**Dr. Babasaheb Ambedkar Technological University (Established as University of Technology in the State of Maharashtra)**
**(Under Maharashtra Act No. XXIX of 2014)**
**P.O. Lonere, Dist. Raigad, Pin 402 103,**
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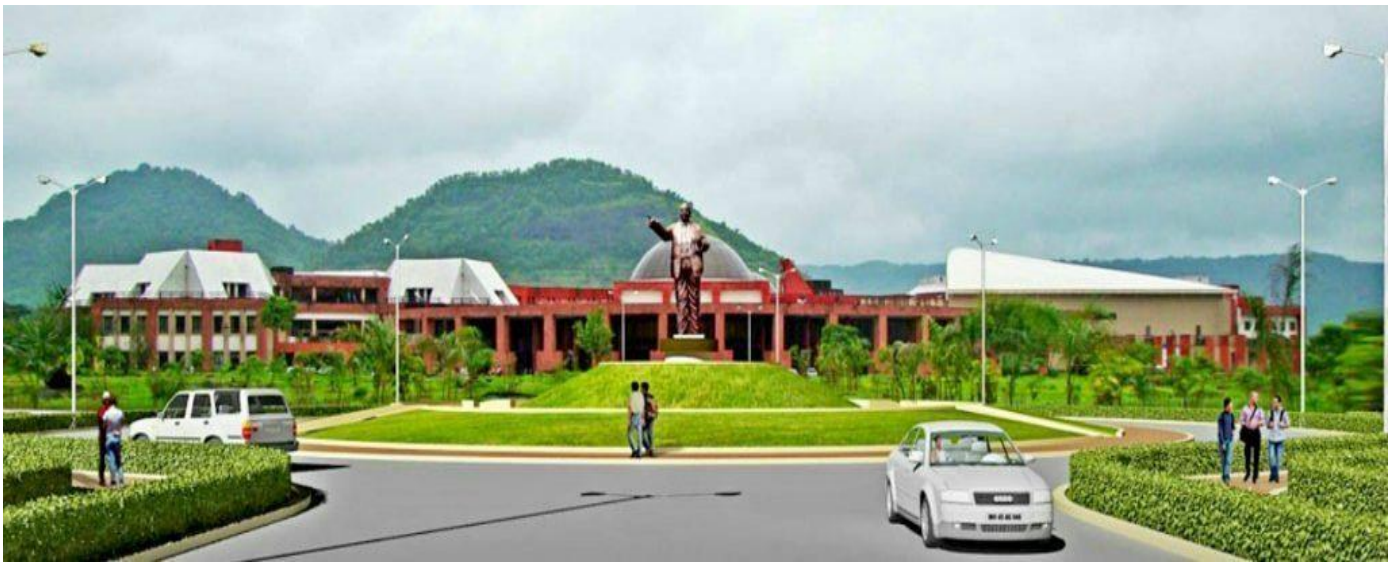
# UNDER GRADUATE PROGRAMME

# B. Tech

# First Year

## MECHANICAL ENGINEERING

**WITH EFFECTIVE FROM THE ACADEMIC YEAR 2023-2024**
**(For University Department only)**



# Department of Mechanical Engineering

## Vision

The vision of the department is to achieve excellence in teaching, learning, research and transfer of technology and overall development of students.

## Mission

Imparting quality education, looking after holistic development of students and conducting need based research and extension.

## Credit Framework under Four-Years UG Engineering Programme with Multiple Entry and Multiple Exit options:

- The Four-year Bachelor's Multidisciplinary Engineering Degree Programme allows the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning from different institutions.
- The minimum and maximum credit structure for different levels under the Four-year Bachelor's Multidisciplinary Engineering UG Programme with multiple entry and multiple exit options are as given below:

### Credit Framework

| Levels | Qualification Title | Credit Requirements | | Semester | Year |
|---|---|---|---|---|---|
| | | Minimum | Maximum | | |
| **4.5** | One Year UG Certificate in Engg./ Tech. | 40 | 44 | 2 | 1 |
| **5.0** | Two Years UG Diploma in Engg./ Tech. | 80 | 88 | 4 | 2 |
| **5.5** | Three Years Bachelor's Degree in Vocation (B. Voc.) or B. Sc. (Engg./ Tech.) | 120 | 132 | 6 | 3 |
| | 4-Years Bachelor's degree | | | | |

| Levels | Qualification Title | Credit Requirements | | Semester | Year |
|---|---|---|---|---|---|
| | | Minimum | Maximum | | |
| **6.0** | (B.E./ B.Tech. or Equivalent) in Engg./ Tech. with Multidisciplinary Minor | 160 | 176 | 8 | 4 |
| **6.0** | 4-Years Bachelor's degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Honors and Multidisciplinary Minor | 180 | 194 | 8 | 4 |
| **6.0** | 4-Years Bachelor's degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Honors with Research and Multidisciplinary Minor | 180 | 194 | 8 | 4 |
| **6.0** | 4-Years Bachelor's degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Major Engg. Discipline with Double Minors (Multidisciplinary and Specialization Minors) | 180 | 194 | 8 | 4 |

- There are multiple exit options at each level. Student will be given a specific Qualification mentioned in the table depending on the level at which he/she decides to have an exit. Ex. If a student decides to exit after completion of two years (level 5.0) of the program, he will be given a Diploma in Engineering with specific exit condition mentioned in the syllabus of the specific branch. He/she can rejoin the program with the multiple entry option at the level next where he/she chose to exit previously. (Student can join at level 5.5 if successfully completed level 5.0 previously at the time of exit).

- Minimum credit requirements of each level are mentioned in the credit framework table.
- There are 4 distinct options available at level 6.0.
- First one is basic level 6.0 option where minimum 160-maximum 176 credits are mandatory which can be completed as per the Semester-wise Credit distribution structure mentioned in the table given below. Here, the Bachelor's Engineering Degree in chosen Engg./ Tech. Discipline with multidisciplinary minor (min.160-max.176 Credits) i.e. "**B. Tech in Mechanical Engineering with Computer Engineering**" (160-176 credits) enables students to take up five-six or required additional courses of 14 credits in the discipline other than Mechanical Engineering distributed over semesters III to VIII. Here in the case of "**B. Tech in Mechanical Engineering with Computer Engineering**" (160-176 credits) student is supposed to take up 50% or more courses to complete the 50% or more credits (from assigned 14 credits) from **Computer Engineering minor bucket**. The remaining courses to complete the assigned 14 credits can be covered from other discipline's minor buckets.
- Remaining three level 6.0 options are the advanced options where the student is given an opportunity to get extra qualification by earning some extra credits (18-20 extra credits). These three options are given below:
- Level 6.0: The **Bachelor's Engineering Degree with Honours** in chosen Major Engg./ Tech. Discipline i.e. in Mechanical Engineering with Honours with Multidisciplinary Minor (180-194 credits) enables students of Mechanical Engineering to take up five-six additional courses of 18 to 20 credits in the Mechanical Engineering discipline distributed over semesters III to VIII. The decision regarding the mechanism of distribution of these 18-20 credits over semesters III to VIII, which are over and above the min.160-max.176 Credits prescribed for the duration of four years will be taken by Academic Authorities of University. **Student must have CGPA equal to or greater than 7.5 at the end of second semester to go for this option**.
- Level 6.0: The **Bachelor's Engineering Degree with Research** in i.e. in Mechanical Engineering with Research with Multidisciplinary Minor (180-194 credits) enables students of Mechanical Engineering to take up a research project of 18 to 20 credits in the Mechanical Engineering discipline distributed over semesters VII to VIII. **Student must have CGPA equal to or greater than 7.5 at the end of sixth semester to go for this option**.
- Level 6.0: The **Bachelor's Engineering Degree in chosen Engg./ Tech. Discipline with Double Minor** (Multidisciplinary and Specialization Minor, 180-194 credits), i.e. "**B. Tech in Mechanical Engineering with *other selected discipline in* Engineering (as MDM) with Specialization Minor in Computer Engineering**" (180-194 credits) enables students to take up five-six additional courses of 14 credits in the discipline other than Mechanical Engineering(for completion of multidisciplinary minor) and 18 to 20 extra credits in the **Computer Engineering discipline** distributed over semesters III to VIII. Here, the ***other selected discipline* in Engineering should be different from Specialization Minor i.e. Computer Engineering**. This enables students to take up five-six or required additional courses of 18 to 20 credits in the **Computer Engineering** discipline distributed over semesters III to VIII, which are over and above the min.160-max.176 Credits. The decision regarding the mechanism of distribution of these 18-20 credits over semesters III to VIII, prescribed for the duration of four years

will be taken by Academic Authorities of University. **Student must have CGPA equal to or greater than 7.5 at the end of second semester to go for this option**.

## Semester-wise Credit distribution structure for Four Year UG Engineering Program - One Major, One Minor

| Semester | | I | II | III | IV | V | VI | VII | VIII | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| Basic Science Course | BSC/ESC | 06-08 | 08-10 | | -- | -- | -- | -- | -- | 14-18 |
| Engineering Science Course | | 10-08 | 06-04 | | -- | -- | -- | -- | -- | 16-12 |
| Programme Core Course (PCC) | Program Courses | -- | 02 | 08-10 | 08-10 | 10-12 | 08-10 | 04-06 | 04-06 | 44-56 |
| Programme Elective Course (PEC) | | -- | -- | -- | -- | 04 | 08 | 02 | 06 | 20 |
| Multidisciplinary Minor (MD M) | Multidisciplinary Courses | | - | 02 | 02 | 04 | 02 | 02 | 02 | 14 |
| Open Elective (OE) Other than a particular program | | -- | -- | 04 | 02 | 02 | -- | -- | -- | 08 |
| Vocational and Skill Enhancement Course (VSEC) | Skill Courses | 02 | 02 | -- | 02 | -- | 02 | -- | -- | 08 |
| Ability Enhancement Course (AEC -01, AEC-02) | Humanities Social Science and Management (HSSM) | 02 | -- | -- | 02 | -- | -- | -- | -- | 04 |
| Entrepreneurship/Economics/ Management Courses | | -- | | 02 | 02 | -- | -- | -- | -- | 04 |
| Indian Knowledge System (IKS) | | | 02 | | -- | -- | -- | -- | -- | 02 |
| Value Education Course (VEC) | | -- | -- | 02 | 02 | -- | -- | -- | -- | 04 |
| Research Methodology | Experiential Learning Courses | -- | -- | -- | -- | -- | -- | | 04 | 04 |
| Comm. Engg. Project (CEP)/Field Project (FP) | | -- | -- | 02 | -- | -- | -- | - | - | 02 |
| Project | | -- | -- | -- | -- | -- | -- | | 04 | 04 |
| Internship/ OJT | | -- | --- | | | -- | -- | 12 | - | 12 |
| Co-curricular Courses (CC) | Liberal Learning Courses | 02 | 02 | | -- | -- | -- | -- | - | 04 |
| **Total Credits (Major)** | | **20-22** | **20-22** | **20-22** | **20-22** | **20-22** | **20-22** | **20-22** | **20-22** | **160-176** |

Student need to follow the Semester-wise Credit distribution structure for Four Year UG Engineering Program as prescribed in the table given above.

- There are seven vertical categories with specific credits distributed in specific semesters.
- Student can choose a Program Elective Course (PEC) in that specific semester from the given subjects.
- Multidisciplinary course (MDM) and Open Elective (OE) courses can be chosen from the MDM and OE Buckets depending on students choice. Completion of total credits given in the last column of the table for each vertical is mandatory.
- Students can complete 40% of the courses through online platforms like NPTEL/SWAYAM. The NPTEL SWAYAM course content should be at least 80% similar to the course content in the syllabus.

## General Rules and Regulations

1. The normal duration of the course leading to B. Tech degree will be EIGHT semesters.

2. The normal duration of the course leading to M. Tech degree will be FOUR semesters.

3. Each academic year shall be divided into 2 semesters, each of 20 weeks duration, including evaluation and grade finalization, etc. The Academic Session in each semester shall provide for at least 90 Teaching Days, with at least 40 hours of teaching contact periods in a five to six days session per week. The semester that is typically from Mid-July to November is called the ODD SEMESTER, and the one that is from January to Mid-May is called the EVEN SEMESTER. Academic Session may be scheduled for the Summer Session/Semester as well. For 1st year B. Tech and M. Tech the schedule will be decided as per the admission schedule declared by Government of Maharashtra.

4. The schedule of academic activities for a Semester, including the dates of registration, mid-semester examination, end-semester examination, inter-semester vacation, etc. shall be referred to as the Academic Calendar of the Semester, which shall be prepared by the Dean (Academic), and announced at least TWO weeks before the Closing Date of the previous Semester.

5. The Academic Calendar must be strictly adhered to, and all other activities including co-curricular and/or extra -curricular activities must be scheduled so as not to interfere with the Curricular Activities as stipulated in the Academic Calendar.

## Registration:

1. Lower and Upper Limits for Course Credits Registered in a Semester, by a Full- Time Student of a UG/PG Programme:
   A full time student of a particular UG/PG programme shall register for the appropriate number of course credits in each semester/session that is within the minimum and maximum limits specific to that UG/PG programme as stipulated in the specific Regulations pertaining to that UG/PG programme.
2. Mandatory Pre-Registration for higher semesters: In order to facilitate proper planning of the academic activities of a semester, it is essential for the every institute to inform to Dean (Academics) and COE regarding details of total no. of electives offered (Course-wise) along with the number of students opted

for the same. This information should be submitted within two weeks from the date of commencement of the semester as per academic calendar.

3. PhD students can register for any of PG/PhD courses and the corresponding rules of evaluation will apply.
4. Under Graduate students may be permitted to register for a few selected Post Graduate courses, in exceptionally rare circumstances, only if the DUGC/DPGC is convinced of the level of the academic achievement and the potential in a student.

## Course Pre-Requisites:

1. In order to register for some courses, it may be required either to have exposure in, or to have completed satisfactorily, or to have prior earned credits in, some specified courses.
2. Students who do not register on the day announced for the purpose may be permitted LATE REGISTRATION up to the notified day in academic calendar on payment of late fee.
3. REGISTRATION IN ABSENTIA will be allowed only in exceptional cases with the approval of the Dean (Academic) / Principal.
4. A student will be permitted to register in the next semester only if he fulfils the following conditions:
   i) Satisfied all the Academic Requirements to continue with the programme of Studies without termination
   ii) Cleared all Institute, Hostel and Library dues and fines (if any) of the previous semesters;
   iii) Paid all required advance payments of the Institute and hostel for the current semester;
   iv) Not been debarred from registering on any specific ground by the Institute.

## Evaluation System:

1. Absolute grading system based on absolute marks as indicated below will be implemented from academic year 2023-24, from I year B. Tech.

| Percentage of marks | Letter Grade | Grade Point |
|---|---|---|
| 91-100 | EX | 10.0 |
| 86-90 | AA | 9.0 |
| 81-85 | AB | 8.5 |
| 76-80 | BB | 8.0 |
| 71-75 | BC | 7.5 |
| 66-70 | CC | 7.0 |
| 61-65 | CD | 6.5 |
| 56-60 | DD | 6.0 |
| 51-55 | DE | 5.5 |
| 40-50 | EE | 5.0 |
| <40 | EF | 0.0 |

2. Class is awarded based on CGPA of all eighth semester of B. Tech Program.

| CGPA for pass is minimum 5.0 | |
|---|---|
| CGPA upto <5.50 | Pass class |
| CGPA ≥ 5.50 | Second Class |
| &<6.00 | First Class |
| CGPA ≥ 6.00 | Distinction |
| [Percentage of Marks =CGPA*10.0] | |

3. A total of 100 Marks for each theory course are distributed as follows:

| | |
|---|---|
| Mid Semester Exam (MSE) Marks | 20 |
| Continuous Assessment Marks | 20 |
| End Semester Examination(ESE)Marks | 60 |

4. A total of 100 Marks for each practical course are distributed as follows

| | | |
|---|---|---|
| 1. | Continuous Assessment Marks | 60 |
| 2. | End Semester Examination (ESE)Marks | 40 |

- It is mandatory for every student of B. Tech to score a minimum of 40 marks out of 100, M. Tech to score a minimum of 45 marks out of 100 with a minimum of 20 marks out of 60 marks in End Semester Examination for theory course.
- This will be implemented from the first year of B. Tech starting from Academic Year 2023-24

**5. Description of Grades**

EX Grade: An 'EX' grade stands for outstanding achievement.

EE Grade: The 'EE' grade stands for minimum passing grade.

The students may appear for the remedial examination for the subjects he/she failed for the current semester of admission only and his/her performance will be awarded with EE grade only.

If any of the students remain absent for the regular examination due to genuine reason and the same will be verified and tested by the Dean (Academics) or committee constituted by the University Authority.

FF Grade: The 'FF' grade denotes very poor performance, i.e. failure in a course due to poor performance .The students who have been awarded 'FF' grade in a course in any semester must repeat the subject in next semester.

**6. Evaluation of Performance**

**a. Semester Grade Point Average (SGPA)**

The performance of a student in a semester is indicated by Semester Grade Point Average (SGPA) which is a weighted average of the grade points obtained in all the courses taken by the student in the

semester and scaled to a maximum of 10. (SGPI is to be calculated up to two decimal places). A Semester Grade Point Average (SGPA) will be computed for each semester as follows:

$$SGPA = \frac{[\sum_{i=1}^{n} c_i g_i]}{[\sum_{i=1}^{n} c_i]}$$

Where

'$n$' is the number of subjects for the semester,

'$c_i$' is the number of credits allotted to a particular subject, and

'$g_i$' is the grade-points awarded to the student for the subject based on his performance as per the above table.

SGPA will be rounded off to the second place of decimal and recorded as such.

**b. Cumulative Grade Point Average (CGPA):**

An up to date assessment of the overall performance of a student from the time he entered the Institute is obtained by calculating Cumulative Grade Point Average (CGPA) of a student. The CGPA is weighted average of the grade points obtained in all the courses registered by the student since s/he entered the Institute. CGPA is also calculated at the end of every semester (upto two decimal places).Starting from the first semester at the end of each semester (S); a Cumulative Grade Point Average (CGPA) will be computed as follows:

$$CGPA = \frac{[\sum_{i=1}^{m} c_i g_i]}{[\sum_{i=1}^{m} c_i]}$$

Where,

'm' is the total number of subjects from the first semester onwards up to and including the semester S,

'ci' is the number of credits allotted to a particular subject, and

'gi' is the grade-points awarded to the student for the subject based on his/her performance as per the above table.

CGPA will be rounded off to the second place of decimal and recorded as such.

**7. Attendance Requirements:**

**a.** All students must attend every lecture, tutorial and practical classes.

**b.** To account for approved leave of absence (eg. representing the Institute in sports, games or athletics; placement activities; NCC/NSS activities; etc.) and/or any other such contingencies like medical emergencies, etc., the attendance requirement shall be a minimum of 75% of the classes actually conducted. If the student failed to maintain 75% attendance, he/she will be detained for appearing the successive examination. The Dean (Academics)/ Principal is permitted to give 10% concession for the genuine reasons as such the case may be. In any case the student will not be permitted for appearing the examination if the attendance is less than 65%.

**c.** The course instructor handling a course must finalize the attendance 3 calendar days before the last day of classes in the current semester and communicate clearly to the students by displaying prominently in the department and also in report writing to the head of the department concerned.

**d.** The attendance records are to be maintained by the course instructor and he shall show it to the student, if and when required.

**8. Transfer of Credits:**

The courses credited elsewhere, in Indian or foreign University/Institutions/ Colleges/Swayam Courses by students during their study period at DBATU may count towards the credit requirements for the award of degree. The guidelines for such transfer of credits are as follows:

a. 20 % of the total credit will be considered for respective calculations.
b. Credits transferred will be considered for overall credits requirements of the programme.
c. Credits transfer can be considered only for the course at same level i.e. UG, PG etc.
d. A student must provide all details (original or attested authentic copies) such as course contents, number of contact hours, course instructor /project guide and evaluation system for the course for which he is requesting a credits transfer. He shall also provide the approval or acceptance letter from the other side. These details will be evaluated by the concerned Board of Studies before giving approval. The Board of Studies will then decide the number of equivalent credits the student will get for such course(s) in DBATU. The complete details will then be forwarded to Dean for approval.
e. A student has to get minimum passing grades/ marks for such courses for which the credits transfers are to be made.
f. Credits transfers availed by a student shall be properly recorded on academic record(s) of the student.
g. In exceptional cases, the students may opt for higher credits than the prescribed.

# Dr. Babasaheb Ambedkar Technological University Lonere
## University Department of Mechanical Engineering
### First year structure 23-24 as per NEP 2020

| Semester I | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Category under NEP** | **Course Code** | **Course Title** | **Teaching Scheme** | | | **Evaluation Scheme** | | | | |
| | | | | **L** | **T** | **P** | **CA** | **MSE** | **ESE** | **Total** | **No. of Credits** |
| | ***Mandatory*** | | ***Induction Program*** | ***3-weeks duration in the beginning of the semester*** | | | | | | | |
| BSC1 | Mandatory: Major | 23UD1000BS101 | Engineering Mathematics- I | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| BSC2 | Open Elective | 23UD1PHYBS102 | Engineering Physics | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| BSC3 | Open Elective | 23UD1PHYBS103L | Engineering Physics Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| ESC1 | Mandatory: Major | 23UD1EGDES104 | Engineering Graphics and Design | 2 | | - | 20 | 20 | 60 | 100 | 2 |
| ESC3 | Skill Enhancement course | 23UD1EGDES105L | Engineering Graphics and Design Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| ESC2 | Minor | 23UD1000ES106 | Basic Electrical and Electronics Engineering | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| ESC4 | Minor | 23UD1000ES107L | Basic Electrical and Electronics Lab | | | 2 | 60 | - | 40 | 100 | 1 |
| HSSM1 | Ability Enhancement course | 23UD1000HM108 | Communication Skills | 2 | - | - | 20 | 20 | 60 | 100 | 2 |
| HSSM2 | Ability Enhancement course | 23UD1000HM109L | Communication Skills Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| PCC1 | Vocational Skill courses | 23UD1000VS110L | Workshop Practices | | | 4 | 60 | - | 40 | 100 | 2 |
| HSSM3 | Co-curricular courses | 23UD1000CC112A/ 23UD1000CC112B/ 23UD1000CC112C | Basic Life Skills for Modern Youth/Yoga for Health /UHV | 1 | | - | 20 | 20 | - | 40 | 1 |
| | | | **Total** | **14** | **1** | **12** | | | | | **21** |

| Semester II | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Category under NEP** | **Course Code** | **Course Title** | **Teaching Scheme** | | | **Evaluation Scheme** | | | | **No. of Credits** |
| | | | | **L** | **T** | **P** | **CA** | **MSE** | **ESE** | **Total** | |
| BSC4 | Mandatory: Major | | Engineering Mathematics- II | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| ESC5 | Mandatory: Major | | Engineering Mechanics | 3 | | - | 20 | 20 | 60 | 100 | 3 |
| ESC6 | Minor | | Computer Programming | 2 | - | - | 20 | 20 | 60 | 100 | 2 |
| BSC5 | Open Elective | | Engineering Chemistry | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| ESC7 | Open Elective (Self Study) | | Energy and Environmental Engineering | | - | - | 20 | 20 | - | 40 | Audit |
| BSC6 | Open Elective | | Engineering Chemistry lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| ESC8 | Minor | | Computer Programming Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| HSSM4 | Ability Enhancement course | | Technical Writing and Presentation Skills | 1 | | | 20 | 20 | - | 40 | 1 |
| PCC2 | Skill Enhancement course | | AutoCAD | | | 2 | 60 | - | 40 | 100 | 1 |
| PCC3 | Vocational Skill courses | | Basic Mechanical Practices | | | 2 | 60 | - | 40 | 100 | 1 |
| ESC9 | Indian Knowledge System | | Ancient Indian Weapons Technology | 1 | | | 20 | 20 | - | 40 | 1 |
| HSSM3 | Co-curricular courses | | NSS/NCC/ Sports | | | 4 | 20 | 20 | - | 40 | 2 |
| ESC10 | Minor | | Engineering Mechanics Lab | | | 2 | 60 | - | 40 | 100 | 1 |
| | | | **Total** | **13** | **1** | **14** | | | | | **21** |
| | Total Credits: 21 +21 = 42 Cr<br>**Exit Option I : Qualifier for UG Certificate**<br>**Students opting for this option, should complete the well-defined project activity which is equivalent to 4 Credits (120hrs) in the appropriate industry/organization. The topics may include but not restricted to the following :**<br>**1. CNC Turning 2. 3 D Printing 3. Joining Practices**<br>**4. Mechanical Draftsman 5. Refrigeration and Air-conditioning Practice 6. Vehicle Maintenance**<br>**The project should be evaluated by a panel of examiners.** | | | | | | | | | | |

# 23UD1000BS101: Engineering Mathematics – I

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lectures: 3hrs/week<br>Tutorial: 1hr/week<br>Credits: 4 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks<br>End Semester Exam: 60 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Able to develop an ability to find the rank, inverse, eigen values and eigen vectors of a matrix and consistency of linear equations using the concepts of rank |
| **CO2** | Able to find the partial derivatives of functions using ordinary laws of partial differentiation |
| **CO3** | Able to apply the concepts of partial differentiation to find the percentage error in the measurement of quantities, series expansions and maxima and minima of functions containing two variables |
| **CO4** | Able to find the reduction formulae, tracing of curves. |
| **CO5** | Able to evaluate the double and triple integrals and apply the same to calculate area, volume, surface area, moment of inertia, centre of gravity, etc. |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 2 | 1 | | 1 | 1 | 1 | 1 | | | | | 1 |
| **CO2** | 2 | 1 | | 1 | 1 | | | 1 | 1 | 1 | 1 | 2 |
| **CO3** | 2 | 1 | | 1 | 1 | | | 1 | 1 | 1 | 1 | 1 |
| **CO4** | 2 | 1 | | 1 | 1 | | | | 1 | | 1 | 2 |
| **CO5** | 3 | 1 | 1 | 1 | 1 | | | | | | | 1 |

**Course Contents:**

**Unit 1: Linear Algebra- Matrices** **6hrs**

Inverse of a matrix by Gauss-Jordan method; Rank of a matrix; Normal form of a matrix ; Consistency of non- homogeneous and homogeneous system of linear equations ; Eigen values and Eigen vectors ; Properties of eigen values and eigen vectors(without proofs); Cayley-Hamilton's theorem (without proof) and its applications.

**Unit 2: Partial Differentiation** **6hrs**

Partial derivatives of first and higher orders; Homogeneous functions – Euler's Theorem for functions containing two and three variables (with proofs); Total derivatives; Change of variables.

**Unit 3: Applications of Partial differentiation** **6hrs**

Jacobians - properties; Taylor's and Maclaurin's theorems (without proofs) for functions of two variables; Maxima and minima of functions of two variables; Lagrange's method of undetermined multipliers.

**Unit 4: Reduction Formulae and Tracing of Curves** **6hrs**

Reduction formulae for $\int_0^{\frac{\pi}{2}} sin^n x\, dx$, $\int_0^{\frac{\pi}{2}} cos^n x\, dx$, $\int_0^{\frac{\pi}{2}} sin^m x\, cos^n x\, dx$; Tracing of standard curves given in Cartesian, parametric & polar forms.

**Unit 5: Multiple Integrals**
**6hrs**

Double integration in Cartesian and polar co-ordinates; Evaluation of double integrals by changing the order of integration and changing to polar form; Triple integral; Applications of multiple integrals to find area as double integral , volume as triple integral and surface area.

**Text Books**


**1.** Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.

**2.** Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.

**3.** A course in Engineering Mathematics (Vol I) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.

**4.** Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.


**Reference Books**


1. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

# 23UD1PHYBS102: Engineering Physics

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lectures: 3hrs/week<br>Credits: 3 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks<br>End Semester Exam: 60 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Students acquired basic knowledge of differential equation and can create wave equation and analysis of the intensity variation of light due to interference and polarization. Students are able to understand the light propagation in fibre and use of Laser in Science and engineering. |
| **CO2** | Students can apply the knowledge of quantum mechanics to set Schrödinger's equations. |
| **CO3** | Students will familiar with some of the basic laws related to electromagnetism and Maxwell's equation as well as properties of dielectrics. |
| **CO4** | Students are able to understand key principle and application of nuclear physics. Identify planes in crystal and characteristics measurements of cubic system. |
| **CO5** | Students able to explain fundamental concepts of magnetism and they should analyze the properties of semiconducting materials and describe various applications of superconductor. |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**

**Unit 1: Engineering Optics** **10hrs**

Interference: in thin film due to reflected light, wedge shaped film, Newton' Rings, Applications, Polarization: types of polarization, optical activity, specific rotation and Laurentz half shade polarimeter, Lasers: characteristics, Gas Laser, solid state Laser and semiconductor lasers, Applications of Lasers, Optical fibres: Acceptance cone, Numerical aperture, applications, Oscillations: free oscillations, forced oscillations and damped oscillation, resonance and it's condition.

**Unit 2: Quantum Mechanics** **6hrs**

Wave and particle duality of radiation – de Broglie concept of matter waves – Wave function and its physical significance, Heisenberg's uncertainty principle and its application – Schrodinger's wave equation – eigen values and eigen functions, particle confined in one dimensional infinite square well potential, Introduction to quantum computing.

**Unit 3: Electromagnetism** **6hrs**

Differential and integral calculus: Operator, Concept of gradient, divergence and curl, Ampere's law, Faraday law, Gauss–Divergence theorem, integral and differential forms of Maxwell equations and their physical significance, EM waves in free space. Dielectrics: polarization, Types of Dielectric polarization, dielectric constant, polar - non polar dielectrics,

**Unit 4: Crystal Structure** **6hrs**

Fundamental concepts, Crystal systems Cubic structure: Number of atoms, co-ordination number, packing fraction, Atomic radius, Miller indices, relation between 'ρ' and 'a', Nuclear Physics**:** Nuclear properties Introduction to mass defect & packing fraction, Nuclear reaction: Q value of Nuclear reaction,- Radioactivity – properties of $\alpha$, $\beta$ and $\gamma$ rays, GM Counter

**Unit 5: Physics of Advanced Materials** **8hrs**

Types of magnetic materials, ferrites and garnets, magnetic domain and hysteresis curve, Semiconductors, conductivity of semiconductors, Hall Effect Superconductors: definition – Meissner effect – type I & II superconductors, Nanomaterials: introduction and properties – synthesis: top-down and bottom-up approach, Introduction to SCADA, XRD, FESEM, VSM and applications.

**Text /Reference books:**


1) Introduction to Electrodynamics –David R. Griffiths.
2) Concept of Modern Physics – Arthur Beizer. Tata McGraw-Hill Publishing Company Limited.
3) Optics –Ajoy Ghatak. MacGraw Hill Education (India) Pvt. Ltd.
4) Science of Engineering Materials- C.M. Srivastava and C. Srinivasan. New Age International Pvt.Ltd.
5) Solid State Physics – A.J. Dekker. McMillan India –Limited.
6) The Feynman Lectures on Physics Vol I, II, III.
7) Introduction to solid state physics – Charles Kittel. John Willey and Sons
8) Engineering Physics – M.N. Avadhanulu and P.G. Kshirsagar.S.Chand and Company LTD.
9) Engineering Physics - R.K. Gaur and S. L. Gupta. Dhanpat Rai Publications Pvt. Ltd.-New Delhi.
10) Fundamental of Physics - Halliday and Resnik. Willey Eastern Limited.
11) Nanotechnology: An Introduction To Synthesis, Properties And Applications Of Nanomaterials- Thomas Varghese , K. M. Balakrishna

# 23UD1PHYBS103L: Engineering Physics Lab

| Practical Scheme: | Examination Scheme: |
|---|---|
| Practical: 2hrs/batch<br>Credit: 1 | Internal Assessment: 60 Marks<br>External Exam: 40 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | To offer a practical basis for the theoretical ideas presented in the lectures |
| **CO2** | Students learn, how to carefully observe experiments, as well as how to analyze and interpret the data. |
| **CO3** | Students are assisted in correlating the conclusions drawn from theory with experimental results and in understanding the importance of direct observations through physics concepts. |
| **CO4** | Students understand the methods and skills related to modern scientific instruments like lasers and fiber optics. |
| **CO5** | Students gain the experience of basic concepts by working in groups to complete laboratory experiments |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**

At least 08 experiments should be performed from the following list.

1) Newton's rings - Determination of radius of curvature of Plano convex lens / wavelength of light
2) Wedge Shaped film - Determination of thickness of thin wire
3) Half shade Polarimeter - Determination of specific rotation of optically active material
4) Laser - Determination of wavelength of He-Ne laser light
5) Magnetron Tube - Determination of 'e/m' of electron
6) G.M. Counter - Determination of operating voltage of G.M. tube
7) Crystal Plane – Study of planes with the help of models related Miller Indices
8) Hall Effect - Determination of Hall Coefficient
9) Four Probe Method - Determination of resistivity of semiconductor
10) Measurement of Band gap energy of Semiconductors
11) Experiment on fibre optics
12) B-H Curve Experiment
13) Experiments on SCAD

# 23UD1EGDES104: Engineering Graphics and Design

| **Teaching Scheme:** | **Examination Scheme:** |
|---|---|
| Lectures: 2hrs/week<br>Credits: 2 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks<br>End Semester Exam: 60 Marks (Duration: 04hrs) |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Introduce the engineering design and its place in society |
| **CO2** | Expose to the visual aspects of engineering design |
| **CO3** | Expose to engineering graphics standards |
| **CO4** | Expose to solid modelling |
| **CO5** | Expose to computer-aided geometric design |
| **CO6** | Expose to creating working drawings |
| **CO7** | Expose to engineering communication |

**Mapping of course outcomes with program outcomes**

| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**

**Unit 1: Introduction to Engineering Drawing**
**4hrs**
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain, Diagonal and Vernier Scales.

**Unit 2: Traditional Engineering Graphics**: **4hrs**
Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

**Unit 3: Computer Graphics**: **4hrs**
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling.

**Unit 4: Projections** **4hrs**
Orthographic Projections: Principles of Orthographic Projections-Conventions - Projections of Points

and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes; Projections of Regular Solids: those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale.

**Unit 5: Sectioning of Solids, Isometric Projections** **4hrs**

Sectioning of solids: Section planes perpendicular to one plane and parallel or inclined to other plane. Isometric projections: Isometric scale, drawing of isometric projections from given orthographic views.

**Reference/Text Books:**


1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 46th Edition, 2003.
2. K. V. Nataraajan, A text book of Engineering Graphic, Dhanalakshmi Publishers, Chennai, 2006.
3. K. Venugopal and V. Prabhu Raja, Engineering Graphics, New Age International (P) Ltd, 2008.
4. Dhananjay A. Jolhe, Engineering Drawing with an Introduction to AutoCAD, Mc GrawHill Education, 2017.


**Alternative NPTEL/SWAYAM Course:**

| S. No. | NPTEL Course | Name Instructor | Host Institute |
|---|---|---|---|
| 1. | Engineering Graphics and Design | Prof. Naresh Varma Datla, Prof. S. R. Kale | IIT Delhi |

# 23UD1EGDES105L: Engineering Graphics and Design Lab

| **Practical Scheme:** | **Examination Scheme:** |
|---|---|
| Practical: 2hrs/batch<br>Credit: 1 | Internal Assessment: 60 Marks<br>External Exam: 40 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Get acquainted with the knowledge of various lines, geometrical constructions and construction of various kinds of scales. |
| **CO2** | Improve their imagination skills by gaining knowledge about points, lines and planes. |
| **CO3** | Become proficient in drawing the projections of various solids. |
| **CO4** | Gain knowledge about orthographic and isometric projections. |
| **CO5** | Understand different concepts of sectioning. |

**Mapping of course outcomes with program outcomes**

| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**

**Drawing Sheets:**

1. Lines, lettering and dimensioning.
2. Geometrical Constructions.
3. Orthographic projections.
4. Projections of points and straight lines.
5. Projections of planes.
6. Projections of solids.
7. Section of solids.
8. Isometric Projections.

# 23UD1000ES106: Basic Electrical and Electronics Engineering

| **Teaching Scheme:** | **Examination Scheme:** |
|---|---|
| Lectures: 3hrs/week<br>Credits: 3 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks<br>End Semester Exam: 60 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Apply basic ideas and principles of electrical engineering. |
| **CO2** | Identify protection equipment and energy storage devices. |
| **CO3** | Differentiate electrical and electronics domains and explain the operation of diodes and transistors. |
| **CO4** | Acquire knowledge of digital electronics |
| **CO5** | Design simple combinational and sequential logic circuits. |

**Mapping of course outcomes with program outcomes**

| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**

**Unit 1: Elementary Electrical Concepts** **4hrs**

Fundamental of Electrical system Potential difference, Ohm's law, Effect of temperature on resister, resistance temperature coefficient, Electrical wiring system: Study of different wire gauges and their applications in domestic and industry. Energy Resources and Utilization: Conventional and nonconventional energy resources; Introduction to electrical energy generation from different resources, transmission, distribution and utilization, Advantages & Disadvantages of AC & DC transmission. Concept of Supply Demand, Power Factor, Need of unity factor.

**Unit 2: Measurement of Electrical Quantities** **4hrs**

Measurement of Voltage, Current, and Power; Measurement of 3 phase power; Study of Energy meters. Study of Electrical Storage devices: Batteries such as Nickel-cadmium (NiCd), Lithium- ion (Li-ion), Lithium Polymer (Li-pol.) batteries. Study of circuit breakers & Actuators (MCB & MPCB, Power Contactors & Aux contactors, Electro-Mechanical & Solid state Relays)

**Unit 3: Diodes and Circuits** **4hrs**

The P-N Junction Diode, V-I characteristics, Diode as Rectifier, specifications of Rectifier Diodes, Half Wave, Full wave, Bridge rectifiers, Equations for $I_{DC}$ $V_{DC}$ $V_{RMS}$, $I_{RMS}$, Efficiency and Ripple Factor for each configuration. Filters: Capacitor Filter, Choke Input Filter, Capacitor Input Filter (Π Filter), Zener Diode, Characteristics, Specifications, Zener Voltage Regulator, Types of Diodes: LED, Photodiode

**Unit 4: Semiconductor Devices and Applications** **4hrs**

Transistors: Introduction, Classification, CE, CB, and CC configurations, α, β, concept of gain and bandwidth. Operation of BJT in cut-off, saturation and active regions (DC analysis). BJT as an amplifier, biasing techniques of BJT, BJT as a switch.

Introduction to Digital Electronics: Number System, Basic logic Gates, Universal Gates, Boolean Postulates, De-Morgan Theorems

**Reference/Text Books:**


1. V. N. Mittal and Arvind Mittal, Basic Electrical Engineering, McGraw-Hill Publication.
2. Brijesh Iyer and S. L. Nalbalwar, A Text book of Basic Electronics, Synergy Knowledgeware Mumbai, 2017.ISBN:978-93-8335-246-3
3. Vincent DelToro, Electrical engineering Fundamentals, PHI Publication, 2nd Edition, 2011.
4. Boylstad, Electronics Devices and Circuits Theory, PearsonEducation.
5. Edward Hughes, Electrical Technology, PearsonEducation.
6. D. P. Kothari and Nagrath, Theory and Problems in Electrical Engineering, PHI Publication, 2011.
7. B. L. Theraja, Basic Electronics, S. Chand Limited, 2007.
8. Millman Halkias, Integrated Electronics-Analog and Digital Circuits and Systems, McGraw-Hill Publication, 2000.
9. Donald Neaman, Electronic Circuit Analysis and Design, McGraw-Hill Publication, 3rd Edition.
10. Donald Neaman, Electronic Circuit Analysis and Design, McGraw-Hill Publication, 3rd Edition.
11. Printed Circuit Boards Design &Technology, Walter C. Bosshart, McGraw-Hill Publication.


**Note:** Students are advised to use internet resources whenever required

# 23UD1000ES107L: Basic Electrical and Electronics Engineering Lab

| **Practical Scheme:** | **Examination Scheme:** |
|---|---|
| Practical: 2hrs/batch<br>Credit: 1 | Internal Assessment: 60 Marks<br>External Exam: 40 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Able to connect circuit and to take readings basic parameters of electrical engineering. |
| **CO2** | To practically identify protection equipment and energy storage devices. |
| **CO3** | Able to differentiate electrical and electronics domains and explain the operation of diodes and transistors. |
| **CO4** | To acquire knowledge of digital electronics by handling practically |
| **CO5** | Design simple combinational and sequential logic circuits. |

**Mapping of course outcomes with program outcomes**

| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**
**At least 08 experiments should be performed from the following list**
**List of Experiments:**

1. Measure voltage current and power in 1 phase circuit with resistive load.
2. Measure voltage current and power in R L series circuit.
3. Determine transformation ratio (K) of 1 phase transformer
4. Connect single phase transformer and measure input output quantities.
5. Identify various passive electronic components in the given circuit.
6. Connect resistors, capacitors in series and parallel combination on bread board and measure its value using multimeter.
7. Identify various active electronic components in the given circuit.
8. Test the performance of PN junction diode.
9. Test the performance of Zener diode.
10. Test the performance of NPN transistor.

# 23UD1000HM108: Communication Skills

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lecture: 2hrs/week<br>Credits: 2 | Internal Assessment:20 Marks<br>Mid Term Test: 20 Marks<br>End Semester Exam: 60 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | To provide learning environment to practice listening, speaking, reading and writing skills |
| **CO2** | To assist the students to carry on the tasks and activities through guided instructions and materials |
| **CO3** | To effectively integrate English language learning with employability skills and training |
| **CO4** | To provide hands-on experience through case-studies, mini-projects, group and individual presentations. |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | 2 | | 1 |
| **CO2** | | | | 2 | | | | | 1 | 2 | 3 | |
| **CO3** | | | | | 1 | 2 | | 2 | | 1 | | 3 |
| **CO4** | | | | | | 1 | 1 | 1 | | 3 | | |
| **CO5** | | | | | | | | | | | | 1 |

**Course Contents:**

**Unit 1**: **Vocabulary Building**

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives; Synonyms, antonyms, and standard abbreviations.

**Unit 2: Basic Writing Skills**

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

**Unit 3**: **Identifying Common Errors in Writing**

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

**Unit 4**: **Nature and Style of sensible Writing**

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion; **Writing Practices-** Comprehension, Précis Writing, Essay Writing

**Unit 5: Oral Communication**

(This Module involves interactive practice sessions in Language Lab)

Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations

**Text/Reference Books:**


**1. AICTE's Prescribed Textbook: English (with Lab Manual) ISBN: 978-93-91505-097**

2. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
3. Practical English Usage. Michael Swan. OUP. 1995.
4. Remedial English Grammar. F.T. Wood. Macmillan.2007
5. On Writing Well. William Zinsser. Harper Resource Book. 2001
6. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
7. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
8. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.


| **Alternative NPTEL/SWAYAM Course: S. No.** | **NPTEL Course Name** | **Instructor** | **Host Institute** |
|---|---|---|---|
| 1 | ENGLISH LANGUAGE FOR COMPETITIVE EXAMS | PROF. AYSHA IQBAL | IIT MADRAS |
| 2. | TECHNICAL ENGLISH FOR ENGINEERS | PROF. AYSHA IQBAL | IIT MADRAS |

# 23UD1000HM109L: Communication Skills Lab

| **Practical Scheme:** | **Examination Scheme:** |
|---|---|
| Practical: 2hrs/batch<br>Credit: 1 | Internal Assessment: 60 Marks<br>External Exam: 40 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | To facilitate appropriate platform to practice the studied and/or acquired skills, like listening, speaking, reading and writing skills |
| **CO2** | To create and avail the convenient linguistic background to carry on the tasks and activities through guided instructions and materials |
| **CO3** | To help the students to imagine, feel and experience the communication at the work place and use it effectively |
| **CO4** | To avail a platform to study, learn and practice the presentation skills professionally. |
| **CO5** | To facilitate appropriate platform to practice the studied and/or acquired skills, like listening, speaking, reading and writing skills |

**Mapping of course outcomes with program outcomes**

| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | 2 | | 1 |
| **CO2** | | | | 1 | | | | | 1 | 3 | 3 | |
| **CO3** | | | | | 1 | 1 | | 2 | | 2 | | 3 |
| **CO4** | | | | | | 1 | 2 | 1 | | 3 | | - |
| **CO5** | | | | | | | | | | | | 2 |

**Course Contents:**

**List of Practicals:**

1. How to introduce oneself? (02hrs)
2. Know your friend (02hrs)
3. Introduction to Phonemic symbols (02hrs)
4. Articulation of sounds in English with proper manner (02hrs)
5. Practice and exercises on articulation of sounds (02hrs)
6. Read Pronunciations/transcriptions from the dictionary (02hrs)
7. Practice and exercises on pronunciations of words (02hrs)
8. Introduction to stress and intonation (02hrs)
9. Rapid reading sessions (02hrs)
10. Extempore (02hrs)
11. Group discussion (02hrs)
12. Participating in a debate (02hrs)
13. Presentation techniques (02hrs)
14. Interview techniques (02hrs)

# 23UD1000VS110L: Workshop Practice

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Practical: 4hrs/batch<br>Credits: 2 | Internal Assessment: 60 Marks<br>External Exam: 40 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Prepare simple wooden joints and parts using wood working tools and machines (Apply) |
| **CO2** | Apply the fitting and plumbing skills and produce a job with specified dimensions (Apply) |
| **CO3** | Practice sheet metal tools and machine to develop the sheet metal articles (Apply) |
| **CO4** | Practice edge preparation for simple Lap, Butt, T joint using Arc/Gas/Resistance welding equipment (Understand) |
| **CO5** | Demonstrate machining processes including turning, facing, step turning, drilling and parting (Understand) |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 1 | | | | 1 | 1 | | | | | 2 | 1 |
| **CO2** | 1 | | | | 1 | 1 | | | | | 2 | 1 |
| **CO3** | 1 | | | | 1 | 1 | | | | | 2 | 1 |
| **CO4** | 1 | 1 | | | 1 | 1 | | | | | 2 | 1 |
| **CO5** | 1 | 1 | | | 1 | 1 | | | | | 2 | 1 |

**Course Contents**

**List of Practicals:**

1. Wood sizing exercises in planning, marking, sawing, chiseling and grooving to make half lap joint and cross lap joint.
2. A job involving cutting, filing to saw cut, filing all sides and faces, corner rounding, drilling and tapping on M. S. plates.
3. A job on use of plumbing tools and preparation of plumbing line involving fixing of water tap and use of elbow, tee, union and coupling, etc.
4. Making a small parts using GI sheet involving development, marking, cutting, bending, brazing and soldering operations- i)Tray ii) Funnel and similar articles.
5. Exercise in Arc welding (MMAW) to make a square butt joint.
6. Exercise in Resistance (Spot) welding to make a lap joint.
7. Ajobusing power operated tools related to sheet metal work, Welding, Fitting, Plumbing, Carpentry and patternmaking.
8. A job on turning of a Mild Steel cylindrical job using center lathe.

**Contents:**

a) **Carpentry:** Technical Terms related to wood working, Types of wood, Joining materials,

Types of joints - Mortise and Tenon, Dovetail, Half Lap, etc., Methods of preparation and applications, Wood working lathe, safety precautions.

b) **Welding:** Arc welding - welding joints, edge preparation, welding tools and equipment, Gas welding - types of flames, tools and equipment, Resistance welding - Spot welding, joint preparation, tools and equipment, safety precautions.

c) **Fitting and Plumbing:** Fitting operation like chipping, filing, right angle, marking, drilling, tapping etc., Fitting hand tools like vices, cold chisel, etc. Drilling machine and its operation, Different types of pipes, joints, taps, fixtures and accessories used in plumbing, safety precautions.

d) **Sheet Metal Work:** Simple development and cutting, bending, Beading, Flanging, Lancing and shearing of sheet metal, Sheet metal machines - Bending Machine, Guillotine shear, Sheet metal joints, Fluxes and their use.

e) **Machine shop**: Lathe machine, types of lathes, major parts, cutting tool, turning operations, safety precautions

**Reference/Text Books:**

1. K. C. John, Mechanical Workshop Practice, Prentice Hall Publication, New Delhi, 2010.
2. Hazra and Chaudhary, Workshop Technology-I, Media promoters & Publisher private limited.

# 23UD1000CC112A: Basic Life-Skills for Modern Youth

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lecture: 1hr/week<br>Credit: 1 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Explain the methods of stress management |
| **CO2** | Explain the benefits of positive thinking |
| **CO3** | Demonstrate the listening skills and methods to improve it. |
| **CO4** | Decision making skill |
| **CO5** | Demonstrate with examples critical and creative thinking |
| **CO6** | Explain the importance of goal setting. |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**

Total 16 topics are covered in three modules under this course. Ideally, 2 lessons will be covered in a week in an 8-week session. Each lesson is designed to be delivered for 90 mins for discussion, activities, and group work.

**Unit 1: Self-Awareness**

Knowing and living with oneself: This theme covers topics that foster the student's relationship and under- standing of themselves including their thoughts, feelings and behaviours: Stress management, Emotional regulation, Positive thinking, Self-esteem

**Unit 2: Interpersonal Skills**

Knowing and living with others: The lessons in this theme explore how to establish healthy, respectful relation- ships; lessons highlight the use of non-violent communication, assertiveness and dispute resolution: Empathy, Listening skills, Interpersonal effectiveness, Handling disputes, Managing relationships, Confident communication

**Unit 3: Thinking Skills**

Making effective decisions: The skills taught in this theme include concrete ways of thinking and executing tasks so that youth will make effective decisions, set relevant goals, and be informed

consumers of information: Goal setting, Decision making, Problem solving, Critical and creative thinking, Executive function skills, Resilience (bouncing back from adversity)

**Text-Books/Reference Books:**


1. Life-Skill Education-Planning and Research published by WHO
2. Curriculum for Life Skills (Jeevan Kaushal) by UGC

# 23UD1000CC112B: Yoga for Health

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lecture: 1hr/week<br>Credit: 1 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | What are current trends of career in physical education |
| **CO2** | Importance of physical fitness |
| **CO3** | What are components of physical fitness and wellness |
| **CO4** | What is meaning and importance of yoga in physical and mental fitness? |
| **CO5** | Demonstration of various asanas in standing posture and sitting posture. |
| **CO6** | Explain various relaxation methods and meditation techniques. |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**

**Unit 1**: **Changing trends & Career in Physical Education**- Meaning & definition of physical education; its aims & objectives; career options *(2 Hrs theory)*

**Unit 2**: **Physical Fitness, Wellness & Lifestyle**- Meaning & importance of physical fitness, wellness & lifestyle; Components of Physical fitness & wellness *(Theory 4 Hrs).*

**Unit 3**: **Yoga**: History and development, traditional school of yoga. Meaning and importance of yoga; (Theory 2 Hrs)

***Warm up***: Neck bending, shoulder bending, neck rotation, shoulder movement, trunk movement, knee movement, ankle movement

**Yogasanas:**

***A) Standing posture*** (Palm tree posture, Padahastasana, Ardhacakrasana, Trikunasana), Pranayam,

***B) Sitting posture***: (Padmasana, Bhadrasana, Dandasana,Vajrasana, Adhrauttarasana,Uttarasana, Sasakasana,Uttaramandukasana,Vakrasana,)

***C) Prone posture***: (Makarasana, Bhujangasana, Salabhasna, Setubandhanasana, Naukasana, Uttanapadasana, Ardhasalsana, Swasana).Surya pranam etc.

*(Theory 4 Hrs; Practical 12 Hrs)*

***Pranayam and Shanti Prarthana***: Kapalbhati, Anulam-Viloma, Bhramari Pranayama, Kapalbhati, Sitali Pranayama
*(1 hr Theory; 1 hr Practical).*

**Unit 4**: **Relaxation methods**
*(Theory 1 Hr; Practical 1 Hr)*

**Unit 5**: **Meditation-** Introduction to various meditation techniques, yoga for concentration & related asanas benefits of meditation
*(Theory 1 Hr; Practical 1 Hr)*

**Textbooks & Reference Books**

1. Rath, S.S. Physical Fitness and Wellness
2. A Textbook on Yoga for Health by NCERT

# 23UD1000CC112C: Universal Human Values (UHV)

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lecture: 1hr/week<br>Credit: 1 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Explain need and process for value education |
| **CO2** | Demonstrate right understanding of happiness and prosperity |
| **CO3** | Explain the correct understanding of harmony, prosperity, physical need and swasthya |
| **CO4** | Differentiate between harmony in family, society and human relationship |
| **CO5** | Explain the harmony at all levels of human existence |
| **CO6** | Establish the interrelation between holistic understanding harmony and professional ethics. |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents**

**Unit 1: Need, basic guidelines, contents and process for value education**

Understanding the need, basic guidelines**,** content and process for Value Education**,** Self-Exploration-what is it? – its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self- exploration**,** Continuous Happiness and Prosperity- A look at basic Human Aspirations**,** Right understanding**,** Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority**,** Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario**,** Method to fulfil the above human aspirations: understanding & living in harmony at various levels.

**Unit 2: Understanding harmony in human being- harmony in myself YSELF**

The understanding human being as a co-existence of the sentient 'T' and the material 'Body, Understanding the needs of Self ('T') and 'Body' – Sukh and Suvidha, Understanding the Body as an instrument of 'T' (I being the doer, seer, and enjoyer), Understanding the characteristics and activities of 'T' and harmony in T, Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam & Swasthya.

**Unit 3: Understanding harmony in family and society - harmony in human relationship. YSELFN RELATIONSHIP**

Understanding harmony in the Family- the basic unit of human interaction; Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay tripti; Trust (Vishwas) and Respect (Samman) as the foundational vales of relationship; Understanding the meaning of Vishwas; Difference between intention and competence; Understanding the meaning of Samman; Difference between respect and differentiation; the other salient values in relationship; Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals;Visualizing a universal harmonious order in society; Undivided Society (Akhand Samaj); Universal Order (Sarvabhaum Vyawastha) – from family to world family.

**Unit 4: Understanding harmony in the nature and in existence IT-4: UNDERSTAINY**

Understanding the harmony in the Nature; Interconnectedness and mutual fulfilment among the four orders of nature – recyclability and self-regulation in nature; Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space; Holistic perception of harmony at all levels of existence.

**Unit 5: Implications of the above holistic understanding harmony on professional ethics**,

Natural acceptance of human values, The definitiveness of Ethical Human Conduct, The basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for the transition from the present state to Universal Human Order: a) At the level of the individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

**Textbooks/Reference books:**


1. A Foundation Course in Human Values and Professional Ethics, R. R. Gaur, R. Asthana, G. P. Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019, ISBN 978-93-87034-47-1
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R. R. Gaur, R. Asthana, G. P. Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019, ISBN 97893- 87034- 53-2

# Semester II
# Engineering Mathematics II

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lecture: 3hrs/week<br>Tutorial: 1hr/week<br>Credits: 4 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks<br>End Semester Exam: 60 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Able to comprehend the geometrical meaning and properties of the complex numbers |
| **CO2** | Able to find the solutions of the differential equations of the first order and first degree, and apply the same to mechanical and electrical systems |
| **CO3** | Able to find the solutions of linear differential equations with constant coefficients |
| **CO4** | Able to make the Fourier series expansions of functions in various ranges, and apply the same in harmonic analysis |
| **CO5** | Able to apply the concepts of gradient of a scalar point function, divergence of a vector point function, curl of a vector point function, line integral, surface integral and volume integral in respect of various problems pertaining to science and engineering |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 2 | | | 1 | | | 1 | | | | | 1 |
| **CO2** | 3 | 2 | 1 | 2 | 2 | | 1 | 1 | 1 | 1 | 1 | 2 |
| **CO3** | 2 | 2 | 1 | 2 | 2 | | 1 | 1 | 1 | 1 | 1 | 1 |
| **CO4** | 3 | 2 | | 2 | 2 | | 1 | | 1 | | 1 | 2 |
| **CO5** | 3 | | | 1 | | | | | | | | 1 |

**Course Contents:**

**Unit 1: Complex Numbers**
**9hrs**

Definition and geometrical representation ; De-Moivre's theorem(without proof) ; Roots of complex numbers by using De-Moivre's theorem ; Circular functions of complex variable – definition ; Hyperbolic functions ; Relations between circular and hyperbolic functions ; Real and imaginary parts of circular and hyperbolic functions ; Logarithm of Complex quantities.

**Unit 2: Ordinary Differential Equations of First Order and First Degree and Their Applications**

**9hrs**

Linear equations; Reducible to linear equations (Bernoulli's equation); Exact differential equations; Equations reducible to exact equations ; Applications to orthogonal trajectories , mechanical systems and electrical systems.

**Unit 3: Higher Order Linear Differential Equations with Constant Coefficients 9hrs**

Introductory remarks - complementary function, particular integral; Rules for finding complementary functions and particular integrals; Method of variation of parameters; Cauchy's homogeneous and Legendre's linear equations.

**Unit 4: Fourier Series 9hrs**

Introductory remarks- Euler's formulae ; Conditions for Fourier series expansion - Dirichlet's conditions ; Functions having points of discontinuity ; Change of interval ; Odd and even functions - expansions of odd and even periodic functions ; Half -range series.

**Unit 5: Vector Calculus 9hrs**

Scalar and vector fields: Gradient, divergence and curl; Solenoidal and irrotational vector fields; Vector identities (statement without proofs); Green's lemma, Gauss' divergence theorem and Stokes' theorem (without proofs).

**Text Books**


1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.
3. A course in Engineering Mathematics (Vol II) by Dr. B. B. Singh, Synergy Knowledgeware, Mumbai.
4. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.


**Reference Books**


1. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

# Engineering Mechanics

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lecture: 3hrs/week<br>Credits: 3 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks<br>End Semester Exam: 60 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Apply fundamental Laws of Engineering Mechanics |
| **CO2** | Apply Conditions of static equilibrium to analyze given force system |
| **CO3** | Compute Centre of gravity and Moment of Inertia of plane surfaces |
| **CO4** | Compute the motion characteristics of a body/particle for a Rectilinear Motion |
| **CO5** | Know and discuss relation between force and motion characteristics |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**

**Unit- 1 Introduction and Fundamental principles** **6hrs**

**Introduction:** objectives of engineering analysis and design, idealization of engineering problems, simplification of real 3D problems to 2-D and 1-D domain, basis of assumptions, introduction to types of supports and loads, free body diagram, laws of motion.

**Fundamental principles:** force systems, resolution and composition of a forces, resultant, couple, moment, Lami's theorem Varignon's theorem.

**Unit- 2 Equilibrium** **6hrs**

**Static equilibrium:** analytical and graphical conditions of equilibrium, equilibrium of coplanar concurrent forces, coplanar non concurrent forces, parallel forces. Centroid of composite shapes, moment of inertia of planer sections.

**Friction:** Coulomb's laws, friction angles, wedge friction, sliding friction.

**Unit- 3 Beams and Trusses** **6hrs**

**Beams:** Types of beam, loads and supports, beam reactions for simply supported beams, continuous beams (with 3 supports only)

**Simple trusses:** Types of trusses, analysis of plane trusses by method of joints and method of sections.

**Unit- 4 Kinematics of Particle** **6hrs**

**Kinematics of linear motion:** types of motion, laws of motion, kinematics of particles, rectilinear motion, constant and variable acceleration, study of motion diagrams, motion under gravity, projectile motion, concept of relative velocity

**Unit- 5 Kinetics and Work, Power, Energy** **6hrs**

**Kinetics of particle:** D'A1embert's principle: applications in linear motion, kinetics of rigid bodies, applications in translation.

Work done by a force, potential energy, kinetic energy of linear motion and rotation, work energy equation, conservation of energy, power. Collision of elastic bodies, Impulse momentum principle.

**Text Books:**


1. S. Timoshenko, D. H. Young, "Engineering Mechanics", McGraw Hill, 1995.
2. Tayal A. K., "Engineering Mechanics", Umesh Publications, 2010.
3. Bhavikatti S. S., Rajashekarappa K. G., "Engineering Mechanics", New Age International Publications,

2nd Edition.

4. Beer, Johnston, "Vector Mechanics for Engineers", Vol. 1: Statics and Vol. 2: Dynamics, McGraw Hill Company Publication, 7th edition, 1995.


**Reference Books:**


1. Irving H. Shames, "Engineering Mechanics -Statics and Dynamics", Pearson Educations, Fourth edition, 2003.
2. McLean, Nelson, "Engineering Mechanics", Schaum's outline series, McGraw Hill Book Company, N. Delhi, Publication.
3. Singer F. L., "Engineering Mechanics -Statics & Dynamics", Harper and Row Pub. York.
4. Junnarkar S.B., and Shah, H.J. "Applied Mechanics", Charotar Publication House Anand

# Computer Programming

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lecture: 2hrs/week<br>Credits: 2 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks<br>End Semester Exam: 60 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Able to implement flow chart and algorithm, Understand the components of computer and C programming development. |
| **CO2** | Able to understand and apply mathematical operators, tokens and data types. |
| **CO3** | Able analyse and develop C program using control flow statements, functions and structure. |
| **CO4** | Able to design, develop and analyse C program using array |
| **CO5** | Able to develop and implement C program by using different C proramming concepts. |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**

**Unit 1: Process of programming** **4hrs**

Editing, Compiling, Error Checking, executing, testing and debugging of programs. IDE commands. Eclipse for C Program development, Flowcharts, Algorithms.

**Unit 2: Types, Operators and Expressions** **4hrs**

Variable names, Data types, sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence
and order of evaluation.

**Unit 3: Control Flow** **4hrs**

Statements and Blocks. If-else, else-if switch Loops while and for, do-while break and continue goto and Labels. Functions and Program Structure: Basic of functions, functions returning no integers external variables scope rules.

**Unit 4: Arrays in C** **4hrs**

Initializing arrays, Initializing character arrays, multidimensional arrays.

**Unit 5: Structures C** **4hrs**

Basics of structures, structures and functions arrays of structures.

**Pointer in C**. Pointers to integers, characters, floats, arrays, structures.
***Special Note: Topic of Pointers in C is only for lab exercises and not for end semester examinations.***

**Reference/Text Books:**


1. Brain W. Kernighan & Dennis Ritchie, The C Programming Language, Prentice Hall, 2nd Edition, 1988.
2. R. S. Bichkar, Programming with C, Orient Blackswan, 1 st Edition, 2012.
3. Herbert Schildit, C the Complete Reference, McGraw-Hill Publication, 2000.
4. Balguruswamy, Programming in C, PHI.
5. Yashwant Kanitkar, Let Us C, PHI

# Engineering Chemistry

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lecture: 3hrs/week<br>Credits: 3 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks<br>End Semester Exam: 60 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | It is expected that by the end semester, student will develop the following competencies. Students should be able to understand and explain the basic concepts of Water treatment and capable to explain softening processes and water Characteristics. |
| **CO2** | Students should be able to classify and explain various types of Corrosion and should apply methods to minimize the rate of Corrosion. |
| **CO3** | Students should be able to classify and explain various types of coals and lubricants, its physical and chemical properties and industrial importance. |
| **CO4** | Students should know the concept of Electrochemistry and its importance. |
| **CO5** | Student should be able to understand and explain various instrumental methods of Analysis. |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | | 2 | | | | 3 | | | | 1 | |
| **CO2** | 3 | 1 | 2 | | | | | | | | | |
| **CO3** | 2 | | | | | | | | | | | |
| **CO4** | 3 | | | | | | 2 | | | | | |
| **CO5** | 3 | | | 2 | | | | | | | 1 | |

**Course Contents:**

**Unit 1: Water Treatment** **7hrs**

Introduction, Hard and soft water, Disadvantages of hard water, Softening of water – Ion exchange process, Hot lime –soda process, Hardness and its determination by EDTA method, Dissolved oxygen (DO) and its determination by Winkler's method, Numerical based on hardness, Sewage water treatment.

**Unit 2: Corrosion and its Control** **7hrs**

Introduction, Fundamental reason of corrosion, Electrochemical corrosion ( Wet Corrosion), Mechanism of Wet corrosion, Direct Chemical corrosion (Dry corrosion), Factors affecting the rate of corrosion, Types of corrosion-Pitting corrosion, Microbiological corrosion, Methods to minimize the rate of corrosion- Proper designing, Cathodic and anodic protection method.

**Unit 3: Fuels and Lubricants** **7hrs**

**Fuels:** Introduction, Classification of fuel, Calorific value of a fuel, Characteristics of a good fuel,

Solid fuel- Coal and various types of coal, Analysis of coal- Proximate and Ultimate analysis, Liquid fuel-Refining of petroleum.

**Lubricants:** Introduction, classification of lubricants - Solid, Semi –solid and Liquid lubricants, Properties of lubricants: Physical properties – viscosity, viscosity index, surface tension, Flash point and Fire point. Chemical properties – acidity, saponification value.

**Unit 4: Electrochemistry** **8hrs**

Introduction, Electrical conductance, Conductance measurement by Wheatstone bridge method, Cell constant, Conductometric titrations, Glass electrode and its application for pH measurement, Ostwald's theory of acid- base indicator, Rechargeable batteries i) Lithium ion battery ii) Lithium battery, Fuel cell ($H_2$-$O_2$), Advantages of fuel cell.

**Unit 5: Instrumental Methods of Analysis** **7hrs**

UV-Visible spectroscopy-Introduction, Laws of absorption -Beer's - Lambert's law, Instrumentation and working of double beam spectrophotometer. Flame Photometry (Flame emission spectroscopy) - Introduction, Principle and working. Chromatography- Introduction, Classification, Thin layer chromatography (TLC). Brief discussion on IR spectroscopy.

**Textbooks:**


1. Jain P.C & Jain Monica, Engineering Chemistry, Dhanpat Rai& Sons, Delhi, 1992.
2. Bhal &Tuli, Text book of Physical Chemistry, S. Chand & Company, New Delhi.
3. Shikha Agarwal, Engineering Chemistry- Fundamentals and applications, Cambridge Publishers - 2015.
4. Gurudeep Chatwal and Sham Anand, Instrumental methods of Chemical Analysis, Himalaya Publishing House, New Delhi


**Reference books:**


1. Barrow G.M., Physical Chemistry, McGraw-Hill Publication, New Delhi.
2. O. G. Palanna, Engineering Chemistry, Tata McGraw-Hill Publication, New Delhi.
3. WILEY, Engineering Chemistry, Wiley India, New Delhi 2014.
4. S. S. Dara, Engineering Chemistry, McGraw Hill Publication, New Delhi.
5. Willard, Hobart H.; Merritt, Lynne L., Jr.; Dean, John A. Instrumental Methods of Analysis, American Chemical Society

# Energy and Environment Engineering

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lecture:<br>Credits: | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | List the conventional and renewable sources of energy, energy conservation principles, environmental protection practices (Remember Level) |
| **CO2** | Explain the operation of conventional power plants and working principle of renewable power generation (Understand Level) |
| **CO3** | Compare merits and demerits of the conventional power generation and renewable power generation methods (Understand Level) |
| **CO4** | List and discuss the energy conservation practices and environmental protection principles (Remember Level) |
| **CO5** | Demonstrate the sources, effects and control measures of air, water, noise and soil pollution (Understand Level) |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 1 | | | | 1 | 1 | | | | | | |
| **CO2** | 1 | 1 | | | 1 | 1 | | | | | | 1 |
| **CO3** | 1 | 1 | | | 1 | 1 | | | | | | 1 |
| **CO4** | 1 | | | | 1 | 1 | | | 1 | 1 | 1 | 1 |
| **CO5** | 1 | | | | 2 | 1 | | 1 | 1 | 1 | 1 | 1 |

**Course Contents:**

**Unit 1: Conventional Power Generation** **4hrs**

Steam power station, Nuclear power plant – Gas turbine power plant- Hydro power station: Schematic arrangement, advantages and disadvantages, Thermo electric and thermionic generators, Environmental aspects for selecting the sites and locations of power plants.

**Unit 2: Renewable Power Generation** **4hrs**

Solar, Wind, Biogas and Biomass, Ocean Thermal energy conversion (OTEC), Tidal, Fuel cell, Magneto Hydro Dynamics (MHD): Schematic arrangement, advantages and disadvantages.

**Unit 3: Energy Conservation and Environment Protection** **4hrs**

The Energy and Environment Relationship, carbon dioxide ($CO_2$) emissions and climate change, Energy Conservation and Environmental Protection, Energy conservation: Scope for energy conservation and its benefits, Energy conservation in day-to-day life, such as lighting, cooking, transportation etc. Environment protection in everyday life: reuse, recycle, water conservation etc.

**Unit 4: Air Pollution** **4hrs**

Environment and Human health - Air pollution: sources- effects- control measures - Particulate emission, air quality standards, and measurement of air pollution.

**Unit 5: Water Pollution** **4hrs**

Water pollution- effects- control measures- Noise pollution –effects and control measures, Disposal of solid wastes, Bio-medical wastes-Thermal pollution – Soil pollution -Nuclear hazard.

**Reference/Text Books:**


1. A Chakrabarti, M. L Soni, P. V. Gupta, U. S. Bhatnagar, A Text book of Power System Engineering, Dhanpat Rai Publication.
2. Rai. G. D., Non-Conventional Energy Sources, Khanna Publishers, Delhi, 2006.
3. Rao S., Parulekar B.B., Energy Technology-Non conventional, Renewable and Conventional, Khanna Publishers, Delhi, 2005.
4. Glynn Henry J., Gary W. Heinke, Environmental Science and Engineering, Pearson Education, Inc, 2004.
5. J. M. Fowler, Energy and the Environment, McGraw-Hill, 2nd Edition, 1984.
6. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2nd Edition, Prentice Hall, 2003.

# Engineering Chemistry Laboratory

| **Practical Scheme:** | **Examination Scheme:** |
|---|---|
| Practical: 2hrs/batch<br>Credit: 1 | Internal Assessment: 60 Marks<br>Practical Examination / Oral: 40 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Student should able to understand and perform water quality monitoring parameters such as Chloride content, Hardness and Dissolve Oxygen etc. |
| **CO2** | Student should able to understand and perform the Physical properties in the liquid state such as Viscosity, and Surface Tension. |
| **CO3** | Student should able to understand and perform the Chemical properties of the lubricant. |
| **CO4** | Student should able to know and perform the rate of corrosion of metals and alloys. |
| **CO5** | Student should able to know and perform the quantitative analysis such as pH-metry and Conductometry (Instrumental methods). |

**Mapping of course outcomes with program outcomes**

| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 3 | | 2 | | | | 3 | | | | 1 | |
| **CO2** | 3 | | 2 | | | | | | | | | |
| **CO3** | 2 | | 2 | 1 | | | | | | | | |
| **CO4** | 3 | 1 | 1 | | | | 2 | | | | | |
| **CO5** | 3 | | | 2 | | | | | | | | |

**Course Contents:**

**List of Experiments: (Perform any 10 Experiments)**

1. Determination of Hardness of water sample by EDTA method.
2. Determination of Chloride content in water sample by precipitation titration method.
3. Determination of Dissolve Oxygen in water by Iodometric method.
4. Determination of Percent purity of Bleaching Powder.
5. pH – metric Titration (Acid Base titration)
6. Conductometric Titration (Acid Base titration)
7. Surface tension
8. Viscosity
9. To determine Acidity of water sample.
10. To determine Calorific value of a fuel.
11. Determination of Acid value of an oil sample.
12. Determination of Saponification value of an oil sample.
13. To verify Beer's-Lambert's law.
14. To determine Alkalinity water sample.
15. Determination of rate of corrosion of metal.
16. To determine the maximum wavelength of absorption of a given solution by colorimeter.
17. Experiment on Chromatography.

**Reference Books:**

1. Systematic experiments in Chemistry, A. Sethi, New Age International Publication, New Delhi.
2. Practical Inorganic Chemistry, A. I. Vogel, ELBS Pub.
3. Practical in Engineering Chemistry, S. S. Dara.

# Computer Programming in C: Laboratory

| **Practical Scheme:** | **Examination Scheme:** |
|---|---|
| Practical: 2hrs/batch<br>Credit: 1 | Internal Assessment: 60 Marks<br>External Exam: 40 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Able to explain programming fundamentals. |
| **CO2** | Able to demonstrate programming with operators and control structures |
| **CO3** | Able to implement advanced programming concepts in C arrays, structures, strings, and pointers. |
| **CO4** | Able to solve real-life industrial problems using C concepts. |

**Mapping of course outcomes with program outcomes**

| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**

**List of Practicals:**

1. Assignment on Flow Chart.
2. A Simple program to display a message “Hello world” on screen.
3. A Program to take input from user and display value entered by user on screen.
4. Basic example for performing different C Operations using operator. (With and without using scanf()).
5. Basic Program on Operator. (Using scanf()).

a) Program to find and print area, perimeter and volume of geometric objects.

b) Program to check a number entered by user is Perfect number or not.

6. Program to find maximum and minimum between two numbers given by user using if-else and conditional Operators.
7. Program to swap two numbers.
8. Program to print square and factorial of an entered number using while loop.

9. Program to check a number is Palindrome number or not.
10. Program to check Armstrong number.
11. Program to check and generate prime numbers up to n.
12. Program to find GCD of two entered numbers.
13. Program to find maximum and minimum from n entered numbers.
14. Program to print alternate numbers from n entered numbers.
15. Program to search an element in an Array using linear and binary search.
16. Program to print entered numbers in ascending order using sorting.
17. Program to print addition, subtraction and multiplication of Matrices.
18. Program to find length of string. (With and without using library function).
19. Programs demonstrating use of Structures, Arrays of Structures and Structure containing arrays.
20. Programs demonstrating use of pointers to integers, floats, char, strings, structures and arrays.

# Technical Writing and Presentation Skills

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lecture: 1hr/week<br>Credit: 1 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Develop an understanding of the rules of academic writing |
| **CO2** | Differentiate between abstracts, summaries and synopses |
| **CO3** | Write technical reports |
| **CO4** | Make effective presentations |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents**

**Unit 1. WRITING SKILLS**

Technical Writing-Basic Principles: Words-Phrases-Sentences, Construction of Cohesive Paragraphs, Elements of Style; Principles of Summarizing: Abstract, Summary, Synopsis Technical Reports: Salient Features, Types of Reports, Structure of Reports, Data Collection, Use of Graphic Aids, Drafting and Writing; **Process:** Writing process - planning a text – finding materials - drafting – revising – editing - finalizing the draft - computer as an aid – key board skills - word processing - desk top publishing. Academic writing - writing examinations - evaluating a text - note-making-paraphrasing – summary writing - planning a text – organizing paragraphs – introduction – body – conclusion. **Writing models:** Expansion of ideas- Dialogue- Correspondence- Letter writing – personal letters - formal letters - CV – surveys – questionnaire – email – fax – job application- Report writing

**Unit 2. PRESENTATION SKILLS**

Speaking Skills: Accuracy vs. Fluency, the Audience, Pronunciation Guidelines, Voice Control
Professional Presentations: Planning, Preparing, Presentation Strategies, Overcoming Communication Barriers, Using Technology, Effective Presentations; handouts – use of power point – clarity of presentation - non-verbal communication - seminar presentation and discussion.

**Reference Books:**

1. Kumar, Sanjay & Pushp Lata, “Communication Skills”, Oxford University Press, 2011
2. Quirk & Randolph, “A University Grammar of English”, Pearson, 2006
3. Rutherford, Andrea J., “Basic Communication Skills for Technology”, Pearson, 2007
4. Rizvi, M Ashraf, “Effective Technical Communication”, McGraw Hill, 2009

5. Leigh, Andrew & Maynard, Michael, “The Perfect Presentation”, Random House, 2003.
6. Barker, Larry L., “Communication”, Prentice-Hall, 1984.
7. Lesikar & Flatley, “Basic Business Communication-Skills For Empowering the Internet Generation”, Tata McGraw-Hill, 2001.

# AutoCAD (Lab)

| **Practical Scheme:** | **Examination Scheme:** |
|---|---|
| Practical: 2hrs/batch<br>Credit: 1 | Internal Assessment: 60 Marks<br>External Exam: 40 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Know various tools and functions of AutoCAD |
| **CO2** | To be able to draw simple sketches of engineering objects using AutoCAD |
| **CO3** | To apply various basic and advance editing tools |
| **CO4** | To be able to prepare a printable drawing using AutoCAD |
| **CO5** | To be able to add various detailing to the drawing |

**Mapping of course outcomes with program outcomes**

| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**

**List of Practical's/Assignments**

**1) Introduction of AUTOCAD:** Learning about the user interface of AutoCAD, such as panels, ribbon, model space, etc. Understanding the setup tips of AutoCAD**,** Learning basic drawing tools**,** Using the Mouse, Keyboard, and Enter Key to work quickly and efficiently in AutoCAD

**2) Starting with Sketching:** Lines, Circles, Rectangles**,** Polygons

**3) Editing the sketches:** Move, Copy, Rotate, Mirror**,** Scale

**4) Advanced Editing Commands:** Trim and Extend, Fillet and Chamfer, Polyline Edit, Spline, Offset, Explode, Join

**5) Printing Your Drawing:** Using Layouts and Viewports, Scaling Viewports, Model Space vs. Paper Space in Layouts**,** Printing from Layout Tabs, Printing from the Model Tab

**6) Adding detailing to the drawing:** Adding text, The Multileader Tool, Hatching**,** Adding Dimensions Using Dimensioning Tools, Dimensioning in a Layout Tab vs. the Model Tab, Using Dimension Styles, Editing Dimensions

# Basic Mechanical Practices (Lab)

| **Practical Scheme:** | **Examination Scheme:** |
|---|---|
| Practical: 2hrs/batch<br>Credit: 1 | Internal Assessment: 60 Marks<br>External Exam: 40 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Identify and apply suitable power tools for various workshop processes (Apply) |
| **CO2** | Prepare a piping layout using different plumbing tools and fittings (Understand) |
| **CO3** | Make the use of joining practices using riveting, soldering and brazing (Apply) |
| **CO4** | Make use of blanking, punching, drawing and bending to make a simple part (Analyze) |
| **CO5** | Practice assembly /disassembly skills for the engine or machine system (Understand) |

**Mapping of course outcomes with program outcomes**

| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | 1 | | | | 1 | 1 | | | | | 2 | 1 |
| **CO2** | 1 | | | | 1 | 1 | | | | | 2 | 1 |
| **CO3** | 1 | | | | 1 | 1 | | | | | 2 | 1 |
| **CO4** | 1 | | | | 1 | 1 | | | | | 2 | 1 |
| **CO5** | 1 | | | | 1 | 1 | | | | | 2 | 1 |

**Course Contents:**

**List of Practical's/Experiments/Assignments:**
A student is expected to do atleast one job from each of the following:

1. Power Tooling Operations
2. Plumbing Tools and Operations
3. Soldering, Brazing and Riveting
4. Press Fitting Operations
5. Assembly/Disassembly of a two wheeler engine or a simple machine

# Ancient Indian Weapon Technology

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lecture: 1hr/week<br>Credit: 1 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | To understand type of materials used for manufacturing ancient weapons in India |
| **CO2** | To understand various sources to study ancient weapon technology in India |

**Mapping of course outcomes with program outcomes**

| Course Outcomes | Program Outcomes | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |

**Course Contents:**

**Unit 1: Material, Techniques and Methods of operation**

Bows and Arrows: Materials and Techniques, Operational Methods, Modes of Shooting; Talwar (Swords), Kharga (Heavy Sword), Zaghnal (War Hammer), Gurz (Round headed spiky mace), Gada (Mace), Parashu (Battle Axe), Trishul (Triple bladed spear), Bhuj, Kirpan (Dagger), Bhaala (Spear), Chakkar/chakri/Chakram

**Unit 2: Weapons found in Indian History**

Weapons depicted in Indian coins, Weapons depicted in Indian Paintings, Decoration of Indian Arms, Maratha Arms, Mughal Arms, Rajput Arms, Sikh Arms, Tribal Weapons

**Reference Books:**


1. G N Pant, "Studies in Indian Weapons and Warfare", Army Educational Stores, New Delhi, 1970 (available at https://archive.org/details/dli.ministry.27123/mode/2up, and https://indianculture.gov.in/ebooks/studies-indian-weapons-and-warfare)
2. G N Pant, "Indian Arms and Armour Vol- 1", Army Educational Stores, New Delhi, 1978 (available at https://archive.org/details/dli.ministry.25958/mode/2up, and https://www.indianculture.gov.in/ebooks/indian-arms-and-armour-vol-i)
3. V R Ramachandra Dikshitkar, "War in Ancient India", Maccmillan and Co. Ltd., 1944
4. S Krishnaswami Aiyangar, "Ancient India", Luzac & Co. Great Russell Street Londaon, 1911
5. Bimal Kanti Majumdar, "The military System in Ancient India" Firma K L Mukhopadhyay Publishers Calcutta, 1960

# National Service Scheme (NSS)

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Practical: 4hr/week<br>Credit: 2 | Internal Assessment: 20 Marks<br>Mid Term Test: 20 Marks |

**Course Contents:**

**Unit 1: Life Competencies and skill**

Definition and importance of life competencies, Communication, Inter Personal, Problem solving and decision making, Positive thinking, Self-confidence and self-esteem, Life goals, Stress and time management

**Unit 2: Social Harmony and National Integration**

Indian history and culture, Role of youth in peace-building and conflict resolution, Role of youth in Nation building

**Unit 3: Youth Development Programmes in India**

National Youth Policy, Youth development programmes at the National Level, State Level and voluntary sector, Youth-focused and Youth-led organizations

# Engineering Mechanics Laboratory

| **Practical Scheme:** | **Examination Scheme:** |
|---|---|
| Practical: 2hrs/batch<br>Credit: 1 | Internal Assessment: 60 Marks<br>External Exam: 40 Marks |

**Course Outcomes:**

| | |
|---|---|
| **CO1** | Estimate the various engineering application and their principles |
| **CO2** | Apply conditions of equilibrium for solving problems of mechanics. |
| **CO3** | Analysis the behavior of object subjected to external loading. |
| **CO4** | Identify the surfaces and solids with respect to centre of gravity and centroid. |
| **CO5** | Examine the forces acting on the object under the dynamic conditions. |

**Mapping of course outcomes with program outcomes**

| **Course Outcomes** | **Program Outcomes** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO10** | **PO11** | **PO12** |
| **CO1** | | | | | | | | | | | | |
| **CO2** | | | | | | | | | | | | |
| **CO3** | | | | | | | | | | | | |
| **CO4** | | | | | | | | | | | | |
| **CO5** | | | | | | | | | | | | |

**Course Contents:**

**At least 08 experiments should be performed from the following list**

1. To verify the law of Force Polygon
2. To verify the law of Moments using Parallel Force apparatus. (simply supported type)
3. To verify the law of moments using Bell crank lever.
4. To determine support reaction for beam.
5. To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.
6. Simple / compound pendulum.
7. Moment of Inertia of fly wheel
8. To find CG and moment of Inertia of an irregular body using Computation method.
9. Verification of force transmitted by members of given truss.
10. Collision of elastic bodies (Law of conservation of momentum
11. Verification of law of machine by using worm and worm wheel.
12. Any other innovative experiment
13. Assignment on beam reaction with at least 05 examples
14. Application of spreadsheet program for determination of beam reaction, laws of moment, any other topic from the syllabus.

# DEPARTMENT OF MECHANICAL ENGINEERING
## CERTIFICATE COURSES

## CNC Turning

**Duration: 120 Hrs.**
**Credits: 4**

**The students should learn the following during 120 Hrs. of time and will be eligible to work on CNC Turning Machine in the industry.**

**Course Contents:**

| **Content** | **Contact Hrs.** | **Training Mode** |
|---|---|---|
| CNC machine fundamentals | 8 | CNC Turning Lathe |
| CNC lathe and various systems | 4 | CNC Turning Lathe |
| Major parts of the CNC Turning Lathe and their functions | 4 | CNC Turning Lathe |
| Functions of CNC control | 4 | CNC Turning Lathe |
| Operation of CNC Lathe – Various modes | 4 | CNC Turning Lathe |
| Tooling for CNC Lathe | 4 | CNC Turning Lathe |
| Basics of part programming using G and M codes | 4 | CNC Simulator |
| Setting the Datum and plane creation, datum shift (G17, G18 and G19 working planes) | 8 | CNC Simulator |
| G96 and G97 Spindle control | 2 | CNC Simulator |
| All main cycles including Roughing and finishing cycles | 20 | CNC Simulator |
| Screw threading and tapping cycle, parting off | 10 | CNC Simulator |
| Centerline drilling and Boring cycle | 10 | CNC Simulator |
| Editing of programs online | 10 | CNC Simulator |
| Writing part programs for the work drawing | 10 | CNC Simulator |
| CNC simulation for all turning cycles | 10 | CNC Simulator |
| Understanding alarms and responding to it in CNC machines | 4 | CNC Simulator |
| Safety in CNC Machine operation | 4 | CNC Turning Lathe |

**Reference**: - HASS CNC simulator manual for CNC lathe

# 3D Printing

**Duration: 120 Hrs.**
**Credits: 4**

**Course Contents:**

1. Explain the concept of 3D printing or additive manufacturing
2. To analyze 3D printing technology
3. Install 3D software to be used
4. Demonstrate different stages of Additive manufacturing process
5. Use of correct CAD formats to manufacture a 3D printed part
6. Show how to do slicing of a 3D model
7. Prepare STLs for 3D Printing
8. Prepare CAD Models with STL file
9. Planning for 3D printing
10. Part orientation/placement
11. Time/material/machining cost estimations
12. Process Simulations
13. Demonstrate the working of 3D printer
14. Basic maintenance and calibration of 3D printers

# Joining Practices

**Duration: 120 Hrs.**
**Credits: 4**

**Course Contents:**

**Unit 1**: Oxyfuel-Gas Welding **30hrs**

**Unit 2:** Arc-welding processes, Electrodes for Arc welding, Types of weld joint **30hrs**

**Unit 3:** Brazing, Soldering and Adhesive-bonding **30hrs**

**Unit 4**: Mechanical Fastening Processes **30hrs**

**References:**


1. ASM Handbook, Vol.6: Welding, Brazing, and Soldering, ASM International, 1993.
2. ASM Handbook, Vol. 6A: Welding Fundamentals and Processes, ASM International, 2011.

# Mechanical Draftsman

**Duration: 120 Hrs.**
**Credits: 4**

**Course Contents:**

**Unit 1: Construct different Geometrical figures using drawing Instruments**

Perform assignment using drawing instruments: Draw straight and parallel lines, triangles, polygons, circles, parallelogram, angle bisector and line bi-sector. Construct regular polygons (up to 8 sides) on equal base. Layout an A3 drawing sheet as per SP -46: 2003 with margin and name plate. Fold a sheet of A0 size for filing Cabinets or binding as per SP: 46- 2003. Write block letters & numerals in single & double stroke. Write name of the drawing title on heading at centre alignment in double stroke 5:4 block letter. Draw a sample title block as used in industry. Label a drawing views showing the types of line are used. Construct ellipse, parabola & hyperbola. Construct involutes, cycloid curves, helix & spiral.

**Unit 2: Draw Orthographic Projections and sectional views giving proper dimensioning with title block using appropriate line type and scale**

Generate views in orthographic projection by placing object between horizontal and vertical plane of axes. Generate side view of laminar objects in different inclination on VP and HP by auxiliary vertical plane. Provide dimension on object as per SP-46:2003 Draw orthographic projection of points, lines and plain laminar figures. Draw orthographic projection of solids viz. prism, cones, pyramids and their frustums in 1st angle and 3rd angle method.

Sketch Conventional signs and symbols for section. Draw sectional views with adjacent object showing cutting plane and direction of view. Sketch different types of section lines and abbreviations for different materials as per SP-46:2003. Draw Orthographic drawing of solids (viz., cube, prisms, cone and pyramids) finding out the true shape surfaces cut by oblique planes

**Unit 3: Draw and indicate the specification of different types of fasteners, welds and other mechanical devices as per SP-46:2003**

Draw different Screw threads with SP-46:2003conventions. Draw bolts, studs, nuts, washers and other fasteners as per SP46:2003 conventions. Draw different locking arrangement of nuts, machine screws, caps screw set screw as per convention. Draw a half sectional view of a coupler nut. Draw eye foundation bolt, rag foundation bolt and Lewis foundation bolt. Draw welded joints giving welding symbols in welded structures. Draw section of welded steel structural column & bracket fabricated by plate. Draw keys, cotters, circlips and pins as per convention. Draw different types of pipe fittings and pipe joints (flanged, welded, threaded, socket and spigot). Draw structural steel sections with dimension as per IS specification. Draw rivets and riveted joints with conventional specification. Draw a double strap, double riveted zig-zag butt joint.

Draw the diagram illustrating basic size deviations and tolerances. Draw symbols for machining and surface finishes (grades and micron values). Draw the system of indication of geometrical tolerances of form and position as per standard. Draw muff coupling, flanged coupling, friction grip coupling, pin type flexible coupling, universal coupling, Oldham's coupling, claw coupling, cone friction clutch. Draw details and assembly of simple bearing and foot step bearing, Plummer Block and self-aligning bearing (swivel bearing). Construct tooth profile of a spur gear above 30 teeth. Draw two spur gears and bevel gears in mesh.

**Unit 4: CAD application and create 2D and 3D objects on CAD.**

Perform file management in Windows operating system. Create, save and print a document, worksheet and pdf file. Start drawing in CAD from: new, template wizard and existing drawing file. Select Drawing limit of the CAD drawing space. Select proper setting of ribbon and toolbars, choice of workspace, scale. Draw object in CAD drawing space using commands from icons in the ribbon, from menu bar, from floating toolbar and by typing command at the command prompt. Use functional keys to access certain commands. Input or locate point by Absolute Coordinate system, Polar Coordinate System and Relative Co-ordinate System. Create geometrical figures using draw tools

Draw object CAD drawing space using line, polyline, polygon, circle, rectangle, arc, ellipse commands. Modify object using Break, Erase, Trim, Offset, Fillet, Chamfer, Commands. Manage object using Move, Copy, Array, Insert Block, Make Block, Scale, Rotate, Hatch Commands. Create templates, Insert drawings,

Layers, Modify Layer properties. Provide dimension, annotation on object and customize different Dimension and Text styles. Construct orthographic drawing using shortcut keyboard command. Construct isometric drawing of machine blocks. Create viewports in layout space to view drawings in model space.

Identify three axes of the object. Change origin to create aligned objects under supervision. Create 3D solid objects using command from 3D primitives, Extrude, Revolve, subtract, union. Create 3D drawing by changing User co-ordinate systems. Annotate and dimension of the 3D model. Generate orthographic views from model space to layout space. Generate Print preview and Plotting. Customize page set up, Print preview and Plotting of 3D drawing.

# Refrigeration & Air Conditioning Practice

**Duration: 120 Hrs.**
**Credits: 4**

**Course Contents:**

**Unit 1:** Basics of Refrigeration and Air conditioning **: 30hrs**

**Unit 2:** Refrigeration & Air conditioning tools, safety and standards **: 30hrs**

**Unit 3:** Refrigeration and Air conditioning System installation and Maintenance **: 30hrs**

**Unit 4:** Non-conventional Refrigeration and air conditioning, Process Planning and cost estimation, Automobile air conditioning **: 30hrs**

**References:**


1. Basic of Refrigeration and Air conditioning, P N Ananthanarayanan
2. International Standards in Refrigeration and Air Conditioning , UNEP (United Nations Environment Program
3. Refrigeration and Air Conditioning data book, New Age International Publication

# Vehicle Maintenance

*[Four-Wheeler or Two-Wheeler]*

**Duration: 120 Hrs.**
**Credits: 4**

| | **Examination Scheme:** |
|---|---|
| **Credits: 4** | Continuous Assessment: CA1-10 Marks (Based on Part A)<br>Continuous Assessment: CA2-10 Marks (Based on Part B) |

Students are expected to spend 120 hours on **Part A**: Study of theoretical aspect of vehicle and engine & **Part-B**: hands -on experience in the Vehicle Service Workshop to learn vehicle maintenance through 10 modules:

**Course Contents:**

**A) Theory Classes for understanding basics of Engine/Vehicle (Approx. 10 days)**

**1) Fundamentals of IC Engines**

Applications, nomenclature, engine components, Engine classification, two and four stroke cycle engines; fundamental difference between SI and CI engines; valve timing diagrams.

**2) Power Cycles:** Air standard Otto, Diesel and Dual cycles; **Combustion:** Introduction, important qualities and ratings of SI Engines fuels; qualities and ratings of CI Engine fuels. Combustion in S.I. Engines, Combustion in C.I. Engines, combustion knock; types of SI and CI Engine combustion chambers.

**3) Various Engine Systems**

Starting systems, fuel supply systems, engine cooling system, ignition system, lubrication systems, governing systems.

**4) Motor Vehicle Technology:**

CHASSIS LAYOUT, CLUTCH SYSTEM, GEAR BOX, FINAL DRIVE**,** FRAME AND BODY, SUSPENSION SYSTEM STEERING SYSTEM AND FRONT AXLE BRAKING SYSTEM

**B) Hands-on Experience in Service Workshop of Four-Wheeler or Two-Wheeler (Approx. 20 days)**

**1)** Handling of Tools, Equipment's & Measuring Instruments

**2)** Awareness of Shop Floor Equipment

**3)** Awareness of Safety Precautions

**4)** Knowledge of Engineering Tools

**5)** Study of Petrol and Diesel Engines of Four/Two-Wheeler Vehicles through cut-section models/charts/videos.

**6)** Do Servicing, Overhauling, Lubrication Work, Wheel Alignments of Four//Two-Wheeler Vehicles.

**7)** Diagnose, Dismantle, Inspection of vehicles of Four/Two-Wheeler Vehicles.

**8)** Trace out Fault of Engines, Gear Box, transmission System, Suspension System, steering systems, Brakes, Electronic Components, Wiring, & Accessories etc. & repair them.

**9)** Study of Hydraulic Systems, Air-conditioning systems

**10)** Engine Tests

## Textbooks:


1. Automotive Mechanics by W. Crouse,Tata McGraw-Hill
2. Internal Combustion Engines by Dr. V. Ganesan, Tata McGraw-Hill