabulators will also carefully check the marks so entered by the examiners and duly process the result for publishing.

**6.2. Theory Course:** (if school follow the Double Examiner System, DES)

**6.2.1.** The process of attendance, class performance, and continuous assessment is similar to section 6.1.1; however, the process of grading answer scripts shall be done according as in the following.

**6.2.2.** The internal examiner will examine the scripts thoroughly without making any marks on the answer scripts and put on the Marks on the mark-sheet within 15 (fifteen) days after the examination of that specified course. Then, s/he will send the original detailed mark-sheet in a sealed envelope and the packet of answer scripts to the Chairman of the Examination Committee and one copy of the original mark sheet in a sealed envelope to the Controller of Examinations. S/he will enter the marks using the software so approved for result processing.

**6.2.3.** In case an examiner is from an outside university, s/he will examine the scripts thoroughly as per the instruction without making any marks on the scripts, put on the Marks on the marksheet within 15 (fifteen) days after the receipt of the answer scripts of the specified course. Then s/he will send one copy of the mark-sheet in a sealed envelope and the packet of answer scripts to the Controller of Examinations and the original mark sheet in a sealed envelope to the chairman of the Examination Committee. Upon receipt of the packet of the answer script, the chairman of the Examination Committee will send only the Packet to the Controller of Examinations for evaluation by the (outside) second examiner. The Chairman and Tabulators will do enter the marks of the external examiners using the approved software for result processing.

**6.2.4.** Upon receipt of the answer scripts and the Marks from the internal examiner, the chairman of the examinations committee will send the packet of the answer scripts along with the (a) the top-sheet. (b) question paper, (c) a blank mark sheet, (d) special envelopes, and (e) the detailed instruction of the grading procedure to the second examiner within the next 3 (three) working days**.**

**6.2.5.** The second (internal) examiner will examine the scripts thoroughly without making any marks on the answer script and put on the Marks on the mark-sheet within 15 (fifteen) days after the examination of the specified course. Then, s/he will send the original detailed mark- sheet in a sealed envelope and the packet of answer scripts to the Chairman of the Examination Committee and one copy of the original detailed mark-



sheet in a sealed envelope to the Controller of Examinations. S/he will have to enter the marks using the approved software for result processing.

**6.2.6.** As soon as the chairman of the examination committee receives the envelopes of the marksheets from the two examiners of a course, s/he will send those two detailed mark- sheets to two members (not tabulators) of the examination committee for checking the sum of each total marks. The concerned members will check/scrutinize the sum of each total mark of the examiners and return the checked mark-sheets to the chairman within a working day. Then, the chairman and tabulators will tally the total marks of the examiners and the respective members to ensure the obtained marks have been correctly put on and do the needful for any discrepancies.

(1) If the examination committee finds genuinely for any answer script the difference between the two marks of the two examiners is 20% or more, then the committee will propose the name of the third examiner for the concerned course to evaluate such answer script(s) to the Dean for the appointment. The Dean will ratify that appointment and send it to the Controller of Examinations for the approval of the Vice-Chancellor.

The committee will send the answer scripts singled out for third examinations along with the (a) top-sheet, (b) question paper, (c) blank mark-sheet, (d) special envelopes, and (e) detailed instruction of the grading procedure to the third examiner.

(2) If marks of two examiners differ by 15% or more in case of 50% or more answer scripts of a course, then the committee will propose the name of the third examiner for the concerned course to evaluate all the answer scripts to the Dean for the appointment. The Dean will ratify that appointment and send it to the Controller of Examinations for the approval of the Vice-Chancellor.

The third examiner should not be a member of the examination committee. S/he (third examiner) will send the original detailed mark-sheet in a sealed envelope and the packet of answer scripts to the chairman of the examination committee and one copy of the original detailed mark-sheet in a sealed envelope to the Controller of Examinations. S/he will have to enter the marks using the approved software for result processing.

**6.2.7** Result processing of the theory courses shall be accomplished as in the following:

- The total marks of the two examiners in which the difference is less than 20% will be averaged.
- In the case of the third examination closer (by smaller difference) two marks, otherwise the higher (for equal differences) two marks of the examiners will be averaged.
- The final letter grades and grade points for the examinees of the specified course will be determined by taking the sum of (a) the marks from class attendance, (b) the marks from class performance and continuous assessment, and (c) average marks.

**6.2.8** For every course, the committee (excluding members from the disciplines offering the general education courses) will make at least 3 (three) copies of the final grade points along with marks from the attendance. class performance. continuous assessments, and final examination. The committee has to authenticate them by their signatures, save one

copy for the record, send a second copy to the Controller of Examinations, and the other copies to the concerned. disciplines for which the course has been offered. The result must be signed by all the members for publishing. Any changes in the list of members of the examination committee must be stated in the resolution of the committee. The committee will announce only the grade points and letter grades of the students for all the courses on the department notice board.

**6.3. Other Courses**

**6.3.1** For Lab/Sessional courses:

**(a)** In the disciplines for which the evaluation of the lab/sessional examination is a continuous process, the designated teachers will determine the grades of the students for the lab/sessional course through a series of quizzes, assignments, viva, reports, etc. At the end of the semester, one of the assigned the lab/sessional teachers will display one copy of the result on the notice board and send one copy to the Chairman of the Examination Committee and the Controller of Examinations. S/he will also enter the marks using the result processing software.

**(b)** In the disciplines which conduct the final lab examination, the designated course teacher will be the chief invigilator and as per rule of the examination, invigilators will be assigned to conduct the lab/sessional examination. Invigilators will help the chief invigilator to determine the grades of the examinees. After the end of the lab examination, the lab teachers will display one copy of the result on the notice board and send one copy to the Chairman of the Examination Committee and the Controller of Examinations. S/he will also enter the marks using the result processing software.

The examination committee will authenticate the result with their signatures, convert into the letter and numeric grades if necessary, and make at least three copies. The committee will save one copy for the record, send one copy to the Controller of Examinations and other copies to the discipline for which the course has been offered.

**6.3.2** For Theses/Project reports/assignment (Industrial) reports/monographs, the supervisor will give an overall assessment for the student and on her/his thesis/project, which will count 30% of the total marks. Evaluation of the thesis/project/reports/monographs by the 2 (two) external examiners who are not involved in supervision/co-supervision will count 40% of the total marks, and from the final presentation in the presence of the examination committee, 30% of marks will be counted. The examination committee will enter the aggregated Marks of the examinees using the software and process the result.

**6.3.3** The viva-voce examination will be conducted by the Examination Committee (excluding the members of the disciplines offering the general education courses). During the viva-voce, all the members have to be present (full time) and will grade separately/individually. The average of the marks of the members participating will be considered as the final mark for determining the grade. The chairman of the examination committee will enter the mark using the software for result processing.



**6.3.4** For BNCC, examination will be administered by the ordinance approved in 99th Academic Council.

**6.4. Preparation of final grade**

**6.5.**

For every course, the examination committee will calculate the Grade Point and corresponding Letter Grade as per the Semester System Ordinance (7.1) using the result processing Software, which will be published through the tabulation sheet.

**6.6. Withholding of Results**

In some special cases, results of the examinees could be withheld: (a) If the examinee has unpaid dues, (b) an objection from the residential halls; proctor office, (c) other obligations to the university, (d) If the university has taken some form of disciplinary action against the examinee, and (e) If the syndicate decides to withhold the result for some specific reasons.

## 7. Preparation of Tabulation Sheet and Publication of Result

**7.1** Four original tabulation sheets will be prepared by the tabulators and checked by the members. Finally, tabulation sheets have to be signed by the chairman, tabulators, and members of the examination committee. The tabulation sheets will contain the Grade Points of every course and the weighted average of the Grade Points (GPA) for every student at that level. For each of the examinees, CGPA will be calculated according to the process mentioned in the Semester System Ordinance (7.2.2) from the second semester onwards. The examination committee will send the tabulation sheets to the Controller of Examinations for her/his signature, and then for the approval of the Vice- Chancellor.

**7.2** For the use and preservation of these four duly signed tabulation sheets: (a) one copy will be kept in the office of the Controller of examinations, (b) one copy will be kept in the Department, (c) one copy will be kept in the office of the respective Dean, and (d) one copy will be kept in the store of the Controller's Office.

**7.3** The Controller of Examinations will publish the results taking permission of the Vice- Chancellor, subject to post-facto approval of the syndicate.

**7.4** For the final semester, the Examination Committee will send a list of students graduating in that particular semester showing the total credits, CGPA, and state if any student is awarded Distinction. Also, the committee will declare in writing that they have thoroughly checked, scrutinized and correctly prepared the tabulation sheets as per rules. This list will be used as the result notification. Finally, the Controller of Examinations will take the approval for publishing the result.

**7.5** The Controller of Examinations will issue the grade sheets and provisional certificates after 7 (seven) days of publication of the result. A student may collect the Provisional Certificate subject to the No Objection Certificate from the Librarian, Proctor, Student's Advisor, Treasurer (student's union), University Medical Officer, Provost, and head of the Discipline.

**7.6** The original certificates will be signed by the Vice-Chancellor, Controller of Examinations, and will be issued to the graduates after the convocation. The graduate has to return her/his provisional certificate to collect the original one. If the convocation is not held on time, then the Controller of Examinations may issue a student his original certificate in very special cases, subject to the permission of the Vice-Chancellor.

**7.7** If a certificate or grade-sheet is lost or destroyed, a student may apply for a duplicate. However, s/he has to file a General Diary in the police station, publish in the newspaper about the loss, and attach a copy of the two documents along with the application to the Controller of examinations. If the certificate or grade-sheet is partly damaged, then the concerned student may have a duplicate by paying the required fee and returning the damaged certificate/grade-sheet to the office of the Controller of Examinations. Every duplicate certificate/mark-sheet has to be signed by the Controller of Examinations.

**7.8** If a student has to correct the spelling of her/his own or her/his parent's name consistent with the SSC certificate he has to affidavit through Judicial Magistrate, publish the matter in a newspaper, and apply to Registrar through the Head of the discipline. Registrar will inform the Controller of Examinations after taking permission from the Vice-Chancellor. The Controller of Examinations will exchange his old certificate or mark-sheets with the corrected copies. The documents with affidavit will be signed and dispensed by the Controller.

**7.9** The controller of Examinations will preserve the used answer scripts for 1 (one) year after an examination has taken place. The office may dispose of these answer scripts through an auction at the end of this period.

## 8. Payment of Bills

**8.1** The syndicate, according to the recommendation of the Academic Council, will decide all the remunerations related to the examination process.

**8.2** The Controller of Examinations will process the bills as per the work-schedule submitted by the chairman of the examination committee, check the authenticity, and submit to the office of the Director of Accounts, which will take the necessary action for payment of the bills.

## 9. Examination Ethics

**9.1** Everyone involved in the process of the examination shall guard the confidentiality of the question papers, examination grades, and results. The examinee, under any circumstance, cannot try to tamper with the examiners. Such attempts of the examinees shall be brought to the attention of the Controller of Examinations.

**9.2** A student may never be asked any question that may hurt her/his religious or ethnic background/identity.



**9.3** If someone involved in offering a course or in the examination process having the following relatives as examinees, s/he shall inform the head of the discipline and the Controller of Examinations or the controlling authority immediately.

(a) Husband/Wife (b) Son/Daughter (c) Brother-in-law/Sister-in-law (d) Son in law/Daughter in law (e) Nephew/Niece (f) Uncle/Aunt (g) First cousins (h) brother/sister.

## 10. Question Structure

Each discipline must follow one unique question structure for final examinations. For 3.00 (three) or 4.00 (four) credits theory courses: (a) the written (final) examinations will be conducted for 60 marks, (b) there will be six questions for Double Examiner System (three questions in each part of the question paper for Single Examiner System), and the examinees will be asked to answer all of them, and (c) the examination time/duration will be 3 (three) hours. However, for 2.00 (two) credits theory courses: (a) the written (final) examination will be conducted for 60 marks, (b) there will be four questions for Double Examination System (two questions in each part of the question paper for Single Examination System), and the examinees will be asked to answer all of them, and (c) the examination time/duration will be 2 (two) hours. For the GPA calculation, 60% of the secured marks of the examinees will be considered in the result processing. Question setters are liable to set questions covering the entire curriculum of the course, and the examination committee shall have the liberty to investigate it and to do other necessary corrections during moderation. Moderated question paper must be printed and supplied to the examinee.

## 11. Compliance

A student (clearing graduate) may appeal to the Controller of Examinations for the reexamine of his/her answer scripts for a maximum of 2 (two) theory courses within 2 (two) weeks after publishing the result. In this case s/he must pay a fee determined by the AC filling the prescribed form supplied by the office of the Controller of Examinations. Then, based on the appeal, two examiners (except the previous examiners) will be appointed soon by the Grievance Cell, and the Controller of Examinations will take the approval from the Vice- Chancellor. In the case of the single examiner system (SES), two examiners will evaluate two answer scripts A and B (of the appealed course) separately, and their given Marks will be added together for obtaining the total mark. Whereas for the double examiner system (DES). two examiners will evaluate the single answer script (of the appealed course) separately, and then the two Marks will be averaged. If the present total/average mark is at least 10% less or higher than the previous total/average mark, only then, the Grievance Cell will ask the concerned Examination Committee and the Controller of Examinations to revise the grade of the applicant. Otherwise, her/his previous grade shall stand.

### 11.1. Grievance cell

In each discipline for exam-oriented compliance, a four/five members' committee as in the following will be formed:

| | |
|---|---|
| Dean of the school | Convener |
| Head of the discipline (if not examiner) | Member |

| | |
|---|---|
| Two senior faculties (not examiners) nominated by the discipline | Member |
| The Controller of Examinations | Member secretary |

### 12. General Instruction

- Disable (only handicapped) and slow learning students will be allowed 5 (five) minutes extra per hour during the examination.
- Disable (blind/without hand only) students will be allowed to take support in writing during the examination. But the writer should be junior and unfamiliar with the course for which the examinee is hiring her/him.
- Application for result correction may be accepted if it is submitted/lodged within the next 3 (three) months since the publication of the result. Chairman of the concerned examination committee/ Head of the discipline and the Controller of Examinations will do the corrections as per rules.
- The result/ tabulation sheet for course improvement will be signed by the examination committee of the present semester of the examinee.

### 13. Exam Hall structure

For final examination of theory courses the number of invigilators will be as in the following.

(a) For each exam hall:

- For 1 – 25 examinees, 2 (two) invigilators will be assigned.
- For 26 – 40 examinees, 3 (three) invigilators will be assigned.
- After 40 examinees, 1 (one) invigilator will be increased for each 20 examinees.

For each course, one chief invigilator will be assigned to conduct the examination.

(b) For Term Test of theory courses, the number of invigilators will be as in the following.

For each exam hall:

- For 1 – 25 examinees, 2 (two) invigilators will be assigned.
- For 26 – 40 examinees, 3 (three) invigilators will be assigned.
- After 40 examinees, 1 (one) invigilator will be increased for each 20 examinees.

For each course, one chief invigilator will be assigned to conduct the examination.

(c) For continuous assessment, course teacher will do the needful and no other invigilators are required.



## Curriculum of Undergraduate Program

### Vision Statement

The vision of the Department of Mechanical Engineering is to be nationally and internationally recognized in providing mechanical engineering education, leading to well qualified engineers who are innovative, immediate contributors to their profession and successful in advanced studies.

### Missions

The Mechanical Engineering program makes available a high quality, relevant engineering education to all the students admitted in the Department. The Program dedicates itself to providing students with a set of skills, knowledge and attitudes that will permit its graduates to succeed and thrive as engineers and leaders. The Program strives to:

- Prepare its graduates to pursue life-long learning, serve the profession and meet intellectual, ethical and career challenges
- Maintain a vital, state-of-the-art research enterprise to provide its students and faculty with opportunities to create, interpret, apply and disseminate knowledge.
- Prepare its graduates to become industrial and civic leaders and demonstrate entrepreneurial spirit

### Objectives of the B.Sc. (Engg.) in Mechanical Engineering program (Program Educational Objectives, PEO)

**PEO1.** Help graduates excel in diverse career paths using their engineering knowledge and professional skills to address complex problems and make positive impacts on society.

**PEO2.** Train graduates to serve their profession and the public as ethical team members and leaders with awareness of modern issues, commitment to inclusive collaboration, and effective communication.

**PEO3.** Our graduates' practice adaptive learning, expanding and enhancing their knowledge, creativity, and skills through professional development, continuing education, research and/or earning advanced degrees.

**PEO to Mission Statement Mapping**

| Mission/PEO | PEO1 | PEO2 | PEO3 |
|---|---|---|---|
| M1 | ✔ | ✔ | ✔ |
| M2 | ✔ | | ✔ |
| M3 | | ✔ | ✔ |

**Program Learning Outcome (PO):**

The PO for the degree *B.Sc. in Mechanical Engineering* at *Shahjalal University of Science and Technology are as follows.*

By the time students' graduate, they should demonstrate:

PO1 - Engineering knowledge: Graduates of Mechanical Engineering program should demonstrate a thorough knowledge of engineering principles, concepts, theories, and techniques, as well as knowledge of mathematics, science, and engineering fundamentals.

PO2 - Problem analysis: Graduates should be able to identify, formulate, and solve complex engineering problems, and analyze and make decisions based on data and knowledge.

PO3 - Design/development of solutions: Graduates should be able to design, develop, and implement systems, components, or processes that meet specified needs while considering public health and safety, and cultural, societal, and environmental factors.

PO4 - Investigation: Graduates should possess the ability to conduct investigations, analyze data and information, and draw conclusions, and have knowledge of modern engineering tools, techniques and methods.

PO5 - Modern tool usage: Graduates should be able to use current and emerging engineering tools, techniques and methods to analyze complex engineering problems and develop solutions.

PO6 - The engineer and society: Graduates should recognize the impact of engineering solutions on a global, economic, environmental, and societal context and the need for sustainable development.

PO7 - Environment and sustainability: Graduates should recognize the importance of developing and implementing sustainable engineering solutions that balance technical, economic, and environmental considerations.

PO8 - Ethics: Graduates should exhibit a sense of ethics and professional responsibility, recognize ethical considerations in engineering practices, and uphold ethical standards.

PO9 - Individual work and teamwork: Graduates should be able to work independently and in teams effectively, and acknowledge the importance of collaboration and communication in the engineering profession.

PO10 - Communication: Graduates should be able to communicate effectively and clearly, both orally and in writing, and acknowledge the need for effective communication in the engineering profession.



PO11 - Project management and finance: Graduates should be able to manage and plan engineering projects, including schedules, budgets, and resource allocation, and recognize the principles of engineering project finance.

PO12 - Life-long learning: Graduates should exhibit a commitment to life-long learning, acknowledge the importance of continuous professional development, and engage in self-directed study and continuing professional development activities.

**Program Objectives (PEO/PO) to Program Learning Outcome (PO) Mapping:**

| PO/PEO | PEO1 | PEO2 | PEO3 |
|---|---|---|---|
| PO1 | ✔ | | ✔ |
| PO2 | ✔ | | ✔ |
| PO3 | ✔ | ✔ | |
| PO4 | | ✔ | |
| PO5 | ✔ | ✔ | |
| PO6 | ✔ | | |
| PO7 | ✔ | | |
| PO8 | ✔ | ✔ | |
| PO9 | | ✔ | |
| PO10 | ✔ | ✔ | |
| PO11 | ✔ | ✔ | ✔ |
| PO12 | ✔ | ✔ | ✔ |

**Semester Wise Course List for Undergraduate Program**

**First Year: 1st Semester**

| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
|---|---|---|---|---|
| CHE 05311101Q | Fundamentals of Chemistry | 3 | 3.00 | |
| MAT 05411101Q | Differential Calculus and Geometry | 3 | 3.00 | |
| ENG 02311101Q | Effective Communication in English | 2 | 2.00 | |
| PHY 05331107Q | Physics I | 3 | 3.00 | |
| MEE 07151181 | Introduction to Mechanical Engineering | 3 | 3.00 | |
| CHE 05311112Q | Chemistry Sessional | 3 | 1.50 | |
| ENG 02311102Q | English language lab | 2 | 1.00 | |
| MEE 07151172 | Mechanical Engineering Drawing | 3 | 1.50 | |
| MEE 07151176 | Foundry and Welding Shops | 2 | 1.00 | |
| Total | | | 19 | |

**First Year: 2nd Semester**

| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
|---|---|---|---|---|
| CHE 05311203Q | Chemistry of Engineering Materials | 3 | 3.00 | |
| MAT 05411203Q | Integral Calculus and Differential Equations | 3 | 3:00 | |
| PHY 05331209Q | Physics-II | 3 | 3.00 | |
| EEE 07131211Q | Fundamentals of Electrical & Electronics Engineering | 3 | 3.00 | |
| MEE 07151241 | Programming Methodology for Mechanical Engineering | 3 | 3.00 | |
| PHY 0533 1212Q | Physics Sessional | 3 | 1.50 | |



| | | | | |
|---|---|---|---|---|
| EEE 07131212Q | Fundamentals of Electrical & Electronics Engineering Sessional | 2 | 1.00 | |
| MEE 07151242 | Programming Methodology for Mechanical Engineering Lab | 2 | 1.00 | |
| MEE 07151274 | Computer-aided Mechanical Engineering Drawing | 3 | 1.50 | MEE 0715-1172 |
| MEE 07151278 | Machine Shop Practice | 2 | 1.00 | |
| MEE 07151288 | Comprehensive Viva-I | | 0.50 | |
| Total | | | 21.5 | |

**Second Year: 1st Semester**

| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
|---|---|---|---|---|
| MAT 05412103Q | Vector Analysis, Matrices and Laplace Transform | 3 | 3.00 | |
| ECO 03112105Q | Principles of Economics | 3 | 3.00 | |
| MEE 07152131 | Basic Thermodynamics | 3 | 3.00 | |
| MEE 07152157 | Engineering Mechanics-I | 3 | 3.00 | |
| EEE 07132113Q | Fundamentals of Electrical Machines | 3 | 3.00 | EEE 0713-1211Q |
| MEE 07152132 | Basic Thermodynamics Sessional | 3 | 1.50 | |
| EEE 07132114Q | Electrical Machines Sessional | 2 | 1.00 | |
| Total | | | 17.5 | |

**Second Year: 2nd Semester**

| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
|---|---|---|---|---|
| MAT 05412205Q | Complex Variables, Harmonic Analysis and Partial Differential Equations | 3 | 3.00 | |

| | | | | |
|---|---|---|---|---|
| MEE 07152259 | Engineering Mechanics-II | 3 | 3.00 | MEE 0715-2157 |
| MEE 07152245 | Numerical Analysis | 3 | 3.00 | |
| MEE 07152253 | Mechanics of Solids | 3 | 3.00 | MEE 0715-2157 |
| MEE 07152255 | Engineering Materials (Metallic and Composites) | 3 | 3.00 | |
| MEE 07152246 | Numerical Analysis Sessional | 2 | 1.00 | |
| MEE 07152254 | Mechanics of Solids Sessional | 3 | 1.50 | |
| MEE 07152256 | Engineering Materials Sessional | 2 | 1.00 | |
| MEE 07152288 | Comprehensive Viva-II | | 0.50 | |
| Total | | | 19 | |

**Third Year: 1st Semester**

| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
|---|---|---|---|---|
| MEE 07153121 | Fluid Mechanics –I | 3 | 3.00 | |
| MEE 07153131 | Heat Transfer | 4 | 4.00 | |
| MEE 07153151 | Mechanics of Machinery | 3 | 3.00 | MEE 0715-2253 |
| MEE 07153171 | Production Processes | 3 | 3.00 | |
| MEE 07153167 | Instrumentation and Measurement | 3 | 3.00 | |
| MEE 07153168 | Electro-mechanical System Design | 2 | 1.50 | |
| MEE 07153122 | Fluid Mechanics- I Sessional | 3 | 1.50 | |
| MEE 07153132 | Heat Transfer Sessional | 3 | 1.50 | |
| MEE 07153152 | Mechanics of Machinery Sessional | 3 | 1.50 | |
| MEE 07153172 | Production Processes Sessional | 2 | 1.00 | |
| MEE 07153182 | Industrial Tour (Selected by MEE Department) | - | 0.50 | |



| | | | |
|---|---|---|---|
| Total | | 23.5 | |

**Third Year: 2nd Semester**

| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
|---|---|---|---|---|
| MEE 07153223 | Fluid Mechanics-II | 3 | 3.00 | MEE 07153121 |
| MEE 07153233 | Heat Transfer Equipment Design | 3 | 3.00 | |
| MEE 07153253 | Machine Design | 4 | 4.00 | MEE 07152253 |
| MEE 07153275 | Machine Tools | 3 | 3.00 | |
| SOC 01343207Q | Industrial Sociology | 2 | 2.00 | |
| MEE 07153224 | Fluid Mechanics- II Sessional | 3 | 1.50 | |
| MEE 07153234 | Heat Transfer Equipment Design Sessional | 2 | 1.00 | |
| MEE 07153254 | Machine Design Sessional | 3 | 1.50 | |
| MEE 07153282 | Industrial Tour (Selected by MEE Department) | | 0.50 | |
| MEE 07153288 | Comprehensive Viva-III | | 0.50 | |
| Total | | | 20 | |

**Fourth Year: 1st Semester**

| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
|---|---|---|---|---|
| MEE 07154221 | Fluid Machinery | 3 | 3.00 | |
| MEE 07164131 | Internal Combustion Engines | 3 | 3.00 | |
| MEE 07154261 | Control Engineering | 3 | 3.00 | |
| Optional I | Selected from prescribed optional subject-I | 3 | 3.00 | |
| Optional II | Selected from prescribed optional subjects-II | 3 | 3.00 | |

| | | | | |
|---|---|---|---|---|
| MEE 07154222 | Fluid Machinery Sessional | 2 | 1.00 | |
| MEE 07154132 | Heat Engine Sessional | 2 | 1.00 | |
| MEE 07154284 | Industrial Training | 4 Weeks | 1.00 | |
| MEE 07154180 | Project/Thesis | 6 | 3.00 | |
| Total | | | 21.00 | |

**Fourth Year: 2nd Semester**

| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
|---|---|---|---|---|
| IPE 04134205Q | Industrial Management | 3 | 3.00 | |
| MEE 07134233 | Power Plant Engineering | 3 | 3.00 | |
| Optional III | Selected from Prescribed Optional Subjects-III | 3 | 3.00 | |
| Optional IV | Selected from Prescribed Optional Subjects-IV | 3 | 3.00 | |
| Optional V | Selected from Prescribed Optional Subjects-V | 3 | 3.00 | |
| MEE 07134234 | Power Plant Engineering Sessional | 2 | 1.00 | |
| MEE 07154288 | Comprehensive Viva-IV | | 0.50 | |
| MEE 07154180 | Project/Thesis (Continuation) | 6 | 3.00 | |
| Total | | | 19.5 | |

**TOTAL CREDIT FOR GRADUATION: 161**

**All departmental courses offered by the Department of Mechanical Engineering are compulsory to obtain the degree.

**Optional Courses**

| Optional-I | | | | |
|---|---|---|---|---|
| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
| MEE 07154123 | Biomedical Fluid Mechanics | 3 | 3.00 | MEE 0715-3223 |



| | | | | |
|---|---|---|---|---|
| MEE 07154135 | Refrigeration, A.C. and Building Mechanical System | 3 | 3.00 | |
| MEE 07154175 | CAD/CAM | 3 | 3.00 | |
| MEE 07154179 | Engineering Economy & Cost Management | 3 | 3.00 | |
| MEE 07154171 | Operations Research | 3 | 3.00 | |

**Optional II**

| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
|---|---|---|---|---|
| MEE 07154141 | Theory of Structures | 3 | 3.00 | |
| MEE 07154125 | Aerodynamics | 3 | 3.00 | MEE 07153223 |
| MEE 07154153 | Noise and Vibration | 3 | 3.00 | |
| MEE 07134191 | Energy Resources & Utilization | 3 | 3.00 | |

**Optional III**

| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
|---|---|---|---|---|
| MEE 07154261 | Machine Learning for Mechanical Engineers | 3 | 3.00 | |
| MEE 07114283 | Bio-Engineering | 3 | 3.00 | |
| MEE 07154233 | Fluidics | 3 | 3.00 | |
| MEE 07154237 | Advanced Thermodynamics | 3 | 3.00 | MEE 07152131 |
| MEE 07154273 | Quality Control and Management | 3 | 3.00 | |
| MEE 07154177 | Production Planning and Control | 3 | 3.00 | |

**Optional IV**

| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
|---|---|---|---|---|
| MEE 07154265 | Basic Mechatronics | 3 | 3.00 | |
| MEE 07164281 | Automobile Engineering | 3 | 3.00 | |
| MEE 07134293 | Nuclear Engineering | 3 | 3.00 | |

| | | | | |
|---|---|---|---|---|
| MEE 07154251 | Fatigue, Creep and Fracture | 3 | 3.00 | |
| MEE 07154225 | Fluids Engineering | 3 | 3.00 | |
| **Optional V** | | | | |
| Course No. | Course Title | Contact Hours/Week | Credits | Prerequisite |
| MEE 07154241 | Applied Engineering Mathematics | 3 | 3.00 | |
| MEE 07154243 | Applied Statistics for Engineers | 3 | 3.00 | |
| MEE 07154239 | Combustion and Pollution | 3 | 3.00 | |
| MEE 07144263 | Robot Mechanics and Control | 3 | 3.00 | |
| MEE 07154295 | Renewable Energy | 3 | 3.00 | |

**Courses Offered by MEE Department to Students of Other Department**

| Course No. | Course Title | Year-Semester (Dept.) | Contact Hours/Week | Credits |
|---|---|---|---|---|
| MEE 07152113F | Engineering Mechanics | 2-1 (FET) | 3 | 3.00 |
| MEE 07151274F | Computer-aided Mechanical Engineering Drawing | 2-1 (FET) | 3 | 2 |
| MEE 07153113E | Fundamentals of Mechanical Engineering | 3-1 (EEE) | 3 | 3.00 |
| MEE 07153114E | Mechanical Engineering Drawing | 3-1 (EEE) | 3 | 1.5 |
| MEE 07153115A | Building Service II – Mechanical | 3-1 (ARC) | 2 | 2.00 |
| MEE 0714 3203G | Measurement and Instrumentation | 3-2 (IPE) | 3 | 3.00 |
| MEE 0714 3204G | Measurement and Instrumentation Sessional | 3-2 (IPE) | 2 | 1.00 |



**Course Profiles**

**First Year First Semester**

| Course No: CHE 05311101Q | Credit: 3.0 | Year: First | Semester: First |
|---|---|---|---|
| Course Title: Fundamentals of Chemistry | | Course Status: Theory | |

**Course Rationale:**
This course aims to provide a preliminary understanding of Chemistry and important concepts of chemistry that will be needed for the further study of higher courses.

**Course Objectives:** The objectives of this course are to
- Familiarize the students with the basic concept of atomic structure
- Acquire the knowledge about the thermochemistry
- Introduce preliminary ideas of chemical equilibrium and kinetics
- Facilitate the necessary knowledge on common phenomena of Electrochemistry
- Make the students understand and relate the colloids and their applications
- Acquaint students with the fundamentals of organic chemistry

**Course Content:**
Concept of Atomic Structure: Quantum numbers, electronic configuration, and periodic table; Properties and uses of noble gases; hybridization and molecular structure of compounds; selective organic reactions.
Thermo-chemistry: Laws of thermochemistry; heat of reaction, heat of solution, heat of combustion, heat of formation and heat of neutralization; experimental determination of thermal changes during chemical reactions.
Chemical kinetics: Definition, rate of reaction, order and molecularity of reaction, determination of order of reaction; collision theory and activated complex theory; effect of catalyst on kinetics.
Chemical Equilibrium (reaction control): Definition, classification, properties, law of mass action, relation between kp, kc and, kx; Effect of pressure, concentration, and temperature on equilibrium for various chemical reactions.
Colloids: Classification of colloids; methods of preparation and purification of colloidal solutions, properties of colloids, applications of colloids.
Electrochemistry: Electrolysis; theories of electrolytic dissociation, ionic equilibrium, Ostwald's dilution law, ionization of water and pH concept, and buffer solution. Galvanic cell, electrolytic cell, prevention of corrosion.
Fundamentals of Organic Chemistry: Introduction, Classification, Nomenclatures, preparations, and Properties (Physical & Chemical) of (i) Aliphatic and aromatic hydrocarbons, (ii) Aldehydes and ketones, (iii) Carboxylic acids and (iv) Alcohols and phenols. Selective organic reactions, introduction to polymer.
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**Course Outcomes:**
After the successful completion of the course, students will be able to
CO1. Classify elements, orbit & orbitals, electron distribution, energy level and hybridization, and apply different principles to determine the configuration for any atom or ion.
CO2. Explain the development of the periodic table of elements, analyze and compare periodic trends in physical and chemical properties of elements in the periodic table.

CO3. Describe basic concepts of thermochemistry and the phenomenon related with laws of thermochemistry.
CO4. Interpret the relationship between chemical kinetics and equilibrium.
CO5. Explain the properties and applications of colloids, basics of electrochemistry and also be able to explore a little bit about organic compounds.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | | | | | | | | | | | |
| CO02 | 2 | | | | | | | | | | | |
| CO03 | 2 | | 1 | | | 1 | 1 | | | | | |
| CO04 | 2 | | 1 | | | | | | | | | |
| CO05 | 2 | | 2 | | | 1 | 1 | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture, PPT Demonstration | Class test (Short Q and MCQ) |
| CO2 | Lecture, PPT Demonstration, Discussion | Quiz, assignment |
| CO3 | Lecture, animated VDO clips, Question-Answer session | Class test (Short Q and MCQ) |
| CO4 | Lecture, Group discussion | Essay type test, problem solving |
| CO5 | Lecture, PPT presentation, Group discussion for problem analysis | Essay type test, problem solving |

**Books Recommended:**
1. S. Z. Haider, Introduction to Modern Inorganic Chemistry.
2. Haque and Nawab, Physical Chemistry
3. R. T. Morrison and R. N. Boyd, Organic Chemistry (6th edition)
4. Raymond Chang, General Chemistry

| **Course No: MAT 05411101Q** | **Credit: 3.0** | **Year: First** | **Semester: First** |
|---|---|---|---|
| **Course Title: Differential Calculus and Geometry** | | **Course Status: Theory** | |

**Course Rationale:**
This course is about the basic mathematics that is a fundamental and essential component in all streams of undergraduate studies in sciences and engineering. In this course, the students will study principles of differential calculus and coordinate geometry, and apply rules to calculate the derivative of various types of functions. Coordinate geometry is a very powerful language of mathematics that will be used for understanding derivatives and its applications. By the end of this course, students will have the ability to apply basic principles and techniques of differential calculus to the solution of various practical problems.



**Course Objectives:**
The objectives of this course are:
to make the students interest on differential calculus and coordinate geometry as needed for solving problems in mechanics;
to develop students' skills in understanding derivatives of real variable functions and their properties;
to use coordinate geometry for understanding the problems and solutions;
the emphasis is given on concepts, techniques of solving the problems and its applications to real problems.

**Course Content:**
Differential Calculus: Functions, limits and continuity. Derivative of trigonometric, exponential and logarithmic functions, inverse trigonometric functions and hyperbolic functions. Finding rate of change, velocity and acceleration. Differentiation of explicit and implicit functions and parametric equations, successive differentiation. Expansion of functions. Extreme values of functions, concavity and inflexions, asymptotes and curve tracing. Finding roots of equations, linear approximations, Taylor polynomials, indeterminate forms. Functions of several variables, partial derivatives. Euler's theorem, chain rule, total derivatives, total differential.
Geometry: Coordinate system; straight line and pair of straight line, circle, parabola, ellipse, hyperbola, parametric curves, General equation of 2nd degree. Rectangular coordinate system, Planes and straight lines in 3-space, distances, quadric surfaces.

**Course Outcomes (CO):**
After successful completion of the course, students will be able to:
CO1. Explain the concept of limit, continuity and derivative of real valued functions, and apply the concepts in practical applications.
CO2. Compute the derivatives of transcendental functions, and expand the transcendental functions to polynomial functions.
CO3. Find maximum and minimum values of functions and its application to real life and compute the partial derivatives of multi variables functions.
CO4. Trace the Cartesian, Polar, Parametric Curves, rectify the curves and compute arc length and areas.
CO5. Identify and apply the cartesian, spherical, polar and cylindrical coordinate systems to solve engineering problems.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 1 | 1 | | | | | | | | | |
| CO02 | 1 | 1 | 1 | | | | | | | | | |
| CO03 | 2 | 1 | 2 | 2 | | | | | | | | |
| CO04 | 1 | 1 | 1 | | | | | | | | | |
| CO05 | 2 | 2 | 2 | 2 | | | | | | | | 1 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|

| | | |
|---|---|---|
| CO1 | Lecture, and Board | Class test (Short Q and MCQ) |
| CO2 | Lecture, and Board | Quiz, assignment |
| CO3 | Lecture, Board, Question-Answer session | Class test (Short Q and MCQ) |
| CO4 | Lecture, Board, Question-Answer session | Essay type test, problem solving |
| CO5 | Lecture, PPT presentation, Group discussion for problem analysis | Essay type test, problem solving |

**Books Recommended:**


1. R.A. Adams, Calculus.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, Ninth Edition.


| **Course No: ENG 02311101Q** | **Credit: 2.0** | **Year: First** | **Semester: First** |
|---|---|---|---|
| **Course Title: Effective Communication in English** | | **Course Status: Theory** | |

**Course Rationale:**

This course is expected to develop two basic skills i.e., reading and writing. A variety of reading strategies and texts will be used to effectively develop first year students' academic reading skills thereby facilitating their future study. Also, the course focuses on developing the writing skills of students by familiarizing them with grammar rules, providing them with practice and enabling them to demonstrate the accurate use of grammar in their writing.

**Course Objectives:**

- To enable students to write with accuracy;
- To facilitate effective and comprehensible writing;
- To raise awareness of common errors that occur in writing;
- To develop students' ability to understand write-ups on issues of general concern;
- To improve the vocabulary of learners for effective communication.

**Course Content:**

a) Reading: Different Reading Strategies, Guessing Meaning from the Context, Critical Reading (Analyze), Critical Reading (Synthesize), Critical Reading (Evaluate), Annotation, Summary Writing.
Materials: A selection of 08-10 editorials and reports from newspapers/ magazines/ journals, etc., Reading texts in New Headway Upper Intermediate Student's Book (Current edition), Selected passages from recommended books, A selection of other materials may be supplied as handouts by the instructor as necessary
b) Writing: Forms and functions of different word categories (noun, verb, adjective, etc.), Aspects and uses of tense, Subject-verb agreement, use of infinitive, gerund, modals, causatives, conditionals, subjunctives, modals, use of sentence connectors/ cohesion markers/ punctuation, Effective combination of sentences (simple, complex, compound), Developing a paragraph/ connecting paragraphs. Academic writing

**Course Outcomes:**



At the end of the course, students will be able to
CO 01: Apply grammar rules
CO 02: Express oneself correctly by using appropriate words, phrases, sentences, or ideas.
CO 03: Critically reflect on a text (grasp abstract ideas and interpret them effectively, arrive at well-reasoned conclusions and solutions)
CO 04: Create using earned knowledge both independently and in collaboration with peer groups
CO 05: Demonstrate comprehension of subject knowledge and its subsequent use

**Mapping of COs with POs:**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | | | | | | | | | 2 | 3 | | |
| CO02 | | | | | | | | | 3 | 3 | | |
| CO03 | | | | | | | | | 3 | 3 | | |
| CO04 | | | | | | | | | 3 | 3 | | |
| CO05 | | | | | | | | | 3 | 2 | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using board/projectors, Assignment/project/seminar/workshop/tutorial, Self-learning using reference books/research articles/case study/other online materials | Midterm Examination 1/ Midterm Examination 2, Quiz / Assignment |
| CO2 | Lecture using board/ projectors/Assignment/ project/seminar/workshop/tutorial, Self-learning using reference books/research articles/case study/other online materials | Midterm Examination 1/ Midterm Examination 2, Assignment/Presentation |
| CO3 | Lecture using board/ projectors, Assignment/project/seminar/workshop/tutorial, Self-learning using reference books/research articles/case study/other online materials | Assignment/Presentation |
| CO4 | Assignment/project/seminar/workshop/tutorial | Presentation |
| CO5 | Lecture using board/projectors, Assignment/ project/ seminar/ workshop/tutorial, Self-learning using reference books/research articles/case study/other online materials, Simulation/field demonstration | Midterm Examination 1/ Midterm Examination 2 |

**Books Recommended:**


1. Tibbits, E. E., editor. Exercises in Reading Comprehension. Longman, 2013.
2. Liz and John Soars. New Headway Upper Intermediate Student's Book. Oxford University Press, 2014.
3. Payle, Michael. Cliff's TOEFL Preparation Guide. 12th ed., Cliffs Notes Inc., 2019.

4. Other resources recommended by course instructors.

| Course No: PHY 05331107Q | Credit: 3.0 | Year: First | Semester: First |
|---|---|---|---|
| Course Title: Physics I | | Course Status: Theory | |

**Course Rationale:**
To gain the fundamental knowledge of natural sciences.

**Course Objectives:**
The objectives of this course are:
- to accumulate basic ideas about the internal composition and electrical nature of solids.
- to know the detailed description of oscillations, waves and sound, and apply the concepts to analyze the mechanical systems.
- to develop the theoretical knowledge of difficulties and to overcome the difficulties in real image formation.
- to provide new mechanics for dealing with Physics of microscopic mechanical systems.

**Course Content:**
Structure of Matter: Crystalline and non-crystalline solids, Single crystal and polycrystalline solids, Unit cell, Crystal systems, Coordination number, Bragg's law, Crystal planes & direction, NaCl & CsCl structure, Packing factor, Miller indices, Relation between interplanar spacing from diffraction patterns; Defects in solids: Point defects, Line defects, Bonds in solids, Interatomic distances, Calculation of cohesive & Bonding energy; introduction to band theory: Distinction between Metal, semiconductor and insulator.
Waves & Oscillation: Simple Harmonic Oscillator, Total energy and average energy, Combination of Simple Harmonic Oscillator, Spring-mass system, Calculation of time period of torsional pendulum. Damped oscillation, Determination of damped coefficient, forced oscillation, Resonance, Two-body oscillations, Reduce mass, Progressive wave, Power & intensity of wave motion, Stationary wave, Group velocity and Phase velocity, Architectural Acoustics, Reverberation and Sabine's formula.
Geometrical Optics: Combination of lenses: Equivalent focal length, Cardinal points of a lens, Power of a lens, Defects of image: Spherical aberration, Astigmatism, Coma, Distortion, Curvature, Chromatic aberration; Optical instruments: Compound microscope, polarizing microscope, Resolving power of a microscope, Camera and photographic techniques.
Wave Mechanics: Principles of statistical physics, probabilities, Introduction and overview of statistical mechanics: Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein Statistics, Fundamental postulates of wave mechanics, Time dependent Schrodinger equation, Schrodinger equation for one-electron atom and its solution.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Differentiate the solid in terms of the periodic arrangement of the atoms, know the compactness in different crystals applying structural analysis and classify materials based on electrical property to choose best one in electrical usage



CO2. Introduce and describe the free, damped and forced oscillation to manufacture the large mechanical system not to produce huge vibration and wave making any accidents.
CO3. Design a mechanical system within audibility limit.
CO4. Identify the factors affecting the image quality and apply the concept to design and manufacture the instrument to have the best quality image in real life.
CO5. Explain the concept of quantum mechanics and statistical mechanics to know behavior quantities involved in various physical systems.

**Mapping of the COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | | | | | | | | 2 |
| CO02 | 3 | | | | | | | | | | | 2 |
| CO03 | 3 | | | | | | | | | | | 2 |
| CO04 | 3 | | | | | | | | | | | 2 |
| CO05 | 3 | | | | | | | | | | | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture, PPT presentation, Question-answer session | Class test (Short Q and MCQ) |
| CO2 | Lecture, PPT presentation, Question-answer session | Quiz, assignment |
| CO3 | Lecture, PPT presentation, Board | Class test (Short Q and MCQ) |
| CO4 | Lecture, PPT presentation | Essay type test, problem solving |
| CO5 | Lecture, PPT presentation, Question-answer session | Essay type test, problem solving |

**Recommended Books**
1. Kittel, C.: Introduction to Solid State Physics
2. Beiser, A.: Perspective of Modern Physics
3. Halliday, D. and Resnick, R.:Physics (Vol. I )
4. Sears, Zemansky and Young: University Physics
5. Puri, S.P.: Fundamentals of Vibrations and Waves
6. Chowdhury, S.: Quantum Mechanics
7. Ahmad, Gias Uddin: Physics for Engineers Part-1
8. Ahmad, Gias Uddin: Physics for Engineers Part-2

| Course No: MEE 07151181 | Credit: 3.0 | Year: First | Semester: First |
|---|---|---|---|
| Course Title: Introduction to Mechanical Engineering | | Course Status: Theory | |

**Course Objectives:** The objectives of this course are:

- To introduce major fields of mechanical engineering.
- To know about mechanical engineering curriculum and the content of engineering courses
- To familiarize various forms and sources of energy.
- To clarify how mechanical advantage and efficiency are defined and determined
- To understand principles of scientific computation and engineering solutions.
- To introduce students with various mechanical devices and their working principle.

**Course Content:**
Energy: Study of forms and sources of energy: conventional and renewable, energy conservation and management, environmental pollution.
Basic Mechanical Devices/Systems: introduction to steam, gas and water turbines with their accessories; internal combustion engines, automobiles; introduction to pumps, blowers and compressors; refrigeration and air conditioning systems.
Study of Steam Generating Unit: study of steam generation units with their accessories and mountings; performance study of steam generators.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Compare and contrast among different sources of energy.
CO2. Explain different turbines.
CO3: Identify different components of IC engine.
CO4: Differentiate between different mechanical components such as pumps, blowers, and compressors, and effectively apply them in the context of refrigeration and air conditioning systems.
CO5: Explain steam generation units with their accessories and mountings.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | | | | | | | | |
| CO02 | 2 | | | 2 | | | | | | | | |
| CO03 | 2 | | | | 2 | | | | | | | |
| CO04 | 1 | | | | 1 | | | | | | | 1 |
| CO05 | 1 | | | | | | | | | | | |

Mapping Course Outcomes (Cos) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lectures using Projectors and Board, Discussion | Term Test 01, Final Exam |
| CO2 | Lectures using Projectors and Board,Discussion | Term Test 02, Final Exam |
| CO3 | Lectures using Projectors and Board, Discussion | Assignment, Final Exam |
| CO4 | Lectures using Projectors and Board, Group Discussion. | Assignment, Final Exam |



| | | |
|---|---|---|
| CO5 | Lectures using Projectors and Board, Group Discussion. | Term Test, Assignment, Final Exam |

**Books Recommended:**
1. An Introduction to Mechanical Engineering – Jonathan Wickert, Kemper Lewis
2. A Textbook of Thermal Engineering – RS Khurmi, JK Gupta

| **Course No: CHE 05311112Q** | **Credit: 1.5** | **Year: First** | **Semester: First** |
|---|---|---|---|
| **Course Title: Chemistry Sessional** | | **Course Status: Sessional** | |

**Rationale of the Course:**
This laboratory-based course is aimed to provide students hands-on experimental skill based on chemistry theory and principle.

**Course Objectives:**
The objectives of this course are:
- Familiarize students with the basic concept of qualitative and quantitative analysis
- Develop skill on different titrimetric techniques.
- Develop student's practical skill for oil analysis, waste water analysis etc.

**Course Content:**
Qualitative analysis and quantitative Analysis, Acidimetry-alkalimetry, Titrations involving redox reactions, determination of Fe, Cu and Ca volumetrically,
Complexometric titration for the determination of hardness of water, Estimation of I2 value of oil or fat, determination of some waste water quality parameters,

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1: Explain the lab safety and measurement units of chemical analysis.
CO2: Interpret the sample quality based on chemical analysis.
CO3: Prepare standard solution and standardization of a solution of unknown concentration.
CO4: Interpret the sample quantity based on chemical analysis followed by calculation.
CO5: Perform complexometric titration technique for determining the hardness of water, back titration of I2 value calculation.

**Mapping of Course Outcomes (COs) with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | | | | | | | | | 1 | | |
| CO02 | 2 | 3 | | | | | | | 2 | | | |
| CO03 | 2 | 3 | | | | | | | 2 | | | |
| CO04 | 2 | 3 | | | | | | | 2 | | | |
| CO05 | 2 | 2 | | | 2 | | | | 2 | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture, Lab Demonstration | Class test (Short Q and MCQ) |
| CO2 | Lab Demonstration on solution preparation and installation of equipment. | Spot test and experimental performance evaluation |
| CO3 | Lab Demonstration on instrumental analysis | Assessment of instrumental handling and data presentation |
| CO4 | Problem solving on data analysis and tips for good graphical presentation (hand written and software-based graphs). | Oral test and report evaluation |
| CO5 | Lab Exam on specific experiment | Assessment of Oral presentation and grading based on overall skill attained |

**Books Recommended:**


1. Vogel, Qualitative Inorganic Analysis
2. A.I. Vogel, A Text Book of Practical Organic Chemistry
3. A.I. Vogel, Elementary Practical Organic Chemistry (Part 1)
4. Vogel, Text book of Quantitative Analysis.


| **Course No: ENG 02311102Q** | **Credit: 1.00** | **Year: First** | **Semester: First** |
|---|---|---|---|
| **Course Title: English Language Lab** | | **Course Status: Sessional** | |

**Course Rationale:**

This course is designed to improve the speaking and listening skills of students in the English language. Emphasis is laid on proper pronunciation for accurate articulation and recognition of speech sounds as well as correct stress, intonation and language use in varied situations.

**Course Objectives:**

To enable students' understanding of the variations in pronunciation;
To teach proper pronunciation and accurate articulation;
To facilitate appropriate stress and intonation in speech;
To encourage use of English effectively in everyday situations;
To ensure overall improvement of oral communication through listening and speaking.

**Course Contents**

Speaking: Articulators, English Phonetic Alphabet (British and American) and International Phonetic Alphabet (IPA), Stress rules of English, Intonation rules and functions of intonation, Communication styles and cultural context, Fluency, mistakes, misunderstandings, audience, taboos, self-esteem, confidence, Activities: dialogue, debate, extempore speech, interview, role-play.
Listening: Basics of listening, Various types of pronunciation, IPA, RP, transcription Different accents and intonation patterns, Activities for meaning-focused listening, Information transfer strategies, Listening practice through selection of audio clips.



**Course Outcomes:**

At the end of the course, students will be able to
CO1: read the symbols of the International Phonetic Alphabet used to represent the sounds of the English language
CO2: apply appropriate intonation and stress patterns in English words and sentences
CO3: interpret information accurately
CO4: collaborate and apply intonation and stress patterns.
CO5: produce continuous speech clearly and convincingly

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | | | | | | 1 | | | | | | 3 |
| CO02 | | | | | | | | | | 2 | | 2 |
| CO03 | | | | | | | | | | 3 | | 2 |
| CO04 | | | | | | | | | | | | 2 |
| CO05 | | | | | | | | | | 3 | | 3 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using board/LCD projectors/OHP projectors, Lecture using board/LCD projectors/OHP projectors, Self-learning using reference books/research articles/case study/other online materials. | Midterm Examination 1/ Midterm Examination 2, Quiz /Assignment |
| CO2 | Lecture using board/LCD projectors/OHP projectors, Lecture using board/LCD projectors/OHP projectors, Self-learning using reference books/research articles/case study/other online materials. | Midterm Examination 1/ Midterm Examination 2, Assignment/ Presentation (Individual/group) /Viva voce |
| CO3 | Lecture using board/LCD projectors/OHP projectors, Lecture using board/LCD projectors/OHP projectors, Self-learning using reference books/research articles/case study/other online materials. | Assignment/ Presentation (Individual/group) /Viva voce |
| CO4 | Lecture using board/LCD projectors/OHP projectors, Lecture using board/LCD projectors/OHP projectors, Self-learning using reference books/research articles/case study/other online materials. | Midterm Examination 1/ Midterm Examination 2, Quiz /Assignment |
| CO5 | Lecture using board/LCD projectors/OHP projectors, Lecture using board/LCD projectors/OHP projectors, Self-learning using reference books/research articles/case study/other online materials. | Midterm Examination 1/ Midterm Examination 2, Assignment/ Presentation (Individual/group) /Viva voce |

**Evaluation**
IELTS, TOEFL and other standardized testing formats for assessing the level of listening skill will be followed. Test items may be as follows: fill in blanks, true/false, multiple choice/ matching word meanings/ information transfer/matching, etc.
Speaking skill will be tested through dialogue, debate, extempore speech, presentation, role-play, etc.

**Books Recommended**

1. Anderson, Anne C., et al. Listening. Oxford University Press, 1988.
2. Anderson, Kenneth, et al. Study Speaking. Cambridge University Press, 2007.
3. Hancock, Mark. English Pronunciation in Use. Cambridge University Press, 2004.
4. Jones, Daniel. Cambridge English Pronunciation Dictionary. Cambridge University Press, 2011. Richards, Jack C., and David Bohlke. Speak Now: 1. Oxford University Press, 2013.
5. Richards, Jack C., et al. Person to Person. Oxford University Press, 2007.
6. Roach, Peter. English Phonetics and Phonology. Cambridge University Press, 2009.


| Course No: MEE 07151172 | Credit: 1.5 | Year: First | Semester: First |
|---|---|---|---|
| Course Title: Mechanical Engineering Drawing | | Course Status: Sessional | |

**Course Objectives:** The objectives of this course are:
- To give information about the important tools of engineering drawing
- To make students learn how to draw the shapes, angels and lines and others which is essential for an engineer
- To understand the principle of projection and sectioning
- To help students learn basic engineering drawing formats.
- To understand the main idea of using dimension for engineering drawing.
- To develop student's imagination and ability to represent the shape size and specifications of physical objects.

**Course Content:**
Introduction; Instruments and their uses; First and third angle projections; Orthographic drawings; Isometric views; Missing lines and views; Sectional views and conventional practices; Auxiliary views.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. define different engineering design parameter like shapes, angels and lines
CO2. draw different views including auxiliary views, orthographic projections and sections
CO3. Develop the ability to read and interpret engineering drawings created by others.
CO4. Create complex engineering drawings.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | | | | | | | | |
| CO02 | | 3 | | | | | | | | | | |
| CO03 | | | | 2 | | | | | | 2 | | 1 |
| CO04 | | | 2 | | | | | | 2 | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using board, Assignment | Class work, Assignment, Final Exam |
| CO2 | Lecture using board, Discussion | Class work, Assignment, Final Exam |
| CO3 | Lecture, Question-Answer session | Class work, Assignment, Final Exam |
| CO4 | Lecture, Group discussion | Class work, Assignment, Final Exam |
| CO5 | Lecture using board, Assignment | Class work, Assignment, Final Exam |

**Books Recommended:**

1. Mechanical Engineering Drawing - Dr. Md. Quamrul Islam
2. Fundamentals of Engineering Drawing - French & Vierck
3. Metric Drafting - Paul Wallah
4. Drafting Technology and Practice - William P. Spence


| Course No: MEE 07151176 | Credit: 1.0 | Year: First | Semester: First |
|---|---|---|---|
| Course Title: Foundry and Welding Shops | | Course Status: Sessional | |

**Course Objectives:** The objectives of this course are:
- To provide detailed information about the molding processes.
- To provide knowledge of various casting process in manufacturing.
- To impart knowledge of various joining process used in manufacturing.
- To provide adequate knowledge of quality test methods conducted on welded and casted components

**Course Content:**
Foundry: Introduction to foundry, tools and equipment. Patterns: function, pattern making. Molding: molding materials sand preparation, types of molds, procedure. Cores: types, core making materials. Metal melting and casting. Inspection of casting and casting defects.
Welding: Metal joints: riveting, grooving, soldering, welding. Welding practice: electric arc steel, aluminum. types of electrodes. Welding defects: visual, destructive and nondestructive tests of welding. Gas welding and equipment, types of flame, welding of different types of materials. Gas welding defects. Test of gas welding.

**Course Learning Outcomes:**

After Successful completion of the course, students will be able to

CO1.Operate foundry tools and equipment safely and effectively, including pattern making, molding, and core making procedures, and produce high-quality castings with minimal defects.

CO2.Apply welding techniques, such as electric arc welding and gas welding, to join different types of metal joints, and use appropriate electrodes and gases to optimize welding quality.

CO3. Identify and troubleshoot welding defects and apply visual, destructive, and nondestructive tests to assess welding quality, and propose solutions to improve welding performance.

CO4. Demonstrate proficiency in selecting and using welding equipment, tools, and materials, as well as following safety procedures and practices while working in the foundry and welding shops.

CO5. Analyze and evaluate the advantages and limitations of different welding techniques and materials, and propose solutions to welding problems based on their knowledge of welding principles and techniques.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 2 | 1 | 2 | 2 | | | | 1 | 4 | | |
| CO02 | 2 | 1 | | 1 | 1 | | | | 1 | 4 | | |
| CO03 | 1 | 2 | | 1 | 1 | | | | 1 | 4 | | |
| CO04 | | 1 | | | | | | | | 3 | | |
| CO05 | 2 | 2 | 1 | 1 | 1 | | | | 1 | 4 | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Laboratory | Assignment |
| CO2 | Laboratory | Quiz |
| CO3 | Laboratory | Assignment |
| CO4 | Laboratory | Quiz |
| CO5 | Laboratory | Assignment |

**Books Recommended:**

1. Manufacturing Technology—Foundry, Forming and Welding, 5e (Volume 1); by P. N. Rao



**First Year Second Semester**

| Course No: CHE 05311203Q | Credit: 3.0 | Year: First | Semester: Second |
|---|---|---|---|
| Course Title: Chemistry of Engineering Materials | | | Course Status: Theory |

**Course Rationale:**

This course aims to provide basic chemistry principles, chemicals and reactions along with applied materials involved in the Industrial Manufacturing process of some industries that will be needed for professional life after graduation.

**Course Objectives:** The objectives of this course are:

- Provide the knowledge on sources, classification, composition of glass, ceramic, cement, plastic, carbon, Lubricant and Paint
- Provide the knowledge on industrial manufacture and applications of glass, ceramic, cement, plastic, carbon, Lubricant and Paint
- Facilitate necessary knowledge about the process of metal corrosion and its prevention

**Course Content:**

Glass: Raw materials for normal glass, classification, manufacturing processes, Manufacturing of optical fibers, raw materials and methods of manufacturing optical fiber and its application, glass transition temperature and its importance, Annealing and its importance, tempered glass and other special glass composition and related chemistry.

Ceramics and Refractories: Fundamentals of ceramic industry, raw materials and industrial manufacturing processing, comparison with metals, classification and special application of refractory materials.

Cement Industry: Raw materials, different processes of cement manufacturing (dry and wet methods), clinker composition and formation reactions, importance of additives, fly ash and slag in cement industries. Setting theories and setting and hardening of cement, chemical reactions in the kilns.

Plastics: Polymers and polymerization reactions, Different polymerization reaction (free radical, condensation and step growth polymerization reactions and mechanism), Thermosetting and thermoplastics, additives and its impact on plastics and environment, degradability of plastics and biodegradable plastics.

Carbon: Up to date knowledge of Allotropes of carbon, diamond, graphite, amorphous carbon and porous carbon and their related chemistry, Advanced carbon nanomaterials (fullerene, graphene, and carbon nanotubes CNTs) fabrication and industrial application

Lubricant and crude oil: Principle of lubrication, viscosity and its relationship with lubrication, Fluidostatic lubrication and Fluid-fluid lubrication, mechanical properties of lubricants, synthetic route of lubricant manufacturing, classification of lubricants, crude oil distillation and application.

Paints and Varnishes: Difference between paints and pigments, composition and application of paints, acrylic and synthetic emulsions paints, enamel paints and coating into metals, varnishing materials and application.

Corrosion: Nature forms and types of corrosion, electrochemical mechanism and prevention of corrosion.

Water treatments and its importance: Importance of water treatment in industries, different chemical methods, primary and secondary water treatment processes, activated sludge and its proper handling for water treatment.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Identify the raw materials and understand the composition, properties and uses of different types of glass, ceramic, cement, plastic, carbon, Lubricant and Paint, also able to Understand the chemical reactions that take place during the manufacturing process.
CO2. Express the basic concept of cement manufacturing and on setting and hardening of cement that will help acquiring mechanisms of structural-reinforcement.
CO3. Explain the use, function and importance of additives and its impact on plastics and environment; and understand the degradability of plastics and biodegradable plastics
CO4. Explain the related chemistry of different allotropic forms of carbon elements and their applications
CO5. Describe the manufacture of paint and varnishes by using chemical substances and the future prospect of paint industry in Bangladesh. Also able to handle water pollutant treatment mechanism and implementation into the plant.

**Mapping of Course Outcomes (COs) with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | | 1 | | 1 | | | | | | | 2 |
| CO02 | 2 | | 2 | | 2 | | | | | | | 2 |
| CO03 | 3 | | 2 | | 2 | | | | | | | 2 |
| CO04 | 2 | | 3 | | 2 | | | | | | | 3 |
| CO05 | 3 | 1 | | | | | | | | 2 | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture, PPT Demonstration | Class test (Short Q and MCQ) |
| CO2 | Lecture, PPT Demonstration, Discussion | Quiz, assignment |
| CO3 | Lecture, animated video clips, Question-Answer session | Class test (Short Q and MCQ) |
| CO4 | Lecture, Group discussion | Essay type test, problem solving |
| CO5 | Lecture, PPT presentation, Group discussion for problem analysis | Essay type test, problem solving |

**Books Recommended:**

1. Shreve, Chemical Process Industries
2. Morrison and Boyd, Organic Chemistry.
3. B. K Sharma, Industrial Chemistry
4. Roger's, Manual for Industrial Chemistry
5. J. A. Kent, Regels' Hand Book of Industrial Chemistry





6. Colin Frayne, Boiler Water Treatment Principles and Practice, Volume I, CHEMICAL PUBLISHING CO. INC. New York, N.Y
7. Igor L. Shabalin, Ultra-High Temperature Materials I (Carbon (Graphene/Graphite) and Refractory Metals), Springer Dordrecht Heidelberg New York London.
8. Malkiat S. Johal Lewis E. Johnson, Understanding Nanomaterials, 2nd edition, CRC press.


| Course No: MAT 05411203Q | Credit: 3.0 | Year: First | Semester: Second |
|---|---|---|---|
| Course Title: Integral Calculus and Differential Equations | | Course Status: Theory | |

**Rationale of the Course:**
This course provides the essential mathematical techniques of engineering. These are the methods of multivariable integral calculus and differential equations. The course consists of topics in ordinary differential equations and Applications, and multiple integral and techniques with applications to various engineering problems. It will provide the students with a solid foundation for further study in engineering.

**Course Objectives:** The objectives of this course are:
- to engage students in sound mathematical thinking and reasoning;
- to facilitate the necessary knowledge about the fundamental aspects of integral calculus and differential equations;
- to develop students' skills in understanding techniques to solve the problems of integral calculus and differential equations;
- to help the students understand how to analyze the structure of real-world problems and solution strategies.

**Course Content:**
Integral calculus: Definition of integration, integration by method of substitution, integration by parts, standard integrals, method of successive reduction. Definite integral, its properties and use in summing series. Improper integral, Beta and Gamma function. Area under a plane curve in cartesian and polar coordinates, area of the region enclosed by two curves in cartesian and polar coordinates, Arc length of curves in cartesian and polar coordinates, volumes of solid of revolution; area of surface of revolution.
Differential Equations: Ordinary differential equation and formation of differential equations, Solution of first order differential equations with various methods. Solutions of second order and higher order linear equations with constant coefficients in general. Solutions of homogeneous linear differential equations and its applications. Solution of differential equations of the higher order when the dependent and independent variables are absent. solutions of differential equations by the method based on factorization of the operators.

**Course Outcomes:**
After successful completion of the course, students will be able to:
CO01. Acquire the skills to calculate the indefinite integral, definite integral and improper integral.

CO02. Apply the ideas of accumulation to calculate areas and volumes.
CO03. Formulate differential equation in different area of science and engineering.
CO04. Solve the differential equations of science and engineering problems by choosing the most suitable method.
CO05. Formulate and solve differential equation problems in the field of engineering.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 3 | 1 | | | | | | | | | 1 |
| CO02 | 1 | 2 | | | | | | | | | | |
| CO03 | | 2 | 2 | 3 | | 2 | 1 | | | | | 1 |
| CO04 | | 3 | | 1 | | | 1 | | | | | 1 |
| CO 05 | 2 | 2 | | | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using whiteboard | Quiz, Midterm exam 1, Semester final exam |
| CO2 | Lecture using whiteboard | Quiz, Midterm exam 1, Semester final exam |
| CO3 | Lecture using whiteboard | Quiz, Midterm exam 1, Semester final exam |
| CO4 | Lecture using whiteboard | Quiz, Semester final exam |
| CO5 | Lecture using whiteboard | Quiz, Midterm exam 2, Semester final exam |

**Books Recommended:**
1. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry, 9th Edition.
2. W.E. Boyce and R.C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition.

| **Course No: PHY 05331209Q** | **Credit: 3.0** | **Year: First** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Physics II: Electricity, Magnetism & Modern Physics** | | | **Course Status: Theory** |

**Rationale of the Course:**
This course provides an introduction to electric and magnetic field and a brief idea about electromagnetic field using Maxwell's equation. It also gives an idea of modern physics and quantum mechanics.

**Course Objectives:** The objectives of this course are:
- To facilitate necessary knowledge of electricity and magnetism.
- To develop a basic understanding of electric and magnetic fields using Maxwell's equations.
- To provide an outline of modern physics with emphasis on its empirical basis which paved the way for quantum mechanics.



**Course Content:**
Electrostatics: different electrical units, Coulomb's law, electric field, Gauss's law and its applications, electric potential and potential energy, capacitance, dielectrics and Gauss's Law, three electric vectors, energy storage in an electric field.
Magnetostatics: magnetic field and field strength, magnetic forces on charge and current, torque on a current loop, Hall effect, Ampere's Law, Biot-Savart law and their applications.
Electrodynamics: Faraday's law of induction, Lenz's law, time-varying magnetic field, inductance, energy in magnetic field, Maxwell's equations, EM energy, Poynting vector, scalar and vector potentials, the wave equations
Modern Physics: atomic models, Bohr's atom, atomic spectra, photoelectric effect, x-rays, Bragg's law. atomic nucleus, nuclear forces, radioactivity, de Broglie wave, uncertainty principle.

**Course Outcomes:**
After the successful completion of the course, students will be able
CO1. Interpret fundamental laws of electricity and magnetism.
CO2. Apply the fundamental laws of electricity and magnetism in various physical problems.
CO3. Interpret the laws of electromagnetic induction and Maxwell's equations to electromagnetic wave in conducting and non-conducting media.
CO4. Interpret the classical and quantum mechanical concepts of atoms and nucleus.

**Mapping of the COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 2 | | | | | | | | | | 1 |
| CO02 | 1 | 3 | | 2 | | | | | | | | |
| CO03 | 2 | 1 | | 2 | | 1 | | | | | | |
| CO04 | 1 | | | | | 1 | 1 | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using whiteboard | Quiz, Midterm exam 1, Semester final exam |
| CO2 | Lecture using whiteboard | Quiz, Midterm exam 1, Semester final exam |
| CO3 | Lecture using whiteboard | Quiz, Midterm exam 1, Semester final exam |
| CO4 | Lecture using whiteboard | Quiz, Semester final exam |

**Books Recommended:**
1. Halliday, D and Resnick, R: Physics (Part II)
2. Halliday, D, Resnick, R and Walker, J: Fundamentals of Physics
3. Young, H D and Freedman, R A: University Physics
4. Beiser, A: Perspectives of Modern Physics

5. Krane, K S: Modern Physics
6. Ahmed, G.: Physics for Engineers (Vol. I & II)

| Course No: EEE 07131211Q | Credit: 3.0 | Year: First | Semester: Second |
|---|---|---|---|
| Course Title: Fundamentals of Electrical & Electronic Engineering | | | Course Status: Theory |

**Rationale:**
The aim of this course is to provide basic knowledge of the principles and practices of different types of circuit analysis techniques to analyze simple and complex circuits. It also provides ideas about AC networks, including phasor and impedance diagrams. This course endeavors to build on this knowledge and further expand student's skills in analyzing and designing circuits involving transistors, diodes and operational amplifiers. The course focuses on developing fundamental ideas and basic concepts on electrical equipment and electronic devices. Upon completion, students should be able to construct, analyze, verify, and troubleshoot electrical and digital circuits using appropriate techniques and test equipment.

**Course Objectives:**
- To facilitate necessary knowledge about electrical charge, voltage, current and power.
- To help students develop basic knowledge of DC circuit behavior.
- Help the students to conceptualize with the use of circuit analysis theorems and methods.
- To familiarize the students with the basics of AC networks.
- Acquaint students with the modeling and analysis of single phase RLC circuits for impedances, voltages, currents, powers and phase shift.
- Accumulate the basic knowledge about operations, device and circuit characteristics of diodes, BJT, JFET, MOSFET and Op-Amp.

**Course Contents:**
Circuit variables and elements: Voltage, current, power, energy, independent and dependent sources, and resistance.
Basic laws: Ohm's law, Kirchhoff's current and voltage laws.
Simple resistive circuits: Series and parallel circuits, voltage and current division, wye-delta transformation.
Techniques of circuit analysis: Nodal and mesh analysis.
Network theorems: Source transformation, Thevenin's, Norton's and superposition theorems with applications in circuits having independent and dependent sources, maximum power transfer condition.
Energy storage elements: Inductors and capacitors, series parallel combination of inductors and capacitors.
Sinusoidal functions: Instantaneous current, voltage, power, effective current and voltage, average power, phasors and complex quantities, impedance, real and reactive power, power factor.
Analysis of single-phase AC circuits: Series and parallel RL, RC and RLC circuits, nodal and mesh analysis.



P-N junction as a circuit element: Intrinsic and extrinsic semiconductors, operational principle of p-n junction diode, contact potential, current-voltage characteristics of a diode, Diode circuits: Half wave and full wave rectifiers, rectifiers with filter capacitor, characteristics of a Zener diode, clamping and clipping circuits.
Bipolar Junction Transistor (BJT) as a circuit element: current components, BJT characteristics and regions of operation, BJT as an amplifier, BJT as a switch.
Metal Oxide Semiconductor Field Effect Transistor (MOSFET) as circuit element: structure and physical operation of an enhancement MOSFET, threshold voltage, current-voltage characteristics of an enhancement MOSFET, and biasing discrete MOS amplifier circuits, single-stage MOS amplifiers, MOSFET as a switch.
Operational amplifiers (Op-Amp): Properties of ideal Op-Amps, non-inverting and inverting amplifiers, inverting integrators, differentiator.

**Course Outcomes:**
After the successful completion of the course, the student will be able to-
CO1. Explain the Basic concepts of Electrical Circuits.
CO2. Solve and analyze the electrical circuits using different analysis methods and theorems
CO3. Interpret and apply the idea of AC networks and phasor.
CO4. Evaluate the basics of diode, BJT and MOSFET and their applications.
CO5. Transform the basic functions of Op-Amps in real-life applications.

**Mapping of COs with POs:**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | | | | | | | | 1 |
| CO02 | | 3 | | 2 | 1 | | | | | 2 | | 1 |
| CO03 | 2 | 3 | | 2 | | | | | | | | |
| CO04 | 1 | 2 | | 1 | 3 | 1 | | | | 1 | | 1 |
| CO05 | | 1 | | 1 | 3 | | 1 | | | | | 1 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lectures | Class Test, Final Exam |
| CO2 | Lectures, Assignments | Class Test, Final Exam |
| CO3 | Lectures, Demonstration | Class Test, Final Exam |
| CO4 | Lectures | Assignment, Final Exam |
| CO5 | Lectures | Class Test, Final Exam |

**Recommended Books**
1. Introductory Circuit Analysis by Robert L. Boylestad
2. Electronic Devices and Circuit Theory by Robert L. Boylestad
3. Alternating Current Circuits by Russel M. Kerchner, George F. Corcoran
4. Operational Amplifiers and Linear Integrated Circuits-Robert F. Coughlin (Author), Frederick F. Driscoll

| Course No: MEE 07151241 | Credit: 3.0 | Year: First | Semester: Second |
|---|---|---|---|
| Course Title: Programming Methodology for Mechanical Engineering | | | Course Status: Theory |

**Course Objectives:** The objectives of this course are:

- to introduce computer hardware and its working principle.
- to provide the fundamental programming concepts and methodologies which are essential to building good C/python programs.
- to help students to code, document, test, and implement a well-structured, robust computer program using the C/python programming language.
- to make students able to write reusable modules (collections of functions).

**Course Content:**

Introduction to computer hardware and its working principle; Programming logic, algorithms and flowcharts.
Introduction to standard programming; Overview of C and python programming languages; C and python fundamentals – Variables; Data structures/Data types; Inputs and outputs; Expressions and statements; Operators; Libraries/modules; Keywords; Functions; Control statements; Iterations; Pointers; Object oriented programming; Exception handling; File handling. Introduction to user interface, how to use programming languages to solve mechanical engineering problems.

**Course Outcomes:**

After successful completion of this course student will be able to
CO1. Identify the basic components of computer hardware and are expected to demonstrate a comprehensive understanding of its working principle.
CO2. Develop algorithms and flowcharts to solve mechanical engineering problems.
CO3. Write code in C and Python programming languages, including basic data structures, inputs and outputs, and control statements.
CO4. Utilize the object-oriented programming approach, as well as implement exception handling and file handling techniques in their programming.
CO5. Apply programming concepts to create user interfaces and solve real-world mechanical engineering problems.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | | | | | | | | | | | |
| CO02 | 2 | 3 | | 1 | | | | | | | | |
| CO03 | 2 | | | | 2 | | | | | | | |
| CO04 | 2 | | | | 2 | | | | | | | |
| CO05 | | | 3 | 2 | | | | | | 2 | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Assignment |
| CO2 | Lecture using board/LCD projectors | Quiz |
| CO3 | Lecture using board/LCD projectors/ Programming practice | Assignment |
| CO4 | Lecture using board/LCD projectors/ Programming practice | Quiz |
| CO5 | Assignment/project | Assignment |



**Books Recommended:**

1. TEACH YOURSELF C - Herbert Schildt
2. SCHAUM's Outlines Programming with C - Byron Gotteried
3. The C Programming Language - Brian W. Kernighan, Dennis M. Ritchie
4. Learn Python the Hard Way – Zed A. Shaw

| Course Code: PHY 05331212Q | Credit: 1.5 | Year: First | Semester: Second |
|---|---|---|---|
| Course Title: Physics Sessional | | Course Status: Lab | |

**Rationale of the Course:**

This course makes the students adept in experimental works so that they can verify physical laws and principles, and can measure the various natural quantities.

**Course Objectives:** The objectives of the course are:

- to facilitate students in applying the theoretical knowledge of basic physics in experimental cross checks.
- to train students about the use of scientific apparatus, measurements, analysis and interpretation of experimental data.
- to instruct students about scientific report writing, oral communication, making logical arguments in favor of experimental findings.

**Course Content:**

Mechanics:
1. Determination of the moment of inertia of a flywheel.
2. Determination of g, the acceleration due to gravity, by means of a compound pendulum and the determination of its moment of inertia.
Properties of Matter:
3. Using a flat spiral spring: a) Verification of Hooke's law and determination of its stiffness constant, b) Determination of 'g' and the effective mass of the spring, c) Determination of the modulus of rigidity of the material of the spring.
4. Determination of Young's modulus of the material of a given bar by the method of bending.
5. Determination of the modulus of rigidity of the material of a given rod by static method.
Electricity:
6. Determination of the resistance of a galvanometer by half deflection method.

**Course Outcomes:**

After the successful completion of the course, students will be able to:

CO1. learn how to collect, plot and analyze experimental data properly, perform error analysis and present the findings in a formal report.
CO2. apply the principle of conservation of mechanical energy to calculate the moment of inertia of a flywheel, find the value of the acceleration due to gravity using a special type of physical pendulum, namely, the compound pendulum and to calculate its rotational inertia by measuring its time period.
CO3. realize that oscillations involving a massive spring can be considered simple harmonic provided that one-third of its mass is added to the mass of the load.
CO4. Grasp the technique to study the properties of material like Young's modulus, rigidity modulus.
CO5. explain the concepts of resistance, potential difference, Ohm's law and Kirchhoff's rule, and to construct a simple circuit with a galvanometer for determining the resistance of the galvanometer.

**Mapping of the COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 3 | | 3 | | | | | | 3 | | |
| CO02 | 3 | | | 2 | 2 | | | | | | | |
| CO03 | 2 | | | 2 | 2 | | | | | | | |
| CO04 | 3 | | | 3 | 2 | | | | | | | |
| CO05 | 3 | | | 2 | 2 | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using white board / OHP projectors | Quiz and viva |
| CO2 | Lecture using white board and laboratory teaching aids, giving instruction at experimental site | Quiz, evaluation of experimental report and semester-end oral examination |
| CO3 | Lecture using white board and laboratory teaching aids, giving instruction at experimental site | Quiz, evaluation of experimental report and semester-end oral examination |
| CO4 | Lecture using white board and laboratory teaching aids, giving instruction at experimental site | Quiz, evaluation of experimental report and semester-end oral examination |
| CO5 | Lecture using white board and laboratory teaching aids, giving instruction at experimental site | Quiz, evaluation of experimental report and semester-end oral examination |

**Recommended Books:**


1. Worsnop, B.L. and Flint, H. T.: Advanced Practical Physics
2. Chowdhury, S. A. and Basak, A. K.: Byaboharik PadarthaBidya
3. Ahmed, G. and Uddin, M.S.: Practical Physics
4. Topping, J: Errors of Observation and Their Treatment




| Course Code: EEE 07131212Q | Credits: 1.0 | Year: First | Semester: Second |
|---|---|---|---|
| Course Title: Fundamentals of Electrical & Electronic Engineering Sessional | | | Course Status: Sessional |

**Rationale**

In this course, students will perform experiments to verify practically the theories and concepts learned in EEE-111Q. Theoretical knowledge is incomplete without hands-on experiments using the basic components and measuring devices used in electrical circuit analysis. This course teaches the fundamentals of electrical circuits, the application of circuit laws, theorems and measuring techniques for DC circuits. It contains experiments investigating the performance characteristics of diodes and different types of diode circuits. It contains a broad idea of transistors, Op-Amp and their applications.

**Course Objectives:** The objectives of the course are

- To facilitate the necessary knowledge to implement dc circuits application in real-time environment
- Enable students with network analysis techniques to solve different types of circuits.
- To understand the transient analysis and steady-state analysis of a capacitor and inductor in a network.
- Help students to develop the ability in building AC electrical circuits and perform experiments on them.
- To provide the knowledge to apply Op-Amp, BJT and MOSFET in circuits.

**Course Contents:**

To get familiar with the operation of different electrical instruments. To verify the following theorems: KCL and KVL theorem, Superposition theorem, Thevenin's theorem, Norton's theorem and Maximum power transfer theorem RL and RC response. Study the frequency response of an RLC circuit and find its resonant frequency. Basic electrical element like fan, bulb, calling bell etc. connection from 220v AC Single phase supply. To familiar with electronics devices and Laboratory Equipment. To study of V-l Characteristics curve of P-N junction diode. To study of Half-Wave Rectification circuit. To study of Full-Wave Rectification circuit (Bridge Center- tap). To study of Clipping and clamping circuit. To study MOSFET and BJT characteristics. Speech/ Audio amplification using NPN/PNP Transistor. MOSFET as an amplifier and switch. Different operational amplifier circuits.
In this course, students will perform experiments to verify practically the theories and concepts learned in EEE 111Q.
Lab 1-2: To familiarize students with the operation of different electrical instruments including measuring Equipment: Multi-meter, Frequency meter and Oscilloscope.
Lab 3-7: To verify the following theorems:
KCL and KVL theorem,
Superposition theorem,
Thevenin's theorem,
Norton's theorem and
Maximum power transfer theorem.
Lab 8: Diode Circuit and Half-wave rectifier
Lab 9: AC circuit, frequency measurement and lead-lag measurement.
Lab 10: Basic BJT circuits

Lab 11: To construct circuits using MOSFET
Lab 12: To implement different circuits using Op-Amp.
Lab 13: Lab test.
Lab 14: Quiz

**Course Outcomes:**
After the successful completion of the course, students will be able to-
CO1. Explain the basic operation of different types of electrical instruments and measuring devices.
CO2. Implement network theorems and laws for different types of circuit analysis.
CO3. Measure the AC quantities in single phase circuit
CO4. Construct rectifier circuits using diode.
CO5. Manipulate logic expressions using binary BJT, MOS, Op-Amp.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 1 | | | | | | | 2 | 1 | | 2 |
| CO02 | 2 | 3 | | 1 | | | | | | 2 | 1 | |
| CO03 | | | 2 | 1 | | | 1 | | 2 | 1 | | |
| CO04 | | 2 | | 2 | 3 | 1 | | | | 2 | 1 | |
| CO05 | | | 3 | | 3 | | 1 | | 2 | 1 | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lectures, Demonstration | Viva, Quiz, Laboratory Test |
| CO2 | Demonstration | Laboratory Test |
| CO3 | Lectures, Demonstration | Laboratory Test, viva, Quiz |
| CO4 | Lectures, Demonstration | Viva, Quiz, Laboratory Test |
| CO5 | Lectures, Demonstration | Laboratory Test, Quiz, Viva |

**Recommended Books:**
1. Fundamental of Electric Circuits – Charles K. Alexander and Matthew N.O. Sadiku
2. Introductory Circuit Analysis by Robert L. Boylestad
3. Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashlesky
4. Microelectronic Circuits- Sedra/Smith

| **Course No: MEE 07151242** | **Credit: 1.0** | **Year: First** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Programming Methodology for Mechanical Engineering Sessional** | | | **Course Status: Sessional** |

**Course Objectives:** The objectives of this course are:
- To help students to develop programming skills to solve different problems



- To assist student to implement various concepts and structures of C/python programming language
- To help students develop their critical and creative thinking for lifelong learning

**Course Content:**
Based on MEE 07151241

**Course Outcomes:**
After successful completion of the course, students will be able to
CO1. Identify the basic components of computer hardware and are expected to demonstrate a comprehensive understanding of its working principle.
CO2. Develop algorithms and flowcharts to solve mechanical engineering problems.
CO3. Write code using C and Python programming languages, including basic data structures, inputs and outputs, and control statements.
CO4. Utilize the object-oriented programming approach, as well as implement exception handling and file handling techniques in their programming.
CO5. Apply programming concepts to create user interfaces and solve real-world mechanical engineering problems.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | | | | | | | | | | | |
| CO02 | 2 | 3 | | 1 | | | | | | | | |
| CO03 | 2 | | | | 2 | | | | | | | |
| CO04 | 2 | | | | 2 | | | | | | | |
| CO05 | | | 3 | 2 | | | | | | 2 | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Computer Assemble and disassemble | Assignment |
| CO2 | Lecture using board/LCD projectors | Quiz |
| CO3 | Programming practice | Assignment |
| CO4 | Programming practice | Quiz |
| CO5 | Assignment/project | Assignment |

**Books Recommended:**
1. TEACH YOURSELF C - Herbert Schildt
2. SCHAUM's Outlines Programming with C - Byron Gotteried
3. The C Programming Language - Brian W. Kernighan, Dennis M. Ritchie
4. Learn Python the Hard Way – Zed A. Shaw

| **Course No: MEE 07151274** | **Credit: 1.5** | **Year: First** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Computer-aided Mechanical Engineering Drawing** | | | **Course Status: Sessional** |

**Course Objectives:** The objectives of this course are:

- To provide for the students an insight into computer aided design and modeling.
- To develop an ability to create 2-D sketches, create and edit dimensions.
- To develop an ability to create solid models of machine components.
- To develop an ability to create assembly models of simple machines.
- To develop the ability to apply limits, fits, and dimensional tolerances, as well as geometric tolerances to components and assemblies on engineering drawings.
- To develop an ability to create 2D drawings from 3D models

**Course Content:**
Prereq.: MEE172
Review of orthographic projections; Fasteners, gears, keys and springs; Sectional views and conventional practices; Auxiliary views; Specifications for manufacture; Working drawings; Introduction to Computer Aided Design (CAD).

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. recall all the drawing tools of AutoCAD and SolidWorks software
CO2. justify the engineering design with dimensions
CO3. design engineering components using AutoCAD and SolidWorks software

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | 1 | | | | | | 3 | |
| CO02 | 2 | 2 | | 1 | | | | | | | 2 | 2 |
| CO03 | | 2 | 3 | | | | | | 1 | | | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using PPT, Assignment | Class work, Assignment, Final Exam |
| CO2 | Lecture using PPT, Discussion | Class work, Assignment, Final Exam |
| CO3 | Lecture using PPT, Question-Answer session | Class work, Assignment, Final Exam |

| **Course No: MEE 07151278** | **Credit: 1.0** | **Year: First** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Machine Shop Practice** | | **Course Status: Sessional** | |

**Course Objectives:** The objectives of this course are



- To give ME undergraduates the opportunity to engage in machine shop operation under the supervision of qualified machine shop personnel.
- To be familiar with the common bench and hand tools.
- To operate drilling machine, lathe machine, shaper machine, milling machine, grinding machine.

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

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Integrate the concept of machine design with fabrication.
CO2. Analyze the feasibility of manufacturing specific pieces
CO3. Operate machines safely
CO4. Conduct themselves ethically and responsibly in a machine shop context
CO5. Develop the skill of working in a group

**Mapping of COs with POs:**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | | 2 | | | | | | | | | |
| CO02 | | | | 3 | 2 | | | | | | | |
| CO03 | | | | | 3 | | | | | | | |
| CO04 | | | | | | | | 2 | | | | |
| CO05 | | | | | | | | | 3 | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lab Demonstration | Lab Final |
| CO2 | Lab Demonstration | Lab Final |
| CO3 | Lab Demonstration | Lab Final |
| CO4 | Lab Demonstration | Lab Final |
| CO5 | Lab Demonstration | Lab Final |

| **Course No: MEE 07151288** | **Credit: 0.5** | **Year: First** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Comprehensive Viva-I** | | **Course Status: Viva** | |

**Course Rationale:**
This course aims to improve students' communication capability and also provide an experience of viva.

**Course Objectives:** The objectives of this course are:

- To help students to communicate effectively with others

- To facilitate necessary knowledge about different topics related to courses
- To develop skills on speak in English fluently
- To facilitate students to share different ideas & thoughts in practical life
- To help students to identify better choice among all alternatives
- To understand basic solution process
- To introduce students about practical service life

**Course Content:**
Topics covered by all theoretical and practical courses in both two semesters of the running year.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. communicate effectively with other employees and workers in service life.
CO2. explain the understanding about different practical problems relevant to the course.
CO3. develop the capability of leading a team.
CO4. explain the integrated engineering knowledge learned throughout the semester.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | | | | | | 2 | | | | 3 | | |
| CO02 | 2 | 2 | | | | | | | | | | |
| CO03 | | | | | | 1 | | | 3 | 2 | | |
| CO04 | 3 | 2 | | 2 | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Self-learning using interpersonal relationship | Viva voce |
| CO2 | Self-learning using reference books/other online materials | Viva voce |
| CO3 | Self-learning using interpersonal relationship | Viva voce |
| CO4 | Self-learning using reference books/other online materials | Viva voce |

**Second Year First Semester**

| **Course No: MAT 05412103Q** | **Credit: 3.0** | **Year: Second** | **Semester: First** |
|---|---|---|---|
| **Course Title: Vector Analysis, Matrices and Laplace Transform** | | | **Course Status: Theory** |

**Course Rationale:**
This course is designed for the students of the Mechanical Engineering department. It is the standard complete introduction to the concepts and methods of vector analysis, matrix and Laplace transform. The emphasis is given to teach the understanding of using



vector and matrix algebra, real valued vector functions and Laplace transform. The applications for the related discipline will be discussed.

**Course Objectives:** The objectives of the course are:
- Introduce students to the fundamental concepts of matrices and vectors.
- Teach techniques and methods to solve a system of linear equations using matrix properties and its applications.
- Acquire knowledge of behavior of vector functions by studying its derivatives and integrations.
- Expose students to mathematical applications of matrices and vector functions to handle diverse problems which occur in mechanics.
- Introducing Laplace transform and its application to solve mathematical problems.

**Course Content:**
Vector analysis: Vector products and its application to geometry and mechanism. Vector calculus: Differentiation together with elementary applications. Gradient of a scalar function. Divergence and curl of a vector function. Physical significance of gradient, divergence and curl. Integration of vectors together with elementary applications. Line, surface and volume integrals. Stoke's theorem, Green's theorem, Gauss's theorem and their applications.
Matrices: Types of matrices and algebraic properties. Rank and elementary transformations of matrices. Solution of linear equation by matrix methods. Linear dependence and independence of vectors. Determination of characteristic roots and vectors.
Laplace transforms: Definition of Laplace transforms. Elementary transformation and properties. Convolution. Solution of differential equation by Laplace transforms. Evaluation of integrals by Laplace transforms.

**Course Outcomes:**
After the successful completion of the course, students will be able to
CO1. Compute the area and volume formed by the position vectors and discuss the nature of vector functions using derivatives.
CO2. Find the length of a curve, surface area and volume of some models.
CO3. Find the solution set of a system of equations using matrices.
CO4. Determine linearly dependent and independent vectors and determine characteristic roots and corresponding vectors.
CO5. Apply Laplace transform to solve mathematical problems such as ordinary and partial differential equation.

**Mapping of COs with POs:**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | | 3 | | | | | | | | | | |
| CO02 | | 3 | | | | | | | | | | |
| CO03 | 2 | | | | | | | | | | | |
| CO04 | | | 3 | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO05 | | | | | 3 | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture | Midterm Examination 1, Semester-end Examination |
| CO2 | Lecture | Semester-end Examination |
| CO3 | Lecture | Midterm Examination 2 |
| CO4 | Lecture | Semester-end Examination, Assignment |
| CO5 | Lecture | Semester-end Examination |

**Books Recommended:**


1. Speigel, M R.: Vector analysis
2. Howard Anton and Chris Rorres: Elementary linear algebra with applications, 9th edition
3. Spiegel, M. R.: Laplace Transform


| **Course No: ECO 03112105Q** | **Credit: 3.0** | **Year: Second** | **Semester: First** |
|---|---|---|---|
| **Course Title: Principles of Economics** | | **Course Status: Theory** | |

**Course Description and Objectives:**

This ECO 105 course provides an introduction to the main ideas and concepts involved in modern economics and attempts to provide students with an understanding of how the economy works, what type of problems economists attempts to solve, and how they set about trying to solve them. The course is primarily concerned with the analysis of individual decision-making agents, the behavior of firms and industries in the economy (microeconomics), on the economy as a whole (macroeconomics) and the inherent problems facing underdeveloped and developing countries (economic development).

Microeconomics part provides a brief and simple introduction to the subject matter and scope of Economics. This section aims to provide an introduction to microeconomic analysis. It outlines the theory of markets with relevant applications to business, social and individual issues. The course covers the principles and consequences of "rational" choice by individual economic agents in markets. The course also provides an introductory analysis of the role of governments in seeking to ensure the efficient operation of markets.

Macroeconomics section provides a brief and simple introduction to the subject matter and scope of Macroeconomics. It also aims to provide an introduction to macroeconomic analysis outlining how the national income is measured and determined. It also provides a framework in which the interaction of money and goods and services markets can be developed, allowing students to understand the process by which the levels of economic activity, employment is determined.

Economic development section provides students with an understanding of economic theories and analysis in the field of development economics. The section is designed to deal with a selection of issues and problems facing the developing economies.

**Prerequisites:**



Basic arithmetic and an ability to learn, to understand, and manipulate simple graphs are required, else it would be difficult to do any job in the private or public sector without these skills.

**Course Content:**

Introduction to Microeconomics: Definition and scope; basic concepts and tools—PPF and circular flow model; fundamental economic problems and solution systems; Concepts of demand, supply and equilibrium; Concepts of elasticity, different types of elasticities, their applications; Concepts of total and marginal utility; Concepts of production, cost and profit, characteristics of different types of markets.; Introduction to Macroeconomics: Key macroeconomic indicators and their performance measurement - GNP, GDP, inflation, unemployment; money, functions of money, function of commercial and central bank, monetary policy; fiscal policy and structure of govt. budget.; Development and related issues: Growth and development; concept of poverty and poverty measures; HDI; key human-socio-economic development indicators of Bangladesh, Sustainable Development Goals (SDG).

**Course Outcome (CO):**

Successful completion of this course should enable students to:

CO1. Understand the analysis of individual decision-making agents, the behavior of firms and industries in the economy.

CO2. Understand the concept of elasticity quantitatively and qualitatively in economic analysis and know differences between different types of markets;

CO3. Explain macroeconomic concepts and use simple economic models to interpret the behavior of key macroeconomic variables;

CO4. Understand monetary and fiscal policy and Government budget;

CO5. Understand the main issues confronting underdeveloped and developing countries.

**Mapping of COs with POs**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 |
|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | 2 | | 2 | | | |
| CO2 | | | | | 2 | | 2 | | | |
| CO3 | | | | | | | 2 | | | |
| CO4 | | | | | 2 | | 2 | | | |
| CO5 | | | | | | | 2 | | | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture | Midterm Examination 1, Semester-end Examination |
| CO2 | Lecture | Semester-end Examination |
| CO3 | Lecture | Midterm Examination 2, Semester-end Examination |
| CO4 | Lecture | Semester-end Examination, Assignment |

| | | |
|---|---|---|
| CO5 | Lecture | Semester-end Examination |

**Books Recommended:**


1. Arnold, R. A. (2014): Economics, South Western Publishing Company, Eleventh Edition
2. Bangladesh Economic Review relevant issues.
3. Mankiw, N. G. (2012): Principles of Economics, Thomson South Western Publishing, Sixth Edition
4. Samuelson, P. A. and Nordhaus, W. D. (2009): Economics, McGraw-Hill USA, Nineteenth Edition.
5. Todaro, M. P. and Smith, S. C. (2012): Economics of Development in the Third World, Longman, Eleventh Edition


| **Course No: MEE 07152131** | **Credit: 3.0** | **Year: Second** | **Semester: First** |
|---|---|---|---|
| **Course Title: Basic Thermodynamics** | | **Course Status: Theory** | |

**Course Rationale:**

"Basic Thermodynamics" introduces students to the fundamental principles governing energy transfer and transformation in various physical systems. Through a blend of theoretical concepts and practical applications, students gain insight into the behavior of matter and energy, essential for fields like engineering and physics. This course lays the groundwork for understanding heat, work, and energy interactions, enabling students to analyze and predict the behavior of systems in equilibrium and non-equilibrium states. By fostering an appreciation for the universal nature of thermodynamics, students develop critical problem-solving skills that have broad relevance in scientific and technological endeavors.

**Course Objectives:**

To introduce the concept of dynamics involved in thermal energy transformation.
To prepare them to carry out experimental investigation and analysis related to thermal interaction with the environment.
To illustrate applications of thermodynamics in the field of mechanical engineering.

**Course Content:**

Fundamental concepts; Basic concepts and definitions; thermodynamic systems, property and state, thermodynamic processes and cycles. Pure Substance: Properties of water and steam; P-V-T behavior of simple compressible substances; phase rule; thermodynamic property tables and charts; ideal and real gases. Properties of gases and vapors.

Laws of thermodynamics and their corollaries. Applications of First law to non-flow and flow processes and cycles. Ideal gas cycles. Power cycles, refrigeration cycles and reciprocating compressors. Second law of thermodynamics: direct and reversed heat engines. Reversibility, processes and cycles. Carnot cycle, Clausius inequality. Application of second law to processes and cycles: Entropy changes of pure substances in non-flow, flow processes and different cycles. PV and TS diagrams.

Thermodynamic relations and equations of state. Mixtures of gases and vapors; Psychrometric; Fuels and combustion.



**Course Outcomes:**

After the successful completion of the course, students will be able to
CO1. Interpret fundamental concepts relevant to thermodynamics.
CO2. Explain the concepts of work, power, and heat in a thermodynamic system
CO3. apply the laws of thermodynamics in various practical application.
CO4. Determine thermodynamic properties of pure substances.
CO5. Apply the concepts of thermodynamics for a control volume, including with turbines, compressors, nozzles, diffusers, heat exchangers, and throttling devices.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | | | | | | | | | | | 1 |
| CO02 | | 2 | | 2 | | | | | | | | |
| CO03 | | | 2 | 1 | | | | | | | | |
| CO04 | 2 | | | 1 | | | | | | | | |
| CO05 | 1 | 2 | | | | | | | | | | 1 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using PPT and board | Midterm Exam-I, Assignment, Final Exam |
| CO2 | Lecture using PPT and board | Midterm Exam-II, Assignment, Final Exam |
| CO3 | Lecture using PPT, Question-Answer session | Class work, Assignment, Final Exam |
| CO4 | Lecture using PPT and board | Assignment, Final Exam |
| CO5 | Lecture using PPT, Question-Answer session | Assignment, Final Exam |

**Books Recommended:**


1. Y. A. Cengel, M. A. Boles; Thermodynamics – An Engineering Approach; Tata McGraw Hill Education Pvt. Ltd. New Delhi.4th Ed; 2012.
2. P. K Nag; Engineering Thermodynamics; Tata McGraw Hill Education Pvt. Ltd.; NewDelhi.4th Ed.; 2008.
3. P. W Gill, J. H. Smith., E. J. Ziurys; Fundamentals of Combustion Engines; Oxford & IBH Publishing Co. Pvt. Ltd.; 4th revised Ed.;1967


| **Course No: MEE 07152157** | **Credit: 3.0** | **Year: Second** | **Semester: First** |
|---|---|---|---|
| **Course Title: Engineering Mechanics-I** | | **Course Status: Theory** | |

**Course Rationale:**

This course aims to provide a preliminary understanding of Chemistry and important concepts of chemistry that will be needed for the further study of higher courses.

**Course Objectives:**

- To develop the capacity to predict the effects of force and motion
- To develop a knowledge of the physical and mathematical principles of mechanics
- To develop the ability to visualize physical configurations in terms of real materials, actual constraints, and the practical limitations which govern the behavior of machines and structures.
- To make them learn the fundamentals of Mechanics, equation of static equilibrium & dynamic equilibrium of particles and rigid bodies.
- To help learn the effect of friction on equilibrium
- To implement the above, know how to solve practical problems.

**Course Content:**

Basic concepts of mechanics; Statics of particles and rigid bodies; Centroids of lines, areas and volumes; Forces in truss, frames, and machines; Forces in cables; Friction, Power transmission by belts and ropes; Moments of inertia of areas and masses; Method of virtual work.

**Course Outcomes:**

After the successful completion of the course, students will be able to

CO1. Apply basic principles of mechanics to solve static problems of particles and rigid bodies, and analyze forces in trusses, frames, machines, and cables.

CO2. Evaluate and predict frictional forces and understand power transmission through belts and ropes.

CO3. Compute centroids of lines, areas, and volumes and use them to solve practical problems.

CO4. Determine moments of inertia of areas and masses using mathematical methods.

CO5. Apply the method of virtual work to analyze and solve mechanical problems.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 3 | 2 | 2 | 3 | 1 | | 1 | 2 | 3 | 2 | 2 |
| CO02 | | | | | 1 | | 1 | | 2 | 3 | 1 | |
| CO03 | 1 | | 1 | 1 | 1 | | 2 | | 1 | 3 | 1 | 1 |
| CO04 | 2 | 1 | 1 | 3 | 2 | | 1 | | 2 | 2 | 1 | 2 |
| CO05 | 2 | 2 | 2 | 3 | 2 | | 1 | | 2 | 2 | 2 | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Assignment |
| CO2 | Lecture using board/LCD projectors | Quiz |
| CO3 | Lecture using board/LCD projectors | Assignment |
| CO4 | Lecture using board/LCD projectors | Quiz |
| CO5 | Lecture using board/LCD projectors | Assignment |



**Books Recommended:**

1. Engineering Mechanics: Statics - Russell Hibbeler
2. Engineering Mechanics: Dynamics - Russell Hibbeler
3. Vector Mechanics for Engineers – Ferdinand P. Beer

| Course Code: EEE 07132113Q | Credit: 3.0 | Year: Second | Semester: First |
|---|---|---|---|
| Course Title: Fundamentals of Electrical Machines | | Course Status: Theory | |

**Course Rationale:**

The main aim of this course is to provide practical knowledge of the principles and practices of different types of Electrical Machines. Electrical engineering includes study of a large number of electrical machines which are used every day. These machines are found in regular wrist watches as well as large industries. The wide usage of these machines compels every engineer to know and understand their basic functions. So, students should have insight into how electric machines work and how to handle them. This course examines the basic theory, characteristics, construction, operation and application of rotating electrical machines. It includes the study of transformers, poly-phase induction motors, synchronous generators, synchronous motors and DC machines.

**Course Objectives:**

- To provide the basic concepts of the construction, characteristics, operation and application of both DC and AC machines including transformer, poly-phase induction motors, synchronous generator, synchronous motor and DC machines.
- To help the students develop skills to solve problems relating to rotor speed, flux, torque, developed power, generated voltage, terminal voltage, currents, load power factors, input and output power, efficiency, and voltage /speed regulation etc. in transformers, DC generators and DC motors.
- Acquaint the students with the techniques of solving different types of problems relating to generated voltage, terminal voltage, current, frequency, synchronous impedance, synchronous speed, slip, rotor frequency, rotor voltage, rotor current, torque, developed power, efficiency and power factor in poly-phase induction motors.
- Facilitate necessary knowledge to explain the results of laboratory tests on various rotating and static electrical machines under load conditions.
- Helping the students to develop the ability to safely wire and operate electrical rotating machines and their associated metering and starting equipment.
- To introduce the basic idea about the design of major classes of electric machines.

**Course Content:**

Transformer: Ideal transformer- transformation ratio, no-load and load vector diagrams; actual transformer- equivalent circuit, regulation, short circuit and open circuit tests.

Three phase induction motor: Rotating magnetic field, equivalent circuit, vector diagram, torque-speed characteristics, motor torque and developed rotor power, no-load test, blocked rotor test, starting and braking and speed control.

Single phase induction motor: Theory of operation, equivalent circuit and starting.

Synchronous Generator: excitation systems, equivalent circuit, vector diagrams at different loads, factors affecting voltage regulation.
Parallel operation: Necessary conditions, synchronizing, circulating current.
Synchronous motor: Operation, effect of loading under different excitation conditions, V-curves and starting.
DC generator: Types, no-load voltage characteristics, build-up of a self-excited shunt generator, critical field resistance, load-voltage characteristic, effect of speed on no-load and load characteristics.
DC motor: Torque, counter emf, speed, torque-speed characteristics, starting and speed regulation.

**Course Outcomes:**
After the successful completion of the course, students will be expected to
CO1. explain Transformer operating principle, Calculate Transformer parameters theoretically and also Identify the inadequacies of Transformers and how to reduce them.
CO2. evaluate induction motor parameters theoretically and also explain three-phase and single-phase induction motor design and working principle
CO3. utilize the three-phase synchronous generator operating principle, find voltage regulation on different loads and also Design a system with parallel connected generators.
CO4. interpret synchronous motors V-curves and effect of loading under different excitation conditions
CO5. apply measures for efficient operation of DC electrical machines (dc generator & dc motor), Understand DC machine design and working principle and also Formulate proper procedure for speed control, starting and braking.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 1 | | | | | | | | | | |
| CO02 | 3 | 2 | | | | | | | | | | 1 |
| CO03 | 2 | | | | | | | | | 1 | | 1 |
| CO04 | | | | 2 | | | | | | | | |
| CO05 | 1 | | | | 2 | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lectures, Home Work | Class Test, Final Exam |
| CO2 | Lectures, Assignments, Demonstration | Class Test, Final Exam |
| CO3 | Lectures, Demonstration | Class Test, Final Exam |
| CO4 | Lectures, Video Tutorials | Assignment, Final Exam |
| CO5 | Lectures, Assignments, Demonstration | Class Test, Final Exam |

**Books Recommended:**



1. A Textbook of Electrical Technology (Volume II) by B.L. Theraja and A.K. Theraja
2. Electric Machines by Charles I. Hubert
3. Principles of Electrical Machines by V.K. Mehta and Rohit Mehta

| Course No: MEE 07152132 | Credit: 1.5 | Year: Second | Semester: First |
|---|---|---|---|
| Course Title: Basic Thermodynamics Sessional | | | Course Status: Sessional |

**Course Rationale:**
The "Thermodynamics Lab" complements theoretical knowledge with hands-on experience, allowing students to observe and experimentally verify fundamental thermodynamic principles. By engaging in practical exercises involving heat transfer, thermodynamic cycles, and properties of substances, students develop a deeper understanding of theoretical concepts covered in the classroom. This lab fosters critical thinking and problem-solving skills as students design experiments, collect data, and analyze results. Furthermore, it cultivates familiarity with laboratory instruments and techniques, preparing students for careers in various scientific and engineering disciplines where a strong grasp of thermodynamics is essential. Overall, this lab bridges theory and application, enhancing students' ability to navigate real-world thermodynamic challenges.

**Course Objectives:**
- To identify and use units and notations in Thermodynamics.
- To state and illustrate first and second laws of thermodynamics and apply those laws in various gas processes and cycles.
- To explain the concepts of thermodynamic systems, property, state, process and cycles like entropy, enthalpy, reversibility, irreversibility, Carnot cycle etc.
- To familiarize students with properties of steam, thermodynamic vapor cycles, psychrometric charts& processes, human comfort conditions.

**Course Content:**
Fundamental concepts; Basic concepts and definitions; thermodynamic systems, property and state, thermodynamic process and cycle. Pure Substance: Properties of water and steam; P-V-T behavior of simple compressible substances; phase rule; thermodynamic property tables and charts; ideal and real gases. Properties of gases and vapors.
Laws of thermodynamics and their corollaries. Applications of First law to Non-flow and flow processes and cycles. Ideal gas cycles. Power cycles, refrigeration cycles and reciprocating compressors. Second law of thermodynamics: direct and reversed heat engines. Reversibility, processes and cycles. Carnot cycle, Clausius inequality. Application of second law to processes and cycles: Entropy changes of pure substances in non-flow, flow processes and different cycles. PV and TS diagrams.
Thermodynamic relations and equations of state. Mixtures of gases and vapors; Psychrometric; Fuels and combustion.

**Course Outcomes:**
After the successful completion of the course, students will be able to
CO1.Apply energy balance to systems and control volumes

CO2.Evaluate changes in thermodynamic properties of substances.
CO3. Evaluate the performance of energy conversion devices.
CO4. Differentiate between high grade and low-grade energy.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | | 2 | | | | | | | | | | |
| CO02 | | 2 | | | | | | | | | | |
| CO03 | 1 | 2 | | | | | | | | | | |
| CO04 | | 1 | | 2 | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture, Laboratory, Assignment | Class work, Assignment, Quiz |
| CO2 | Lecture, Laboratory, Discussion | Class work, Assignment, Quiz |
| CO3 | Lecture, Laboratory, Question-Answer session | Class work, Assignment, Quiz |
| CO4 | Lecture, Laboratory, Question-Answer session | Class work, Assignment, Quiz |

**Books Recommended:**

1. Y. A. Cengel, M. A. Boles; Thermodynamics – An Engineering Approach; Tata McGraw Hill Education Pvt. Ltd. New Delhi.4th Ed; 2012.

| **Course Code: EEE 07132114Q** | **Credit: 1.0** | **Year: Second** | **Semester: First** |
|---|---|---|---|
| **Course Title: Electrical Machines Sessional** | | **Course Status: Sessional** | |

**Course Rationale:**
Electrical engineering is a field of engineering that generally deals with the study and application of electricity. The generation of electricity includes electric machinery. So the student should know how electric machinery works and how to handle them. The theoretical knowledge is incomplete without hands-on experiments using the basic components and measuring devices used in Electrical Machines. In this course, students will perform experiments to verify practically the theories and concepts learned in EEE-213Q. This course teaches the fundamentals of electrical machines, the effect of resistive, inductive and capacitive loading on a single and three-phase transformer. It contains a broad and hand on experience on no load test and blocked rotor test of three phase induction motor. It also familiarizes the torque-speed characteristics of the DC motor, voltage regulation of the f DC shunt generator, loading characteristics of the synchronous generator, V-curve of synchronous motor which is derived from the experimental data.



**Course Objectives:**

- To facilitate necessary knowledge about different DC and AC machines and handle various lab apparatus.
- To determine the voltage transformation ratio and turn ratio of transformer and experience their importance.
- Helping the students to develop ability in examining the effect of resistive, inductive and capacitive loading of single-phase transformers.
- To describe different transformer parameters without actually loading the transformer.
- Enable students to determine different AC asynchronous motor parameters without actually loading the motor.
- To help students develop skills to control the speed of a dc motor and observe the existence of back EMF.
- To describe the importance of residual magnetism on voltage build-up of dc generators.
- To teach the students about how to determine voltage regulation of dc generators from experimental data.
- To provide basic knowledge to obtain O.C.C and loading curve of synchronous generator and also the V-curve of synchronous motor.

**Course Content:**
In this course students will perform experiments to verify practically the theories and concepts learned in EEE-214Q.
Lab 1: To familiarize students with the lab, its equipment and laboratory regulation.

Lab 2-4: To determine the following parameters and performance test of a single phase and three phase transformers:

- Voltage transformation ratio and turn ratio
- Voltage regulation and efficiency with resistive, inductive and capacitive loading
- Short circuit and open circuit test

Lab 5-7: Experiment related to No load test and blocked rotor test, speed control and drawing torque-speed curve of a single phase/three phase induction motor

Lab 8: Study of the Single-phase capacitor-run induction motor speed control

Lab 9-10: Determining torque-speed characteristics of DC motor and voltage regulation of DC shunt generator.

Lab 11: No load and loading characteristics of synchronous generator.

Lab 12: Determining V-curve of synchronous motor.

Lab 13-14: Relevant Experiment based on EEE 0713-2114Q.

**Course Outcomes:**
After the successful completion of the course, students will be able to

CO1. Explain the safety procedures for high voltage electrical machines and also Identify and interpret different electrical machines.
CO2. Drawing the equivalent circuit of transformers from experiments, calculate transformer parameters practically also practically find the electrical system's efficiency and improve it.
CO3. Apply induction motor speed control techniques, Draw equivalent circuits of induction motors from experiments and also Calculate induction motor parameters practically.
CO4. Differentiate between synchronous motor and machine V-curve, Calculate synchronous generators voltage regulation on different loads.
CO5. Interpret torque-speed characteristics of different machines, Demonstrate the difference between AC and DC machines.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 1 | | | | | | | | 1 | | |
| CO02 | 2 | 1 | | | | | | | | 1 | | |
| CO03 | 1 | | 3 | | | | | | 1 | 2 | | |
| CO04 | | | | 3 | | | | | | | | |
| CO05 | 1 | | | | 3 | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lectures | Viva |
| CO2 | Demonstration, Lectures | Viva, Quiz, Laboratory Test |
| CO3 | Lectures, Demonstration | Laboratory Test |
| CO4 | Lectures, Demonstration | Laboratory Test |
| CO5 | Demonstration, Lectures | Viva, Quiz, Performance Test |

**Books Recommended:**


1. A Textbook of Electrical Technology (Volume II) by B.L. Theraja and A.K. Theraja
2. Electric Machines by Charles I. Hubert
3. Principles of Electrical Machines by V.K. Mehta and Rohit Mehta


**Second Year Second Semester**

| **Course No: MAT 05412205Q** | **Credit: 3.0** | **Year: Second** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Complex Variables, Harmonic Analysis and Partial Differential Equations** | | | **Course Status: Theory** |

**Course Objectives:** The objectives of this course are as follows:



- To introduce students with the basic concept of complex variables (complex number system, functions of a complex variable and its limits and continuity, differentiation and line integral of complex functions).
- To learn Cauchy-Riemann equations and analytical functions.
- To apply Cauchy's integral formula and related theorems to solve relevant problems of complex function.
- To identify singular points and apply Cauchy's residue theorem to evaluate residues.
- To introduce the techniques of contour integration and conformal mappings.
- To understand the real and complex form of Fourier series, Fourier transform and Fourier integral and solve engineering problems by using them.
- To solve problems by using Laplace's equation in Cartesian, polar, cylindrical and spherical coordinates.
- To equip students with the concepts of partial differential equations and how to solve Partial Differential Equations with different methods.
- To introduce some physical problems in Engineering models that result in partial differential equations.

**Course Content:**
Complex variable: Complex number system. Functions of a complex variable and its limits and continuity. Differentiation of complex functions, Cauchy-Riemann equations and analytical functions. Line integral of complex functions. Cauchy's integral formula and related theorems. Singular points. Residue. Cauchy's residue theorem. Evaluation of residues. Contour integration. Conformal mapping.
Fourier series: Real and complex form. Fourier integral, Fourier transforms and their uses in solving boundary value problems. Harmonic functions. Definition of harmonics. Laplace's equation in Cartesian, polar, cylindrical and spherical coordinates. Solutions of these equations together with applications. Properties of harmonic functions.
Partial differential equation: Introduction, Equations of linear and non-linear first order Standard forms. Linear equations of higher order. Equations of the second order with variable coefficients.

**Course Outcomes:**
After the successful completion of the course, students will be able to
CO1. Define the complex number system, complex functions and integrals of complex functions, grasp the techniques from Cauchy-Riemann equations, power series expansion and Cauchy Integral formulas to study analytic functions from different perspectives.
CO2. Compute contour integrals by calculating residues and construct conformal mappings between many kinds of domain.
CO3. Know the real and complex form of Fourier series, Fourier transform and Fourier integral and apply them in solving different engineering problems.
CO4. Learn Laplace's equation in Cartesian, polar, cylindrical and spherical coordinates and use them to solve various problems.
CO5. Apply a range of techniques to find solutions of standard Partial Differential Equations.

**Mapping of COs with Pos**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 1 | | | | | | | | | | | |
| CO02 | | | | 1 | 2 | | | | | | | |
| CO03 | 2 | 2 | | | | | | | | | | |
| CO04 | 2 | 2 | | | | | | | | | | |
| CO05 | 2 | 2 | | | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture, PPT Demonstration | Class test (Short Q and MCQ) |
| CO2 | Lecture, PPT Demonstration, Discussion | Quiz, assignment |
| CO3 | Lecture, animated VIDEO clips, Question-Answer session | Class test (Short Q and MCQ) |
| CO4 | Lecture, Group discussion | Essay type test, problem solving |
| CO5 | Lecture, PPT presentation, Group discussion for problem analysis | Essay type test, problem solving |

**Books Recommended:**


1. Spiegel, M.R.: Complex Variable
2. Churchill: Introduction to Complex Variable and Applications
3. Rajput, B.S.: Mathematical Physics
4. Stephenson: Mathematical Methods
5. Kreyszig, Erwin: Advanced Engineering Mathematics
6. Khanna, M. L.: Partial Differential Equations
7. Raisinghania, M.D.: Ordinary and Partial Differential Equations


| **Course No: MEE 07152259** | **Credit: 3.0** | **Year: Second** | **Semester: First** |
|---|---|---|---|
| **Course Title: Engineering Mechanics-II** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are as follows:

- To develop a knowledge of the physical and mathematical principles of mechanics.
- To develop the ability to visualize physical configurations in terms of real materials, actual constraints, and the practical limitations which govern the behavior of machines and structures.
- To make them learn the fundamentals of dynamic equilibrium of particles and rigid bodies.
- To provide knowledge of kinematics, kinetics of particle and rigid body, related principles.
- To implement the above, know how to solve practical problems.

**Course Content:**



Kinematics of particles: Kinetics of particles: Newton's second law, energy and momentum method; System of particles; Kinematics of rigid bodies; Plane motion of rigid bodies: forces and acceleration, Energy and momentum methods; Velocity and acceleration in mechanism.

**Course Outcomes:**

After the successful completion of the course, students will be able to

CO1. Apply Newton's second law to analyze the motion of particles and solve problems related to the kinetics of particles.

CO2. Evaluate the energy and momentum methods to analyze the motion of particles and rigid bodies, and to solve related problems.

CO3. Apply the principles of system of particles to solve engineering problems related to the motion of systems.

CO4. Analyze the velocity and acceleration of mechanisms and to apply the concepts of forces and acceleration to solve problems related to plane motion of rigid bodies.

CO5. Apply the principles of energy and momentum methods to analyze the motion of rigid bodies and solve related engineering problems.

Mapping of COs with Pos

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 2 | 1 | 3 | 3 | | | | | | | |
| CO02 | 2 | 2 | 1 | 3 | 3 | | | | | | | |
| CO03 | 1 | 2 | 1 | 3 | 3 | | | | | | | |
| CO04 | 1 | 3 | 1 | 3 | 3 | | | | | | | |
| CO05 | 2 | 2 | 1 | 3 | 3 | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Assignment |
| CO2 | Lecture using board/LCD projectors | Quiz |
| CO3 | Lecture using board/LCD projectors | Assignment |
| CO4 | Lecture using board/LCD projectors | Quiz |
| CO5 | Lecture using board/LCD projectors | Assignment |

**Books Recommended:**


1. Engineering Mechanics: Statics - Russell Hibbeler
2. Engineering Mechanics: Dynamics - Russell Hibbeler
3. Vector Mechanics for Engineers – Ferdinand P. Beer


| **Course No: MEE 07152245** | **Credit: 3.0** | **Year: Second** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Numerical Analysis** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are as follows:

- To develop the basic understanding of numerical algorithms and skills
- To illustrate application of different algorithms in solving engineering problems.

**Course Content:**
Roots of polynomials and transcendental equations; Determinants and matrices; Eigen values and eigen vectors; Solution of linear and non-linear algebraic equations; Solution of first-order and second order differential equations. Solution of system of differential equations. Interpolation methods; Numerical differentiation and integration; Solving equations by finite differences, FEM for 1-D heat flow, FEM for 2-D & 3-D heat flow; Curve fitting.

**Course Outcomes:**
After the successful completion of the course, students will be able to
CO1. Find the roots of polynomials and transcendental equations using numerical methods.
CO2. Solve linear and non-linear algebraic equations using matrix and numerical techniques.
CO3. Apply numerical methods to solve first-order and second-order differential equations, and systems of differential equations, and utilize interpolation techniques to estimate unknown values.
CO4. Apply numerical methods to differentiate and integrate functions and use finite differences and finite element methods (FEM) to analyze 1-D, 2-D, and 3-D heat flow problems.
CO5. Perform curve fitting.

**Mapping of COs with Pos**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 2 | 2 | 3 | 3 | | | | | 3 | | 2 |
| CO02 | 2 | 3 | 2 | 3 | 3 | | | | | 3 | 3 | 2 |
| CO03 | 2 | 2 | 2 | 3 | 3 | | | | | 3 | | 2 |
| CO04 | 2 | 2 | 2 | 3 | 3 | | | | | 3 | 3 | 2 |
| CO05 | 1 | | | | | | | | | 3 | | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| Cos | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Assignment |
| CO2 | Lecture using board/LCD projectors | Quiz |
| CO3 | Lecture using board/LCD projectors | Assignment |
| CO4 | Lecture using board/LCD projectors | Quiz |
| CO5 | Lecture using board/LCD projectors/Project | Assignment |

**Books Recommended:**
1. Numerical methods for engineers, by Stevens C Chapra
2. Numerical methods, by E Balagurusamy



| Course No: MEE 07152253 | Credit: 3.0 | Year: Second | Semester: Second |
|---|---|---|---|
| Course Title: Mechanics of Solids | | Course Status: Theory | |

**Course Objectives:** The objectives of this course are as follows:
- To familiarize the students with stress analysis.
- To provide knowledge about different kinds of loads.
- Getting idea about different kinds of stresses.
- To make students able to analyze and calculate stress in beams, columns, springs, thin-walled cylinder, etc.
- To acquire knowledge about different kinds of failure theories.

**Course Content:**
Stress analysis: statically determinate stress system- stress-strain relationship, statically indeterminate axially loaded member, axially loaded member, thermal and centrifugal stresses; Stresses in thin and thick-walled cylinders and spheres. Beams: shear force and bending moment diagrams; Various types of stresses in beams; Flexure formula; Deflection of beams: integration and area moment methods; Introduction to reinforced concrete beams and slabs. Torsion formula; Angle of twist; Modulus of rupture; Helical springs; Combined stresses: principal stress, Mohr's Circle; Columns: Euler's formula, intermediate column formulas,
the Secant formula; Flexure formula of curved beams.
Introduction to experimental stress analysis techniques; Strain energy; Failure theories; Deflection; Stiffness.

**Course Outcomes:**
After the successful completion of the course, students will be able to
CO1. Calculate axial, thermal and centrifugal stresses and strain.
CO2. Analyze different kinds of applied load and stress in case of different structure like cylinder, beam and column.
CO3. Analyze beam deflection by integration and area moment method.
CO4. Predict the effect of combined stress on a mechanical structure by using formula and Mohr's Circle.
CO5. Analyze the failure of mechanical components.

**Mapping of COs with Pos**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | 3 | | | | | | | | | |
| CO02 | | | 3 | 2 | | | | | | | | 1 |
| CO03 | 1 | 2 | 3 | 2 | | | | | | | | |
| CO04 | 1 | | 2 | 3 | | | | | | | | |
| CO05 | 1 | 2 | 1 | 1 | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|

| | | |
|---|---|---|
| CO1 | Lecture using PPT and board | Midterm Exam-I, Assignment, Final Exam |
| CO2 | Lecture using PPT and board | Midterm Exam-II, Assignment, Final Exam |
| CO3 | Lecture using PPT, Question-Answer session | Class work, Assignment, Final Exam |
| CO4 | Lecture using PPT and board | Assignment, Final Exam |
| CO5 | Lecture using PPT, Question-Answer session | Assignment, Final Exam |

**Books Recommended:**


1. Ferdinand L. Singer & Andrew Pytel - Strength of Materials
2. R.K. Bansal - Mechanics of Solids
3. David K. Felbeck - Strength and Fracture of Engineering Solids
4. James Martin Prentis - Engineering Mechanics
5. Shigley's Mechanical Engineering Design


| **Course No: MEE 07152255** | **Credit: 3.0** | **Year: Second** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Engineering Materials (Metallic and Composites)** | | | **Course Status: Theory** |

**Course Objectives:**

- To familiarize the students with metallic materials and their alloys.
- To demonstrate different material testing methods
- To explain phase diagram and phase rules
- To introduce with composite materials
- To make them differentiate among different composite materials and their specific applications.

**Course Content:**

Metallic Materials: Concept of malleability, ductility, toughness, fatigue resistance and other properties of metallic materials. Mechanical and non-destructive tests of metals. Pig iron: production and uses. Cast iron: production, types, uses and effects of impurities. Steels: Bessemer and open- hearth steels, production and uses. Plain carbon and different types of allow steels. Bearing metals, light alloys, common metals and their alloys. The Fe-FeC equilibrium diagram. Types of heat treatment. Surface Treatments and coatings; joining of metals and alloys.

Composite materials: Different types of composites materials; Polymers; Review of Polymer types, synthesis and structures; structure-property relationships; processing; commodity vs. engineering plastics; case studies.; Polymeric matrix composites: Types and properties of fiber reinforced composites; multiplied laminated composites; applications of fiber-reinforced polymeric matrix composites; case studies.

**Course Outcomes:**

After the successful completion of the course, students will be able to



CO1. make qualitative comparisons between materials and application areas for the most common technical materials in the various materials categories,
CO2. interpret binary phase diagrams and utilize the underlying concepts to explain Fe-FeC phase diagrams
CO3. explain the underlying mechanisms for hardening of metals and surface hardening
CO4. differentiate fundamental differences between iron and steel making procedures in industries and differences between plain carbon and various alloy steels
CO5. explain different fabrication procedures of polymer composites.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 1 | | | 3 | | 2 | | | | | | 2 |
| CO02 | 2 | 3 | 1 | | | | | | | | | |
| CO03 | | | | 2 | | 3 | | | | | | |
| CO04 | | | | | 3 | 2 | 3 | | | | | 2 |
| CO05 | 3 | | | 2 | 2 | | 1 | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture, PPT Demonstration | Class test (Short Q and MCQ) |
| CO2 | Lecture, PPT Demonstration, Discussion | Quiz, assignment |
| CO3 | Lecture, animated VDO clips, Question-Answer session | Class test (Short Q and MCQ) |
| CO4 | Lecture, Group discussion | Essay type test, problem solving |
| CO5 | Lecture, PPT presentation, Group discussion for problem analysis | Essay type test, problem solving |

**Books Recommended:**


1. William D. Callister, Jr., DAVID G. RETHWISCH, Materials Science and Engineering An Introduction, 10th Edition.
2. Krishan K Chawla, composite materials
3. Sydney H. Avner. Introduction to Physical Metallurgy, 2nd Edition.
4. MF Ashby & DRH Jones, Engineering Materials 1: An Introduction to their Properties and Applications, 4th Edition.
5. Arthur K. Kaw, Mechanics of composite materials


| **Course No: MEE 07152246** | **Credit: 1.0** | **Year: Second** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Numerical Analysis Sessional** | | **Course Status: Sessional** | |

**Course Objectives:**

- To develop the basic understanding of numerical algorithms and skills.

- To familiarize basic structure & syntax of the programming language of MATLAB.
- To introduce numerical steps in solving engineering problems using MATLAB.

**Course Content:**
Roots of polynomials and transcendental equations; Determinants and matrices; Eigenvalues and eigenvectors; Solution of linear and non-linear algebraic equations; Solution of first order and second order differential equations, Solution of system of differential equations; Interpolation methods; Numerical differentiation and integration Solving equations by finite differences, FEM for 1-D heat flow, FEM for 2-D & 3-D heat flow; Curve fitting.

**Course Outcomes:**
After the successful completion of the course, students will be able to
CO1. Apply numerical methods to solve linear and non-linear algebraic equations with different approaches, such as bisection method, Newton-Raphson method, and secant method, and evaluate the accuracy and efficiency of each method.
CO2. Analyze the properties of matrices and determinants, and use them to solve systems of linear equations, calculate eigenvalues and eigenvectors, and apply these concepts to solve practical problems.
CO3. Use numerical methods to approximate derivatives and integrals of functions, and apply these methods to solve practical problems, such as evaluating areas and volumes of irregular shapes.
CO4. Apply interpolation methods, such as Lagrange interpolation and spline interpolation, to approximate functions and data sets, and evaluate the accuracy and efficiency of each method.
CO5. Apply finite difference and finite element methods to solve partial differential equations, such as heat flow equations, and analyze the numerical solutions in terms of stability, accuracy, and convergence.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 3 | 1 | 3 | 3 | | | | 1 | 3 | | |
| CO02 | 3 | 3 | 1 | 2 | 2 | | | | 1 | 3 | | |
| CO03 | 2 | 1 | | 2 | 2 | | | | 1 | 3 | | |
| CO04 | 1 | | | 1 | 1 | | | | 1 | 2 | | |
| CO05 | 3 | 3 | 1 | 2 | 3 | | | | 1 | 2 | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Laboratory | Assignment |
| CO2 | Laboratory | Quiz |
| CO3 | Laboratory | Assignment |
| CO4 | Laboratory | Quiz |



| | | |
|---|---|---|
| CO5 | Laboratory | Assignment |

**Books Recommended:**
1. Numerical methods for engineers, by Stevens C Chapra
2. Numerical methods, by E Balagurusamy

| **Course No: MEE 07152254** | **Credit: 1.5** | **Year: Second** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Mechanics of Solids Sessional** | | | **Course Status: Sessional** |

**Course Objectives:** The objectives of this course are
- To learn practically how to operate several instruments
- To understand the process of Hardness test of Metal Specimens
- To introduce students How to operate UTM and perform compression test
- To make the students understand how to perform impact test
- To make the students understand how to perform bending test

**Course Content:**
Hardness test of metal specimens; Compression test and Tension test of metal specimens; Impact test of metal specimens; Bending moment test of metal beam; Whirling speed of column; Torsion test of metals; Simulation of tensile, compression, torsion, shear tests.

**Course Outcomes:**
After the successful completion of the course, students will be able to
CO1. analyze the failure of mechanical components.
CO2. explain the performance of compression test of metal block on UTM
CO3. Observe the strength and deflection of different mechanical structure.

**Mapping of COs with POS**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 3 | | | | | | | 1 | | | |
| CO02 | 1 | | | 2 | | | | | | | | |
| CO03 | | 2 | 3 | | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture, PPT Demonstration | Class test (Short Q and MCQ) |
| CO2 | Lecture, PPT Demonstration, Discussion | Quiz, assignment |
| CO3 | Lecture, animated VDO clips, Question-Answer session | Class test (Short Q and MCQ) |

**Books Recommended:**

1. Solid Mechanics Lab manual (SUST)
2. J. R. Barber - Intermediate Mechanics of Materials
3. Russell C. Hibbeler - Mechanics of Materials

| Course No: MEE 07152256 | Credit: 1.0 | Year: Second | Semester: Second |
|---|---|---|---|
| Course Title: Engineering Materials Sessional | | | Course Status: Sessional |

**Course Objectives:**

- To demonstrate different metal processing methods
- To introduce different heat treatment processes and resulting micro-structure of metallic alloys
- To introduce the working principle and application of metallurgical microscope and heat treatment oven

**Course Content:**

Concept of malleability, ductility, toughness, fatigue resistance and other properties of metallic materials. Mechanical and non-destructive tests of metals. Pig iron: production and uses. Cast iron: production, types, uses and effects of impurities. Steels: Bessemer and open- hearth steels, production and uses. Plain carbon and different types of allow steels. Bearing metals, light alloys, common metals and their alloys. The Fe-FeC equilibrium diagram. Types of heat treatment. Surface Treatments and coatings; joining of metals and alloys.

Composite materials: Different types of composites materials; Polymers; Review of Polymer types, synthesis and structures; structure-property relationships; processing; commodity vs. engineering plastics; case studies.; Polymeric matrix composites: Types and properties of fiber reinforced composites; multiplied laminated composites; applications of fiber-reinforced polymeric matrix composites; Hardness test; case studies.

**Course Outcomes:**

After the successful completion of the course, students will be able to

CO1. Identify crystal structures for various materials and understand the defects in such structures.

CO2. Hypothesize how to tailor material properties of ferrous and non-ferrous alloys.

CO3. Quantify mechanical integrity and failure in materials.

CO4. Identify micro-structures of metals based on different heat treatment processes.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 2 | | 2 | | | | | | 2 | | 2 |
| CO02 | 2 | | 3 | | | 2 | | | 2 | | | |
| CO03 | 1 | 3 | 2 | 2 | | | | | 2 | | | |
| CO04 | | | | 1 | 3 | | | | | 2 | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy



| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture, PPT Demonstration | Class test (Short Q and MCQ) |
| CO2 | Lecture, PPT Demonstration, Discussion | Quiz, assignment |
| CO3 | Lecture, animated VDO clips, Question-Answer session | Class test (Short Q and MCQ) |
| CO4 | Lecture, Group discussion | Essay type test, problem solving |

**Books Recommended:**

1. William D. Callister, Jr., DAVID G. RETHWISCH, Materials Science and Engineering An Introduction, 10th Edition.
2. Krishan K Chawla, composite materials
3. Sydney H. Avner. Introduction to Physical Metallurgy, 2nd Edition.
4. MF Ashby & DRH Jones, Engineering Materials 1: An Introduction to their Properties and Applications, 4th Edition.
5. Arthur K. Kaw, Mechanics of composite materials

| Course No: MEE 07152288 | Credit: 0.5 | Year: Second | Semester: Second |
|---|---|---|---|
| Course Title: Comprehensive Viva-II | | Course Status: Viva | |

**Course Objectives:**

- To help students to communicate effectively
- To facilitate necessary knowledge about different topics related to courses
- To develop skills on speak in English fluently
- To facilitate students to share different ideas & thoughts in practical life
- To help students to identify better choice among all alternatives
- To understand basic solution process
- To introduce students about practical service life

**Course Content:**

Topics covered by all theoretical and practical courses in both two semesters of the running year.

**Course Outcomes:**

After the successful completion of the course, students will be able to

CO1. communicate effectively with other employees and workers in service life.

CO2. explain the understanding about different practical problems relevant to the course.

CO3. develop the capability of leading a team.

CO4. explain the integrated engineering knowledge learned throughout the semester.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | | | | | | 2 | | | | 3 | | |
| CO02 | 2 | 2 | | | | | | | | | | |
| CO03 | | | | | | 1 | | | 3 | 2 | | |
| CO04 | 3 | 2 | | 2 | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Self-learning using interpersonal relationship | Viva voce |
| CO2 | Self-learning using reference books/other online materials | Viva voce |
| CO3 | Self-learning using interpersonal relationship | Viva voce |
| CO4 | Self-learning using reference books/other online materials | Viva voce |

**Third Year First Semester**

| **Course No: MEE 07153121** | **Credit: 3.0** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Fluid Mechanics- I** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are as follows:

- To familiarize the students with the basic concepts of fluids and their properties.
- To make them find out pressure variation in incompressible and compressible static fluid.
- Helping the students conceptualize buoyancy and stability of floating and submerged bodies.
- Making them learn manometry and their application.
- To make them capable of applying continuity, momentum and energy equations for solving engineering problems.
- To introduce different types of pressure, velocity and flow measuring devices.

**Course Content:**

Fundamental concept of fluid as a continuum; Fluid statics: basic hydrostatic equation, pressure variation in static incompressible and compressible fluids; Manometers; Forces on plane and curved surfaces; Buoyant force; Stability of floating and submerged bodies; Pressure distribution of a fluid in a rotating system. Relation between system approach and control volume approach; Continuity , momentum and energy equations; Special forms of energy and momentum equations and their applications; Pressure, velocity and flow measurement devices. Introduction to inviscid incompressible flow to include two dimensional basic flows.

**Course Outcomes:**

After the successful completion of the course, students will be able to:
CO1. Develop the basic foundation about various types of fluids.



CO2. Analyze practical problems based on Newton's law of viscosity.
CO3. Apply the fundamental equations of fluid mechanics in problem solving.
CO4. Identify and describe the use of various devices used for measuring different fluid and flow properties.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 2 | 2 | 2 | 1 | | | | | | | 3 |
| CO02 | 2 | 3 | 3 | 2 | 1 | 1 | 1 | | | | | 2 |
| CO03 | 2 | 3 | 3 | 3 | 1 | | | | | | | 2 |
| CO04 | 2 | 2 | 1 | 2 | 3 | | | | 1 | | | 3 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture | Midterm Examination 1 |
| CO2 | Lecture | Midterm Examination 2 |
| CO3 | Lecture | Assignment |
| CO4 | Lecture | Semester-end Examination |

**Books Recommended:**

1. Mechanics of Fluids- Irving H. Shames
2. Fluid Mechanics- Frank M. White
3. Fundamentals of Fluid Mechanics- Munson

| **Course No: MEE 07153131** | **Credit: 4.0** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Heat Transfer** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- Acquaint students with the basic laws and modes of heat transfer.
- Getting ideas about problems involving steady state heat conduction in different geometries.
- To develop skills for solutions for transient heat conduction in simple geometries.
- To understand the basics of Thermal radiation, Blackbody radiation and net radiation interchange for different geometries.
- Getting an idea about the fundamentals of the convective heat transfer process.
- To facilitate necessary knowledge about laminar and turbulent flow including boundary layer development.
- To evaluate heat transfer coefficients for natural convection from exterior surfaces of common geometrics.
- Helping the students to develop ability in evaluating heat transfer coefficients for forced convection for different geometries.
- To provide the knowledge of heat transfer mechanisms with phase change such as boiling and condensation and also analyze practical problems.

- Getting an idea about the mechanism of mass transfer by diffusion, convection and change of phase and the analogy between Heat and Mass Transfer.

**Course Content:**
Basic modes of heat transfer; General conduction equation; Steady state conduction in different geometries and composite structures; Thermal contact resistance; Unsteady heat conduction in solids; Laws of radiation heat transfer; Radiation shape factor; Radiation interchange between two surfaces; Gas radiation; Heat and momentum transfer associated with laminar and turbulent flows of fluids in forced convection; Velocity and thermal boundary layer developments in tubes (ducts) and over flat plate; Natural convection heat transfer; Heat transfer mechanism with change of phase; Boiling and condensation: mechanism and heat transfer correlations; Mechanism of mass transfer by diffusion, convection and change of phase; Analogy between heat and mass transfer.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. calculate various heat transfer properties by conduction in solids for steady-state and transient conditions and analyze improvement in heat conduction after using different types of fins on the system surface.
CO2. implement fundamental concepts of radiation for blackbody and net radiation interchange to different geometries.
CO3. explain basic heat transfer mechanisms through convection in closed conduits and over external surfaces.
CO4. calculate heat transfer coefficient for both natural and forced convection for different geometry.
CO5. utilize fundamental concepts to mathematical problems involving boiling and condensation and apply mass transfer by analogy to heat transfer surfaces.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 1 | | 2 | | | | | | | | 1 |
| CO02 | 2 | 2 | | 2 | | | | | | | | |
| CO03 | 3 | 2 | 2 | 2 | 1 | | | | | | | 2 |
| CO04 | | 2 | 3 | 3 | | 1 | | | | | | |
| CO05 | 2 | 3 | | 1 | | | 1 | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture | Midterm Examination 1 |
| CO2 | Lecture | Assignment |
| CO3 | Lecture | Midterm Examination 2 |
| CO4 | Lecture | Semester Final Examination |
| CO5 | Lecture | Semester Final Examination |



**Books Recommended:**
1. Heat and Mass Transfer; Yunus A. Cengel & Afshin J. Ghajar.
2. Fundamental of Heat and Mass Transfer; Incropera, Dewitt, Bergman, Lavine.
3. Heat Transfer; J.P. Holman.

| **Course No: MEE 0715-3151** | **Credit: 3.0** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Mechanics of Machinery** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:
- To familiarize the students with mechanisms.
- To facilitate necessary knowledge about turning moment.
- To make the students understand the balancing.
- To make students able to analyze different kinds of vibrations.
- To provide the knowledge of transmission of force.

**Course Content:**
Mechanisms; displacement, velocity and acceleration; Turning moment: inertia and kinetic energy of reciprocating and rotating parts; Static and dynamic balancing: reciprocating and rotating parts, multi-cylinder in-line and V-engines, radial engines, and opposed-piston engines; Balancing machines. Undamped free vibrations with one and two degrees of freedom; Longitudinal, transverse
and torsional vibrations; Damped free and forced vibrations with single degrees of freedom; Whirling of shafts and rotors; Vibration of geared systems; Vibration absorption, isolation and deisolation; Vibration measuring instruments. Study of cams and cam followers; Clutches and brakes; Dynamometers. Study of gears and gear trains; Study of governors; Gyroscopes: principles and applications.

**Course Outcomes:**
After the successful completion of the course, students should be able to:
CO1. Explain different mechanisms and be proficient in the use of mathematical methods to analyze the forces and motion (velocity and acceleration) of complex systems of linkages and mechanisms, and turning moment diagrams.
CO2. Estimate inertia force and kinetic energy of reciprocating and rotating parts and make balancing of machines.
CO3. Design for cams and follower for different operation
CO4. Explain different relationships and diversities of the mechanical elements of power transferring mechanism like brakes, clutches and gear train and solve problems.
CO5. Analyze different types of vibrations in the machine and its application.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | | | | | | | | |
| CO02 | | 3 | | | | | | | | | | |
| CO03 | | | 3 | | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO04 | | | 3 | | | | | | | | | |
| CO05 | | | | 2 | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture | Midterm Examination 1 |
| CO2 | Lecture | Midterm Examination 2 |
| CO3 | Lecture | Assignment |
| CO4 | Lecture | Semester-end Examination |
| CO5 | Lecture | Semester-end Examination |

**Books Recommended:**

1. R.S. Khurmi - Theory of Machines
2. Alex; B. W. Kennedy - The Mechanics of Machinery
3. C. W Ham - Mechanics of machinery
4. Mahmoud A. Mostafa - Mechanics of Machinery

| **Course No: MEE 07153171** | **Credit: 3.0** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Production Processes** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- To familiarize the students with metal removing processes.
- To know about chip formation processes.
- To understand different types of casting.
- To make students able to understand Bulk deformation processes.
- To acquire knowledge about different types of welding.

**Course Content:**

Metal removing processes: turning, drilling, shaping, planing, milling, broaching, grinding, precision and non-precision finishing processes. Tool geometry and chip formation processes. Casting: sand, die, centrifugal and other types of casting, Casting design and casting defects. Bulk deformation processes: Forging; open, COse, coining, Extrusion; Hot and cold extrusion process; Rolling; Welding: arc, gas, TIG, MIG, resistance, thermit, friction, EBW, LBW. Brazing and soldering. Plastic, ceramic and glass product manufacturing processes.

**Course Outcomes:**

After the successful completion of the course, students will be able to:

CO1. Apply principles of engineering, science, and mathematics to solve complex engineering problems related to production processes.

CO2. Use engineering design principles to develop solutions for production processes that consider factors such as public health, safety, welfare, global, cultural, social, environmental, and economic factors.

CO3. Communicate effectively with different audiences, including technical and non-technical stakeholders, about production process design, development, and implementation.



CO4. Work effectively in teams to provide leadership, establish goals, plan tasks, and meet objectives related to production process design, development, and implementation.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 3 | | 3 | | 3 | | 3 | 3 | 3 | | |
| CO02 | 3 | 3 | | 3 | | 3 | | 3 | 3 | 3 | | |
| CO03 | | 2 | 3 | 2 | 3 | | | | | 3 | | |
| CO04 | | 3 | 3 | 2 | 3 | | 3 | | | 3 | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture | Midterm Examination 1 |
| CO2 | Lecture | Midterm Examination 2 |
| CO3 | Lecture | Assignment |
| CO4 | Lecture | Semester-end Examination |

**Books Recommended:**

1. DeVries, Warren R - Analysis of Material Removal Processes
2. Dr. B J Ranganath – Metal Cutting and Tool Design
3. Larry Jeffus - Welding: Principles and Applications

| **Course No: MEE 07153167** | **Credit: 3.0** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Instrumentation and Measurement** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- To provide an introduction to the field of Instrumentation.
- To introduce students to different types of sensing elements.
- Getting ideas about the basic principles of measurement and the measuring system.
- To facilitate necessary knowledge about different physical parameters such as displacement, pressure, temperature, heat flux, flow, motion and vibrations, force, torque and strain.
- To enhance the skill on data acquisition and processing.

**Course Content:**

Basic principles of measurements; Characterization and behavior of typical measuring systems; System dynamics; Measurement error and uncertainty; Different types of sensing elements; Measuring, transmission and recording methods; Measurements of displacement, pressure, temperature, heat flux, flow, motion and vibrations, force, torque and strain; Data acquisition and processing.

**Course Outcomes:**

After the successful completion of the course, students will be able to:

CO1. analyze the behavior shown by different orders of measuring systems and design their system dynamics accordingly.
CO2. calculate different types of errors and uncertainties involved in measurement systems.
CO3. measure various physical parameters with the proper selection of instruments.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | 3 | | | | | | | | | |
| CO02 | | 3 | | 2 | 1 | | | 2 | | | | |
| CO03 | | 2 | 1 | 1 | 3 | | | | | | 2 | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture | Mid Term and Semester Final |
| CO2 | Lecture | Mid Term and Semester Final |
| CO3 | Lecture | Mid Term and Semester Final |

**Books Recommended:**

1. Figliola, R.S. & Beasley, D.E., Theory & Design for Mechanical measurements, J. Wiley & Sons, Inc.
2. Halman, J.P., Experimental Methods for Engineers, McGraw-Hill, Inc.
3. Beckwith, T.G., Marangoni, R.D. & Lienhard, J.H., Mechanical Measurements, Addison Wesley, Inc.


| **Course No: MEE 07153168** | **Credit: 1.5** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Electro Mechanical System Design** | | **Course Status: Sessional** | |

**Course Objectives:** The objectives of this course are:
- To provide an introduction to the field of Instrumentation.
- To introduce students about different types of sensing elements and their operations to measure various parameters.
- Getting ideas about data acquisition.
- Apply the knowledge and develop a project practically based on instrumentation.

**Course Content:**
In this course students are required to undertake a design of a small electro-mechanical or instrumentation system involving sensors, actuations, signal conditioning, feed-back etc. The system design would involve the stages of concept, calculations, fabrication, presentation and demonstration of product. Use of locally available prospects materials will be emphasized.

**Course Outcomes:**
After the successful completion of the course, students will be able to:



CO1. use various sensing elements to sense different properties.
CO2. measure various physical parameters with the proper selection of instruments.
CO3. develop a project with automation by using their knowledge.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | | 3 | | | 2 | | | | 2 | 1 | | |
| CO02 | | 2 | | | | | 2 | 2 | | | 2 | |
| CO03 | | | 3 | | 2 | 1 | | 3 | 3 | 3 | 3 | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Laboratory Demonstration | Project Display |
| CO2 | Self-Learning | Project Display |
| CO3 | Self-Learning | Project Display |

**Books Recommended:**

1. Figliola, R.S. & Beasley, D.E., Theory & Design for Mechanical measurements, J. Wiley & Sons, Inc.
2. Beckwith, T.G., Marangoni, R.D. & Lienhard, J.H., Mechanical Measurements, Addison Wesley, Inc.


| **Course No: MEE 07153122** | **Credit: 1.5** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Fluid Mechanics- I Sessional** | | **Course Status: Sessional** | |

**Course Objectives:** The objectives of this course are as follows:
- To make the students understand the stability of a floating body.
- Making the students verify Bernoulli's equation.
- To make the students study the impact of jet on a flat plate and a hemispherical vane.
- Helping them to study the moment developed on a fully or partially submerged vertical plane surface due to the hydrostatic force.
- To make them calibrate the orifice meter by observing the effect of flow rate on the accuracy of the flow meters and by finding out the loss through the flow meter.
- Helping the students to calibrate a rectangular and a V notch weir to predict the flow over them for different water head.

**Course Content:**
Stability of floating body; Verification of Bernoulli's equation, Impact of jet; Moment on fully and partially submerged plane surface; Flow measurement devices: Venturi meter, Orifice meter, Notch;

**Course Outcomes:**
After the successful completion of the course, students will be able to:

CO1. Explain the importance of vertical center of gravity in the stability of a floating body.
CO2. Identify the application of Bernoulli's equation in the practical world.
CO3. Explain and write up the operational procedures of different flow meters and gauges.
CO4. Develop teamwork skill through mutual collaboration in the experiment
CO5. Develop an ethical perspective about formal report writing.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 2 | 2 | 2 | | | | | | | | |
| CO02 | 3 | 3 | 2 | 3 | 1 | 1 | | | | | | 2 |
| CO03 | 2 | 1 | 2 | 3 | 3 | | | | | | | 1 |
| CO04 | | | 1 | 2 | 1 | 1 | | | 3 | 2 | | 2 |
| CO05 | | | | | | | | 3 | | | | 3 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Laboratory demonstration | Assignment and Quiz |
| CO2 | Laboratory demonstration | Assignment and Quiz |
| CO3 | Laboratory demonstration | Assignment and Quiz |
| CO4 | Laboratory demonstration | Assignment and Quiz |
| CO5 | Laboratory demonstration | Assignment and Quiz |

**Books Recommended:**
1. Fluid Mechanics - I lab sheet (SUST).

| **Course No: MEE 07153132** | **Credit: 1.5** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Heat Transfer Sessional** | | **Course Status: Practical** | |

**Course Objectives:** The objectives of this course are:
- To facilitate necessary knowledge on conduction through a rectangular and cylindrical body and analyze temperature profile and the rate of heat transfer.
- Make the students understand the experiment on conduction through fins with different shapes and to find out fin parameters.
- Getting an idea about radiation of a blackbody experimentally.
- Accumulate basic ideas about experiments on transient heat transfer.

**Course Content:**
Conduction heat transfer through a body with rectangular and cylindrical cross-sectional body; Radiation heat transfer; transient Heat transfer, forced convection heat transfer for flow over a flat plate and inside pipes or ducts, natural convection for horizontal and vertical surfaces, boiling and condensation heat transfer.



**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. analyze conduction heat transfer through a rectangular and cylindrical body.
CO2. conduct experiments on blackbody radiation and analyze radiation heat transfer.
CO3. calculate forced convection for flow over a flat plate and inside pipe/ducts.
CO4. determine heat transfer performance for boiling and condensation heat transfer

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | 3 | 2 | 1 | | | 1 | 2 | | |
| CO02 | | 2 | 3 | | 1 | | 1 | | | 2 | | 1 |
| CO03 | 1 | 2 | | 3 | 2 | | | | 2 | | | |
| CO04 | 2 | 2 | | | | 1 | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Laboratory Demonstration | Assignment and Quiz |
| CO2 | Laboratory Demonstration | Assignment and Quiz |
| CO3 | Laboratory Demonstration | Assignment and Quiz |
| CO4 | Laboratory Demonstration | Assignment and Quiz |

**Books Recommended:**
1. Heat and Mass Transfer; Yunus A. Cengel & Afshin J. Ghajar.

| **Course No: MEE 07153152** | **Credit: 1.5** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Mechanics of Machinery Sessional** | | **Course Status: Sessional** | |

**Course Objectives:** The objectives of this course are:
- To help the students differentiate between Static and Dynamic Balancing of a Shaft
- To make the students understand Free Vibration of a Single Degree of Freedom System
- To provide the knowledge of Mass Moment of Inertia of a Flywheel
- To facilitate necessary knowledge about Gyroscope
- Study of Cam
- To make the students understand Critical Speed of a Shaft

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

**Course Outcomes:**
After the successful completion of the course, students will be expected to:

CO1. Understand the mechanics of different mechanical systems, i.e. epicyclic gear train, gyroscope, vibration, helical spring etc.
CO2. Investigate data obtained from experiment to determine performance parameters of machineries
CO3. Demonstrate experimental results through technical reports individually.
CO4. Develop the skill of group work and discussion

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | | | | | | | | |
| CO02 | | | | 3 | | | | | | | | |
| CO03 | | | | | | | | | | 3 | | |
| CO04 | | | | | | | | | | | | 3 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Laboratory demonstration | Assignment and Quiz |
| CO2 | Laboratory demonstration | Assignment and Quiz |
| CO3 | Laboratory demonstration | Assignment and Quiz |
| CO4 | Laboratory demonstration | Assignment and Quiz |

**Books Recommended:**
1. Mechanics of Machinery Lab manual (SUST)
2. Textbooks on Theory of Machines Applied Kinematics

| **Course No: MEE 07153172** | **Credit: 1.0** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Production Processes Sessional** | | **Course Status: Sessional** | |

**Course Objectives:** The objectives of this course are:
To make the students understand Sand Casting and Casting Defects.
To facilitate necessary knowledge about different types of Joints and Defects by Arc-Welding, TIG MIG Welding, Spot welding and Resistance welding.
To acquaint students with different Types of Turning Operations in Lathe Machine.
To provide the knowledge of different Extrusion processes and Rolling operations.
To develop skills for performing soldering operations.

**Course Content:**
TIG, MIG, Spot welding, Resistance welding. Casting, Extrusion, Rolling, Brazing and Soldering.

**Course Outcomes:**
After the successful completion of the course, students will be able to:



CO1. By the end of the course, students should be able to compare and contrast different welding techniques (such as TIG, MIG, Spot, and Resistance) in terms of their strengths, limitations, and applications.
CO2. By the end of the course, students should be able to demonstrate proficiency in at least two types of welding (such as TIG and MIG), producing high-quality welds that meet specified requirements.
CO3. By the end of the course, students should be able to explain the basic principles of casting, extrusion, and rolling processes and describe how these processes are used in manufacturing products.
CO4. By the end of the course, students should be able to evaluate the advantages and disadvantages of different joining techniques (such as brazing and soldering) and select an appropriate method for a given application.
CO5. By the end of the course, students should be able to analyze and troubleshoot common issues that can arise in welding, casting, extrusion, rolling, brazing, and soldering processes, using appropriate methods (such as non-destructive testing).

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 1 | | | 2 | 1 | | | | 1 | 3 | | |
| CO02 | 2 | 2 | | 1 | 2 | | | | 2 | 3 | | |
| CO03 | | | 3 | | | 1 | | | | 1 | | |
| CO04 | 1 | | | 2 | 1 | | | | 1 | 3 | | |
| CO05 | 1 | | | 1 | | | | | | 2 | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Laboratory demonstration | Assignment |
| CO2 | Laboratory demonstration | Quiz |
| CO3 | Laboratory demonstration | Assignment |
| CO4 | Laboratory demonstration | Quiz |
| CO5 | Laboratory demonstration | Assignment |

**Books Recommended:**
1. Production Process Lab manual (MEE, SUST)
2. Larry Jeffus - Welding: Principles and Applications

| **Course No: MEE 07153182** | **Credit: 0.5** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Industrial Tour** | | **Course Status: Sessional** | |

**Course Objectives:** The objectives of this course are:
- To provide an exposure to students about the practical working environment.
- To let students, know things practically through interaction.

- To bridge the gap between classroom theoretical training and practical learning in a real-life environment.

**Course Content:**
*Visit to prescribed industries selected by the Department.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Integrate theoretical knowledge with industrial perspective.
CO2. Identify the working scope in industries.
CO3. Develop critical insight about the application of academic knowledge in the industrial field.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 1 | 1 | | | 2 | | | | | | | 1 |
| CO02 | | | | | | 2 | | | 1 | | 1 | 2 |
| CO03 | | | | | 1 | 2 | | | 2 | | | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Self-learning | Viva voce/ Presentation |
| CO2 | Self-learning | Viva voce/ Presentation |
| CO3 | Self-learning | Viva voce/ Presentation |

**Third Year Second Semester**

| **Course No: MEE 07153223** | **Credit: 3.0** | **Year: Third** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Fluid Mechanics- II** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are as follows:
- Familiarizing the students with dimensional analysis and different dimensionless numbers
- To provide the knowledge of similitude and different types of similarity
- Making the students understand model and prototype and use the concept in problem solving
- To make them introduced to major loss and minor loss in piping system
- Helping them conceptualize boundary layer theory and find out relative parameters
- Disseminating the ins and outs of laminar and turbulent flow in a pipe
- Providing knowledge about open channel flow and help them find out economic cross section of a channel
- To familiarize them with compressible flow, subsonic, sonic, supersonic flow, choking phenomena, normal shock using converging and C-D nozzle



- To make them understand the fluid properties at stagnation state

**Course Content:**
Dimensional analysis and similitude; Fundamental relations of compressible flow; Speed of sound wave; Stagnation states for the flow of an ideal gas; Flow through converging diverging nozzles; Normal shock. Real fluid flow; Frictional losses in pipes and fittings. Introduction to boundary layer theory; Estimation of boundary layer and momentum thickness, Skin friction and drag of a flat plate. Introduction to open channel flow; Best hydraulic channel cross-sections; Hydraulic jump; Specific energy; Critical depth

**Course Outcomes:**
After the successful completion of the course, students should be able to:
CO1. Evaluate the dimensional analysis similitude for the system involving fluid flow and parameters applying various theorem.
CO2. Differentiate between the compressive and incompressible flow, and the real flow with ideal flow conditions.
CO3. Predict boundary layer, momentum thickness, energy thickness, different types of drag and lift forces developed on various geometry, position of shock wave, and different parameters of real and ideal fluid flow.
CO4. Design piping network, economic section of open channel, converging-diverging nozzle depending on design condition.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | | | | | | | | |
| CO02 | 3 | | | | | | | | | | | |
| CO03 | | 3 | | | | | | | | | | |
| CO04 | | | 3 | | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Self-learning | Viva voce/ Presentation |
| CO2 | Self-learning | Viva voce/ Presentation |
| CO3 | Self-learning | Viva voce/ Presentation |
| CO4 | Self-learning | Viva voce/ Presentation |

**Books Recommended:**
1. Mechanics of Fluids- Irving H. Shames
2. Fluid Mechanics- Frank M. White
3. Fundamentals of Fluid Mechanics- Munson

| **Course No: MEE 07153233** | **Credit: 3.0** | **Year: Third** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Heat Transfer Equipment Design** | | | **Course Status: Theory** |

**Course Objectives:** The objectives of this course are:

- Getting an idea about the fundamentals of thermal system design and heat transfer requirements.
- To facilitate necessary knowledge about design parameters
- To provide fundamental idea about finned surfaces and the key parameters required for fin design.
- To make students familiarized with different types of heat exchangers and key performance parameters.
- To analyze heat exchanger performance by using the method of log mean temperature difference (LMTD) and heat exchanger effectiveness (NTU).
- To introduce typical heat transfer equipment, i.e., boiler, evaporator, condenser, cooling tower etc.
- To introduce students with the basic guidelines to model and design heat exchangers with proper design considerations and performance parameters.

**Course Content:**

Concept of thermal system design: Heat transfer requirements: Mechanical design: Design parameters: Materials, cost and economics: Safety and reliability: Choice and availability; Optimization: Cyclic service. Heat transfer from finned surface: Basic fin design, Types of fins: Fin Performance, Efficiency of fins, Equation of heat transfer from fins, Analysis of unsteady heat conduction. Basic thermal design methods of heat exchangers: Types of heat exchangers; Parallel flow, counter flow, cross flow, shell-and-tube, mixed and unmixed, single and multiple pass, compact heat exchangers: Thermo- fluid characteristics: Sizing of heat exchangers; Fouling of heat exchangers: Performance of heat transfer equipment; The log mean temperature difference: Effectiveness-NTU method; F correction factor. Two-phase heat transfer equipment: Boiler, Evaporator, Condenser, Cooling tower. Thermal systems with internal heat source: Modeling of thermal equipment.

**Course Outcomes:**

After the successful completion of the course, students will be able to:

CO1. formulate and define fundamental concepts related to thermal systems, finned surfaces and heat exchangers.

CO2. apply fundamental design criteria and parameters into fin design to improve heat transfer performance.

CO3. analyze heat exchanger performance by using log mean temperature difference (LMTD) and heat exchanger effectiveness-NTU method.

CO4. identify and interpret fundamental concepts on which fundamental heat transfer equipment's are constructed and run.

CO5. model and design heat exchangers based on proper guidelines and key performance parameters.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | | 2 | | | | | | 1 |
| CO02 | | 2 | 2 | 3 | | | | | | | | |
| CO03 | | 3 | 3 | | | 2 | | | | | | |
| CO04 | 2 | | | | 2 | | | | | | | |
| CO05 | | 3 | 2 | 3 | | | | | | | 1 | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture | Semester Final Exam |
| CO2 | Lecture | Mid Term Exam 1 and Semester Final Exam |
| CO3 | Lecture | Mid Term Exam 2 and Semester Final Exam |
| CO4 | Lecture | Presentation and Semester Final Exam |
| CO5 | Lecture | Assignment and Semester Final Exam |

**Books Recommended:**


1. Heat and Mass Transfer; Yunus A. Cengel & Afshin J. Ghajar.
2. Fundamental of Heat and Mass Transfer; Incropera, Dewitt, Bergman, Lavine.
3. Heat Transfer; J.P. Holman.
4. Convective Heat and Mass Transfer, W.M. Kayes and M. E. Crawford, Crawford, Tata McGraw Hill
5. Convection Heat Transfer, Andrian Bejan, John Wiley and Sons. Inc.
6. Engineering Heat Transfer, William S. Janna


| **Course No: MEE 07153253** | **Credit: 4.0** | **Year: Third** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Machine Design** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- To teach students how to apply the concepts of stress analysis.
- To understand different failure criteria to overcome those failures.
- To make them able to analyze fatigue failure.
- To make students know about the types of fit.
- Getting an idea about the basic concept of screws, fasteners and connections.
- Apply the knowledge of stress analysis in case of structural joints.
- To teach students how to apply the concepts of stress analysis, theories of failure and material science to analyze, design and/or select commonly used machine components.
- To illustrate to students the variety of mechanical components available and emphasize the need to continue learning.
- To teach students how to apply mechanical engineering design theory to identify and quantify machine elements in the design of commonly used mechanical systems.
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.

**Course Content:**

Introduction to design; Statistical considerations; Types of fits; Design for static strength; Design for fatigue strength; Fracture mechanics in design; Design of screws and welded joints;
Design of mechanical springs; rolling contact bearings, lubrication and journal bearings, spur, helical, worm and bevel gears, shafts, rope, belt and chain drives.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. understand the customers' needs, formulate the problem and draw the design specifications.
CO2. formulate and analyze stresses and strains in machine elements and structures in 3-D subjected to various static and fatigue loads.
CO3. understand different design concepts like principal stresses, theories of failure, stress concentration.
CO4. design machine elements to withstand the loads and deformations for a given application, while considering additional specifications.
CO5. analyze the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 1 | 2 | 3 | | | 2 | | 1 | | | 1 | |
| CO02 | | 2 | 2 | 3 | | | | | | | 1 | |
| CO03 | | 2 | 3 | | | | | | | | | |
| CO04 | 1 | 3 | 2 | | | | | | | | | |
| CO05 | | 2 | 3 | | | | 1 | | | | | 1 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using PPT and board | Midterm Exam-I, Assignment, Final Exam |
| CO2 | Lecture using PPT and board | Midterm Exam-II, Assignment, Final Exam |
| CO3 | Lecture using PPT, Question-Answer session | Class work, Assignment, Final Exam |
| CO4 | Lecture using PPT and board | Assignment, Final Exam |
| CO5 | Lecture using PPT, Question-Answer session | Assignment, Final Exam |

**Books Recommended:**
1. Shigley's Mechanical Engineering Design - J. Keith Nisbeth and Richard G. Budynas



| Course No: MEE 07153275 | Credit: 3.0 | Year: Third | Semester: Second |
|---|---|---|---|
| Course Title: Machine Tools | | Course Status: Theory | |

**Course Objectives:** The objectives of this course are as follows:
- To familiarize the students with locators and locating principles.
- To make them understand jigs and fixtures and differentiate them.
- To acquaint the students with different types of slideways, their material, application, advantage, drawbacks.
- To help them gather thorough knowledge of lathe machines, shaping machines, milling machines, drilling machines, and boring machines.
- Making them capable of finding out the sources of machine tools vibration and eliminating them.
- To familiarize the students about how to install machine tools.
- To introduce the acceptance tests of machine tools.
- Providing knowledge of speed range and how to design gearboxes.

**Course Content:**
Locating and Clamping: Purpose of work-piece location; degree of freedom; fundamental locating arrangements; clamping devices and forces. Tooling: Types of tools; jigs and fixtures; general tool design principles and their applications. Dies: Progressive and compound dies; design of cutting, forming and drawing dies; punch design. Design of Power Transmission System: Mechanical, Electrical, Hydraulic and Pneumatic drive-in machine tools. Basic considerations; speed range, gearbox design. Machine Tool Slides and Guides: Slide ways, Guide material, guide wear, effect of temperature and lubrication, error elimination. Detailed Study of Basic Machine Tools: Lathe machines; milling machines; shaping machines, planning machine; drilling machine; boring machine; hobbing machine; grinding machine; broaching, lapping and honing machine with their operations. Structure of Bed, Tables and Columns: Classification, design principles, sources of machine tools vibration and its elimination. Installation and acceptance tests of machine tools

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Identify the major components of machine tools and find out any problem if occurs
CO2. Analyze the vibration caused by machine tools and take proper steps
CO3. Apply knowledge for installation and the acceptance tests necessary for machine tools.
CO4. Design a gearbox
CO5. Apply their knowledge for properly running a machine shop

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 3 | | 2 | | | | | | | | |
| CO02 | | 3 | | 2 | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO03 | 3 | | 1 | | | | | | | | | |
| CO04 | | | 3 | | | | 1 | | 2 | 2 | | |
| CO05 | 1 | | | | 2 | 1 | | 1 | | | | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture | Mid Term Examination I |
| CO2 | Lecture | Mid Term Examination I |
| CO3 | Lecture | Assignment |
| CO4 | Lecture | Assignment and Semester Final |
| CO5 | Lecture | Assignment and Semester Final |

**Books Recommended:**

1. Machine Tools - N. Chernov
2. Elements of Machine Tools – Anwarul Azim

| **Course No: SOC 0134 3207Q** | **Credit: 2.0** | **Year: Third** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Industrial Sociology** | | **Course Status: Theory** | |

**Course Rationale:**

The course is designed to teach students from the non-major department the basics of industrial sociology. It helps students learn different aspects related to work including the base of work as a human organization in the industry and how work is being organized in an industrial organization. In addition, it teaches students about labor in the context of the industry. Moreover, it provides students with an understanding of the sociology of industry, labor, human relations, and conflict management.

**Course Objectives:** The objectives of the course are to:

- Provide students with basic knowledge of the subject matter and the distinctiveness of industrial sociology.
- Help students develop an understanding of key sociological concepts such as society, association, institution, work ideology, work attitude, work satisfaction, work commitment, formal relation in the factory system, and industrial bureaucracy.
- Familiarize students with the nature and causes of industrial conflict and conflict management.
- Help students develop knowledge of the process of industrial development in development.

**Course Contents**

Introduction: Nature, scope and rise of Industrial Sociology, History of Industrialization, ancient and modern, early industrialization in India, arts and crafts, Renaissance, Industrial revolution in Europe, The development of industry and industrial society in Bangladesh. The concept of work: Society, Community, Association, & institution. Work and art, nature of industrial work, work ideology, work values, Role of work in human life, work and mental health, work attitudes, work involvement, the motivation of work, work satisfaction, commitment to industrial work, development and commitment of industrial labor force in Bangladesh. The worker and



the factory: The factory system, its characteristic, the formal relations of production in the factory system. The industrial Bureaucracy: The executive in the industrial bureaucracy, the role of worker, social relations at work, Management as social elite. Industry and the community: Industry and family, industry and social change, shifting values, influence of convictions, religion and industrial development, place of industrial worker in the society, industry and -social stratification. Industrial Conflict: Nature and causes of industrial conflict, role and function of trade unionism, resolution of industrial conflict, collective bargaining. Industrialization and development: Patterns of industrial development in developing countries, role of foreign capital and borrowed technology, technology and social structure, classification of industries, role of cottage industries, labor intensive vs. heavy industries, modernization; Values and Ethics.

**Course Outcomes:**

Upon completion of the course, students will be able to:

CO1. Describe concepts such as society, association, institution, work ideology, work attitude, work satisfaction, work commitment, formal relation in the factory system, and industrial bureaucracy;

CO2. Analyze the nature and causes of industrial conflict and the role of a trade union; and

CO3. Explain the patterns of industrial development in developed countries and the other part of the world.

CO4. Apply sociological concepts in analyzing real social and industrial phenomena.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 1 | | | | | | | 1 | 1 | | 1 |
| CO02 | 1 | 2 | | | | | | | 1 | 1 | | 1 |
| CO03 | | | 1 | | | | | | | 1 | | |
| CO04 | | | | | | | | | 2 | 3 | | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture and Visual Presentation | Class Participation |
| CO2 | Lecture and Class Discussion | Class Participation & Midterm 1 |
| CO3 | Lecture, Visual Presentation and Class Discussion | Class Participation & Midterm 2 |
| CO4 | Lecture | Assignment & Final exam |

**Books Recommended:**

1. Berg I. E. (1979). Industrial Sociology. United States: Prentice-Hall.
2. Watson, T. J. (2008). Sociology, work and industry (5th Ed). United Kingdom: Routledge.

| Course No: MEE 07153224 | Credit: 1.5 | Year: Third | Semester: Second |
|---|---|---|---|
| Course Title: Fluid Mechanics - II Sessional | | | Course Status: Sessional |

**Course Objectives:** The objectives of this course are as follows:

- Helping the students to find the velocity profile in a pipe flow.
- To make the students capable of studying flow in a nozzle.
- To help them find out the major loss in a pipe flow.
- To make them capable of finding the minor loss in a pipe flow.

**Course Content:**
Velocity profile, nozzle, Pipe flow, Major loss in pipe flow, Minor losses in pipe flow; Different types of pipe fittings, valves; CFD simulation of internal and external flow

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Analyze data obtained from experiment to determine performance parameters of fluid flow measuring instruments
CO2. Display individually the procedure of operating fluid flow measuring instruments and taking data
CO3. Develop writing skill through report writing based on each experiment
CO4. Develop communication and speaking skill through oral test

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | | 3 | | | | | | | | | | |
| CO02 | 2 | | | | | | | | | | | |
| CO03 | | | | | | | | | | 3 | | |
| CO04 | | | | | | | | | | | | 3 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Laboratory demonstration | Report and Quiz |
| CO2 | Laboratory demonstration | Report and Quiz |
| CO3 | Laboratory demonstration | Report and Quiz |
| CO4 | Laboratory demonstration | Oral Viva |

| Course No: MEE01753234 | Credit: 1.0 | Year: Third | Semester: Second |
|---|---|---|---|
| Course Title: Heat Transfer Equipment Design Sessional | | | Course Status: Sessional |

**Course Objectives:** The objectives of this course are:

- To facilitate necessary knowledge about thermo-fluid systems and heat exchangers.



- Apply the knowledge of fundamental performance parameters of heat exchangers into practical design criteria.
- To help students excel in group work, communication between teammates and decision-making while completing the project.
- To make students familiarize with economical factors and financing budget in real-life applications regarding thermo-fluid system equipment.
- To conduct experiments based on finned surfaces and to analyze heat transfer performance enhancement.

**Course Content:**
In this course students are required to undertake a design of a thermo-fluid system. Based on the knowledge gained in the relevant courses, the students need to make a group effort for a thermo-fluid system design. The system design should involve the following stages: concept, design, calculation, component selection, specification preparation, and presentation. Costing and availability should be considered.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. transfer basic concepts of thermo-fluid systems into designing considerations of heat exchangers.
CO2. facilitate basic performance parameters into the design criteria of the project.
CO3. model and design a heat exchanger while considering proper budget and group-based decision making.
CO4. calculate the improvement in performances due to the presence of extended surfaces (fin) on heat transfer.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | 3 | 2 | | | 1 | | | | | |
| CO02 | | 3 | 2 | | 1 | 2 | | | | | | 1 |
| CO03 | | | | | | | | 3 | 2 | 3 | 3 | |
| CO04 | | 2 | | | 2 | | | | | | 1 | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Laboratory Demonstration | Assignment and Quiz |
| CO2 | Laboratory Demonstration | Assignment and Quiz |
| CO3 | Laboratory Demonstration | Assignment and Quiz |
| CO4 | Laboratory Demonstration | Assignment and Quiz |

**Books Recommended:**

1. Heat and Mass Transfer; Yunus A. Cengel & Afshin J. Ghajar.

| Course No: MEE 07153254 | Credit: 1.5 | Year: Third | Semester: Second |
|---|---|---|---|
| Course Title: Machine Design Sessional | | Course Status: Sessional | |

**Course Objectives:** The objectives of this course are:

- To teach students how to apply the concepts of stress analysis.
- To enhance the skill on stress analysis mathematically at pressure vessels and curved members.
- To solve problems with different failure criteria.
- To be able to solve problems related to fatigue failure.
- To make students know about the types of fit.
- To understand the basic concept of screws, fasteners and connections.
- To solve structural joints by using stress analysis.
- To introduce fundamental principles of interaction between motion and force in machinery design
- To demonstrate practical design methodology with emphasis on applications (sizing and selection)
- To familiarize with the synthesis of linkages, cams, gears, gear trains, and related components.

**Course Content:**

Introduction to design; Statistical considerations; Types of fits; Design for static strength; Design for fatigue strength; Fracture mechanics in design; Design of screws and welded joints;
Design of mechanical springs; rolling contact bearings, lubrication and journal bearings, spur, helical, worm and bevel gears, shafts, rope, belt and chain drives.
Case study.

**Course Outcomes:**

After the successful completion of the course, students will be able to:
CO2: formulate and analyze stresses and strains in machine elements and structures in 3-D subjected to various static and fatigue loads.
CO3. understand different design concepts like principal stresses, theories of failure, stress concentration in practical cases.
CO4. design machine elements to withstand the loads and deformations for a given application, while considering additional specifications.
CO5. analyze the stress and strain on mechanical components; and understand, identify and quantify failure modes for mechanical parts

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 1 | 2 | 3 | | | 2 | | 1 | | | 1 | |
| CO02 | | 2 | 2 | 3 | | | | | | | 1 | |
| CO03 | | 2 | 3 | | | | | | | | | |
| CO04 | 1 | 3 | 2 | | | | | | | | | |
| CO05 | | 2 | 3 | | | | 1 | | | | | 1 |



Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using PPT and board | Classwork/Homework/Final Quiz |
| CO2 | Lecture using PPT and board | Classwork/Homework/Final Quiz |
| CO3 | Lecture using PPT, Question-Answer session | Classwork/Homework/Final Quiz |
| CO4 | Lecture using PPT and board | Classwork/Homework/Final Quiz |
| CO5 | Lecture using PPT, Question-Answer session | Classwork/Homework/Final Quiz |

**Books Recommended:**

1. Shigley's Mechanical Engineering Design - J. Keith Nisbeth and Richard G. Budynas

| Course No: MEE 07153282 | Credit: 0.5 | Year: Third | Semester: Second |
|---|---|---|---|
| Course Title: Industrial Tour | | Course Status: Sessional | |

**Course Objectives:** The objectives of this course are:

- To provide an exposure to students about the practical working environment.
- To let students, know things practically through interaction.
- To bridge the gap between classroom theoretical training and practical learning in a real-life environment.

**Course Content:**

*Visit to prescribed industries selected by the Department.

**Course Outcomes:**

After the successful completion of the course, students will be able to:
CO1. Integrate theoretical knowledge with industrial perspective.
CO2. Identify the working scope in industries.
CO3. Develop critical insight about the application of academic knowledge in the industrial field.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 1 | 1 | | | 2 | | | | | | | 1 |
| CO02 | | | | | | 2 | | | 1 | | 1 | 2 |
| CO03 | | | | | 1 | 2 | | | 2 | | | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Self-learning | Viva voce/ Presentation |

| | | |
|---|---|---|
| CO2 | Self-learning | Viva voce/ Presentation |
| CO3 | Self-learning | Viva voce/ Presentation |

| | | | |
|---|---|---|---|
| **Course No: MEE 07153288** | **Credit: 0.5** | **Year: Third** | **Semester: Second** |
| **Course Title: Comprehensive Viva-III** | | **Course Status: Viva** | |

**Course Rationale:**
This course aims to improve students' communication capability and also provide an experience of viva.

**Course Objectives:** The objectives of this course are:
- To help students to communicate effectively with others
- To facilitate necessary knowledge about different topics related to courses
- To develop skills on speak in English fluently
- To facilitate students to share different ideas & thoughts in practical life
- To help students to identify better choice among all alternatives
- To understand basic solution process
- To introduce students about practical service life

**Course Content:**
Topics covered by all theoretical and practical courses in both two semesters.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. communicate effectively with other employees and workers in service life.
CO2. explain the understanding about different practical problems relevant to the course.
CO3. develop the capability of leading a team.
CO4. explain the integrated engineering knowledge learned throughout the semester.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | | | | | | 2 | | | | 3 | | |
| CO02 | 2 | 2 | | | | | | | | | | |
| CO03 | | | | | | 1 | | | 3 | 2 | | |
| CO04 | 3 | 2 | | 2 | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Self-learning using interpersonal relationship | Viva voce |
| CO2 | Self-learning using reference books/other online materials | Viva voce |



| | | |
|---|---|---|
| CO3 | Self-learning using interpersonal relationship | Viva voce |
| CO4 | Self-learning using reference books/other online materials | Viva voce |

**Fourth Year First Semester**

| | | | |
|---|---|---|---|
| **Course No: MEE 07154121** | **Credit: 3.0** | **Year: Fourth** | **Semester: First** |
| **Course Title: Fluid Machinery** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:
- Getting idea about different types of turbines.
- Acquaint students with different types of pumps.
- To provide the knowledge of dimensional analysis to compare relative advantage among all hydraulic machines.
- Accumulate basic ideas about performance and characteristics of turbines and pumps.
- Apply the knowledge of fan, blower and compressor.
- To develop skills on Hydraulic transmission.
- Apply the knowledge of hydraulic machines in practical life.

**Course Content:**
Types of fluid machinery; Rotodynamic and positive displacement machines; Velocity diagrams and Euler pump/turbine equation; Impulse and reaction turbines; Centrifugal and axial flow pumps; Deep well turbine pumps; Dimensional analysis applied to fluid machinery: specific speed, unit power, unit speed, unit discharge; Performance and characteristics of turbines and pumps; Design of pumps; Cavitation; Reciprocating pump, gear and screw pumps; Fans, blowers and compressors; Hydraulic transmission: fluid coupling and torque converter; System analysis and selection of fluid machine.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Explain various types of fluid machinery.
CO2. Analyze different types of turbines theoretically and mathematically to select the best one.
CO3. Analyze different types of pumps theoretically and mathematically to select the best one.
CO4. Develop the practice of applying dimensional analysis to compare between different fluid machineries.
CO5. Describe the impact of cavitation in fluid machineries.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | 2 | | | | | 2 | | 2 |
| CO02 | 3 | 3 | 2 | 3 | 2 | | | | | | | 2 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO03 | 3 | 3 | 2 | 3 | 2 | | | | | | | 2 |
| CO04 | 3 | 3 | 3 | 2 | 2 | | | | | | | |
| CO05 | 2 | | | 2 | 3 | | | | | 2 | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lectures | Assignment |
| CO2 | Lectures | Midterm Examination 1 |
| CO3 | Lectures | Midterm Examination 2 |
| CO4 | Lectures | Quiz |
| CO5 | Lectures | Quiz |

**Books Recommended:**

1. Fluid Mechanics, Hydraulics and Hydraulic Machines - Dr. K. R. Arora
2. Hydraulics and Fluid Mechanics including Hydraulic Machines - P. N. Modi, S. M. Seth
3. Hydraulic Machine - Dr. Md. Quamrul Islam

| **Course No: MEE 07154131** | **Credit: 3.0** | **Year: Fourth** | **Semester: First** |
|---|---|---|---|
| **Course Title: Internal Combustion Engines** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are as follows:

- To introduce the students with the details of combustion, flame, stoichiometry
- Familiarizing them with basic engine types, their operation and testing
- To provide insights on IC engine fuels, their properties and tests, knocking
- To give the students complete idea about combustion in SI, CI engine and gas turbines
- To make them learn different fuel injection systems
- To make them capable of analyzing exhaust gas, air pollution and emission control
- Making them understand the performance and design of naturally aspirated and supercharged engines
- Providing knowledge about volumetric efficiency, multistage compression, intercooling
- Preparing the students to analyze air standard cycle as well as fuel air cycle

**Course Content:**

Introduction: basic engine types, their operation and testing; Idealized cycles and processes; Fuels: IC engine fuels, their properties and tests; Combustion: SI engine, CI engine and gas turbines; Equilibrium charts; Exhaust gas analysis and air pollution; Fuel metering: SI engines, CI engines; Air capacity of engines: two and four stroke cycles, naturally aspirated and supercharged; Performance and design: performance of non-supercharged engines and supercharged engines, design considerations, application of principle of similitude in engine design.

Compressors and turbines: compression processes, volumetric efficiency, multistage compression, intercooling; various types of compressors and gas turbines.



**Course Outcomes:**

After the successful completion of course, students will be expected to:

CO 01: Identify the different types of engines, engine components, and its different subsystems.

CO 02: Analyze the factors controlling combustion phenomena of different internal combustion engines depending on different types of fuel, and engine performance.

CO 03: Compare different cycles and their efficiencies.

CO 04: Comprehend engine characteristics, engine performance, combustion system, engine knocking and remedy, engine air charging etc

CO 05: Comprehend the Air Pollution and Emission Control Systems of Engines and investigate the Engine Performance Parameters

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | | | | | | | | |
| CO02 | | | 3 | | | | | | | | | |
| CO03 | | 3 | | | | | | | | | | |
| CO04 | | 2 | | 3 | | | | | | | | |
| CO05 | | 3 | | | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture & Video Demonstration | Midterm Examination 1 |
| CO2 | Lecture | Midterm Examination 2 |
| CO3 | Lecture & Video Demonstration | Assignment |
| CO4 | Lecture | Semester-end examination |
| CO5 | Lecture | Assignment |

**Books Recommended:**

1. Internal Combustion Engine Fundamentals- John B. Heywood
2. Internal Combustion Engines, Edward F. Obert, 3rd Edition, International Textbook Company, 1970
3. Engineering Fundamentals of the Internal Combustion Engine, Willard W. Pulkrabek, Prentice Hall, Upper Saddle River, New Jersey

| **Course No: MEE 07154261** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Control Engineering** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are as follows:

- To make the students familiar with control system represented by differential equation
- Making them capable of expressing a physical system with mathematical modeling and finding out different types of responses

- To make them learn feedback and non-feedback system as well as transfer function of a system
- Making them capable of reducing block diagram
- To make them find out poles and zeros of a system
- Making them prepared to check the stability of a system by poles-zeros and Routh Hurwitz criterion
- To familiarize them with hydraulic and pneumatic control systems
- Providing knowledge about the basic elements of electro-mechanical controls
- To facilitate necessary knowledge about logic gates, Boolean algebra and combinational circuits

**Course Content:**
Introduction to control systems and their representation by different equations and Laplace transforms; Block diagrams and transfer functions; Analog computer solution of system equations; System response, control action and system types; Frequency response; System analysis; System compensation; Analogues of control systems; Hydraulic and pneumatic control systems; Elements of electro-mechanical controls; Introduction to digital computer control.

**Course Outcomes:**
By the end of the course, students should be able to:
CO1. Analyze and design control systems by applying different mathematical representations, such as equations and Laplace transforms, and understand the role of block diagrams and transfer functions in control systems.
CO2. Evaluate system response, control action, and system types, including frequency response, and explain the differences between various control systems, such as analog and digital computer control systems.
CO3. Apply system analysis and compensation techniques to design effective control systems, including hydraulic and pneumatic control systems, as well as electro-mechanical controls.
CO4. Compare and contrast analog and digital computer control systems and their advantages and disadvantages, including their use in industrial applications.
CO5. Synthesize the knowledge gained throughout the course to design and implement effective control systems that meet specific requirements and constraints.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 3 | 3 | 2 | 2 | 1 | | | 3 | | 1 | |
| CO02 | 1 | 2 | 2 | 2 | 2 | 1 | | | 2 | | 1 | |
| CO03 | 3 | 3 | 3 | 2 | 2 | 1 | | | 3 | | 1 | |
| CO04 | 1 | 2 | 2 | 2 | 2 | 1 | | | 2 | | 1 | |
| CO05 | 2 | 2 | 2 | | | | | | 2 | | 1 | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Quiz |
| CO2 | Lecture using board/LCD projectors | Assignment |
| CO3 | Lecture using board/LCD projectors | Quiz |
| CO4 | Lecture using board/LCD projectors | Assignment |
| CO5 | Assignment/project | Assignment |



**Books Recommended:**
1. Control Systems Engineering; Norman S. Nise
2. Introduction to Automatic Controls: Howard L. Harrison, John G. Bollinger
3. Modern Control Engineering; Katsuhiko Ogata

| Course No: MEE 422 | Credit: 1.0 | Year: Fourth | Semester: First |
|---|---|---|---|
| Course Title: Fluid Machinery Sessional | | Course Status: Sessional | |

**Course Objectives:** The objectives of this course are:
- Getting ideas about the turbine and pump.
- To develop skills on Pelton wheel, Francis Turbine and Kaplan Turbine.
- To enhance the skill for centrifugal pumps.
- Accumulate basic ideas about experiment when two pumps are in series or parallel.

**Course Content:**
The concept of turbine and pump; Turbine: Pelton wheel, Francis Turbine, Kaplan Turbine; Centrifugal Pump; Reciprocating Pump Series and Parallel connection of two Pumps.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Distinguish between different types of fluid machineries.
CO2. Analyze impulse and reaction turbines and select the better one depending upon the given conditions.
CO3. Analyze experimentally and mathematically centrifugal pump to make proper applications
CO4. Apply theoretical knowledge to sort out the requirements of series or parallel connection of pumps
CO5. Develop an ethical perspective about formal report writing.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | 2 | 3 | | | | | | | |
| CO02 | 2 | 3 | | 3 | 3 | | | | | | | |
| CO03 | 2 | 3 | | 3 | 3 | | | | | | | |
| CO04 | | 3 | 1 | 2 | 2 | | | | | | | |
| CO05 | | | | | | | | 3 | | | | 3 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Laboratory demonstration | Assignment and quiz |
| CO2 | Laboratory demonstration | Assignment and quiz |
| CO3 | Laboratory demonstration | Assignment and quiz |
| CO4 | Laboratory demonstration | Assignment and quiz |
| CO5 | Laboratory demonstration | Assignment and quiz |

**Books Recommended:**

1. Hydraulic Machine; Dr. Md. Quamrul Islam
2. Fluid Machinery Sessional Lab Sheet (SUST)

| **Course No: MEE 07154132** | **Credit: 1.0** | **Year: Fourth** | **Semester: First** |
|---|---|---|---|
| **Course Title: Heat Engine Sessional** | | **Course Status: Sessional** | |

**Course Objectives:** The objectives of this course are as follows:

- To familiarize the students with different types of engines
- To make them conduct performance test of SI and CI engine
- To make them capable of assembling and dismantling SI and CI engine

**Course Content:**

SI and CI engine combustion, performance test of SI and CI engine, Dismantling and assembling of SI and CI engine

**Course Outcomes:**

After the successful completion of the course, students will be able to:

CO1. Distinguish between SI and CI engines

CO2. Understand fuel injection system, air intake system, lube oil system, ignition system, cooling system, exhaust system of an engine and represent them in block diagram

CO3. Identify different parts of SI and CI engine after dismantling

CO4. Understand clearly how the SI and CI engine works

CO5. Evaluate the performance of a particular engine based on the engine parameters

CO6. Demonstrate the skill of group work and discussion

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | | | | | | | | |
| CO02 | 2 | | | | | 3 | | | | | | |
| CO03 | 3 | | | | | | | | | | | |
| CO04 | 2 | | | | | | | | | | | |
| CO05 | | | | | | 3 | | | | | | |
| CO06 | | | 2 | | 2 | | | | | | | |



Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Laboratory demonstration | Assignment and quiz |
| CO2 | Laboratory demonstration | Assignment and quiz |
| CO3 | Laboratory demonstration | Assignment and quiz |
| CO4 | Laboratory demonstration | Assignment and quiz |
| CO5 | Laboratory demonstration | Assignment and quiz |
| CO06 | Laboratory demonstration | Assignment and quiz |

| **Course No: MEE 07154184** | **Credit: 1.0** | **Year: Fourth** | **Semester: First** |
|---|---|---|---|
| **Course Title: Industrial Training** | | **Course Status: Sessional** | |

**Course Objectives:** The objectives of this course are:

- To provide a comprehensive learning platform to students where they can enhance their employability skills and become job ready along with real corporate exposure.
- To enhance students' knowledge in one particular technology.
- To increase self-confidence of students and help in finding their own proficiency.
- To cultivate a student's leadership ability and responsibility to perform or execute the given task.
- To provide learners hands-on practice within a real job situation.

**Course Contents:**

Intensive training in a particular industry prescribed by the MEE Department.

**Note: Industrial Training will be considered a co-curricular activity. It may be conducted at any convenient time as can be arranged by the Department after the completion of the courses of third year second semester.

**Course Outcomes:**

After the successful completion of the course, students will be able to:

CO1. Identify the gap between academia and industry through a first-hand exposure

CO2. Become updated with the latest changes in technological world

CO3. Identify the application of academic knowledge in industries

CO4. Develop a sense of leadership alongside the attainment of teamwork experience

CO5. Identify, formulate and model problems and find engineering solution based on a systems approach

CO6. Develop the social, cultural, global and environmental responsibility as an engineer

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | 1 | | 2 | | | | | | | | |
| CO02 | 2 | | 1 | | 3 | | | | | | | |
| CO03 | 3 | 2 | 2 | 1 | | | | | | | | |
| CO04 | | | | | | 1 | | | 3 | 2 | 2 | |
| CO05 | 2 | 3 | 3 | 2 | | | | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO06 | | | | | | 3 | 2 | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Self-learning | Viva voce / Presentation |
| CO2 | Self-learning | Viva voce / Presentation |
| CO3 | Field demonstration | Viva voce / Presentation |
| CO4 | Self-learning | Viva voce / Presentation |
| CO5 | Case study and field demonstration | Viva voce / Presentation |
| CO06 | Self-learning | Viva voce / Presentation |

| **Course Code: MEE 07154180** | **Credits: 3.0** | **Year: Fourth** | **Semester: First** |
|---|---|---|---|
| **Course Title: Project/Thesis** | | **Course Status: Thesis** | |

**Course Objectives:** The objectives of this course are:

- To help the students understand the basics of doing scientific research
- Be conversant on analysis of scientific data.
- To make the students understand how to present scientific work.
- To develop skills to conduct research along with understanding of the current research questions.
- To provide the knowledge about ethical issues in an adequate manner related to the scientific work.

**Course Contents:**

The undergraduate thesis /project within the field of Mechanical Engineering research is an individual study that must include hypothesis testing that will substantiate new data.

The undergraduate thesis/project includes search, studies and summary of scientific literature, practical work in COse relation to ongoing Mechanical Engineering research, compilation and critical analysis of the results, and oral and written presentation.

The undergraduate thesis/project is mastered under individual supervision. The supervision includes how to perform a scientific study and how to orally and in writing present gathered data in good scientific manner. The supervisor must have documented scientific experience.

**Course Outcomes:**

CO1. Identify the research gap through proper literature review with a practical approach towards the work

CO2. Explain basics of planning and performance of a scientific work

CO3. Obtain Theoretical and practical professional specialization within Mechanical Engineering including understanding of the current research questions

CO4. Present scientific data and conclusions in written and oral form addressed to different groups

CO5. Develop a sense of responsibility and ethical concern regarding research field

**Mapping of COs with POs**



| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | | | 2 | | 2 | | | | | | |
| CO02 | 1 | 2 | | | | | | | 2 | 2 | | |
| CO03 | 3 | 2 | 3 | 2 | 2 | | | | | | 2 | 2 |
| CO04 | | | | | | | | | | 3 | | 2 |
| CO05 | | | 1 | | | | | 3 | | | | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Assignments using online materials | Viva voce / Presentation |
| CO2 | Lecture | Viva voce / Presentation |
| CO3 | Lectures and self-learning using reference books and research articles | Viva voce / Presentation |
| CO4 | Assignment and self-learning | Viva voce / Presentation |
| CO5 | Self-learning | Viva voce / Presentation |

**Fourth Year Second Semester**

| **Course Code: IPE 04134205Q** | **Credit: 3** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Industrial Management** | | | **Course Status: Theory** |

**Course Rationale:**

This course aims to provide an understanding of the theories and principles of industrial management and encourage the course participants to appreciate these principles in relation to their own experiences and selected managerial case studies.

**Course Objectives:** The objectives of this course are to:

- provide knowledge about the basic principles of management, the major functions of managers, e.g., planning, organizing, staffing, leading, and controlling, and the challenges managers face in each stage
- make students think critically and strategically about management theories and issues which will enable them to develop their decision-making and analytical skills
- familiarize students with the sound employment function as well as implementing a good wage and incentive scheme.
- let the students understand different marketing issues and the fundamental concepts of marketing management.

**Course Content:**

Organization and management: evolution, management functions, organization structure, development of organization theories, study of various types of organization and management information systems, concepts, and scope of application. Personnel management: importance, scope, need hierarchy, motivation theories, defense mechanism, productivity and satisfaction, leadership, group dynamics, job evaluation,

merit rating, personnel development: hiring, training, and wage systems. Marketing management: marketing concept, marketing organization, industrial and consumer selling, channel decisions, advertising decisions, new product strategy. Basics of Technology management; Case studies, implementing technology in product and services, integration of technology in business plan. Management Accounting: Marginal costing, started costing, cost planning and control, budget and budgetary control.

**Course Outcomes (COs):**
After successful completion of the course, students will be able to:
CO1. explain the theories, principles of management, contemporary theories of motivation, and apply these theories to tackle the managerial challenges;
CO2. apply leadership skills and implement its ideas in organizations/industries;
CO3. evaluate the different tasks of personnel management such as recruitment, selection, wages, and incentives
CO4. identify what marketing strategies organizations might practice to attract and retain customer
CO5. describe the concepts and techniques of strategic management of technology.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 2 | | | 2 | | 2 | | | | | | |
| CO02 | 1 | 2 | | | | | | | 2 | 2 | | |
| CO03 | 3 | 2 | 3 | 2 | 2 | | | | | | 2 | 2 |
| CO04 | | | | | | | | | | 3 | | 2 |
| CO05 | | | 1 | | | | | 3 | | | | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using board/projectors | Assignment, Midterm Examination 1, Semester-end examination |
| CO2 | Lecture using board/projectors /Assignment/tutorial | Assignment, Midterm Examination 1, Semester-end examination |
| CO3 | Lecture using board projectors | Assignment, Semester-end examination |
| CO4 | Lecture using board/projectors /Assignment/tutorial | Midterm Examination 2, Assignment, Semester-end examination |
| CO5 | Lecture using board/projectors /Assignment/tutorial | Midterm Examination 2, Assignment, Semester-end examination |

**Books Recommended:**

1. Management-A Global Perspective, Heinz Weihrich and Harold Koontz, McGraw Hill International Edition.
2. Industrial Engineering and Management -A New Perspective, Philip E. Hicks, McGraw Hill International Editions.





3. Industrial Engineering and Management, O.P. Khanna and A. Sarup, Dhanpat Rai Publication Ltd.
4. Andrew J. Dubrin, Essentials of Management, South-Western College Pub.


| Course No: MEE 07134233 | Credit: 3.0 | Year: Fourth | Semester: Second |
|---|---|---|---|
| Course Title: Power Plant Engineering | | Course Status: Theory | |

**Course Objectives:** The objectives of this course are:
- To familiarize the students with difference sources of energy
- To acquaint students with the working principle of different thermal power plants
- To make the students understand the advantages and disadvantages of different power plants
- To provide the knowledge of the efficiency of combined cycle power plant
- To acquire knowledge about governing of water turbine

**Course Content:**
Sources of energy, production of power, comparison of different types of power plants, survey of power plants in Bangladesh. The variable load problem, economic analysis of power plants, theory of rates, Diesel electric power plants: engine types and their performances, advantages, present trend. Gas turbine power plants: cycle analysis; intercooling, regeneration and reheating, governing. Thermal power plants: fuels, combustion equipment; boilers. Steam turbines: reheat, regenerative, superposed, binary and combined cycles. Condensers, evaporators and cooling towers, gas loop and water loop, steam piping and insulations. Hydro-electric power plants: site selection, components of the plant. Governing of water turbines. Nuclear power plant: types of reactors, layout of nuclear power plant; waste disposal.

**Course Outcomes:**
After the successful completion of the course, students should be able to:
CO 1: explain the types, factors related to economic power generation considering load zone, levelized cost of electricity, discount rate etc, the process of site selection of power plants
CO 2: evaluate the performance of the overall power system and the major components of available power plants
CO 3: design smaller-capacity power plants considering social, environmental and economic impacts and their relationships with different sustainable development goals (SDGs)

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | | | | |
| CO2 | | 3 | | | | | | | | | | |
| CO3 | | | 3 | | 2 | | 3 | | | | | |

**Books Recommended:**

1. P K Nag - Power Plant Engineering
2. V. Ganapathy - Industrial Boilers and Heat Recovery Steam Generators: Design, Applications and Calculations
3. M.M. E-Wakil - Power Plant Engineering
4. A.K. Raja, Amit Prakash, Srivastava, Manish Dwivedi - Power Plant Engineering

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy:

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture & Video Demonstration | Midterm Examination 1 |
| CO2 | Lecture | Midterm Examination 2 |
| CO3 | Lecture & Video Demonstration | Semester-end examination |

| **Course No: MEE 07134234** | **Credit: 1.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Power Plant Engineering Sessional** | | **Course Status: Sessional** | |

**Course Objectives:** The objectives of this course are:

- To help the students to know how to perform Performance Test of a Cooling Tower
- To provide the knowledge of boiler
- To help the students understand how to perform Performance Test of a Refrigeration Unit
- To help the students to understand Gas turbine system

**Course Content:**
Laboratory Experiments based on MEE 433.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Analyze the process data and obtained results and write a comprehensive discussion on construction and performance of cooling tower
CO2. Identify different mountings & accessories on a fire tube boiler and draw a line diagram of the water flow circuit which includes the water treatment plant
CO3. Perform Hydraulic test of a boiler and calculate the efficiency of the boiler
CO4. Understand assembled Rover gas turbine and identify different components
CO5. Become familiar with different components of the Turbo Jet Engine

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | 3 | | 1 | | | | | | | 1 |
| CO2 | | 2 | 1 | | | | | | | | | |
| CO3 | | 2 | 3 | | | | | | | | | |
| CO4 | 2 | | | | | | | | | | | |
| CO5 | 2 | | | | 1 | | | | | | | |



**Books Recommended:**

1. Power plant Lab manual (SUST)
2. P K Nag - Power Plant Engineering
3. V. Ganapathy - Industrial Boilers and Heat Recovery Steam Generators: Design, Applications and Calculations
4. M.M. E-Wakil - Power Plant Engineering
5. A.K. Raja, Amit Prakash, Srivastava, Manish Dwivedi - Power Plant Engineering

Mapping of COs with Learning Strategies and Assessment Strategies:

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Assignments using online materials | Viva voce / Presentation |
| CO2 | Lecture | Viva voce / Presentation |
| CO3 | Lectures and self-learning using reference books and research articles | Viva voce / Presentation |
| CO4 | Assignment and self-learning | Viva voce / Presentation |
| CO5 | Self-learning | Viva voce / Presentation |

| **Course No: MEE 07154288** | **Credit: 0.5** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Comprehensive Viva-IV** | | **Course Status: Viva** | |

**Course Rationale:**
This course aims to improve students' communication capability and also provide an experience of viva.

**Course Objectives:** The objectives of this course are:

- To help students to communicate effectively with others
- To facilitate necessary knowledge about different topics related to courses
- To develop skills on speak in English fluently
- To facilitate students to share different ideas & thoughts in practical life
- To help students to identify better choice among all alternatives
- To understand basic solution process
- To introduce students about practical service life

**Course Content:**
Topics covered by all theoretical and practical courses in both two semesters.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. communicate effectively with other employees and workers in service life.
CO2. explain the understanding about different practical problems relevant to the course.
CO3. develop the capability of leading a team.
CO4. explain the integrated engineering knowledge learned throughout the semester.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | 2 | | | | 3 | | |
| CO2 | 2 | 2 | | | | | | | | | | |
| CO3 | | | | | | 1 | | | 3 | 2 | | |
| CO4 | 3 | 2 | | 2 | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Self-learning using interpersonal relationship | Viva voce |
| CO2 | Self-learning using reference books/other online materials | Viva voce |
| CO3 | Self-learning using interpersonal relationship | Viva voce |
| CO4 | Self-learning using reference books/other online materials | Viva voce |

| **Course Code: MEE 07154180** | **Credits: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Project/Thesis** | | **Course Status: Thesis** | |

**Course Objectives:**

- To help the students understand the basics of doing scientific research
- Be conversant on analysis of scientific data.
- To make the students understand how to present scientific work.
- To develop skills to conduct research along with understanding of the current research questions.
- To provide the knowledge about ethical issues in an adequate manner related to the scientific work.

**Course Contents:**

The undergraduate thesis /project within the field of Mechanical Engineering research is an individual study that must include hypothesis testing that will substantiate new data.

The undergraduate thesis/project includes search, studies and summary of scientific literature, practical work in close relation to ongoing Mechanical Engineering research, compilation and critical analysis of the results, an oral and written presentation.

The undergraduate thesis/project is mastered under individual supervision. The supervision includes how to perform a scientific study and how to orally and in writing present gathered data in good scientific manner. The supervisor must have documented scientific experience.

**Course Outcomes:**

CO1. Identify the research gap through proper literature review with a practical approach towards the work

CO2. Explain basics of planning and performance of a scientific work



CO3. Obtain Theoretical and practical professional specialization within Mechanical Engineering including understanding of the current research questions

CO4. Present scientific data and conclusions in written and oral form addressed to different groups

CO5. Develop a sense of responsibility and ethical concern regarding research field

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | | 2 | | 2 | | | | | | |
| CO2 | 1 | 2 | | | | | | | 2 | 2 | | |
| CO3 | 3 | 2 | 3 | 2 | 2 | | | | | | 2 | 2 |
| CO4 | | | | | | | | | | 3 | | 2 |
| CO5 | | | 1 | | | | | 3 | | | | 2 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy:

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Assignments using online materials | Viva voce / Presentation |
| CO2 | Lecture | Viva voce / Presentation |
| CO3 | Lectures and self-learning using reference books and research articles | Viva voce / Presentation |
| CO4 | Assignment and self-learning | Viva voce / Presentation |
| CO5 | Self-learning | Viva voce / Presentation |

**Optional Course-I**

| **Course No: MEE 07154123** | **Credit: 3.0** | **Year: Fourth** | **Semester: First** |
|---|---|---|---|
| **Course Title: Biomedical Fluid Mechanics** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are as follows:

- To help the students differentiate between the various approaches and solutions applied to a wide variety of fluid mechanics problems related to physiological processes, medical devices, and laboratory setups as used for testing and measuring.
- To reinforce the student's prior knowledge in calculus, differential equations, and engineering as it applies to fluid mechanics.
- To make the students capable of reviewing relevant anatomy and physiology emphasizing qualitative considerations

**Course Content:**

Engineering approach to the analysis of circulatory and respiratory systems and to other problems in physiology involving fluid dynamics; Review of relevant anatomy and physiology emphasizing qualitative considerations; Presentations and discussions; Simulation of physiological phenomena

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Explain basic physical properties of bio fluids
CO2. Evaluate force and pressure balances acting on bio fluid
CO3. Analyze and solve biomedical fluid flow problems
CO4. State physiology of the human circulation system
CO5. Apply fluid mechanics to blood flow models

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | | | | | | | | | | | 1 |
| CO2 | | 2 | | 1 | | | | | | | | |
| CO3 | | | 3 | 2 | | | | | | | | |
| CO4 | 2 | | | | | 1 | | | | | | |
| CO5 | | | | 2 | | | | | | | | |

Mapping of COs with Learning Strategies and Assessment Strategies

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using PPT and board | Midterm Exam-I, Assignment, Final Exam |
| CO2 | Lecture using PPT and board | Midterm Exam-II, Assignment, Final Exam |
| CO3 | Lecture using PPT, Question-Answer session | Class work, Assignment, Final Exam |
| CO4 | Lecture using PPT and board | Assignment, Final Exam |
| CO5 | Lecture using PPT, Question-Answer session | Assignment, Final Exam |

**Books Recommended:**

1. Biofluid Mechanics: The Human Circulation -KB Chandran, AP Yoganathan, SE Rittgers
2. Applied Biofluid Mechanics- Lee Waite and Jerry Fine
3. A Brief Introduction to Fluid Mechanics- Young, Munson, and Okiishi


| **Course No: MEE 07154135** | **Credit: 3.0** | **Year: Fourth** | **Semester: First** |
|---|---|---|---|
| **Course Title: Refrigeration, A.C. and Building Mechanical Systems** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:
- Introduce the fundamental principles and different methods of refrigeration and air-conditioning.
- Illustrate various refrigeration cycles and evaluate performance using Mollier charts and/ or refrigerant property tables.



- Provide comparative study of different refrigerants with respect to properties, applications and environmental issues.
- Make students understand the basic air conditioning processes on psychrometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.
- Familiarize with various equipment-operating principles, operating and safety controls employed in refrigeration air conditioning systems

**Course Content:**
Refrigeration: Concept and application of refrigeration, different refrigeration methods, Refrigerants, Analysis of vapor-compression refrigeration system and its modifications, Absorption refrigeration, Air-cycle refrigeration, Low-temperature refrigeration, multi-pressure systems of refrigeration. Refrigeration equipment: Defrost mechanism and automatic controls used in commercial refrigeration systems, Heat-flow problems in condensers and evaporators. Manufacture of water ice and dry ice.
Air Conditioning: Concept and classification of a/c and its use, Psychometric properties, comfort data, cooling and heating load calculation of various applications, Air distribution system and duct design, Air conditioning equipment, Air purification, Installation of units, Charging, Leak detection, wiring diagram and service, Troubleshooting.
Fire Hazards; Firefighting equipment; Vertical transportation, its system design; Escalators and moving ramps.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Illustrate the fundamental principles and applications of refrigeration and air conditioning system,
CO2. Calculate cooling capacity and coefficient of performance by conducting tests on vapor compression refrigeration systems.
CO3. Calculate cooling load for air conditioning systems used for various condition
CO4. Design a lift for vertical transportation in a building
CO5. Operate and analyze the refrigeration and air conditioning systems.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | 1 | | | | | | 1 |
| CO2 | 2 | 3 | | | | | | | | | | |
| CO3 | | 2 | 2 | 3 | | | | | 3 | 2 | | |
| CO4 | | | 3 | 2 | | | | | 3 | 2 | | |
| CO5 | | 1 | | | 3 | | | | | | | |

Mapping of COs with Learning Strategies and Assessment Strategies:

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using PPT and board | Midterm Exam-I, Assignment, Final Exam |

| | | |
|---|---|---|
| CO2 | Lecture using PPT and board | Midterm Exam-II, Assignment, Final Exam |
| CO3 | Lecture using PPT, Question-Answer session | Class work, Assignment, Final Exam |
| CO4 | Lecture using PPT and board | Assignment, Final Exam |
| CO5 | Lecture using PPT, Question-Answer session | Assignment, Final Exam |

**Books Recommended:**


1. Hundy, Trott & Welch (2008), Refrigeration & Air-conditioning, Butterworth-Heinemann.
2. Ameen (2006), Refrigeration & Air-conditioning, Prentice Hall
3. Stoecker & Jones (1983), Refrigeration & Air-conditioning, McGraw-Hill, Inc
4. Dossat (1996), Principles of Refrigeration, Prentice Hall


| | | | |
|---|---|---|---|
| **Course No: MEE 07154175** | **Credit: 3.0** | **Year: Fourth** | **Semester: First** |
| **Course Title: CAD/CAM** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are as follows:

- To understand the concept of use of computers in design and manufacturing.
- To understand the basic design process and product life cycle management.
- To develop 3D modeling skills required for product design.
- To understand the nature & significance of CNC machine tools.
- To develop skills for programming skills required for CNC manufacturing.

**Course Content:**

CAD: fundamental concepts, application, benefits, hardware and software, types of CAD systems, common 2D CAD software features, basic 3D CAD features.
CAM: fundamental concepts, trend of development of numerical control (NC), principles of NC, types of NC systems, types of NC machines, CNC (manual) part programming, CNC part programming using CAM software, interfacing CAM software with CNC machines, computer aided machining.

**Course Outcomes:**

After the successful completion of the course, students will be able to:
CO 01: Explain basic concepts and applications and tools of CAD and CAM.
CO 02: Recognize part families and group technology.
CO 03: Execute the steps required in CAD software for developing 2D and 3D models and perform transformations
CO 04: Explain fundamental and advanced features of NC & CNC machines.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 1 | | | | | | | | | | 1 |
| CO2 | | 2 | | | 2 | | | | | | | |



| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | | | 2 | | 3 | | | | | | | |
| CO4 | 1 | | | | | | 2 | 1 | | | | |

Mapping of COs with Learning Strategies and Assessment Strategies:

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using PPT and board | Midterm Exam-I, Assignment, Final Exam |
| CO2 | Lecture using PPT and board | Midterm Exam-II, Assignment, Final Exam |
| CO3 | Lecture using PPT, Question-Answer session | Class work, Assignment, Final Exam |
| CO4 | Lecture using PPT and board | Assignment, Final Exam |

**Books Recommended:**


1. CAD/CAM: Computer-Aided Design and Manufacturing - Mikell P. Groover


| | | | |
|---|---|---|---|
| **Course No: MEE 07154179** | **Credit: 3.0** | **Year: Fourth** | **Semester: First** |
| **Course Title: Engineering Economy & Cost Management** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- To familiarize the students with the basic concept of Engineering Economy.
- Getting ideas about time value of money and the types of interest.
- To develop skills on different economic analysis and depreciation analysis.
- To be able to make proper economic decisions through analysis.
- To facilitate necessary knowledge about various costing analysis and its management in manufacturing companies.
- To understand basic financial statements broadly and apply it.

**Course Content:**

Basic Concept of Engineering Economy: The role of engineers in business and corporation, time value of money, simple and compound interest, types of investment; Types of Economic Analysis: Present, future and annual worth analysis, Cost-Benefit Analysis, Internal Rate of Return Analysis, Incremental Analysis Depreciation: Straight Line Depreciation, Declining Balance Method, MACRS, Sum of years method etc.; After tax cash flow analysis; Inflation and its impact on economic decision; Capital budgeting and rationing; Sensitivity Analysis.
Cost Management: Scope and Application of cost and management accountancy, costing methods and techniques, marginal costing and standard costing, income measurements in manufacturing companies, Variable Costing Vs. absorption costing, Cost allocation and categories: material costing and labor costing, overheads and their allocations; Financial statements analysis: concept, test for profitability, liquidity, solvency, overall measures, Cost-volume-profit analysis, Budgeting, Variance Analysis.

**Course Outcomes:**

After the successful completion of the course, students will be able to:

CO1. Analyze the time value of money and apply it in economic decision-making.
CO2. Evaluate different types of investments and conduct economic analysis for project evaluation.
CO3. Apply costing methods and techniques to measure costs and analyze financial statements for decision-making.
CO4. Develop budgets and conduct variance analysis to monitor and control costs.
CO5. Demonstrate effective communication skills and work collaboratively in a team to complete assignments related to engineering economy and cost management.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | | |
| CO02 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | | |
| CO03 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | | |
| CO04 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | | |
| CO05 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | | |

Mapping of COs with Learning Strategies and Assessment Strategies:

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO01 | Lecture using PPT, Question-Answer session | Midterm Exam-I, Assignment, Final Exam |
| CO02 | Lecture using PPT and board | Midterm Exam-II, Assignment, Final Exam |
| CO03 | Lecture using PPT, Question-Answer session | Class work, Assignment, Final Exam |
| CO04 | Lecture using PPT and board | Assignment, Final Exam |
| CO05 | Lecture using PPT, Question-Answer session | Assignment, Final Exam |

**Books Recommended:**
1. Engineering Economic & Cost Analysis; Courtland A. Collier, Charles R. Glagola.
2. Fundamentals of Engineering Economics and Decision Analysis; David L. Whitman, Ronald E. Terry.
3. Fundamentals of economics analysis in engineering Projects; Osama khayal.
4. Engineering Economics and costing; Mishra Sasmita.

| **Course No: MEE 07154171** | **Credit: 3** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Operations Research** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:
- To impart knowledge in concepts and tools of Operations Research.
- To make the students understand mathematical models for analysis of real problems in Operations Research.



- To develop skills about the applications of these techniques constructively to make effective business decisions.
- To make the students capable for analyzing different situations in the industrial scenario involving limited resources and finding the optimal solution within constraints.
- To help the students to develop ability in the use of Operations Research approaches and computer tools in solving real problems in industry.

**Course Content:**
Introduction, linear programming (simplex and transportation model), Network analysis, dynamic programming, introduction to simple queuing models, introduction to probabilistic inventory models, game and decision theory, simulation integer programming, scheduling, and reliability.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1.Explain the concepts and tools of Operations Research Understand mathematical models for analysis of real problems in Operations Research
CO2.Develop skills in the applications of Operations Research techniques for effective business decision making
CO3.Analyze different situations in the industrial scenario involving limited resources and finding the optimal solution within constraints
CO4.Develop ability in the use of Operations Research approaches and computer tools in solving real problems in industry

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | | |
| CO02 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | | |
| CO03 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | | |
| CO04 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 | | |
| CO05 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | | |

Mapping of COs with Learning Strategies and Assessment Strategies:

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Quiz |
| CO2 | Lecture using board/LCD projectors | Assignment |
| CO3 | Lecture using board/LCD projectors | Quiz |
| CO4 | Lecture using board/LCD projectors | Assignment |
| CO5 | Assignment/project | Assignment |

**Books Recommended:**
1. C. West Churchman, Russell L. Ackoff & E. L. Aronoff - Introduction to Operations Research

2. Hillier, Frederick S. & Lieberman - Introduction to Operations Research Concepts and Cases
3. J.K. Sharma - Operations Research Theory and Applications

**Optional Course-II**

| Course No: MEE 07154153 | Credit: 3.0 | Year: Fourth | Semester: First |
|---|---|---|---|
| Course Title: Theory of Structures | | Course Status: Theory | |

**Course Objectives:** The objectives of this course are as follows:

- To introduce students with the fundamental concepts of members that form a structure.
- To teach about the fundamental mathematical concepts and assumptions that forms the foundation of a structure.
- To classify and differentiate various types of structures.
- To define and familiarize about the elastic stability and natural frequency of a structure.
- To provide basic understanding of finite element method as a mathematical tool to analyze structures.

**Course Content:**
Preliminaries; Element's stiffness matrices; Pin-joint structures; 2-D rigid joint structures; Elastic plane element structures; Mixed elements structures; Elastic stability of 2-D rigid-joint structures; Frequency of rigid joint structures; Finite element method

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. compare and contrast between various types structural members and elements.
CO2. formulate mathematical models and equations that forms the foundation of various types of structural elements.
CO3. calculate the elastic stability and natural frequencies of different geometries and structures.
CO4. develop mathematical models based on finite element method to solve various problems related to structures.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | | | | | | | | | | | |
| CO02 | 3 | 2 | | | | | | | | | | |
| CO03 | | 2 | 1 | | | | | | | | | |
| CO04 | | | 3 | | | | | | | | | |

Mapping of COs with Learning Strategies and Assessment Strategies:

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using PPT and board | Semester Final Exam |
| CO2 | Lecture using PPT and board | Midterm Exam-I, Assignment, Semester Final Exam |
| CO3 | Lecture using PPT, Question-Answer session | Midterm Exam-II, Semester Final Exam |
| CO4 | Lecture using PPT and board | Assignment, Class Work, Semester Final Exam |

**Books Recommended:**
1. Theory of structures – SP Gupta & GS Pandit
2. Theory of Structures – RS Khurmi
3. Structural Anlaysis – RC Hibbler

| Course No: MEE 07154153 | Credit: 3.0 | Year: Fourth | Semester: First |
|---|---|---|---|
| Course Title: Noise and Vibration | | Course Status: Theory | |

**Course Objectives:** The objectives of this course are as follows:

- To acquaint students with the fundamentals of vibrations and noise.
- To make them analyze the fundamental relationships of noise and vibrations.
- Teaching students the skills required to be proficient in the assessment of the oscillations and acoustics of the machinery and engineering facilities.
- Preparing the students to mathematically model real-world mechanical vibration problems.

**Course Content:**
Sound waves; Sound sources; Sound transmission through walls and structures; Acoustics of large and small rooms; Mechanism of sound absorption; Design of silencers. Vibration isolation, machine foundation design; Vibration absorption; Random vibration; Beam and plate vibrations.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Identify, formulate, and solve engineering problems
CO2. Analyze sound propagation and reflections in space.
CO3. Distinguish between different sounds and noise levels in the environment.
CO4. create model for undamped and damped mechanical systems and structures
CO5. analyze free and harmonically forced vibrations

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | | | | | | | | 1 | 1 |
| CO2 | | 3 | 2 | | | | | | | | | |
| CO3 | 1 | | | | | | | | | | | 1 |
| CO4 | | | 3 | 2 | | | | | | | | |
| CO5 | 1 | 2 | 3 | | | | | | | | | |

Mapping of COs with Learning Strategies and Assessment Strategies:

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using PPT and board | Midterm Exam-I, Assignment, Final Exam |
| CO2 | Lecture using PPT and board | Midterm Exam-II, Assignment, Final Exam |
| CO3 | Lecture using PPT, Question-Answer session | Class work, Assignment, Final Exam |
| CO4 | Lecture using PPT and board | Assignment, Final Exam |
| CO5 | Lecture using PPT, Question-Answer session | Assignment, Final Exam |

**Books Recommended:**

1. Engineering Vibration-D. J. Inman
2. Engineering Acoustics: An Introduction to Noise Control-Michael Möser

| **Course No: MEE 07154125** | **Credit: 3.0** | **Year: Fourth** | **Semester: First** |
|---|---|---|---|
| **Course Title: Aerodynamics** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- To learn the basics of aerodynamics.
- To differentiate types of flow in the context of fluid dynamics.
- To define inviscid incompressible flow with incorporation of flow circulation.
- To familiarize the use of potential function and stream function in case of designing a flow field.
- To understand Kutta-Joukowski theorem, the aerofoil theory and wing theory.
- To understand Drag, aircraft propulsion and propeller.
- To introduce longitudinal stability and control of aerodynamic bodies.

**Course Content:**

Prereq.: MEE 07153223 (Fluid Mechanics-II)

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

**Course Outcomes:**

After the successful completion of the course, students will be able to:

CO1. Describe and apply the basic principles of incompressible flow, including potential function, stream function, and circulation to solve problems related to wing theory and aircraft performance.

CO2. Analyze and predict aerodynamic forces and moments on airfoils and wings using aerodynamic theories, including the Kutta-Joukowski theorem and the concept of circulation.



CO3. Explain the different types of drag and methods for drag reduction, and analyze the performance of aircraft propulsion systems and propellers.

CO4. Analyze and solve static performance problems related to aircraft, including lift, weight, thrust, and drag, and understand the effect of altitude on aircraft performance

CO5. Describe the principles of aircraft stability and control, including longitudinal, lateral, and directional stability, and analyze the performance of control surfaces.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | | | | | | | | 1 | 1 |
| CO2 | | 3 | 2 | | | | | | | | | |
| CO3 | 1 | | | | | | | | | | | 1 |
| CO4 | | | 3 | 2 | | | | | | | | |
| CO5 | 1 | 2 | 3 | | | | | | | | | |

Mapping of COs with Learning Strategies and Assessment Strategies:

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using PPT and board | Midterm Exam-I, Assignment, Final Exam |
| CO2 | Lecture using PPT and board | Midterm Exam-II, Assignment, Final Exam |
| CO3 | Lecture using PPT, Question-Answer session | Class work, Assignment, Final Exam |
| CO4 | Lecture using PPT and board | Assignment, Final Exam |
| CO5 | Lecture using PPT, Question-Answer session | Assignment, Final Exam |

**Books Recommended:**

1. Fundamentals of Aerodynamics - John D. Anderson
2. Aerodynamics for Engineers - John J. Bertin, Russell M. Cummings

| **Course No: MEE 07134191** | **Credit: 3.0** | **Year: Fourth** | **Semester: First** |
|---|---|---|---|
| **Course Title: Energy Resources & Utilization** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- To familiarize the students with world energy demand, available resources & their extraction system.
- To describe different types of conventional & renewable energy resources.
- To explain Solar energy and its various application to meet human needs.
- To introduce the students with the energy storage & waste heat rejection system.
- To make them understand the environmental impact of energy conversion systems.

**Course Content:**

Resources: The energy cycle of the earth, the energy scope and study of available energy resources for the world and energy demand, levels of extraction and technically feasible extraction.
Conventional and Renewable energy Conversion Systems: Review of current conventional conversion systems, bioenergy, hydro- power, geo-thermal power, wind-power, tidal energy, solar energy.
Application of Solar Energy: Heating, cooling, power generation, pumping, desalination, etc.
Utilization: Efficiencies of conversion system in current use, matching of energy sources to application hybrid and stored energy system, waste heat rejection and utilization.
Environmental Impact: Aspects of air and thermal pollution and waste disposal problems arising from conversion systems.

**Course Outcomes:**
After the successful completion of the course, students should be able to:
CO1. Define basic properties of different sources of energy and technologies for their utilization
CO2. Describe main elements of technical systems designed for utilization of resources of energy,
CO3. Interpret advantages and disadvantages of different resources of energy
CO4. Undertake simple analysis of energy potential of resources of energy
CO5. Select engineering approach to problem solving when implementing the projects on resources of energy

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 03 | | | | | | | | | | | |
| CO2 | | | | | 02 | | | | | | | |
| CO3 | 03 | | | | | | | | | | | |
| CO4 | | | | | 02 | | | | | | | |
| CO5 | | | | | | | | | | | 03 | |

**Teaching-Learning & Assessment Strategy**

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Quiz |
| CO2 | Lecture using board/LCD projectors | Assignment |
| CO3 | Lecture using board/LCD projectors | Quiz |
| CO4 | Lecture using board/LCD projectors | Assignment |
| CO5 | Assignment/project | Assignment |

**Books Recommended:**
1. Energy Resources, Utilization & Technologies; by AnjaneyuluYerramilli and Francis Tuluri



**Optional Course-III**

| Course No: MEE 07154263 | Credit: 3.0 | Year: Fourth | Semester: Second |
|---|---|---|---|
| Course Title: Machine Learning for Mechanical Engineers | | Course Status: Theory | |

**Course Objectives:** The objectives of this course are:
- To establish foundational knowledge of machine learning concepts and workflows relevant to mechanical systems
- To develop proficiency in regression, classification, and clustering techniques for engineering applications
- To master model evaluation methodologies for predictive maintenance and fault diagnosis
- To implement advanced neural networks for mechanical defect detection and system optimization
- To explore emerging ML paradigms including Physics-Informed Neural Networks (PINNs) and generative AI

**Course Content:**
Foundations of Machine Learning: Definition and scope of machine learning in engineering; Types of learning: supervised, unsupervised, and reinforcement learning; Key concepts: features, labels, model training, testing; Bias–variance trade-off: under fitting vs. overfitting; Standard ML workflow: data collection, preprocessing, model selection, validation, deployment.
Regression Models & Applications: Simple linear regression and least squares, Multiple linear regression, polynomial regression, Feature engineering for mechanical data (e.g., stress, strain inputs); Regularization: Ridge, Lasso, Engineering Applications (e.g., Predicting stress-strain behavior).
Classification Techniques & Fault Diagnosis: Logistic regression fundamentals, Decision trees: structure and splitting criteria, Ensemble methods: Bagging, Random Forest, Engineering Applications (e.g., Mechanical-fault classification, Quality control in manufacturing).
Unsupervised Learning & Dimensionality Reduction: Clustering: k-means, hierarchical clustering; Dimensionality reduction: Principal Component Analysis (PCA); Engineering Applications (e.g., Material microstructure analysis and segmentation).
Model Evaluation & Validation: Train/test split, k-fold cross-validation; Performance metrics: MSE, MAE, $R^2$ for regression; accuracy, precision, recall, ROC curves and area under curve (AUC); Case Study (e.g., Bearing life prediction: compare models, discuss error trade-offs, select optimal algorithm).
Advanced Neural Network Methods: Basics of artificial neural networks (ANNs): architecture, activation functions, backpropagation; Deep learning introduction: depth vs. width, vanishing gradients; Convolutional Neural Networks (CNNs) for image-based defect detection; Transfer learning and fine-tuning; Hands-on Project (e.g., Train a CNN to detect surface defects from images of machined parts). Physics-Informed Neural Networks (PINNs) for solving PDEs; Reinforcement Learning (RL) for control systems and optimization.

**Course Outcomes:**
After the successful completion of the course, students will be able to:

CO1: Explain core ML concepts including bias-variance tradeoffs and standard workflows
CO2: Apply regression/classification techniques to predict mechanical behavior and diagnose faults
CO3: Implement clustering and dimensionality reduction for material analysis
CO4: Evaluate model performance using appropriate validation techniques and metrics
CO5: Design CNN/PINN solutions for defect detection and physical system modeling

Mapping of Cos with POs

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO01 | 3 | 1 | | | 2 | | | | | | | 1 |
| CO02 | 2 | 3 | 2 | 2 | 3 | | | | 1 | | | |
| CO03 | 2 | 2 | 1 | 3 | 3 | | 1 | | | | | |
| CO04 | 1 | 3 | | 3 | 2 | 1 | | 1 | 2 | 1 | | |
| CO05 | 3 | 2 | 3 | 3 | 2 | | 2 | | 2 | | 1 | 2 |

Mapping Course Outcomes (Cos) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lectures + Interactive Q&A sessions | Quiz 1, Midterm Exam (Theory) |
| CO2 | Python coding + Case studies | Assignment 1 (Regression), Term Test 1 |
| CO3 | Data visualization workshops + Group projects | Assignment 2 (Clustering), Project Phase 1 |
| CO4 | Model evaluation exercises + Peer review | Term Test 2, Bearing Life Prediction Report |
| CO5 | CNN/PINN implementation + Design challenges | Final Project, Viva Voce |

**Books Recommended:**
1. Python Machine Learning – Sebastian Raschka & Vahid Mirjalili
2. Deep Learning – Ian Goodfellow, Yoshua Bengio, Aaron Courvill
3. Physics-Informed Neural Networks – George Em Karniadakis
4. Hands-On Machine Learning with Scikit-Learn and TensorFlow – Aurélien Géron
5. An Introduction to Statistical Learning – Gareth James et al.

| **Course No: MEE 07114283** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Bio-Engineering** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:
- To introduce students to the human musculoskeletal system
- To introduce students to the Biomechanics of human movement
- To make the students understand the material characterization of bones, ligaments, muscle and joints



- To integrate the knowledge core of traditional engineering disciplines and modern biology to solve problems encountered in living systems
- To facilitate necessary knowledge about imaging and sensing, therapeutics, biomechanics, cell and tissue engineering, and computational and systems biology

**Course Content:**
Introduction to human musculoskeletal system; Biomechanics of human movement: applications of engineering mechanics to the movements of muscles, bones and skeletal joints; Material and structural characteristics of bones, ligaments, muscle/tendons and joints - alternative materials.
Introduction to biomechanical fluid mechanics; Engineering approach to the function of circulatory and respiratory systems involving fluid dynamics.
Introduction to biomedical instrumentation; Ultrasound, x-ray, laser, microwave and ultraviolet rays - physics and technology of generation - their use in diagnostic, therapeutic, and processing applications in medicine and industry.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
CO2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare
CO3. Utilize major medical imaging modalities in radiology, including X-ray, CT, nuclear medicine, ultrasound, and MRI
CO4. Evaluate the engineering mechanics including stress, strain, deformation, and analysis of structures with application to biomechanical phenomena over a range of biological length scales
CO5. Utilize computational fluid dynamics tools to investigate momentum transport (viscous flow) and mass transport (diffusion and convection) in living systems

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 3 | 3 | 1 | | | | | | | |
| CO2 | 1 | 2 | 3 | 3 | 2 | 2 | 2 | | | | | |
| CO3 | 1 | 1 | 2 | 3 | 3 | | | | | | | |
| CO4 | 3 | 3 | 2 | 3 | | | | | | | | |
| CO5 | 2 | 3 | | 2 | 2 | | | | | | | |

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors/Projects | Assignment |

| | | |
|---|---|---|
| CO2 | Lecture using board/LCD projectors/Projects | Quiz |
| CO3 | Lecture using board/LCD projectors/Projects | Assignment |
| CO4 | Lecture using board/LCD projectors/Projects | Quiz |
| CO5 | Assignment/Projects | Assignment |

**Books Recommended:**

1. Y C Fung - Introduction to Bioengineering
2. S. A. Berger, W. Goldsmith, and E. R. Lewis - Introduction to Bioengineering
3. Satya Prakash and Dominique Shum-Tim - Stem Cell Bioengineering and Tissue Engineering Microenvironment
4. M Cerrolaza - Computational Bioengineering

| **Course No: MEE 07154233** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Fluidics** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- To make the students familiar with the fluid power control system and its components.
- To make them capable of analyzing the hydraulic pipelines.
- To familiarize students with the energy conversion devices of a hydraulic system.
- To make them design a fluidic circuit for useful mechanical work.
- Introducing the usage of electrical components in a fluidic control system.
- To let them know the proper maintenance of a hydraulic system.

**Course Content:**

Hydraulic and pneumatic components and systems; Servo Control valves; Fluid transmission lines; Actuators; Fluids; Power supplies and fluid motors; Compressibility and leakage; System modeling, stability and compensation.

**Course Outcomes:**

After successful completion of the course, students will be able to

CO1. Analyze and design a fluid power control system.

CO2. Apply the knowledge of fluid mechanics in calculating the power losses in a hydraulic pipeline.

CO3. Explain the principles of energy conservation devices used in fluidic systems.

CO4. Identify the fluidic circuit in practical applications and model such circuits to get useful mechanical work.

CO5. Apply their knowledge in the maintenance of hydraulic systems.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 2 | | | 1 | | | | | |
| CO2 | 2 | 1 | | 2 | 2 | | | | | | | |
| CO3 | 2 | | | | | | | | | | | |
| CO4 | 1 | 1 | 2 | 1 | | 1 | 1 | | | | | |



| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO5 | 1 | 3 | | 2 | | | | | | | | |

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Assignment |
| CO2 | Lecture using board/LCD projectors | Quiz |
| CO3 | Lecture using board/LCD projectors | Assignment |
| CO4 | Lecture using board/LCD projectors | Quiz |
| CO5 | Lecture using board/LCD projectors | Assignment |

**Books Recommended:**

1. Fluid Power with Applications, 7th Edition, Anthony Esposito.

| **Course No: MEE 07154237** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Advanced Thermodynamics** | | | **Course Status: Theory** |

**Course Objectives:** The objectives of this course are:

- To facilitate necessary knowledge about the laws of thermodynamics
- Make the students understand the concept of availability, reversibility etc.
- Getting idea about entropy
- To facilitate necessary knowledge of different energy functions.
- To provide broad knowledge about ideal gas and ideal gas mixtures.
- To develop skills on Statistical mechanics.
- Apply the knowledge of Thermodynamic probability.
- To enhance the skill on optimization procedures for thermodynamic systems with applications.

**Course Content:**

Introduction to classical and statistical viewpoints in thermodynamics; Concepts of equilibrium, stability, reversibility, irreversibility and availability; Concepts of entropy; Principle of increase of entropy; Calculation of entropy changes; Statistical interpretation; Entropy of mixing; Absolute entropy; Entropy flow and entropy production; Properties of pure substances; Ideal gasses; Ideal gas mixtures of constant composition; Ideal gas mixtures of variable compositions; Thermodynamic potentials: Helmholtz free energy functions, Gibbs free energy function; Application of free energy functions;

Transformations and thermodynamic potentials; Maxwell relations; Phase transitions; The Clausius-Clapeyron equation; Statistical mechanics: fundamental principles, energy states and levels; Thermodynamic probability: Bose-Einstein statistics, Fermi-Dirac statistics; Thermodynamic properties of a system; Special Topics: elastic systems, fuel cells, magnetic systems, thermo-electricity.

**Course Outcomes:**

After successful completion of the course, students will be able to

CO1. Apply classical and statistical viewpoints in thermodynamics to analyze the concepts of equilibrium, stability, reversibility, irreversibility, and availability of thermodynamic systems.

CO2. Calculate and interpret entropy changes in thermodynamic systems, and analyze the entropy of mixing, absolute entropy, entropy flow, and entropy production.
CO3. Apply the principles of thermodynamic potentials, including Helmholtz and Gibbs free energy functions, to determine the stability and spontaneity of a thermodynamic system and its transformations.
CO4. Apply statistical mechanics and thermodynamic probability, including Bose-Einstein and Fermi-Dirac statistics, to analyze the thermodynamic properties of a system.
CO5. Analyze and evaluate the thermodynamic properties of special systems, including elastic systems, fuel cells, magnetic systems, and thermo-electric systems

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | | 3 | 2 | | | 2 | 2 | | | 2 |
| CO2 | | | | 3 | 2 | | | 1 | 2 | | | 1 |
| CO3 | | 1 | 1 | 3 | 2 | | | 1 | 2 | | | 1 |
| CO4 | | | | 3 | 2 | | | | 1 | | | |
| CO5 | | | | 3 | 1 | | | | 1 | | | |

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Assignment |
| CO2 | Lecture using board/LCD projectors | Quiz |
| CO3 | Lecture using board/LCD projectors | Assignment |
| CO4 | Lecture using board/LCD projectors | Quiz |
| CO5 | Lecture using board/LCD projectors | Assignment |

**Books Recommended:**
1. Heat and Mass Transfer; Yunus A. Cengel &Afshin J. Ghajar
2. Advanced Thermodynamics for engineers; Desmond E. Winterbone and Ali Turan.
3. Advanced Thermodynamic engineering; Dr. Kalyan Annamalai, Dr. Ishwar K. Puri,Dr. Milind A. Jog.

| **Course No: MEE 07154273** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Quality Control & Management** | | | **Course Status: Theory** |

**Course Objectives:** The objectives of this course are:
- To facilitate necessary knowledge about quality and its measurement, characteristics, principle, cost etc.
- Getting ideas about quality management and quality planning.
- To enhance the skill of total quality management to manage quality of product.
- To understand the basics of quality standards.

**Course Content:**



Concept of Quality: Modern concept of quality and its measurement, quality redefined, identification of quality characteristics: quality of design conformance and performance, Deming's principles on quality and productivity, Quality costs and their interpretation; Statistical Quality Control: Control and measurement of quality, Elementary SPC tools: Control charts, Process capability analysis, Design of experiments, Acceptance sampling plans: OC curves, single and double sampling plane, rectifying inspection, AOQ; Quality Management: Fundamentals of Quality Management, Quality planning, Total Quality Management: origin, concept and implementation, QCC, TQC, Quality Standards – ISO 9000 and 14000, 5S, TPM, SMED, Poka-Yoke etc.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Understand the modern concept of quality and its measurement, including the identification of quality characteristics and Deming's principles on quality and productivity.
CO2. Apply statistical quality control techniques, such as control charts, process capability analysis, design of experiments, and acceptance sampling plans, to control and measure quality.
CO3. Develop skills in quality management, including quality planning, total quality management (TQM), quality control circles (QCC), and total productive maintenance (TPM).
CO4. Describe the fundamentals of quality management standards, including ISO 9000 and 14000, 5S, single and double sampling plans, rectifying inspection, and mistake-proofing (poka-yoke) process.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | | |
| CO2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | | |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | | |
| CO4 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | | |

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Quiz |
| CO2 | Lecture using board/LCD projectors | Assignment |
| CO3 | Lecture using board/LCD projectors | Quiz |
| CO4 | Lecture using board/LCD projectors | Assignment |

**Books Recommended:**
1. Fundamentals of Quality Control and improvement; AmitavaMitra.
2. Economic Control of Quality of Manufactured product; Walter A. Shewhart.
3. The Handbook for Quality Management; Thomas Pyzdek, Paul Keller.

| Course No: MEE 07154177 | Credit: 3.0 | Year: Fourth | Semester: First |
|---|---|---|---|
| Course Title: Production Planning and Control | | Course Status: Theory | |

**Course Objectives:** The objectives of this course are:
- To deliver goods in required quantities to customers in required delivery schedules.
- To ensure maximum utilization of all resources
- To ensure production quality products
- To minimize the product throughput time
- To maintain optimum level inventory
- To maintain flexibility in manufacturing operations
- To coordinate between labor and machines and various supporting departments

**Course Content:**
Elements of production planning and control, types of production system. Forecasting methods and their application, aggregate planning, master production scheduling, MRPI, MRPII, coding and standardization, capacity planning, inventory management, ABC analysis. Production scheduling techniques, CPM and PERT, line balancing, capacity planning. Plant location and layout, work study and method study, plant performance measurement. Computers in production planning and control and MRPII, JIT.

**Course Outcomes**:
After successful completion of this course student will be able to
CO1. Demonstrate the elements of production planning and control and the types of production systems.
CO2. Compare and evaluate the different forecasting methods and apply them in aggregate planning.
CO3. Apply MRPII in inventory management and evaluate its effectiveness using ABC analysis.
CO4. Analyze and compare CPM, PERT, and line-balancing techniques in production scheduling.
CO5. Evaluate plant location and layout, and measure plant performance using work-study and method study.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 2 | | | | | | | |
| CO2 | 2 | 3 | | 2 | 2 | | | | 2 | 2 | | 2 |
| CO3 | 2 | 3 | | 3 | 3 | | | | | | 2 | 2 |
| CO4 | 2 | 2 | | 3 | 3 | | | | | | | 2 |
| CO5 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | | 2 | 2 | 2 | 2 |

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Assignment |
| CO2 | Lecture using board/LCD projectors | Quiz |
| CO3 | Lecture using board/LCD projectors | Assignment |
| CO4 | Lecture using board/LCD projectors | Quiz |
| CO5 | Lecture using board/LCD projectors | Assignment |

**Books Recommended:**
1. Elements of Production Planning and Control - Samuel Eilon
2. Modern Production / Operations Management – Baffa & RakeshSarin



**Optional Course-IV**

| Course No: MEE 07154265 | Credit: 3.0 | Year: Fourth | Semester: Second |
|---|---|---|---|
| Course Title: Basic Mechatronics | | Course Status: Theory | |

**Course Objectives:** The objectives of this course are as follows:
- To facilitate necessary knowledge about closed loop controllers
- To provide the knowledge of different types of operational amplifier, filter and their implementation in controllers
- Making the students skilled in data acquisition system: ADC and DAC conversion and data transmission system
- To familiarize them with CAD, CAM, CIM
- Introducing different types of sensors and actuators to the students
- Providing the knowledge of machine vision and its key elements
- To help the students conceptualize basic robotics and learn about different types of robots
- To acquaint them with the fundamentals of industrial, home and office automation

**Course Content:**
Organization structure; System concept; mechanical, electrical, electronic and software components; process; software-based tools: Virtual instrumentation; CAD; CAM; Computer integrated system; Computer interfacing; manipulator; actuator types; Sensors and vision system; Smart robots; Artificial Intelligence; Factory, Office and Home automation; MEMS and Nanotechnology; Future trends.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1.Understand the basic principles and components of mechatronics systems
CO2.Analyze and design mechatronics systems using software-based tools such as CAD, CAM and virtual instrumentation
CO3.Demonstrate the ability to integrate mechanical, electrical, electronic and software components in mechatronic systems
CO4.Describe the function and selection of sensors, actuators and vision systems in mechatronics systems
CO5.Analyze and design smart robots and computer-controlled systems using artificial intelligence

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 3 | | | | | | | | 1 | 1 |
| CO2 | | 3 | 2 | | | | | | | | | |
| CO3 | 1 | | | | | | | | | | | 1 |
| CO4 | | | 3 | 2 | | | | | | | | |
| CO5 | 1 | 2 | 3 | | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Quiz |
| CO2 | Lecture using board/LCD projectors | Assignment |
| CO3 | Lecture using board/LCD projectors | Quiz |
| CO4 | Lecture using board/LCD projectors | Assignment |
| CO5 | Assignment/project | Assignment |

**Books Recommended:**

1. Mechatronics; W. Bolton
2. Introduction to Mechatronics and Measurement Systems; David Alciatore

| **Course No: MEE 07164281** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Automobile Engineering** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- To familiarize the students with the anatomy of the automobile in general
- To understand the location and importance of each part.
- To know the functioning of the engine and its accessories, gear box, clutch, brakes, steering, axles and wheels.
- To know how suspension, frame, springs and other connections work.
- To know about emissions, ignition, controls, electrical systems and ventilation.

**Course Content:**

Introduction to road vehicles; Components of automobiles; Ignition system; Alternative fuels and alternative types of engines; Engine cooling and exhaust systems.

Vehicle performance: linear and angular inertia, braking effects, gyroscopic effects and reactions, tractive effort and vehicle vibration; Resistance to vehicle motion: gradient resistance, aerodynamic resistance, rolling and frictional resistance; Development strategies for minimum resistance.

Automotive transmission systems and powertrain: clutch, gear, differential and final drives. Automotive safety: brakes; Reduction of injuries; Automotive body: materials and vehicle shape; Springs and suspension: Steering system.

Electrical systems: cranking motor, alternator and lighting; Electronic control systems and indicators. Environmental considerations: vehicle emissions and control strategies; Noise pollution and control; Vehicle fuel economy. Testing of vehicles; Motor vehicle regulations



**Course Outcomes:**

After the successful completion of the course, students will be expected to:

CO1. Identify the different components of automobile.

CO2. Develop strategies to minimize the resistance to motion experienced by the vehicle and increase performance of the vehicle changing various parameters of body and engine.

CO3. Describe how the safety system, automotive drive-train, transmission, clutch, brakes, steering, tire and the suspension systems operate.

CO4: Explain the environmental implications of automobile emissions and motor vehicle regulations.

CO5: Explain the working of various parts like engine, cooling system, lubricating system, electronic and electrical system, fuel and ignition system, exhaust and emission system.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | | | | | | | | | | |
| CO2 | | | 3 | | 3 | | | | | | | |
| CO3 | | | | 3 | | | | | | | | 3 |
| CO4 | | | | | | 3 | 3 | | | | | |
| CO5 | 2 | | | | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Quiz |
| CO2 | Lecture using board/LCD projectors | Assignment |
| CO3 | Lecture using board/LCD projectors | Quiz |
| CO4 | Lecture using board/LCD projectors | Assignment |
| CO5 | Assignment/project | Assignment |

**Books Recommended:**

1. Hillier's Fundamentals of Motor Vehicle Technology - V. A. W. Hillier
2. Automotive Engineering Fundamentals - Richard Stone
3. Automotive Technology: A Systems Approach - Jack Erjavec
4. Automotive Mechanics-William H. Crouse, Donal L. Anglin.
5. Advanced Vehicle Technology-H. Heisler
6. Automobile Engineering (Volume–1 & 2)-Dr. Kirpal Singh

| **Course No: MEE 07134293** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Nuclear Engineering** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- To teach students fundamental physics that applies to a broad range of nuclear technologies

- To develop skills to differentiate different nuclear reactions
- To introduce students to environmental impacts of nuclear technology, and the physical and biological effects of ionizing radiation
- To provide the knowledge of reactor coolants
- To make the students understand how to dispose nuclear waste

**Course Content:**
World energy resources; Importance of fission energy; Atomic structure; Nuclear energy and nuclear forces; Nuclear fission and fusion processes; Nuclear fission reactors; Reactor controls; Reactor coolants; Process waste disposal; Nuclear power reactor systems.

**Course Outcomes:**
CO1. Explain the basic nuclear terminologies and describe the breadth of current and potential nuclear applications
CO2. Describe the fundamentals of sustained neutron chain reactions, fission reactor design, and fission products
CO3. Define and describe various reactor types and enumerate the basic systems of each reactor type
CO4. Identify the threats posed by nuclear wastes and describe their safe disposal process
CO5. Explain the importance of nuclear energy in the context Bangladesh power sector

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 2 | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | |
| CO3 | 3 | 2 | 3 | 2 | 1 | | | | | | | |
| CO4 | 2 | 1 | | 1 | | | 3 | | | | | 2 |
| CO5 | 2 | | | 2 | | 2 | | | | | | 3 |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy:

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lectures | Assignment |
| CO2 | Lectures | Midterm Examination 1 |
| CO3 | Lectures | Midterm Examination 2 |
| CO4 | Lectures | Quiz |
| CO5 | Lectures | Quiz |

**Books Recommended:**

1. J. Kenneth Shultis& Richard E. Faw - Fundamentals of Nuclear Science and Engineering
2. John R. Lamarsh and Anthony J. Baratta - Introduction to Nuclear Engineering
3. James E. Turner - Atoms, Radiation, and Radiation Protection




| Course No: MEE 07154251 | Credit: 3.0 | Year: Fourth | Semester: Second |
|---|---|---|---|
| Course Title: Fatigue, Creep and Fracture | | | Course Status: Theory |

**Course Objectives:** The objectives of this course are:
- To define and understand basic concepts of fatigue, creep and fracture failure.
- To acquire fundamental insight into the underlying mechanisms controlling mechanical deformation.
- To gain a basic understanding of the mechanical properties of different engineering materials.
- To develop a detailed understanding of mechanical testing.
- To acquire basic understanding of complex stress states and principal states of stress.
- To learn about basic yielding and fracture criteria used to predict and control yield and fracture.
- To know how to apply basic concepts of fracture mechanics to predict fracture.
- To understand basic techniques used to predict and control fatigue.
- To learn about basic mechanisms behind creep and how to model and control creep.

**Course Content:**
Fatigue: Fatigue failure; types of fatigue with fixed and varying amplitude, Combined stress fatigue properties; Notch sensitivity, factors influencing fatigue strength; fatigue tests, Utilization of fatigue properties in design.
Creep: Creep-stress-time -temp. Relation for simple tension and combined stresses, Recovery creep and relaxation, testing techniques, Creep in tension, bending, torsion and buckling.
Fracture: Basic modes of fracture, Theories of linear elastic fracture mechanics, Griffith theory of brittle fracture, Irwin's theory of fracture in elastic plastic materials, stress intensity factors; fracture toughness testing, Interpretation of test data.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Understand fatigue failure and its types
CO2. Analyze and interpret the relation between stress, time, and temperature in creep
CO3. Apply theories of linear elastic fracture mechanics to real-world scenarios
CO4. Conduct fracture toughness testing and interpret the test data
CO5. Compare and contrast the different types of fatigue testing techniques

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 2 | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | |
| CO3 | 3 | 2 | 3 | 2 | 1 | | | | | | | |
| CO4 | 2 | 1 | | 1 | | | 3 | | | | | 2 |
| CO5 | 2 | | | 2 | | 2 | | | | | | 3 |

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Quiz |
| CO2 | Lecture using board/LCD projectors | Assignment |
| CO3 | Lecture using board/LCD projectors | Quiz |
| CO4 | Lecture using board/LCD projectors | Assignment |
| CO5 | Assignment/project | Assignment |

**Books Recommended:**


1. Fracture Mechanics: fundamentals and applications - T.L. Anderson
2. Fracture Mechanics: an introduction - E.E. Gdoutos
3. Metal Fatigue in Engineering - R.I. Stephens, A. Fatemi, R.R. Stephens, and H.O Fuchs
4. Multiaxial Fatigue - D.F. Socie and G.B. Marquis


| **Course No: MEE 07154225** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Fluids Engineering** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- To make them know the prospects of the gas transmission system in Bangladesh.
- To make them capable of analyzing and designing a gas transmission network.
- To make them use their knowledge in pipeline system analysis.
- To provide them the concepts of different flow properties

**Course Content:**

Conservation of mass, momentum and energy; Derivation of Navier Stokes equations; Steady and unsteady flows; Flow in 2-D and axisymmetric ducts; Laminar jets; Stability of laminar flow; Orr-Sommerfield equation; Flow in branching pipe systems; Unsteady flow in pipes; Water hammer; Economics of pipe systems; Hydraulic machines: press, intensifier, ram, jigger, lift, jack.

**Course Learning Outcomes:**

After the successful completion of the course, students will be able to:
CO1. Explain the usefulness of mathematics in the advanced engineering problems
CO2. Identify the advanced mathematical methods and tools relevant to theoretical and mathematical aspects of mechanical engineering research
CO3. Solve nonlinear differential equations utilizing different numerical methods
CO4. Use Finite Difference Method and Finite Element Method to solve physical problems
CO5. Explain the basics of boundary element method, calculus of variations and Chaos Theory

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 2 | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | |



| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | 3 | 2 | 3 | 2 | 1 | | | | | | | |
| CO4 | 2 | 1 | | 1 | | | 3 | | | | | 2 |
| CO5 | 2 | | | 2 | | 2 | | | | | | 3 |

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Quiz |
| CO2 | Lecture using board/LCD projectors | Assignment |
| CO3 | Lecture using board/LCD projectors | Quiz |
| CO4 | Lecture using board/LCD projectors | Assignment |
| CO5 | Assignment/project | Assignment |

**Books Recommended:**


1. Gas Principles Hydraulics, 2005; E. Shashi Menon.
2. Slurry transport using centrifugal pumps; K.C. Wilson, G. R. Addie, A. Sellgren, R. Clift.
3. Hydraulics of pipeline systems; Bruce E. Larock, Roland W. Jeppson, Gary Z. Watters


**Optional Course-V**

| **Course No: MEE 07154241** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Applied Engineering Mathematics** | | | **Course Status: Theory** |

**Course Objectives:** The objectives of this course are:

- To give broad coverage of mathematics useful to senior year Mechanical Engineering students
- To provide the students with sufficient exposure to advanced mathematical methods and tools that are relevant to theoretical and mathematical aspects of mechanical engineering research.
- To make students able to solve nonlinear differential equations utilizing different numerical methods
- To help students learn the basics of Finite Difference Method and Finite Element Method to solve physical problems
- To facilitate students with understanding of boundary element method and calculus of variations
- To provide an introductory knowledge about Chaos Theory

**Course Content:**

Nonlinear differential equations: asymptotic method, perturbation method, Rayleigh-Ritz method, collocation method; Finite difference method; Finite element method; Boundary element method; Calculus of variations; Chaos theory.

**Course Learning Outcomes:**

After the successful completion of the course, students will be able to:
CO1. Explain the usefulness of mathematics in the advanced engineering problems

CO2. Identify the advanced mathematical methods and tools relevant to theoretical and mathematical aspects of mechanical engineering research
CO3. Solve nonlinear differential equations utilizing different numerical methods
CO4. Use Finite Difference Method and Finite Element Method to solve physical problems
CO5. Explain the basics of boundary element method, calculus of variations and Chaos Theory

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 2 | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | |
| CO3 | 3 | 2 | 3 | 2 | 1 | | | | | | | |
| CO4 | 2 | 1 | | 1 | | | 3 | | | | | 2 |
| CO5 | 2 | | | 2 | | 2 | | | | | | 3 |

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Quiz |
| CO2 | Lecture using board/LCD projectors | Assignment |
| CO3 | Lecture using board/LCD projectors | Quiz |
| CO4 | Lecture using board/LCD projectors | Assignment |
| CO5 | Assignment/project | Assignment |

**Books Recommended:**
1. Fourier Series and Numerical Methods for Partial Differential Equations- Richard Bernatz
2. Numerical Methods for Solving Partial Differential Equations- Byron Gottfried
3. Fundamentals of Finite Element Analysis - David V. Hutton

| **Course No: MEE 07154243** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Applied Statistics for Engineers** | | | **Course Status: Theory** |

**Course Objectives:** The objectives of this course are:
- To develop the student's knowledge in engineering data collection, interpretation & problem-solving process
- To develop student's skills in various sampling methods & decision-making problems.
- To develop student's skills in analyzing data from engineering experiments and apply CRD, RBD and CSD.

**Course Content:**
Simple regression and correlations, multiple regression. Tests of significance. Analysis of variance. Experimental design. Factor analysis. Statistical packages.



**Course Outcomes:**
After successful completion of the course, students will be able to
CO1. Apply simple regression and correlation techniques to analyze the relationship between two variables and interpret their findings effectively.
CO2. Use multiple regression analysis to identify and explain the impact of multiple independent variables on a dependent variable.
CO3. Conduct hypothesis testing and use statistical tests of significance to evaluate whether observed differences in means or proportions are statistically significant or not.
CO4. Design and analyze experiments using techniques like analysis of variance (ANOVA) and factor analysis, and interpret the results to draw meaningful conclusions.
CO5. Use statistical packages effectively to conduct data analysis and produce meaningful statistical output that informs decision-making processes.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | | 2 | 2 | | | | 2 | 3 | | 2 |
| CO2 | 1 | 2 | | 1 | 2 | | | | 1 | 2 | | 2 |
| CO3 | | 1 | | | 1 | | | | | 2 | | 1 |
| CO4 | | | 2 | 1 | 1 | 1 | 2 | | | 1 | | |
| CO5 | 1 | 2 | | 2 | 2 | | | | 1 | 3 | | 2 |

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors/Projects | Assignment |
| CO2 | Lecture using board/LCD projectors/Projects | Quiz |
| CO3 | Lecture using board/LCD projectors/Projects | Assignment |
| CO4 | Lecture using board/LCD projectors/Projects | Quiz |
| CO5 | Assignment/Projects | Assignment |

**Books Recommended:**
1. The Elements of Statistical Learning; by Jerome H. Friedman, Robert Tibshirani, and Trevor Hastie
2. Statistical Models: Theory and Practice; by David A. Freedman

| **Course No: MEE 07154239** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Combustion and Pollution** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are as follows:
- To introduce the students with combustion, heat of reaction, flame temperature, heating value etc.
- Familiarizing them with the chemistry and kinetics of reaction
- To make them learn flame propagation and structure of laminar premixed flame
- Making them understand combustion process for internal and external combustion engines

- To make them analyze the emission from combustion and control pollution
- To make them understand the process of exhaust gas recirculation

**Course Content:**
Introduction to combustion; Heat of reaction, adiabatic flame temperature, heating values, chemical composition of products of combustion; Chemistry and kinetics of reactions; Reaction rate and flame propagation; Structure of laminar premixed flames; Explosions and fuel oxidation; Detonation; Combustion in internal and external combustion engines.
Production of pollutants in combustion systems; Emissions of greenhouse gas, carbon monoxide, oxides of nitrogen and sulfur, and other pollutants. Pollution control: post-engine exhaust treatment for emission control - thermal reactors, exhaust gas recirculation, catalysis; Pollution control by modification of combustion parameters; other pollution control strategies

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Analyze combustion process in internal and external combustion engines
CO2. Identify the impacts of emission on the environment and search for new modifications that can be incorporated for the further reduction of emission pollution
CO3.Explain the details of flame propagation and structure of laminar premixed flame

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 2 | | | | | | | | |
| CO2 | 3 | 3 | 2 | 3 | 3 | | 3 | | | | | 2 |
| CO3 | 3 | 2 | | | | | | | | | | |

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy:

| COs | *Teaching-Learning Strategy* | *Assessment Strategy* |
|---|---|---|
| CO1 | *Lectures* | *Assignment* |
| CO2 | *Lectures* | *Midterm Examination 1* |
| CO3 | *Lectures* | *Midterm Examination 2* |

**Books Recommended:**
1. Internal Combustion Engine Fundamentals- John B. Heywood
2. Handbook of Air Pollution from Internal Combustion Engines: Pollutant Formation and Control-Eran Sher

| **Course No: MEE 07144263** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Robot Mechanics & Control** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:
- To introduce various robot structures and their workspace.



- To develop student's skills in performing spatial transformations associated with rigid body motions.
- To demonstrate kinematics analysis of robot systems.
- To familiarize the student of the singularity issues associated with the operation of robotic systems.
- To provide the student with some knowledge and analysis skills associated with trajectory planning.
- To provide the student with some knowledge and skills associated with robot control.

**Course Content:**
Robotics system components. Notations. Position definitions. Coordinate frames. Different orientation descriptions. Free vectors. Translation's rotations and relative motion. Homogeneous transformations; Manipulator Forward and Inverse Kinematics: Link coordinate frames. Denavit-Hartenberg convention. Joint and end- effect r Cartesian space. Forward kinematics transformations of position. Inverse kinematics of position. Solvability. Trigonometric equations. Closed-Form Solutions. Workspace; Mechanics of Robot Motion: Translational and rotational velocities. Velocity Transformations. The Manipulator Jacobian. Forward and inverse kinematics of velocity. Singularities of robot motion; Static Forces and Compliance: Transformations of static forces and moments. Joint and End-Effect or force /torque transformations; Robot Dynamics and Trajectory Planning: Lagrangian formulation. Model properties. Newton-Euler equations of motion. Simulations. Joint-based motion planning. Cartesian-based path planning; Robot Control: Independent joint control. Feed forward control. Inverse dynamics control, Robot controller architectures. Mobile Robots and Automated Guided Vehicles, Human Robot Interaction. Implementation problems.

**Course Outcomes:**
After the successful completion of the course, students should be able to:
CO1. Demonstrate knowledge of the relationship between mechanical structures of industrial robots and their operational workspace characteristics.
CO2. Apply spatial transformation to obtain forward kinematics equations of robot manipulators.
CO3. Solve inverse kinematics of simple robot manipulators.
CO4. Obtain the Jacobian matrix and use it to identify singularities.
CO5. Generate joint trajectory for motion Planning

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 02 | | | | | | | | | | | |
| CO2 | | | 03 | | | | | | | | | |
| CO3 | | | 03 | | | | | | | | | |
| CO4 | | 02 | | | | | | | | | | |
| CO5 | | 03 | | | | | | | | | | |

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors | Quiz |
| CO2 | Lecture using board/LCD projectors | Assignment |
| CO3 | Lecture using board/LCD projectors | Quiz |
| CO4 | Lecture using board/LCD projectors | Assignment |
| CO5 | Assignment/project | Assignment |

**Books Recommended:**

1. Introduction to Robotics: Mechanics and Control 4th Edition; by John Craig
2. Industrial Robotics Fundamentals: Theory and Applications Third Edition;by Larry T. Ross, Stephen W. Fardo, Michael F. Walach

| **Course No: MEE 07154295** | **Credit: 3.0** | **Year: Fourth** | **Semester: Second** |
|---|---|---|---|
| **Course Title: Renewable Energy** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- To make the students understand various forms of conventional energy resources
- To introduce students to the economics of sustainable energy sources and the financing options available in the sector
- To help the students understand various forms of conventional energy resources
- To provide the knowledge of the present energy scenario and the need for energy conservation
- To develop skills to analyze the environmental aspects of renewable energy resources

**Course Content:**

Reserves of non-renewable fuels; Prospects of renewable energy, and its sources and pattern of usage; characteristics of renewable sources: intermittent, low power density etc.; use of renewables in small scale systems; Current technology: wind wave, tidal, passive and active solar, biological and examples of devices; Energy management, interaction of non-technical requirements (social, economic, political, environment) in engineering design and innovation; case-study.

**Course Outcomes:**

After the successful completion of the course, students will be able to:

CO1.Identify the differences between renewable and non-renewable energy sources, and analyze the potential of renewable energy to address current and future energy needs.

CO2.Evaluate the characteristics of different renewable energy sources, including intermittency and power density, and assess the technical and economic feasibility of utilizing these sources.

CO3.Analyze the technological aspects of different renewable energy systems, including wind, wave, tidal, solar, and biological systems, and evaluate the efficiency, reliability, and environmental impact of these systems.

CO4.Apply principles of energy management to the design and operation of renewable energy systems, and analyze the interplay between technical and non-technical requirements in engineering design and innovation.



CO5.Utilize case studies to assess the practical applications and limitations of different renewable energy systems in various contexts, and develop strategies for optimizing their performance.

**Mapping of COs with POs**

| CO/PO | PO01 | PO02 | PO03 | PO04 | PO05 | PO06 | PO07 | PO08 | PO09 | PO10 | PO11 | PO12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 1 | 2 | | | | | | | | |
| CO2 | 3 | 2 | 1 | 1 | | | | | | | | |
| CO3 | 3 | 2 | 3 | 2 | 1 | | | | | | | |
| CO4 | 2 | 1 | | 1 | | | 3 | | | | | 2 |
| CO5 | 2 | | | 2 | | 2 | | | | | | 3 |

Mapping of COs with Learning Strategies and Assessment Strategies:

| COs | Teaching-Learning Strategies | Assessment Strategies |
|---|---|---|
| CO1 | Lecture using PPT and board | Midterm Exam-I, Assignment, Final Exam |
| CO2 | Lecture using PPT and board | Midterm Exam-II, Assignment, Final Exam |
| CO3 | Lecture using PPT, Question-Answer session | Class work, Assignment, Final Exam |
| CO4 | Lecture using PPT and board | Assignment, Final Exam |
| CO5 | Lecture using PPT, Question-Answer session | Assignment, Final Exam |

**Books Recommended:**

1. John Twidell, Tony Weir- Renewable Energy Resources
2. Roland Wengenmayr, Thomas Bührke- Renewable Energy: Sustainable Energy Concepts for the Energy Change
3. David Buchla, Thomas Kissell, Thomas Floyd - Renewable Energy Systems

**Courses Offered by MEE Department to Students of Other Department**

| **Course No: MEE 07152113F** | **Credit: 3.0** | **Year: Second** | **Semester: First** |
|---|---|---|---|
| **Course Title: Engineering Mechanics** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:

- To develop skills on the capacity to predict the effects of force and motion
- To provide the knowledge of a knowledge of the physical and mathematical principles of mechanics
- Getting an idea about the ability to visualize physical configurations in terms of real materials, actual constraints, and the practical limitations which govern the behavior of machines and structures.
- To make them learn the fundamentals of Mechanics, equation of static equilibrium & dynamic equilibrium of particles and rigid bodies.
- To provide the knowledge of the effect of friction on equilibrium.

- To understand the basics of kinematics, kinetics of particles and rigid body, related principles.
- Apply the knowledge to solve practical problems.

**Course Content:**
Basic concepts of mechanics; Statics of particles and rigid bodies; Centroids of lines, areas and volumes; Forces in truss, frames, and cables; Friction; Moments of inertia of areas and masses; Relative motion.
Kinetics of particles: Newton's second law of motion; Principles of work, energy, impulse and momentum; System of particles; Kinematics of rigid bodies; Kinetics of plane motion of rigid bodies: forces and acceleration; Principles of work and energy.

**Course Outcomes:**
After Successful completion of the course, students will be able to
CO1. Apply the principles of statics to analyze and solve problems involving forces in truss, frames, and cables.
CO2. Use the principles of kinetics to analyze the motion and forces of particles and rigid bodies, including work, energy, impulse, and momentum.
CO3. Calculate centroids of lines, areas, and volumes, as well as moments of inertia of areas and masses, and apply these concepts to practical engineering problems.
CO4. Analyze and solve problems related to friction and relative motion, and apply these concepts to real-world situations.
CO5. Apply the principles of work and energy to analyze the motion and forces of rigid bodies in plane motion, including forces and acceleration, and apply these concepts to practical engineering problems.

**Mapping of COs with POs**
According to the POs of the FET department.

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors/Projects | Assignment |
| CO2 | Lecture using board/LCD projectors/Projects | Quiz |
| CO3 | Lecture using board/LCD projectors/Projects | Assignment |
| CO4 | Lecture using board/LCD projectors/Projects | Quiz |
| CO5 | Assignment/Projects | Assignment |

**Books Recommended:**

1. Engineering Mechanics: Statics - Russell Hibbeler
2. Engineering Mechanics: Dynamics - Russell Hibbeler
3. Vector Mechanics for Engineers – Ferdinand P. Beer




| Course No: MEE 07152174F | Credit: 2.0 | Year: Second | Semester: First |
|---|---|---|---|
| Course Title: Computer-aided Mechanical Engineering Drawing | | | Course Status: Sessional |

**Course Rationale:**
In today's rapidly evolving technological landscape, computer-aided design (CAD) has become an integral part of the mechanical engineering field. Computer-Aided Mechanical Engineering Drawing is designed to equip students with the essential skills and knowledge needed to create accurate, efficient, and innovative engineering drawings using advanced CAD tools. This course aims to bridge the gap between traditional drafting techniques and modern CAD software, enabling students to produce high-quality drawings that are vital for the design, analysis, and manufacturing processes within the engineering discipline.

**Course Objectives:** The objectives of this course are:
- To provide for the students an insight into computer aided design and modelling.
- To develop an ability to create 2-D sketches, create and edit dimensions.
- To develop an ability to create solid models of machine components.
- To develop an ability to create assembly models of simple machines.
- To develop the ability to apply limits, fits, and dimensional tolerances, as well as geometric tolerances to components and assemblies on engineering drawings.
- To develop an ability to create 2D drawings from 3D models

**Course Content:**
Introduction to Mechanical Engineering Drawing; Instruments and their uses; Introduction to Computer Aided Design (CAD); First and third angle projections; Orthographic drawings; Isometric views; Missing lines and views; Sectional views and conventional practices; Auxiliary views. Fasteners, gears, keys and springs; Specifications for manufacture; Working drawings; Process Design.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO1. Define different engineering design parameter like shapes, angels and lines.
CO2. Draw different views including auxiliary views, orthographic projections and sections using AutoCAD software.
CO3. Justify the engineering design with dimensions.
CO4. Develop the ability to read and interpret engineering drawings created by others.
CO5. Create complex engineering drawings and processes using AutoCAD Software.
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**Mapping of COs with POs**
According to the POs of the FET department.

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using PPT, Assignment | Class work, Assignment, Final Exam |
| CO2 | Lecture using PPT, CAD Lab Demonstration, Discussion | Class work, Assignment, Final Exam |

| | | |
|---|---|---|
| CO3 | Lecture using PPT, CAD Lab Demonstration, Question-Answer session | Class work, Assignment, Final Exam |
| CO4 | CAD Lab Demonstration | Class work, Assignment, Final Exam |
| CO5 | CAD Lab Demonstration | Class work, Assignment, Final Exam |

**Books Recommended:**
1. Joshua Rose: Mechanical drawing self-taught
2. Brian C. Benton.: Mastering AutoCAD 2021 and AutoCAD LT 2021

| **Course No: MEE 07153113E** | **Credit: 3.0** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Fundamentals of Mechanical Engineering** | | **Course Status: Theory** | |

**Course Objectives:** The objectives of this course are:
- Make the students understand the various forms of conventional energy resources
- To provide the knowledge of the Thermodynamics
- To develop skill on Thermodynamics Laws
- To apply the knowledge of different Fluid Machineries
- To understand the basic working principle of different Thermal Engines

**Course Content:**
Sources of Energy: Classification, Applications, Advantages and Disadvantages; Thermodynamics: Basic concepts and definitions of cycle, Properties, Processes, 1st and 2nd laws of Thermodynamics and their application; Thermal Engines: IC Engine, Gas Turbine, Boiler, Steam Turbine: Classification, Operating Principle, Performance, and Applications; Fluid Machineries: Turbine, Pump, Compressor, Blower, Fan: Classification, Operating Principle, Performance, Applications.

**Course Outcomes:**
After the successful completion of the course, students will be able to:
CO 01. Compare and contrast among different sources of energy.
CO 02: Explain different turbines
CO 03: Introduced with different mechanical components including pumps, blowers and compressors; refrigeration and air conditioning systems.
CO 04: Explain steam generation units with their accessories and mountings.

**Mapping of COs with POs**
According to the POs of the EEE department.

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/LCD projectors/Projects | Assignment |
| CO2 | Lecture using board/LCD projectors/Projects | Quiz |
| CO3 | Lecture using board/LCD projectors/Projects | Assignment |



| | | |
|---|---|---|
| CO4 | Lecture using board/LCD projectors/Projects | Quiz |
| CO5 | Assignment/Projects | Assignment |

**Books Recommended:**
1. Devendra Vashist - Mechanical Engineering: Fundamentals
2. R.L. Timings - Fundamentals of Mechanical Engineering
3. Claus Borgnakke, Richard E. Sonntag - Fundamentals of Thermodynamics
4. Munson - Fundamentals of Fluid Mechanics

| **Course No: MEE 07153114E** | **Credit: 1.5** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Mechanical Engineering Drawing** | | **Course Status: Sessional** | |

**Course Objectives:**
- To introduce students to essential tools and concepts of mechanical engineering drawing, including projection systems, sectional views, and dimensioning techniques relevant to hardware development in EEE.
- To train students in using SolidWorks for 2D and 3D CAD modeling, focusing on the design of electro-mechanical components such as enclosures, heat sinks, sensor mounts, and PCB holders.
- To bridge the gap between mechanical design and electronic application by enabling students to model, assemble, and simulate mechanical parts used in embedded and mechatronic systems.
- To develop visualization and spatial reasoning skills, empowering students to interpret and create complete engineering drawings for functional products.
- To provide exposure to modern manufacturing workflows, including sheet metal fabrication, mold design, CAM output, and 3D printing, so that students can design components ready for prototyping and production.
- To prepare students for interdisciplinary collaboration, allowing them to effectively communicate design intent with mechanical engineers and product developers in real-world projects.

**Course Content:**
SolidWorks Interface and Sketching: Introduction to SolidWorks environment, 2D sketching tools and geometric constraints, CAD setup for engineering drawing
3D Modeling Fundamentals: Basic features: Extrude, Cut, Fillet, Chamfer, Design of enclosures, switch panels, and mechanical parts
View Layouts and Engineering Drawings: Projection views, section views, annotations, Creating detailed drawings and BOM (Bill of Materials)
Surface and Complex Geometry Modeling: Surface modeling techniques, transitioning from surface to solid geometry, Designing ergonomic and curved casings
Assembly Modeling: Mating components in assemblies, Standard and mechanical mates, Modeling of electro-mechanical assemblies (e.g., motor + gear + shaft)
Motion Analysis: Simulation with motors, springs, and gravity, Time-based motion analysis of mechanical systems
Sheet Metal Design and CAM: Sheet metal features: flanges, bends, reliefs, DXF generation for laser cutting, Introduction to CAM tools

Mold Design and Product Manufacturing: Design for injection molding: parting lines, core cavity generation, Draft analysis, undercuts, wall thickness guidelines
Simulation and Analysis: Finite Element Analysis (FEA) for stress and strain, Thermal and airflow simulation over electronic components, Optimization of heatsinks and casing designs
3D Printing for Engineering Prototypes: STL file generation, slicing, G-code creation, Preparing parts for 3D printing (e.g., ENDER-3 Pro), Design for manufacturability (DFM) in additive manufacturing

**Course Learning Outcome**
After the successful completion of the course, the student will be able to-
CO1. Interpret and apply principles of mechanical engineering drawing including projection, sectioning, and dimensioning.
CO2. Use SolidWorks to develop 2D and 3D models of electro-mechanical components.
CO3. Assemble, simulate, and document functional electromechanical systems using modern CAD tools.
CO4. Prepare engineering drawings suitable for manufacturing including exploded views, motion studies, and BOM.
CO5. Communicate design ideas and technical drawings effectively with multidisciplinary teams and stakeholders.

**Mapping of COs with POs**
According to the POs of the department of EEE.

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture, Classwork | Practical, Assignment, Quiz |
| CO2 | Lecture, Problem based learning. | Practical, Assignment, Quiz |
| CO3 | Lecture, Problem based learning. | Practical, Assignment, Quiz |
| CO4 | Lecture, Problem based learning. | Practical, Assignment, Quiz |
| CO5 | Lectures, Presentation | Practical, Assignment, Quiz |

| **Course No: MEE 0715 3113A** | **Credit: 2.0** | **Year: Third** | **Semester: First** |
|---|---|---|---|
| **Course Title: Building Services I – Mechanical** | | **Course Status: Theory** | |

**Course Rationale**
The intent of the subject is to make the students learn about the advanced mechanical services with special reference to lighting and acoustics.

**Course Objectives:** The objectives of this course are:
- To understand the basic concept of thermodynamics so that students are able to understand psychrometry and air conditioning systems.
- To introduce the fundamental principles and different methods of air conditioning.
- To make students able to apply psychrometric charts in calculating psychrometric properties.



- To make students understand the basic air conditioning processes on psychrometric charts, calculate cooling load for its applications in comfort and industrial air conditioning.
- To introduce various equipment-operating principles, operating and safety controls employed in air conditioning systems
- Getting idea about fire-fighting methods in application of building service
- To familiarize different vertical transportation systems employed in building structures.

**Course Content:**
Thermodynamics, Introduction: Definition and applications of thermodynamics, Basic concept and definition: Systems and control volume, state and equilibrium, process and cycles, thermodynamic properties, forms of energies, Laws of thermodynamics.
Psychrometry: Definition, psychrometric properties, psychrometric chart, and its application.
Air-conditioning: importance application of air-conditioning, air-conditioning systems, basic refrigeration cycle: Basic concept, vapor compression cycle for air-conditioning, air-conditioning equipment, cooling load calculation;
Duct system design: Concept, importance and objectives of duct system design, air handling and distribution, different types of supply and return duct systems, duct design methods; Fire hazards, fire- tetrahedron, different classes of fire and corresponding extinguishers, sprinkler system.
Vertical Transportation: Types of elevators, Determination of size and quality of elevators, Incoming and outgoing traffic handling, Escalators and moving ramps.

**Course Outcomes:**
After successful completion of the course, students will be able to
CO1. Explain fundamental laws and concepts of thermodynamics,
CO2. Design duct systems for the application of air handling in building systems.
CO3. Calculate cooling load for air conditioning systems used for various conditions.
CO4. Explain different vertical transport systems for the application in building service.
CO5. Design fire-fighting system in multi-storied buildings

**Mapping of COs with POs**
According to the POs of the Architecture department.

Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture, Text book. | Mid-term examination 1, Semester-end examination |
| CO2 | Lecture, Text book, Problem based learning. | Mid-term examination 1, Semester-end examination |
| CO3 | Lecture, Text book, Problem based learning. | Mid-term examination 2, Semester-end examination |
| CO4 | Lecture, Text book, Problem based learning. | Mid-term examination 2, Class evaluation, Semester-end examination |

| | | |
|---|---|---|
| CO5 | Lectures using Projectors and Board, Group Discussion. | Mid-term examination 2, Class evaluation, Semester-end examination |

**Books Recommended:**


1. Grondzik, Kwok, Stein and Reynolds. Mechanical and Electrical Equipment for Buildings 11th Edition (Basic Books. 2009)
2. Hundy, Trott & Welch (2008), Refrigeration & Air-conditioning, Butterworth-Heinemann
3. Ameen (2006), Refrigeration & Air-conditioning, Prentice Hall


| Course No: MEE 07143203G | Credit: 3.0 | Year: Third | Semester: Second |
|---|---|---|---|
| Course Title: Instrumentation and Measurement | | | Course Status: Theory |

**Course Objectives:** The objectives of this course are to:

- familiarize students with different engineering measuring instrument
- provide the knowledge of working principles for various measuring devices
- facilitate necessary knowledge about sensors and transducers
- help them conceptualize different signal conditioning techniques
- acquaint students with the knowledge and concept of modern instrumentation and control systems like PLC.

**Course Content:**

Introduction to engineering measurements, testing and calibration, error analysis, tolerance, allowance and fit; Taylor's principle on limit gauge; Dimension measurement, Abbey's principles of measuring threads and gears; Ultrasonic measurement, Measurement of light wave interference; Sensors and transducers; Liquid level measurement; Force, pressure, torque measurement; Temperature measuring systems; Signal conditioning processes: Purpose, amplifying elements, filters, Wheatstone bridge, analog to digital conversion, multiplexers, digital signal processing; Analog and digital methods for data presentation; Sampling and normality test; Study and use of instrumentation and control systems: Analog and digital instrumentation, characteristics, use, concept of modern instrumentation, Programmable Logic Controller (PLC).

**Course Outcomes**

After the successful completion of the course, students will be able to:
CO 1: explain the fundamental concepts of engineering measurement;
CO 2: distinguish between different measuring systems used in industrial processes;
CO 3: analyze different dimensions necessary for industrial settings;
CO 4: evaluate appropriate measuring instrument based on requirements;
CO 5: design electronic devices for industrial automation, process measurement and control.

**Mapping of COs with POs**

According to the POs of the IPE department.

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy



| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/projectors | Assessment, Midterm Examination 1, Semester-end examination |
| CO2 | Lecture using board/projectors, tutorial | Assessment, Midterm Examination, Semester-end examination |
| CO3 | Lecture using board/projectors, Assignment/ tutorial | Midterm Examination 2, Assignment, Semester-end examination |
| CO4 | Lecture using board/projectors, Assignment, tutorial, Self-learning | Assignment, Semester-end examination |
| CO5 | Lecture using board/projectors, Assignment, tutorial and case study | Assignment, Semester-end examination |

**Books Recommended:**


1. Jain, R.K (2009). Engineering Metrology. Khanna Publishers
2. Bolton, W (2015). Mechatronics: Electronic control systems in mechanical and electrical engineering. Pearson
3. Thomas G. Beckwith, N. Lewis Buck and Roy D. Maragoni, Mechanical measurement, Narosa Publishing House.


| Course No: MEE 07143204G | Credit: 1.0 | Year: Third | Semester: Second |
|---|---|---|---|
| Course Title: Measurement and Instrumentation Sessional | | Course Status: Sessional | |

**Rationale of the Course:**

This course focuses on developing practical knowledge of industrial instruments used in troubleshooting, process measurements and control. Specifically, the course will provide hands-on training on operating different measuring devices, digital electronic components, sensors, transducers, PLCs used for industrial process measurement and control.

**Course Objectives:** The objectives of this course are to:

- familiarize the students with different instrumentation and control systems
- make students able to test and calibrate different measuring instruments
- enable students to perform Shaft Alignment Test, Thickness Test
- help them conceptualize Abbey's principles of measuring threads and gears
- develop skills on ultrasonic measurement, sampling and normality testing.

**Course Content:**

Study and use of instrumentation and control systems; Shaft alignment test; Dry film thickness test, Testing and calibration; Error analysis (Roundness of the ball and squareness of the plate); Dimension measurement; Abbey's principles of measuring threads and gears; Ultrasonic measurement; Sampling and normality test.

**Course Outcomes:**

After the successful completion of the course, students will be able to:

CO 1: explain different instrumentation and control systems;
CO2: measure dimensional accuracy and calibration of different measuring instruments;
CO3: perform shaft alignment test, thickness measuring test, ultrasonic test, sampling and normality test, etc.;
CO4: develop electrical measuring instruments in a group used for industrial purposes.

**Mapping of COs with POs**
According to the POs of the IPE department.

Mapping Course Outcomes (COs) with the Teaching-Learning & Assessment Strategy

| COs | Teaching-Learning Strategy | Assessment Strategy |
|---|---|---|
| CO1 | Lecture using board/projectors, experimental work | Report, Quiz and Semester-end examination |
| CO2 | Lecture using board/projectors, experimental work | Report, Quiz and Semester-end examination |
| CO3 | Lecture using board/projectors, experimental work | Report, Quiz and Semester-end examination |
| CO4 | Lecture using board/projectors, video demonstration, case study, experimental work | Device assessment, Report, presentation |
| CO5 | Lecture using board/projectors, experimental work | Report, Quiz and Semester-end examination |

**Books Recommended:**

1. Jain, R.K (2009). Engineering Metrology. Khanna Publishers.
2. Bolton, W (2015). Mechatronics: Electronic control systems in mechanical and electrical engineering. Pearson