ANNAMALAI UNIVERSITY

Annamalainagar

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MANUFACTURING ENGINEERING

B.E. Mechanical Engineering (Manufacturing)
Four Year Degree Programme
Choice Based Credit System
(Full - Time)

HAND BOOK
2016
1. **Condition for Admission**

Candidates for admission to the first year of the four year B.E. Degree programmes shall be required to have passed the final examination of the plus 2 Higher Secondary Course with Mathematics, Physics and Chemistry as subjects of study and candidates who have passed the Higher Secondary Examination through vocational stream under Engineering, conducted by the Board of Secondary Education, Government of Tamilnadu or an examination of any other authority accepted by the Syndicate of this University as equivalent thereto. They shall satisfy the conditions regarding qualifying marks, age and physical fitness as may be prescribed by the Syndicate of the Annamalai University from time to time.

Candidates who have passed the Diploma course in Engineering of the State Board of Technical Education, TamilNadu (listed in Annexure-1) will be eligible for admission to the second year of the four year degree programme in B.E. under the lateral entry scheme provided they satisfy other conditions.

2. **Branches of Study in B.E.**

   - **BRANCH I** - Civil Engineering
   - **BRANCH II** - Civil and Structural Engineering
   - **BRANCH III** - Mechanical Engineering
   - **BRANCH IV** - Mechanical Engineering (Manufacturing)
   - **BRANCH V** - Electrical and Electronics Engineering
   - **BRANCH VI** - Electronics and Instrumentation Engineering
   - **BRANCH VII** - Chemical Engineering
   - **BRANCH VIII** - Computer Science and Engineering
   - **BRANCH IX** - Information Technology
   - **BRANCH X** - Electronics and Communication Engineering

3. **Courses of study**

   The courses of study and the respective syllabi are given separately.

4. **Scheme of Examinations**

   The scheme of Examinations is given separately.

5. **Choice Based Credit System (CBCS)**

   The curriculum includes six components namely Humanities/Social Sciences/Management, Basic Sciences, Engineering Sciences, Professional Core, Professional Electives and Open Electives in addition to Seminar & Industrial Training and Project. Each semester curriculum shall normally have a blend of theory and practical courses. The total credits for the entire degree Programme is 176 (135 for lateral entry students).
6. Eligibility for the Degree

A candidate shall be eligible for the degree of Bachelor of Engineering if the candidate has satisfactorily undergone the prescribed courses of study for a period of four academic years and has passed the prescribed examinations in all the four academic years. For the award of the degree, a student has to:

1. Earn a minimum of 176 credits (135 for lateral entry students).
2. Serve in any one of the Co-curricular activities such as:
   - National Cadet Corps (NCC)
   - National Service Scheme (NSS)
   - National Sports Organization (NSO)
   - Youth Red Cross (YRC)

for at least one year. The students enrolled in any one of the co-curricular activities (NCC / NSS / NSO / YRC) will undergo training for about 80 hours and attend a camp of about seven days. The training shall include classes on hygiene and health awareness and also training in first-aid. While the training activities will normally be during weekends, the camp will normally be during vacation period.

(OR)

Enroll as a student member of a recognized professional society such as:
- Student Chapters of Institution of Engineers (India)
- Student Chapters of other Professional bodies like ICI, ISA, IICHE

7. Assignment of Credits for Courses

Each course is normally assigned one credit per hour of lecture / tutorial per week and one credit for two hours or part thereof for laboratory or practical or drawing per week.

8. Duration of the programme

A student is normally expected to complete the B.E. programme in four years but in any case not more than eight years from the time of admission.

9. Registration for courses

A newly admitted student will automatically be registered for all the courses prescribed for the first, second and third semesters without any option.

Every other student shall enroll for the courses intended to be credited in the succeeding semester in the current semester itself by completing the registration form indicating the list of courses. This registration will be done a week before the last working day of the current semester.

A student is required to earn 176 (135 for lateral entry students) credits in order to be eligible for obtaining the degree. However, the student is entitled to enjoy an option to earn either more or less than the total number of credits prescribed in the curriculum of a particular semester on the following guidelines:

The slow learners may be allowed to withdraw certain courses with the approval by Head of the Department and those courses may be completed by them in the fifth year of study and still they are eligible to be awarded with I Class. A student can withdraw a maximum of 2 courses per semester from IV semester to VII semester and take up those courses in the fifth year of study. However, courses withdrawn during odd semesters (V and VII) must be registered in the odd semester of fifth year and courses withdrawn during even semesters (IV and VI) must be registered in the even semester of fifth year.
The advance learners may be allowed to take up the open elective subjects of eighth semester in sixth and seventh semesters one in each to enable them to pursue industrial training / project work in the entire eighth semester period provided they should register those courses in the fifth semester itself. Such students should meet the teachers offering those elective courses themselves for clarifications. No specific slots will be allotted in the time table for such courses.

10. Seminar / Industrial Training
The student has to present a seminar on the chosen topic. However, the student can select a topic duly approved by the Seminar Coordinator and the Head of the Department concerned. The student who has presented the seminar has to submit a report and appear for viva-voce examination at the end of the semester.

Project Work
The student typically registers for project at the end of seventh semester and completes it at the end of the eighth semester along with the courses prescribed for study in the eighth semester. However a student who has registered and successfully completed the courses of eighth semester by acquiring additional credits in the earlier semesters can attempt to spend his / her period of study in an industry and complete his / her project work, submit the project report and appear for viva-voce examination at the end of eighth semester.

11. Industrial Training (Value added courses)
One credit courses shall be offered by a Department with the prior approval from the Dean, Faculty of Engineering and Technology. For one credit course, a relevant potential topic may be selected by a committee consisting of Head of the department concerned and the Board of Studies member from the Department and a senior faculty member from the department concerned. An expert from industry familiar with the topic chosen may be accordingly invited to handle classes for the students. The details of the syllabus, time table and the name of the industrial expert may be sent by the above committee to the Dean for approval. The credits earned through the one credit courses shall be over and above the total credit requirement prescribed in the curriculum for the award of the degree. Students can take a maximum of two one credit courses (one each in VI and VII semesters). They shall be allowed to take one credit courses offered in other Departments with the permission of Head of the Department offering the course. A separate mark sheet shall be issued for one credit courses.

12. Electives
The elective courses fall under two categories: Professional Electives and Open Electives. The Professional Elective courses are offered in the concerned branch of specialization and a student can choose the Professional Elective courses with the approval of the Head of the Department concerned. Apart from the various Professional elective courses, a student can choose the open electives from any specialization offered in any Department in the Faculty of Engineering & Technology during the entire period of study, with the approval of the Head of the Department and the Head of the Department offering the course.

Further, the student can also credit not more than two courses offered through the SWAYAM Portal of UGC with the approval of the Head of the Department concerned. These courses will be considered as equivalent of open electives.
13. Assessment

The break-up of continuous assessment and examination marks for theory courses is as follows:

First assessment (Mid-Semester Test-I) : 10 marks
Second assessment (Mid-Semester Test-II) : 10 marks
Third Assessment : 5 marks
End Semester Examination : 75 marks

The break-up of continuous assessment and examination marks for Practical courses is as follows:

First assessment (Test-I) : 15 marks
Second assessment (Test-II) : 15 marks
Maintenance of record book : 10 marks
End Semester Examination : 60 marks

The continuous assessment marks for the seminar / industrial training will be 40 and to be assessed by a seminar committee consisting of the Seminar Coordinator and a minimum of two members nominated by the Head of the Department. The continuous assessment marks will be awarded at the end of seminar session. 60 marks are allotted for the seminar / industrial training and viva voce examination conducted based on the seminar / industrial training report at the end of the semester.

The continuous assessment marks for the project work will be 40 and to be assessed by a review committee consisting of the project guide and a minimum of two members nominated by the Head of the Department. One of the committee members will be nominated as the Chairman by the Head of the Department. The Head of the Department may be a member or the Chairman. At least two reviews should be conducted during the semester by the review committee. The student shall make presentation on the progress made before the committee. 60 marks are allotted for the project work and viva voce examination at the end of the semester.

14. Substitute Assessment

A student who has missed, for genuine reasons accepted by the Head of the Department, one or more of the assessments of a course other than the final examination, may take a substitute assessment for any one of the missed assessments. The substitute assessment must be completed before the date of the third meeting of the respective class committees.

A student who wishes to have a substitute assessment for a missed assessment must apply to the Dean / Head of the Department within a week from the date of the missed assessment.
15. Student Counsellors (Mentors)

To help the students in planning their course of study and for general advice on the academic programme, the Dean / Head of the Department will attach a certain number of students to a member of the faculty who shall function as student counsellor for those students throughout their period of study. Such student counsellors shall advise the students, give preliminary approval for the courses to be taken by the students during each semester and obtain the final approval of the Dean / Head of the Department.

16. Class Committee

For all the branches of study during the first two semesters, a common class committee will be constituted by the Dean of the faculty. From among the various teachers teaching the same common course to different classes during each semester of the first year, the Dean shall appoint one of them as course coordinator. The composition of the class committee during first and second semesters will be as follows:

- Course coordinators of all courses.
- All Heads of the Sections, among whom one may be nominated as Chairman by the Dean.
- The Dean may opt to be a member or the Chairman.

For each of the higher semesters, separate class committees will be constituted by the respective Head of the Departments. The composition of the class committees from third to eighth semester will be as follows:

- Teachers of the individual courses.
- A seminar coordinator (for seventh semester only) shall be appointed by the Head of the Department
- A project coordinator (for eighth semester only) shall be appointed by the Head of the Department from among the project supervisors.
- One Professor or Associate Professor, preferably not teaching the concerned class, appointed as Chairman by the Head of the Department.
- The Head of the Department may opt to be a member or the Chairman.

The class committee shall meet three times during the semester. The first meeting will be held within two weeks from the date of class commencement in which the type of assessment like test, assignment etc. for the third assessment and the dates of completion of the assessments will be decided.

The second meeting will be held within a week after the completion of the first assessment to review the performance and for follow-up action.

The third meeting will be held after all the assessments but before the University semester examinations are completed for all the courses, and at least one week before the commencement of the examinations. During this meeting the assessment on a maximum of 25 marks for theory / 40 marks for seminar / industrial training, practical and project work will be finalized for every student and tabulated and submitted to the Head of the Department (to the Dean in the case of I & II Semester) for approval and transmission to the Controller of Examinations.
17. Attendance requirements
The students with 75% attendance and above are permitted to appear for the University examinations. However, the Vice Chancellor may give a rebate / concession not exceeding 10% in attendance for exceptional cases only on Medical Grounds.

18. Temporary break of study
A student is permitted to go on break of study for a maximum period of one year either as two breaks of one semester each or a single break of one year.

The student applies for break of study, the student shall apply to the Dean in advance, in any case, not later than the last date of the first assessment period. The application duly filled by the student shall be submitted through the Head of the Department. In the case of short term employment/ training/ internship, the application for break of study shall be approved and forwarded by the Head of the department concerned to the Dean.

However, the student must complete the entire programme within the maximum period of eight years.

19. Procedure for withdrawing from the Examinations
A student can withdraw from all the examinations of the semester only once during the entire programme on valid grounds accepted by the University. Such withdrawal from the examinations of a semester will be permitted only if the candidate applies for withdrawal at least 24 hours before the commencement of the last examination. The letter grade ‘W’ appears in the mark sheet for such candidates.

20. Passing and declaration of examination results
All assessments of all the courses on an absolute marks basis will be considered and passed by the respective results passing boards in accordance with the rules of the University. Thereafter, the Controller of examinations shall convert the marks for each course to the corresponding letter grade as follows, compute the Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA), and prepare the mark sheets.

<table>
<thead>
<tr>
<th>Marks</th>
<th>Letter Grade</th>
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<tr>
<td>90 to 100</td>
<td>Grade 'S'</td>
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<td>80 to 89</td>
<td>Grade 'A'</td>
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<td>Grade 'E'</td>
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<td>Grade 'RA'</td>
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<tr>
<td>Withdrawn from the examination</td>
<td>Grade 'W'</td>
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</table>

A student who obtains less than 30 / 24 marks out of 75 / 60 in the theory / practical examinations respectively or is absent for the examination will be awarded grade RA.

A student who earns a grade of S,A,B,C,D or E for a course is declared to have successfully completed that course. Such a course cannot be repeated by the student.

A student who is detained for lack of attendance must re-register for and repeat the courses in the respective semester.

A student who obtains letter grade RA / W in the mark sheet must reappear for the examination of the courses.

The following grade points are associated with each letter grade for calculating the grade point average and cumulative grade point average.

\[
\text{S - 10; A - 9; B - 8; C - 7; D - 6; E - 5; RA - 0}
\]
Courses with grade RA / W are not considered for calculation of grade point average or cumulative grade point average.

A student can apply for re-totaling of one or more of his examination answer papers within a week from the date of issue of mark sheet to the student on payment of the prescribed fee per paper. The application must be made to the Controller of Examinations with the recommendation of the Head of the Department.

After the results are declared, mark sheets will be issued to the students. The mark sheet will contain the list of courses registered during the semester, the grades scored and the grade point average for the semester.

GPA is the sum of the products of the number of credits of a course with the grade point scored in that course, taken over all the courses for the semester, divided by the sum of the number of credits for all courses taken in that semester.

CGPA is similarly calculated considering all the courses taken from the time of admission.

21. Awarding degree

After successful completion of the programme, the degree will be awarded with the following classification based on CGPA.

- For **First Class with Distinction**, the student must earn a minimum of 176 credits within four years (135 credits within three years for lateral entry students) from the time of admission, pass all the courses in the first attempt and obtain a CGPA of 8.25 or above for all the subjects from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

- For **First Class**, the student must earn a minimum of 176 credits within five years (135 credits within four years for lateral entry students) from the time of admission and obtain a CGPA of 6.75 or above for all the subjects from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

- For **Second Class**, the student must earn a minimum of 176 credits within eight years (135 credits within seven years for lateral entry students) from the time of admission.

22. Ranking of Candidates

The candidates who are eligible to get the B.E. degree in the First Class with Distinction will be ranked together on the basis of CGPA for all the subjects of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The Candidates passing with First Class will be ranked next after those with distinction on the basis of CGPA for all the subjects of study from I Semester to VIII Semester (III Semester to VIII Semester for lateral entry students).

The ranking of candidates will be done separately for each branch of study.

23. Transitory Regulations

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the courses of study and the syllabi from time to time.

Wherever there had been change of syllabi, examinations based on the existing syllabi will be conducted for three consecutive times after implementation of the new syllabi in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent courses, as per the new syllabi, on the recommendations of the Head of the Department concerned.
### Annexure-1
Diploma Programmes Eligible for the B.E (Lateral Entry) Programmes offered in FEAT (from 2017-2018)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Branches of Study</th>
<th>Eligible Diploma Programme (FT / PT / SW)</th>
</tr>
</thead>
</table>
| 1       | Civil Engineering | i. Civil Engineering  
          |                    | ii. Civil Engineering(Architecture)  
          |                    | iii. Environmental Engineering and Pollution Control(Full Time)  
          |                    | iv. Architectural Assistantship  
          |                    | v. Civil Engineering (Rural Tech.)  
          |                    | vi. Civil and Rural Engineering  |
| 2       | Civil and Structural Engineering. | i. Mechanical Engineering  
          |                    | ii. Mechanical and Rural Engineering  
          |                    | iii. Mechanical Design and Drafting  
          |                    | iv. Production Engineering  
          |                    | v. Production Technology  
          |                    | vi. Automobile Engineering  
          |                    | vii. Automobile Technology  
          |                    | viii. Metallurgy  
          |                    | ix. Mechatronics Engineering  
          |                    | x. Machine Tool Maintenance and Repairs  
          |                    | xi. Tool and Die making  
          |                    | xii. Tool Engineering  
          |                    | xiii. Tool Design  
          |                    | xiv. Foundry Technology  
          |                    | xv. Refrigeration and Air Conditioning  
          |                    | xvi. Agricultural Engineering  
          |                    | xvii. Agricultural Technology  
          |                    | xviii. Marine Engineering  
          |                    | xix. Mechanical Engineering(Production)  
          |                    | xx. Mechanical Engineering(Tool &Die)  
          |                    | xxii. Mechanical Engineering(R & A.C.)  
          |                    | xxiii. Electronics(Robotics)  
          |                    | xxiv. Mining Engineering  
          |                    | xxv. Agricultural Engineering and Farm Equipment Technology  |
| 3       | Mechanical Engineering | i. Mechanical Engineering  
          |                    | ii. Mechanical and Rural Engineering  
          |                    | iii. Mechanical Design and Drafting  
          |                    | iv. Production Engineering  
          |                    | v. Production Technology  
          |                    | vi. Automobile Engineering  
          |                    | vii. Automobile Technology  
          |                    | viii. Metallurgy  
          |                    | ix. Mechatronics Engineering  
          |                    | x. Machine Tool Maintenance and Repairs  
          |                    | xi. Tool and Die making  
          |                    | xii. Tool Engineering  
          |                    | xiii. Tool Design  
          |                    | xiv. Foundry Technology  
          |                    | xv. Refrigeration and Air Conditioning  
          |                    | xvi. Agricultural Engineering  
          |                    | xvii. Agricultural Technology  
          |                    | xviii. Marine Engineering  
          |                    | xix. Mechanical Engineering(Production)  
          |                    | xx. Mechanical Engineering(Tool &Die)  
          |                    | xxii. Mechanical Engineering(R & A.C.)  
          |                    | xxiii. Electronics(Robotics)  
          |                    | xxiv. Mining Engineering  
          |                    | xxv. Agricultural Engineering and Farm Equipment Technology  |
| 4       | Mechanical Engineering (Manufacturing) | i. Electrical and Electronics Engineering  
          |                    | ii. Electronics and Communication Engg.  
          |                    | iii. Electronics and Instrumentation Engg.  
          |                    | iv. Electronics Engineering(Instrumentation)  |
| 5       | Electrical and Electronics Engineering | }
| 6  | Electronics and Instrumentation Engineering | v.  Instrument Technology  
    vi. Instrumentation and Control Engineering  
    vii. Electrical Engineering (Instruments and Control)  
    viii. Electrical Engineering  
    ix. Instrumentation Technology  
    x. Electronics (Robotics)  
    xi. Mechatronics Engineering |
| 7  | Chemical Engineering | i. Petrochemical Engineering  
    ii. Chemical Engineering  
    iii. Environmental Engineering and Pollution Control  
    iv. Leather Technology (Footwear)  
    v. Leather Technology  
    vi. Plastic Technology  
    vii. Polymer Technology  
    viii. Sugar Technology  
    ix. Textile Technology  
    x. Chemical Technology  
    xi. Ceramic Technology  
    xii. Petro Chemical Technology  
    xiii. Pulp & Paper Technology  
    xiv. Petroleum Engineering |
| 8  | Computer Science and Engineering | i. Electronics and Communication Engineering  
    ii. Computer Technology  
    iii. Computer Science and Engineering  
    iv. Information Technology  
    v. Computer Engineering  
    vi. Computer Networking  
    vii. Electronics(Robotics)  
    viii. Mechatronics Engineering |
| 9  | Information Technology |
| 10 | Electronics and Communication Engineering |
### COURSES AND CREDITS - SUMMARY

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### DETAILS OF COURSE CODE

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<td>HS</td>
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<td>HP</td>
<td>Humanities Practical</td>
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<td>Civil and Structural Engg. course</td>
<td>BS</td>
<td>Basic Science Theory</td>
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<tr>
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<td>Mechanical Engg. Course</td>
<td>BP</td>
<td>Basic Science Practical</td>
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<td>Engineering Science Practical</td>
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<td>Electronics and Instrumentation Engg. course</td>
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<td>Chemical Engg. course</td>
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<td>08</td>
<td>Computer Science and Engg. course</td>
<td>PE</td>
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<td>Information Technology course</td>
<td>EP</td>
<td>Professional Elective Practical</td>
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<td>Electronics and Communication Engg. course</td>
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<td>XX</td>
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<td>Project and Viva-voce</td>
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5th digit represents the semester and 6th and 7th digits represent the serial number of courses
## B.E. (Four Year) DEGREE PROGRAMME

Choice Based Credit System (CBCS) (2016)

### Courses of Study and Scheme of Examinations

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FE- Final Examination; CA-Continuous Assessment
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**Semester – VII**

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L-Lecture; T-Tutorial; P-Practical; D-Drawing
FE- Final Examination; CA-Continuous Assessment
SYLLABUS
FIRST SEMESTER

00HS101  TECHNICAL ENGLISH  L  T  P

COURSE OBJECTIVES:
- English technical communication focuses on developing the proficiency of Engineering students in communicative skills, ensuring them to face the demand of their profession with high command in English.
- At the end of the course, the learners will be able to use English for all purposes of technical communication and come out in “flying colours”.

UNIT I: Listening Strategies
This unit makes the students to get exposed to the listening exercises and get registered in their minds the nuances of listening and its importance.
1. Listening process.
2. Types of listening.
3. Barriers to listening.
5. Team listening and note making.

UNIT II: Critical Reading and Creative Writing Skills
This unit introduces communication model like courtesy, body language, role play and good presentation in an effective manner, where the students are given an opportunity to observe, analyze, interpret, imagine and implement their ideas too.
Poem: Road not taken – Robert Frost
Ulysses – Alfred Lord Tennyson.
Prose: Of Studies – Francis Bacon
Science – Destroyer or creator – J. Bronowski
Play: Pygmalion – Bernardshaw.

UNIT III: Speaking Skill
Students shall be motivated to speak in English on familiar or unfamiliar topics. It is a platform to train the students to achieve competency in oral expression.
1. Interview Techniques
2. Group discussion
3. Making presentation and Discussing on the presentation.
4. Sample interviews
5. Dialogue writing

UNIT IV: Professional Writing
Students shall be trained to create their own proficiency in writing like - calling for quotation, asking clarification, placing orders and so on.
1. Poster making
2. Letter writing (formal and E-mail)
3. Analytical writing
4. Format of memos.
5. Report Writing
UNIT V: Theoretical writing
The nuances of English grammar may be taught to the students so as to present flawless English both in their oral and written communication
2. Single word substitution
3. Concord
4. Tag Questions
5. Active voice and passive voice

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
1. Understand the role of speaking in English and its contribution to their success.
2. Help the students increase the lingual power and word power, and frame suitable structures to use appropriately in different contexts.
3. Initiate the students to adopt different strategies for personal and professional writing.
4. Train the students use diversified rhetorical functions of technical English.

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<th>00BS102</th>
<th>ENGINEERING MATHEMATICS - I</th>
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COURSE OBJECTIVES:
To acquaint the student with the concepts in
- matrices,
- differential calculus,
- multiple integrals,
- vector calculus, which are most important in connection with practical engineering problems.

UNIT I: Matrices
UNIT II: Differential Calculus
Curvature in Cartesian and parametric co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes.

UNIT III: Differential Calculus: Functions of Several Variables
Jacobians – Taylor’s and Maclaurin’s series expansions of functions of two variables – Maxima and Minima of functions of two variables – Constrained Maxima and Minima by Lagrange Method.

UNIT IV: Multiple Integrals

UNIT V: Laplace Transform
Definition, Transform of elementary functions, Properties, Derivatives and integrals of transforms, Transforms of derivatives, Convolution theorem, Transforms of periodic functions, Inverse Laplace transform, Application to solution of linear ordinary differential equations of second order with constant coefficients.
(In all units, proof of theorems are not included)

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
1. This course equips students to have knowledge and understanding in matrices, differential calculus, multiple integrals and Laplace transforms.
2. Students will be able to solve problems related to above fields in engineering applications.

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<th>00BS103</th>
<th>APPLIED PHYSICS – I</th>
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COURSE OBJECTIVES:
At the end of the course the students would be exposed to fundamental knowledge in various engineering subjects and applications
- Determine the different modulus of elasticity and viscosity of the less and highly viscous liquids.
- Design of acoustically good buildings.
- Interferometric techniques in metrology, communication and civil engineering.
- Application of quantum physics to optical and electrical phenomena.
• Application of ultrasonics and acoustics.
• Structure identification of engineering materials.
• Applications of Radio isotopes and power reactor systems.

UNIT I: Properties of Matter

UNIT II: Sound
Introduction to Acoustics - factors affecting acoustics of buildings and their remedies– absorption coefficient– Sabine’s formula for reverberation time.
Introduction to Ultrasonics – production – magnetostriction and piezo electric methods – Detection of Ultrasonic waves (Acoustics grating) – Applications.

UNIT III: Optics

UNIT IV: Crystal Physics
Lattice - Unit cell - Bravais lattice - Atomic radius, co-ordination number, Packing factor and their calculations of SC,BCC,FCC and HCP crystal structures - Miller indices - Crystal imperfections (Point defect, Line defect, surface defect and volume defect).

UNIT V: Nuclear Physics

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
1. The Engineering students can gain the basic knowledge in the field of optics, sound, nuclear physics and crystalline materials etc.
2. It will be useful to apply in engineering applications.

COURSE OBJECTIVES
To make the student conversant with the
- Water treatment techniques and disinfection methods.
- Working principle of electrochemical cells.
- Sources, refining and various types of fuels.
- Mechanism, classification, applications of lubricants and introduction adhesives.
- Surface chemistry, principle and applications of chromatography.

UNIT I: Water Treatment

UNIT II: Electrochemistry

UNIT III: Fuels and Combustion

UNIT IV: Engineering Materials – I
development of adhesives strength – physical and chemical factors influencing adhesive action – bonding process of adhesives – adhesives for building and constructions – animal glues, casein glues.

UNIT V: Analytical Technique and Surface Chemistry

Chromatography – Definition – classifications – partition chromatography and adsorption chromatography.


TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
At the end of the course, the student will be able to
1. Understand and develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.
2. Understand and apply the concepts of electrochemistry including electroplating.
3. Understand the properties, sources of fuel and the concept of combustion
4. Gain the knowledge about types of lubricants, uses & their mechanisms and to understand the binding process of adhesives, and its application in building and construction.
5. Separate and purify various organic and inorganic compounds using different chromatographic techniques.
6. Understand the concept of surface chemistry and its applications.

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<th>00SP105</th>
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COURSE OBJECTIVES:
• To enable the students to have a good understanding about the concepts of “C” programming.
• To provide the hands on experience in basic concepts of AUTOCAD to students.

C Programs based on the following concepts:
Basic structure of C Programs – Constants – Variables - Data Types - - Keywords – Identifiers - Operators - Expressions – IF, IF-ELSE, Nested IF-ELSE, Switch, WHILE, DO,
FOR and GOTO statements - Arrays: one dimensional and two dimensional – Strings - Functions.

AUTOCADE:
Special Features – Dimensioning – Angular, Diameter and Radius – Hatching – Patterns – Slides – Attributes – Configuring – Plotting – Exercises in AUTOCADE (2D Drawings only)

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
1. Understand the concepts of C programming.
2. Apply the syntax of conditional and looping statements for writing C programs
3. Use the features of AUTOCADE for 2D drawing

00SP208 ENGINEERING GRAPHICS

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COURSE OBJECTIVES:
• To develop the ability to produce simple engineering drawing and sketches based on current practice.
• To develop the means for communication of ideas, thoughts and design of objects, related to engineering applications, to others through drawing.
• To develop the skills to read manufacturing and construction drawings used in industry.
• To develop a working knowledge of the layout of plant and equipment.
• To develop skills in abstracting information from calculation sheets and schematic diagrams to produce working drawings for manufacturers, installers and fabricators.
• To expose the international standards of technical drawing

UNIT I
Introduction to Engineering Drawing, Use of drafting instruments – Lettering and dimensioning.
Construction of conic sections -Ellipse, Parabola & Hyperbola (Eccentricity Method, Rectangle method, Intersecting arcs method) - Special curves- Simple cycloids and involutes– Tangent and normal at points on the curves only.

UNIT II
Orthographic projections - Projections of Points- Projections of Straight lines (given the projections, to determine the true length and true inclinations).

UNIT III
Projections of Solids like prism, pyramid, cylinder, cone, tetrahedron and octahedron in simple positions.
Auxiliary Projections of prism, pyramid, cylinder, cone when the axis is inclined to one plane only.

UNIT IV
Sections of prism, pyramid, cylinder, cone in simple position – true shape of sections.Intersection of surfaces - cylinder to cylinder and cylinder to cone with axis intersecting at right angles. Development of lateral surfaces of prism, pyramid, cylinder, cone and cut solids.

UNIT V
Isometric Projections of simple solids and combinations. Perspective Projections of simple solids. Conversion of Pictorial view of simple objects into Orthographic views

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Construct, read, and understand the Title and Revision Block
2. Usage of common drafting tools to construct engineering drawings enhances
3. Apply dimensions on engineering drawing.
4. Ability of converting sketches to engineered drawings will increase.
5. Developing cognitive and psychomotor skills, visualize images and their dimensions
6. Develop good communication skills and team work.
SECOND SEMESTER

00BS201 ENGINEERING MATHEMATICS II

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COURSE OBJECTIVES:
- To acquaint the student with the concepts in ordinary differential equations and vector calculus.
- To acquaint the student with the techniques in the theory of analytic functions and complex integration.
- Above topics are most important in connection with practical engineering problems.

UNIT I: Ordinary Differential Equations
Second order linear differential equations with constant coefficients, Second order linear differential equations with variable coefficients (Euler and Legendre’s linear equations), Simultaneous first order linear equations with constant coefficients, method of variation of parameters.

UNIT II: Vector Differentiation
Gradient, divergence and curl, directional derivative, unit normal vector, irrotational and solenoidal vector fields, expansion formulae for operators involving ∇.

UNIT III: Vector Integration
Line, surface and volume integrals, Green’s theorem in a plane, Gauss divergence theorem, Stoke's theorem – Verification of the above theorems and evaluation of integrals using them.

UNIT IV: Analytic Functions
Functions of a complex variable, Analytic function, the necessary conditions (Cauchy-Riemann equations), sufficient conditions, Properties of analytic functions, harmonic functions, construction of Analytic function by Milne-Thomson method, Conformal mapping: w = z^2, 1/z, e^z, sin z, cos z.

UNIT V: Complex Integration
Statement and application of Cauchy theorem, Cauchy integral formulas, Taylor and Laurent expansion, Singularities – Classification; Residues – Statement and application of Cauchy residue theorem, Contour integration round the unit circle.
(In all units, proof of theorems are not included)

TEXT BOOKS:

REFERENCE BOOKS:

**COURSE OUTCOMES:**
1. This course equips students to have knowledge and understanding in ordinary differential equations, vector calculus and complex variables.
2. Students will be able to solve problems related to above fields in engineering applications.

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**COURSE OBJECTIVES:**
At the end of the course the students would be exposed to fundamental knowledge in various materials and applications
- Application of lasers and fiber optics in engineering and technology.
- Astrophysics is the study of physics of the universe. In various objects, such as stars, planets and galaxies.
- To measure positions, brightness, spectra structure of gas clouds, planets, starts, galaxies, globular clusters, quasars etc.
- Physics of modern engineering materials.
- Electromagnetic phenomena and wave propagation
- Applications of nano materials, nano electronics and optoelectronic devices.
- Design of energy sources and applications of solar energy.

**UNIT I: Laser and Fiber Optics**
Fiber optics - Principle and propagation of light in optical fibers - Numerical aperture and acceptance angle - Types of optical fibers (Material, Mode and refractive index) - Applications - Fiber Optic communication system.

**UNIT II: Dielectrics and Superconductors**

**UNIT III: Nano Materials**
UNIT IV: Quantum Mechanics


The wave Equation, Schrödinger’s Time dependent wave equation, Schrödinger’s time independent wave equation - The Wave function and its physical significance - The particle in a box – energy quantization – Eigen values and Eigen functions.

UNITY: Energy Physics


TEXT BOOKS:

REFERENCE BOOKS:
COURSE OUTCOMES:
1. The student will have the theoretical knowledge in this field of laser, dielectrics, Nano technique, energy physics etc.
2. It will be very useful to the students to apply in different field of engineering.

COURSE OBJECTIVES:
To make the students to understand the
- Types of polymers and polymerization processes.
- Phase rule with different kinds of systems.
- Different types of corrosion and their mechanism.
- Working principle and applications of primary and secondary batteries.
- Engineering materials such as refractories and abrasives.

UNIT I: POLYMERS

UNIT II: PHASE RULE

UNIT III: CORROSION AND PREVENTION

UNIT IV: ENERGY STORAGE DEVICES

UNIT V: ENGINEERING MATERIALS II
TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
At the end of the course, the student will be able to
1. Understand the synthesis and applications of various types of polymers and moulding processes.
2. Understand the concept of phase rule and its applications, which is applicable in alloy preparation.
3. Understand the concept of corrosion and to apply the knowledge in the protection of different metals from corrosion.
4. Gain the knowledge about various energy storage devices, especially solar energy.
5. Have the knowledge of converting solar energy into most needy electrical energy efficiently and economically to reduce the environmental pollution.
6. Gain knowledge on classification, synthesis and applications of abrasives and refractories.

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COURSE OBJECTIVES:
- To inculcate a knowledge on essentials of Civil Engineering
- To expose the students on the role, significance and contributions of Civil Engineering in satisfying societal needs
- To illustrate the concepts of various construction techniques

UNIT I
Introduction to Civil Engineering - various disciplines of Civil Engineering, relevance of Civil Engineering in the overall infrastructural development of the country. Introduction to various building materials – Stone, Bricks, Steel, Cement, Concrete, Timber – its characteristics, types and uses. Various types of buildings as per nbc; Selection of suitable site for buildings, Components of a residential building – its functions, Orientation of a building, simple definitions - plinth area / built up area, floor area / carpet area – floor space index.
UNIT II
 Surveying - Principles and objectives of surveying; Types, Classifications of surveying, measurement of areas and distances – chain – compass: Introduction to Leveling, Total station, Remote sensing - fundamental principles and applications.


UNIT III

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
1. Understand the basic knowledge on civil engineering materials
2. Develops the skill to satisfy the social needs
3. Describe the suitable method of construction technique

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<th>00ES204</th>
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COURSE OBJECTIVES:
- To impart the basic principles of generation of electrical energy.
- To explain the operation of electrical machines and various measuring instruments.
- To understand the basic concepts of circuit analysis.
- To provide an overview of the principles, operation and application of semiconductor devices like diodes, BJT, FET and a basic knowledge of fundamentals of Communication Systems.

UNIT I
 Sources of Electrical energy–Generation of electrical energy – working principles of DC generators and alternators– Advantages of electrical energy over other forms of Energy. Operating principle of DC motors– Types of DC motors– Characteristics and uses of

Working principles of MC and MI voltmeters and Ammeters, Dynamo meter type wattmeter, Induction type energy meter and Multimeter–types of wiring– requirements for house wiring–typical layout for a small house– earthing.

UNIT II

DC Circuits: Definition of current, voltage, power and energy– DC voltage and current sources– resistance, types of resistors, series and parallel connections of resistors, current and voltage division–loop method of analysis of simple circuits.

AC Circuits: Sinusoidal signals – average, r.m.s values –inductance, capacitance and their V–I relationships. Analysis of simple single phase series circuits– power and power factor–phasor diagrams– Introductions to three phase AC circuits.

UNIT III

Basic Electronics: Principle and characteristics, uses of PN junction Diode, Zenerdiode, BJT, FET, UJT, Thyristors.- Operating principle of Half wave, Full wave and Bridge rectifiers.


TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
After the completion of the course, the student should be able to
1. Provide comprehensive idea about simple circuit analysis, working principles of machines and common measuring instruments
2. Analyze the behavior of any dc and ac circuits
3. Characterize semiconductor devices that include diodes, BJT and digital functions.
4. Understand fundamental principles of communication systems
COURSE OBJECTIVES:
- To familiarize the students the functioning of different types of Boilers, the mountings and accessories.
- To provide basic knowledge about the use of various machine tools and the basic principles of welding, brazing and soldering.
- To illustrate the concepts of various metal forming operations and metal joining techniques.

UNIT I
Boilers: Classification – Description and working of Simple vertical boiler, Cochran boiler, Babcock and Wilcox boiler - Description and working of boiler mountings: water level indicator, Pressure gauge, Dead weight and Spring loaded Safety value, Fusible plug, Feed check value, Steam stop value and Blow-off cock - Description and working of boiler accessories: Economiser and Super heater.

UNIT II

UNIT III
Machine Tools: Description of parts and operations performed – Lathe, Shaper and Drilling machine.
Metal Forming: Hot working versus cold working; Hand forging – Principle and operations; Rolling – Principle, rolling mill configurations; Extrusion – Direct versus indirect extrusion.

TEXT BOOKS:

REFERENCE BOOKS:
COURSE OUTCOMES:
1. Understand the construction and working principles of boiler operations
2. Distinguish between steam turbines and gas turbines.
3. Select suitable manufacturing methods to produce a new component.

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<th>00HS205</th>
<th>COMMUNICATION SKILLS AND LANGUAGE LABORATORY</th>
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COURSE OBJECTIVES:
- The Language Lab focuses on the production and practices of sounds of language
- The Language Lab familiarizes the students with the use of English in everyday situations and contexts.

Theoretical Session (Internal Assessment only)
1. English sound pattern
2. Sounds of English
3. Pronunciation
4. Stress and Intonation
5. Situational Dialogues/ Role play
6. Oral presentations- Prepared or Extempore
7. ‘Just a Minute’ sessions (JAM)
8. Describing Objects /situations/ people
9. Debate
10. Giving Directions

Practical Session
- To make the students recognize the sounds of English through Audio Visual Aids
- To enable the students speak fluently without fear
- To develop their communicative skill with individual practice through the prescribed package
- The Globarena Package consists of the following exercises
  1. Reading comprehension
  2. Listening comprehension
  3. Vocabulary exercises
  4. Phonetics
  5. Role Play in dialogues
  6. Auto Speak

References:
1. Globarena Package for communicative English
2. Cambridge Advanced Learner’s English Dictionary
3. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
8. English Skills for Technical Students, WBSCTE with British Council, OL.

Distribution and Weightage of Marks:

English Language Laboratory Practical Paper:
1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 40 sessional marks and 60 year-end Examination marks. The year-end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.

COURSE OUTCOMES:
1. Help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such as GRE, TOEFL, GMAT, etc.
2. Train the students to use language effectively to face interviews, group discussions, and public speaking.
3. Initiate the students into greater use of the computer in resume preparation, report writing, format-making, etc.

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COURSE OBJECTIVES:
The ability to offer students a variety of research opportunities
- To determine the radius of curvature of the plano convex lens and the wavelength of the sodium light by measuring the diameter of Newton’s rings.
- We can use a spectrometer to measure this angle of deviation.
- To measure the modulus of elastic material by torsional pendulum and bending of a beam.
- To determine the resistivity of a given steel and brass wire.
- To find the velocity of ultrasonic waves in a liquid.
- Less viscosity of the liquid by poiseuille’s method.

List of Experiments (Any Ten)
1. Non-Uniform Bending - Determination of Young’s modulus of the given scale or beam.
2. Newton’s rings- Determination of Radius of curvature of the given Plano convex lens.
4. Spectrometer – Dispersive power of a given prism.
5. Torsional Pendulum – Determination of Moment of Inertia of the metallic disc and Rigidity Modulus of the material of a wire.
6. Field along the axis of a coil- Determination of horizontal earth magnetic flux density.
7. Air wedge – Determination of thickness of a given thin wire and paper.
8. Viscosity - Determination of co-efficient of Viscosity of a less viscous liquid by Capillary flow method
9. Uniform bending– Determination of Young’s modulus of the given scale or beam.
10. Spectrometer – Determination of wavelength of the prominent spectral lines using Grating.

**COURSE OUTCOMES:**
This course
1. To determine resistivity of a given steel and brass wire.
2. To find the velocity of ultrasonic waves in a liquid.
3. To measure the thickness of a thin materials.
4. To determine the band gap of a given semiconductor.
5. Diffraction patterns can be formed by light passing through a series of fine lines
6. Applications of opto electronic devices

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**COURSE OBJECTIVES:**
- To appreciate the practical significance of acidimetry, alkalimetry and permanganometry
- To analyse quantitatively the amount of a substance present in a given sample.
- To assess the composition of an alloy
- To test the water quality standards.

**LIST OF EXPERIMENTS**
1. Estimation of Potassium hydroxide
2. Estimation of Acetic acid in vinegar
3. Estimation of Temporary hardness of water sample
4. Estimation of Total hardness of water sample
5. Estimate separate amount of sodium carbonate and sodium hydroxide in a mixture.
6. Estimation of Ferrous sulphate
7. Estimation of Mohr’s salt
8. Estimation of ferrous iron
9. Estimation of Oxalic acid
10. Determination of available free chlorine in a water sample.
11. Estimation of copper in brass by iodometry
12. Estimation of iron by dichrometry
13. Estimation of nickel in an alloy

**COURSE OUTCOMES:**
At the end of the course, the student will be able to
1. Gain knowledge in the quantitative chemical analysis of water quality related parameters, acid-base, red-ox and iodometry titrations.
COURSE OBJECTIVES:

- To provide the students simple hands-on-experience in the basic aspects of production engineering in fitting, carpentry and sheet metal.

Workshop Practice in the Shops,

Carpentry: Use of hand tools – exercises in planning and making joints namely, half lap joint, dovetail joint, mortising and tenoning.

Fitting: Use of bench tools, vice, hammers, chisels, files, hacksaw, centre punch, twist drill, taps and dies – Simple exercises in making T joint and dovetail joints.

Sheet Metal Work: Use of hand tools – Simple exercises in making objects like cone, funnel, tray, cylinder.

Smithy: Demonstration of hand forging and drop forging.

COURSE OUTCOMES:

This course

1. Use basic tools of fitting, carpentry and sheet metal fabrication.
2. Experience in the fabrication of simple carpentry joints.
3. Develop skill to make simple fitting joints.
4. Train to make simple shapes of sheet material.
5. Distinguish hand forging and drop forging operation.
DEPARTMENT OF MANUFACTURING ENGINEERING

VISION
To prepare students to be life-long learners and global citizens with successful careers in design, research, development, and management of systems in manufacturing and service organizations

MISSION
• A curriculum and educational experience designed and continuously improved through involvement and contribution of students, faculty, administrators, staff, and industry
• A well-focused research program funded at the local, regional, and national level
• A demonstrated competence and expertise in addressing the needs of industry and community at large

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)
1. The graduates acquire ability to create model, design, synthesize and analyze essential production operational skills, mechanism and automation system.
2. The graduates use their talent, self-confidence, knowledge and engineering practice which facilitate them to presume position of scientific and/or managerial leadership in their career paths.
3. The graduates apply their consciousness of moral, professional responsibilities and motivation to practice life-long learning in a team work environment.

B.E. Mechanical Engineering (Manufacturing)

PROGRAM OUTCOMES (PO)

Upon Completion of the four years of the Bachelor of Mechanical Engineering (Manufacturing) Degree,

PO1: INTEGRATION OF KNOWLEDGE
Graduate will demonstrate strong basics in mathematics, science, engineering and technology which serve as the foundation for the Programme.

PO2: PROBLEM ANALYSIS
Graduate will demonstrate the ability to design and conduct experiments, as well as to analyze and interpret data in the spheres of fundamental engineering.
PO3: DESIGN AND DEVELOPMENT OF SOLUTIONS
Graduate will demonstrate the ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability.

PO4: USE OF MODERN TOOLS AND TECHNIQUES
Graduate will become familiar with modern engineering tools and analyse the problems within the domains of Manufacturing Technology as the members of multidisciplinary teams.

PO5: COLLABORATIVE AND MULTIDISCIPLINARY APPROACH
Graduate will acquire the capability to identify, formulate and solve engineering problems related to manufacturing engineering in interdisciplinary and multidisciplinary sciences.

PO6: ETHICAL PRACTICES AND SOCIAL RESPONSIBILITIES
Graduate will demonstrate an understanding of professional and ethical responsibility with reference to their career in the field of manufacturing engineering.

PO7: COMMUNICATION SKILLS
Graduate interact with engineering community and with society at large, regarding intricate engineering activities on technical perspectives and emerge as an efficient motivator. He will be able to communicate effectively both in verbal and non verbal forms.

PO8: PROJECT MANAGEMENT
Graduate will be able to design and develop innovative / manufacturable / marketable/ environmental friendly products useful to the society and nation at large. Graduate will be able to manage any organization well and will be able to emerge as a successful entrepreneur.

PO9: LIFE LONG LEARNING
Graduate will be capable of understanding the value for life long learning, in the context of technological challenges.

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PE-PROFESSIONAL ELECTIVES

1. Mechanics of Materials
2. Electrical & Electronics Engineering
3. Machine Tool Control
4. Tool Engineering
5. Design of Machine Elements
6. Machine Tool Design
7. Non Traditional Manufacturing Processes
8. Advanced manufacturing processes
9. Surface Engineering
10. Non Destructive Testing

PE-LAB

1. CAD/CAM Lab
2. Mechatronics and CNC Lab
3. Hydraulics Lab
4. Computing and Simulation Lab

OE-OPEN ELECTIVES

1. Fluid Mechanics & Machinery
2. Mechatronics for Automation
3. Computer Aided Product Design
4. Total Quality Management
5. Engineering Economics
6. Sensors and Control Systems in Manufacturing
7. Automotive Engineering
8. Biology for Engineers
9. Disaster Management
10. Entrepreneurship
11. National Service Scheme
12. Human Rights
UNIT I

Introduction - Multidisciplinary nature of environmental studies - Definition, scope and importance - Need for public awareness.

Natural resources - Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT II

Concept of an ecosystem - Structure and function of an ecosystem - Producers, consumers and decomposers - Energy flow in the ecosystem - Ecological succession - Food chains, food webs and ecological - pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT III


UNIT IV

Definition - Cause, effects and control measures of Air pollution - Water pollution - Soil pollution - Marine pollution - Noise pollution - Thermal pollution - Nuclear hazards - Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Disaster management: floods, earthquake, cyclone and landslides. Sustainable development - Urban problems related to energy - Water conservation, rain water harvesting, and watershed management - Resettlement and rehabilitation of people; its problems and concerns. - Environmental ethics: Issues and possible solutions - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust.

UNIT V


Field work:

Visit to a local area to document environmental assets river / forest / grassland / hill / mountain - Visit to a local polluted site - Urban / Rural / Industrial / Agricultural - Study of common plants, insects, birds - Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

TEXT BOOKS:

2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)

REFERENCE BOOKS:

2. Clark R.S., Marine Pollution, Claderson Press Oxford (TB)
5. Down to Earth, Centre for Science and Environment (R)
7. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
16. Survey of the Environment, The Hindu (M)
COURSE OBJECTIVES:
- The students will be trained on the basics of chosen topics of mathematics, namely, partial differential equations, Fourier series, Boundary value problems, Fourier transform and Z-transform.
- The above topics introduced in this course will serve as basic tools for specialized studies in engineering.

UNIT I - Partial Differential Equations

UNIT II - Fourier Series
Dirichlet’s conditions - General Fourier series - Odd and Even functions - Half range sine series - Half range cosine series - Complex form of Fourier series – Parseval’s identity.

UNIT III - Boundary value problems
Solutions of one dimensional wave equation – One dimensional heat equation (without derivation) – Fourier series solutions in Cartesian co-ordinates.

UNIT IV - Fourier Transform
Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem - Parseval’s identity

UNIT V – Z-Transform and difference equations

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
1. Students would acquire basic understanding of the most common partial differential equations and to learn some methods of solving them
2. Students would acquire basic understanding of the Fourier series, Fourier transform and Z-transform and to learn some methods of solving them.
3. The students should be able to solve some boundary value problems.
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**00ES303** | **ENGINEERING MECHANICS** | **L** | **T** | **P** |
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**COURSE OBJECTIVES:**
- To introduce the fundamentals of forces and their effects with their governing laws.
- To understand the definitions of particle, body forces and their equilibrium conditions.
- To understand and predict the forces and its related motions.

**UNIT I - STATICs OF PARTICLES**
- Introduction-Units and Dimensions-Laws of Mechanics-Lami’s Theorem-
  Parallelogram, Triangular and Polygon Law of Forces-Classification of Forces-Vectorial Representation of Forces-Planar Forces-Resolution of Forces.
- Equilibrium of Particle-Vector representation of Space Force-Equilibrium of Particle in Space-Equivalent System of Forces-Principle of Transmissibility.

**UNIT II - EQUILIBRIUM OF RIGID BODIES**

**UNIT III - GEOMETRICAL PROPERTIES OF SURFACES AND SOLIDS**
- Centroid and Centre of Gravity-Determination of Centroid of Sections of Different Geometry- Centre of Gravity of a Body-Area Moment of Inertia-Parallel Axis Theorem-Perpendicular Axis Theorem-Determination of Moment of Inertias of Rectangular, Triangular, Circular and Semi-circular- Moment of Inertias of structural Steel Sections of Standard and Composite Sections.
  - Polar Moment of Inertia-Radius of Gyration-Principal Moment of Inertia-Mass Moment of Inertia- Determination of Mass Moment of Inertia of a Thin Rectangular Plate, Thin Circular Disc, Solid Cylinder, Prism, Sphere and Cone from first principles.

**UNIT IV - DYNAMICS OF PARTICLES**
- Introduction-Kinematics and Kinetics-Displacements, Velocity and Acceleration-Equations of Motion-Types of Motion-Rectilinear Motion-Relative Motion-Curvilinear Motion-Projectiles.
UNIT V - FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS

Rolling Resistance-Translation and Rotation of Rigid Bodies-Velocity and Acceleration-General Plane Motion of Simple Rigid Bodies such as Cylinder, Disc/Wheel and Sphere.

TEXT BOOKS:

REFERENCE BOOKS:
5. Vela Murali, Engineering mechanics

COURSE OUTCOME:
Students can able
1. To explain the forces and its related laws of mechanics in static and dynamic conditions.
2. To analyse the forces and its motions on particles, rigid bodies and structures.
3. To solve the moment of inertia of any sections and masses for the structural members.

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COURSE OBJECTIVES:
To impart fundamental knowledge on the structure of Engineering Materials,
- To impart knowledge about characteristics of polymer, ceramic and metal matrix composite materials.
- To impart knowledge about magnetic characteristics of engineering materials

UNIT I
Unit cell, Crystal systems, BCC, FCC & HCP structures, Crystallographic planes & direction, Miller indices, Crystal imperfections - point, line & area defects. Constitution of alloys, compounds & solid solutions, Gibbs phase rule, lever rule.

UNIT II

UNIT III

UNIT IV

UNIT V

TEXT BOOKS:

REFERENCE BOOKS:
**COURSE OUTCOMES:**
Upon completing this course, students should be able to:
1. Understand the basic structures of Engineering materials
2. Impart fundamental knowledge about Polymer composites;
3. Use Bio degradable materials for the future will keep the environment clean
4. Implement Fiber based composites results in high industrial productivity

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**04PC305  MACHINE TOOL TECHNOLOGY**

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**COURSE OBJECTIVES:**
- To understand the different types and functions of metal cutting machine tools.
- To provide in depth knowledge about various machine tools and operating procedures.
- To illustrate different mechanisms used in metal cutting machines.
- To understand the basic concepts of computer numerical control (CNC) machine tool and CNC programming.

**UNIT I**
Lathe: Specifications of centre lathe - operations performed - accessories and attachments - principle of capstan and turret lathes - layout of tools.
Shaper, Planner and slotter: General arrangement - principle of operation - drive mechanisms.

**UNIT II**
Milling machine: Types - specification - operations - types of cutters - attachments and accessories - examples of work.
Drilling and Boring: Types - specification of drilling machines - operations - accessories and attachments - types of boring machines - jig boring.
Sawing: Power saws - types and principle of operation.

**UNIT III**

**UNIT IV**
UNIT V


TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Know the different types of operations with necessary tools.
2. Understand the mechanisms and their settings involved in appropriate machine tool.
3. Differentiate single point and multi point cutting tools and machines.
4. Obtain knowledge about advanced machine tools.
5. Gain and apply the knowledge of CNC machines and programming
COURSE OBJECTIVES:
- To understand the basic principles of measurements
- To introduce the various methods of measuring mechanical parameters
- To learn about advancements in measurement and automation

UNIT I - Concept of Measurement
General concept - Generalised measurement system - Units and standards - Measuring instruments: sensitivity, stability, range, accuracy and precision - static and dynamic response - repeatability - systematic and random errors - correction, calibration - Introduction to Dimensional and Geometric Tolerancing - interchangeability.

UNIT II - Linear And Angular Measurement

UNIT III - Form Measurement

UNIT IV - Measurement of Mechanical Parameters

UNIT V - Laser And Advances in Metrology
TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Understand the basics of measurements and know various linear, angular, form measuring equipments- their principle of operation and applications.
2. Select appropriate measuring instrument for a required mechanical parameter to a specific application.
3. Know about modern measuring equipments for a production industry.

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COURSE OBJECTIVES:
- To train the students about the operation of basic electrical machines.
- To explain the students about the operation of simple electronic circuits.

LIST OF EXPERIMENTS:
1. Load test on DC shunt motor.
2. Speed control of DC shunt motor.
3. Load test on single phase transformer.
4. Load test on three phase transformer.
5. Load test on single phase induction motor.
7. Half wave and full wave rectifiers with capacitor filter.

COURSE OUTCOMES:
1. Acquire the characteristics of simple electronic circuits.
2. Develop the skill to operate simple electrical machines.
3. Obtain the characteristic curves of electric machines.
4. Experience the speed control methods of motors.
COURSE OBJECTIVES:
- To study the components of I.C. engines, boilers, steam turbines and steam engines.
- To provide practical training on governors, flywheel, cam and follower, balancing and vibration.

LIST OF EXPERIMENTS:
1. Study and valve timing on four stroke diesel engine.
2. Study and port timing on two stroke petrol engine.
3. Load test on four stroke diesel engine.
4. Performance test on air compressor.
5. Experimental verification of natural frequency in natural vibration of single rotor system.
6. Determine the characteristic curves of watt/ Hartnell governors.
7. Determination of mass moment of inertia of connecting rod and fly wheel.
8. Studies on cam and follower mechanism.

COURSE OUTCOMES:
Upon completion of this practical class, the students will be able to:
1. Understand the various types of engines and dynamometers working principle.
2. Know the dismantling and assembling procedure for four stroke CI engines.
3. Understand the concepts of displacement, velocity and acceleration as vectors and how to determine them.
4. Ability to analyze particle dynamics.
5. Ability to make a right decision related to a choice of the system of particles whose motion is to be studied.
SEMESTER - IV

04BS401 PROBABILITY, RANDOM PROCESSES AND NUMERICAL METHODS

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4 0 0

COURSE OBJECTIVES:
- To introduce the probability, random processes, and statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.
- To develop the skills of the students in numerical mathematics - using method of finite difference interpolation,
- Finding numerical solution of algebraic and transcendental equations.
- Finding numerical solution of ordinary and partial differential equations.

UNIT I - Probability and Random Variables
Definition – Types of random variables - probability distribution function - probability density function – expectation and moments – moment generating functions – joint probability distribution - marginal probability distribution function – joint probability density function – marginal probability density function – conditional probability density function.

UNIT II - Random Processes

UNIT III - Test of Significance
Hypothesis, testing – Large sampling tests – small sampling test based on t, F and chi-square distributions – interval estimates of mean, standard deviation and proportion.

UNIT IV - Interpolation, Numerical differentiation and Integration
Interpolation: Gregory Newton forward and backward interpolation formula; Stirling’s central difference formula; Lagrange’s interpolation formula for unequal interval.
Numerical differentiation: Using Newton’s forward and backward interpolation formula.
Numerical integration: Trapezoidal rule, Simpson’s one-third and three-eight rules.

UNIT V - Solution of algebraic, transcendental and ordinary differential equations

TEXT BOOKS:
REFERENCE BOOKS:

COURSE OUTCOMES:
At the end of the course, the students would:
1. Understand the concept of algebraic and transcendental equations
2. Acquire skills in handling situations involving random variables, random processes
3. Solve problems for engineers in using numerical methods.

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04ES402 THERMODYNAMICS L T P 4 0 0

COURSE OBJECTIVES:
- To understand the basic concepts and laws of thermodynamics.
- In depth knowledge of topics in thermal engineering like internal combustion engines, air compressors, steam turbines, refrigeration and air conditioning, and modes of air heat transfer.

UNIT I
Thermodynamics - Definition - heat and work - open system and closed system - state, property and change of state of a system - properties of vapor - internal energy - entropy, dryness fraction - Calorimeter for determination of dryness fraction.

UNIT II

UNIT III
Air compressors: Reciprocating air compressor - single and multistage compression - inter cooling - calculation of main dimensions - Effect of clearance volume - Volumetric efficiency.
UNIT IV
Steam Cycles Rankine cycle with reheating and regenerating, feed heating, steam turbines - details - compounding of turbine - velocity diagram - blade efficiency - reaction turbine - height of blade and diameter of drum.

UNIT V
Heat transfer Primary modes of heat transfer - basic laws of conduction, convection and radiation - simple problems - refrigeration and air-conditioning - General principles of refrigeration - C.O.P calculations of psychometric chart - air conditioning methods. (Use of Steam tables, Mollier chart and Psychrometric chart are permitted)

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completion of this course, the students will be able to understand:
1. Fundamental concepts and definitions, Thermodynamic principles to Engineering Applications.
2. To study the fundamentals properties of steam, gas and gas mixtures.
3. Functioning and performance of IC engines.
4. Principles of refrigeration and air conditioning.
5. Modes of heat transfer and basic laws.

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04PC403 INDUSTRIAL MANAGEMENT

COURSE OBJECTIVES:
- To introduce the students to different functional areas of industrial management including engineering economics and Organizational behaviour.
UNIT I - Engineering Economics


UNIT II - Organizational Behaviour


UNIT III - Elements of Management

Principles of management - Functions of management - Scientific management: Contributions of Taylor, Gilberth, Gantt - Forms of business organisation - line, functional, line and staff organisations - Industrial ownership: single, partnership, joint stock company, co-operative organisations, state and central government owned.

Costing

Objectives - Elements of costs - estimation of selling price, Allocation of overheads - Introduction to activity based costing.

UNIT IV

Break-even analysis - concept and applications - Depreciation - straight line and declining balance method. – Value analysis – Procedure. Supply Chain management – basic concepts – Analytic hierarchy process.

UNIT V


TEXT BOOKS:
REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Recognise the factors such as demand and production for pricing criteria
2. Understand and learn the effective interpersonal, team building and leadership skills
3. Improved the organizational performance through the effective management of human resources
4. Practice the process of management's four functions: planning, organizing, leading, and controlling
5. Differentiate between the various types of organizational structures and patterns

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COURSE OBJECTIVES:
- To impart fundamental knowledge on the structure, properties, heat treatment, testing and applications of metals and alloys.
- To introduce the concept of powder metallurgy and different type of corrosion.

UNIT I
Constitution of alloys, compounds & solid solutions, Gibbs phase rule, lever rule - Diffusion in Solids, Fick’s laws – Solidification, Nucleation and grain growth - constitutional supercooling, formation of dendrites - Directional solidification, Micro segregation, Macro segregation, Porosity and inclusions - Metallography - metallurgical microscope - preparation of specimen, micro & macro examination. Grain size ASTM grain size number, grain size measurement.
UNIT II  
Phases diagrams, isomorphous, eutectic, peritectic, eutectoid and peritectoid reactions,  
Iron - Carbon equilibrium diagram - Classification of steel - Plain carbon steels - effect of  
C, Mn, Si, P & S. Purpose of alloying, effect of important alloying elements. - Important  
low alloy steels, stainless steel, tool steels - types, compositions and applications ; Cast  
iron - types, composition and applications.

UNIT III  
Heat treatment of steel: Isothermal transformation diagram - Time Temperature  
Transformation Diagram, Continuous cooling transformation diagrams, full annealing, stress  
relief annealing, spheroidizing, normalizing, Hardenability and Jominy end quench test-  
Austempering and martempering - case hardening, carburising, nitriding, cyaniding, and  
carbon nitriding, flame hardening, induction hardening, vacuum hardening and cryogenic  
treatment- Precipitation and Age hardening

UNIT IV  
Non ferrous metals: Physical, Mechanical, Metallurgical properties of Aluminum  
alloys, Magnesium alloys, Copper alloys, Nickel alloys and Titanium alloys – Classification  
of these alloys and applications.  
Powder metallurgy : Process fundamentals, production of metal powders,  
characteristics, powder blending, compacting, Sintering, applications  
Corrosion - Factors influencing corrosion, pitting corrosion, cavitation corrosion, cervice  
corrosion, fretting corrosion, inter - granular corrosion - corrosion prevention.

UNIT V  
Mechanical behaviour of materials: Tensile behaviour; engineering stress,  
engineering strain, true stress, true strain, Stress – strain curve, Yield point phenomenon,  
strain aging. Impact behaviour: Charpy and Izod impact testing, DBT curve. Hardness:  
Brinell hardness, Rockwell hardness, micro hardness testing; Fatigue behaviour: Stress  
cycles, S-N curves, fatigue crack initiation, fatigue crack propagation; Creep behaviour: creep  
curve, creep mechanisms, deformation mechanism maps.

TEXT BOOKS:  
   Co., 2008.  
   2015.

REFERENCE BOOKS:  
2. Rollason, E.C., ”Metallurgy for Engineers”, Butterworth-Heinemann Ltd, 4th Revised  
3. Williams, D., “Material Science and Engineering”, Callister Wiley India Pvt. Ltd,  
   IBH, NewDelhi, 1983.  
   ELBS., 1993.
COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Understand the correlation between structure and properties of metals and alloys;
2. Select the appropriate alloys for specific applications;
3. Design heat treatment methods for specific applications;
4. Protect the metals and alloys from environmental degradation;
5. Evaluate the mechanical properties of materials by modern tools and equipments.

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COURSE OBJECTIVES:
- Apply knowledge of materials to prescribe appropriate welding process for specific applications;
- Model and simulate welding processes to conduct experiments and analyze the performance using modern tools;
- Understand the environmental issues related to each welding methods and try to develop ‘green welding’ methods.

UNIT I
Basics of arc welding processes - Classification of welding and allied Processes - Welding arc: physics involved in arc, structure and characteristics, arc efficiency calculation, methods of arc initiation and maintenance, arc stability, arc blow - V-I characteristics, constant current and constant voltage characteristics, duty cycle, simple problems,
Arc Welding Power Sources: welding transformers, generators, rectifiers, inverters; Classsification of electrodes - Metal Transfer: forces affecting metals transfer - modes of metal transfer.

UNIT II
Arc welding processes-Basic principles, Process variables, Chief characteristics and applications of the following processes: Shielded(Manual) Metal Arc Welding (SMAW/MMAW) - Submerged Arc Welding (SAW), Gas Tungsten Arc Welding (GTAW), Gas Metal Arc Welding (GMAW), CO₂ welding, Flux cored Arc Welding (FCAW), Electro Slag and Electro Gas Welding - Atomic Hydrogen Welding.
UNIT III
Resistance welding processes Basic principle, Process variables, Welding Sequence, Process characteristics and applications of the following processes: Spot welding, simple problems - Seam welding - Projection welding - Percussion welding - Resistance Butt welding - Flash Butt welding - High Frequency Resistance Welding (HFRW) and High Frequency Induction Welding (HFIW)

UNIT IV

UNIT V

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Understand the physics behind welding arc and heat flow equations;
2. Distinguish between fusion welding processes and solid state welding processes;
3. Select appropriate welding process for joining specific materials;
4. Inspect welding defects using Non-destructive testing methods;
5. Understand the environmental issues and safety requirements for each processes.
COURSE OBJECTIVES:

- To know the Metal Cutting Process.
- To know the basic concepts of temperature developed during machining.
- To understand Tool Materials, Tool Life and Tool Wear.

UNIT I

Tool Materials: HSS, Carbide and coated tools, CBN, Ceramic and PCD. Tool geometry - single point cutting tool and multi point cutting tool - Tool signature-Tool designation: ASM, DIN, British standards and their relationships.

UNIT II

Metal Cutting Process: Chip formation - Types of chips - chip breakers- Chip thickness ratio, radius of chip curvature, cutting speed, feed and depth of cut –Theories of formation of built-up edge and their effect - Chip formation in drilling and milling.

UNIT III

Introduction to Orthogonal and Oblique cutting processes- The force system- Velocity relationship- forces in turning and milling- Relationship between forces, speed, feed and depth of cut- - Forces and energy calculations (Merchant’s Analysis) Single Point Cutting Tool: Various systems of specifications, single point cutting tool geometry and their inter-relation.

UNIT IV

Tool Life and Tool Wear: Theories of tool wear – adhesion, abrasive and diffusion wear mechanisms, forms of wear, Tool life criteria and machinability index. Effect of machining parameter on tool wear- measurement techniques for tool wear- Tool economics- basic concepts- simple problem

UNIT V

Thermal Aspects of Machining and Cutting Fluid: Regions of heat generation; Heat In the Primary Shear Zone, Heat at the Tool/work Interface, Heat Flow at the Tool Clearance Face, Average shear plane temperature; Average chip-tool interface temperature; method of tool temperature measurement, temperature distribution in tool, Cutting Fluid: Types and composition of cutting fluids, selection of cutting fluid.
TEXT BOOKS:

REFERENCES BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Analyze the Tool Life and Tool Wear.
2. Understand basic concept of tools and tool materials.
3. Distinguish between Orthogonal and Oblique cutting.
4. Understand the concepts of thermal aspects of machining.

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04CP407  MACHINE DRAWING  L  T  P
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COURSE OBJECTIVES:
• To provide basic understanding of machine drawing.
• To study the provide assembly and disassembly drawings of bearings, screw jack ect.

UNIT I - Free Hand Sketches:
Fasteners: Different form of rivet heads – Single, double riveted lap and butt joints - Foundation bolts - Locking arrangements for nuts - lock nut, split pin, locking plate and spring washer - Stud Set screws – Different forms of machine screws - pan, countersunk, slotted and philip headed screws - Keys - sunk taper key, gib headed taper key, feather key, woodruff key, saddle key.

UNIT II - Orthographic and assembly drawings:
To draw orthographic views from the given isometric views of simple objects. Detailed assembly drawing and additional views from the given drawing.
(a) Shaft coupling - Protected type and Pin type flexible coupling
(b) Bearings and Supports - Bushed bearing, Foot step bearing and Plummer Block
(c) Eccentric
(d) Steam engine stuffing box
(e) Screw jack.
TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. An Ability to understand and apply the knowledge of machine drawing as a system of communication in which ideas are expressed clearly and all information fully conveyed.
2. An ability to understand the design a system, component or process to meet desired needs within, realistic constraints such as manufacturability, economic, environmental, safety & sustainability etc., to represent a part drawing and assembly drawings.
3. Recognition of the need for and an ability to engage in self education and life-long learning.

Mapping with Programme Outcomes

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04CP408
STRENGTH OF MATERIALS LABORATORY
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COURSE OBJECTIVES:
• To impart practical training on simple machines like screw jack, worm wheel, etc.,
• To understand the theoretical and practical aspects of elasticity and plasticity of the materials through a variety of experiments

LIST OF EXPERIMENTS:
1. Simple Machines - screw jack, worm and wheel, differential wheel and Axle, Handlowinch
2. Material Testing - Tension, compression and shear tests on different materials
3. Bending and deflection test on beams
4. Hardness, impact and ductility tests on metals
5. Torsion tests on rods, springs and fatigue tests (Demonstration only)
**COURSE OUTCOMES:**
Upon completion of the course the students will be able to

1. Analyze and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials.
2. Utilize appropriate materials in design considering engineering properties, sustainability, cost and weight.
3. Perform engineering work in accordance with ethical and economic constraints related to the design of structures and machine parts.

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**COURSE OBJECTIVES:**
- To understand the different types of mechanism.
- To provide in depth knowledge about power loss in different types of bearings and clutches.
- To draw the turning moment diagram of reciprocating engines.
- To illustrate the different types of problem in balancing and vibration of rotating masses
- To introduce as a tool for static and dynamic analysis of mechanisms for use in design and engineering

**UNIT I**

**UNIT II**

**UNIT III**
UNIT IV
Balancing - static and dynamic balancing - Balancing of rotating masses, balancing of reciprocating masses – introduction to primary and secondary balancing.

UNIT V
Vibrations: Damped and forced oscillations of single degree freedom systems – example - torsional oscillations of two rotor systems - whirling of shafts.

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Know the different types of links and pairs in the kinematic chain.
2. Understand the power loss in friction for different types of clutches and bearings.
3. Obtain knowledge about the turning moment diagram for reciprocating engines.
4. Know the different types of balancing and vibration of static and dynamic system.

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COURSE OBJECTIVES:
- To impart basic knowledge to the students on the applications of industrial engineering.
- To provide basic knowledge about the plant, maintenance and work measurement and accessories
- To provide an understanding of the traditional approaches for managing operations

UNIT I - Plant Location
Locational objectives - Factors influencing locational choice - Locational models - Dimensional analysis, breakeven model, qualitative factor rating method, Brown - Gibson model.

UNIT II - Plant Layout
Need for layout planning - Layout objectives and determinants - Types of layout - Process, product, fixed position, group layout - Comparison - Layout selection for process
layouts - Simple graphic approach, travel chart, load - distance analysis, Muthur - grid technique - computer based layout planning - CRAFT (Description only of algorithm and flowchart) - Line layouts for product layouts - Line balancing methods - Largest candidate rule, Kilbridge and Wester method - COMSOAL (Description of the algorithm only).

UNIT III - Work Study

UNIT IV - Purchasing
Purchasing functions - Single versus multiple sourcing - Vendor performance rating - Methods - categorical plans, cost - ratio plan, weight point plan - Make - or - buy decisions - Learning curve - concepts and applications - Stores management - functions - Methods of pricing - FIFO, LIFO - Stores layout and location system - Classification and codification of materials in stores.

UNIT V - Maintenance
Objectives - Forms of maintenance - Preventive, breakdown and corrective - Preventive and breakdown maintenance costs - spare parts planning - maintenance, insurance and capital spares.

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Understand the applications of Industrial Engineering.
2. Understand the need of maintenance in industry.
3. Understand the importance of plant location and layout.

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COURSE OBJECTIVES:
- To impart about the sand casting process and its importance.
- The basic phenomena involved in metal casting process, gating and risering system.
- To introduce Modern casting methods

UNIT I
Sand: Moulding Sands- Properties- Additives used, Control of Moulding Sands.
Moulding -Types of Moulding- Moulding Processes, Instruments used for different methods.
Pattern: Types of Pattern - Pattern Materials - Pattern Allowances- Pattern Making Machinery. Core: Purpose of Cores- Preparation of Cores- Core Materials and Additions- Core Dressing, Effect on Castings- Location and Fixing.

UNIT II
Melting: Melting Furnaces- Ferrous and Non-Ferrous Metals- Charging Operation in Cupola- Dissolved Gases in Molten Metal, Degassing Methods- Analysis and Composition of the Metal Ladle- Fluxes, Effect of Inoculation.

UNIT III

UNIT IV
Foundry Mechanisation: Moulding- Core Making Sand Conditioning- Removal of Moulds- Pouring Methods- Shake out- Core Cleaning, Fettling, and Handling

UNIT V

TEXT BOOKS:

REFERENCE BOOKS:
COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Understand the basic features and terminologies in casting process, gating, reserving system and their design aspects, the basics in solidification or the casting formation.
2. To obtain knowledge in the advanced casting process
3. Study the types of defects occurred in casting and provide remedial solutions.

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COURSE OBJECTIVES:
- To familiarize the basic concepts of CAD / CAM / CIM
- To introduce the various aspects of automated manufacturing
- To introduce the fundamentals of materials handling and storage system and robotics
- To introduce the concepts of automated assembly and control system

UNIT I - Introduction

UNIT II - Automated Production Systems and Material Handling & Storage System

UNIT III - Robotics
UNIT IV - Group Technology & Flexible Manufacturing System


UNIT V - Automated Assembly, Computer Process Control and Shop Floor Control


TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:

Upon completing this course, students should be able to:
1. Provide engineering knowledge on the importance of CAD / CAM / CIM
2. Understand the various aspects of automated manufacturing
3. Provide knowledge on the concepts of automated assembly and control system
4. Understand the usage of modern materials handling and storage system and industrial robots

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COURSE OBJECTIVES:
- To provide hands-on experience on the use of metal working machines and on preparing various types of moulds.

LIST OF EXPERIMENTS:

**FOUNDRY SHOP**
1. Face Plate (Solid Pattern)
2. Hexagonal Nut (Self Core solid Pattern)
3. Lathe Saddle (Loose Piece Pattern)
4. Oil Cup (Self Core solid Pattern)
5. Ball Handle (Split Pattern)
6. Pipe Flange (Split Pattern)
7. Pulley (Split Pattern)
8. Gear wheel (Solid Pattern)

**MACHINE SHOP**
1. Plain Turing
2. Step Turing
3. Taper Turing
4. Thread Cutting (Internal & External)
5. Knurling

**WOOD TURNING PRACTICE**
1. Coat Stand
2. File Handle
3. Form Turning

COURSE OUTCOMES:
Upon the completion of this course, students would be able to
1. Handle metal working machines like lathe and shaper
2. Prepare green sand moulds for any given component

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COURSE OBJECTIVES:
- To educate the students on the handling and use of precision measuring instruments used during the manufacturing processes.

LIST OF EXPERIMENTS:
1. Checking the straightness of straight edge
2. Calibration of a dial gauge
3. Measurement of internal diameter (4 balls)
4. Calibration of micrometer
5. Measurement of internal taper
6. Measurement of external taper (Sine Bar and Roller)
7. Calibration of plain plug gauge
8. Measurement of external radius and internal radius
9. Inspection of screw thread
10. Lathe tool dynamometer
11. Power measurement in a lathe
12. Gear inspection
13. Checking the flatness of surface plate
14. Process capability
15. Estimation of cutting forces by merchant’s theory
16. Study of spindle speed structure
17. Alignment test on lathe
18. Grinding tool dynamometer
19. Electric discharge machining

COURSE OUTCOMES:
Upon the completion of this course, students would be able to
1. Understand the usage of many precision instruments and their respective handling methods.
2. Learn to calibrate the precision instruments.

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COURSE OBJECTIVES:

- To provide an understanding of the modern approaches to manage the operations,
- To present a broad conceptual framework for the management of the operations function in an organization

UNIT I
Production and operation management – Evolution and objectives - Concept of Production system - Types of Production systems – Continuous, Intermittent -Elements of Production planning and control, concept of Productivity - Production versus Services. Aggregate planning: Costs, Strategies – Application of chase and level strategies and Transportation model - Simple problems.

UNIT II

UNIT III
Inventory planning and control: Need, inventory costs, Determination of EOQ, EPQ/ELS (without shortages) - Effect of quantity discounts. Determination of ROL, Safety Stocks - Methods of calculating safety stock using Normal - single period inventory model, Inventory control systems - P, Q, and S-s System.

UNIT IV
Materials Requirements Planning (MRP) - Master Production Schedule (MPS), Bill of Materials (BOM), MRP concept, Lot sizing: Lot-for-lot technique, EOQ approach, Periodic order quantity approach – Illustrative Examples.

UNIT V
Operations scheduling and sequencing: Notations and definitions - Job shop scheduling: sequencing of n jobs through one machine - Priority decision rules – Measures of Performance - n jobs through 2 machines - Jackson’s rule. Flow shop scheduling: sequencing of n jobs through 2, 3 machines, Johnson's rule. n jobs through m machines - CDS algorithm.

TEXT BOOKS:
REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Develop an understanding of various types of production systems
2. Differentiate Production and services
3. Gain an understanding and appreciation of the principles and applications relevant to the planning, design, and operations of manufacturing/service firms
4. Develop the ability to identify operational methodologies to assess and improve an organizations performance
5. Gain ability to recognize situations in a production system environment that suggests the use of certain quantitative methods to assist in decision making in the areas such as Aggregate planning, Inventory control, forecasting MRP and scheduling

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04PC602 METAL FORMING PROCESSES

COURSE OBJECTIVES:
- To familiarize the students the types of stress, in two and three dimensional.
- To provide basic knowledge of secondary processes and condition for manufacturing defect free end-product.
- To illustrate the concepts of various advanced metal forming processes.

UNIT I
State of stress in two dimensions – two and three dimensions - Principal stresses, Stress deviator, Vonmises criteria, yield criteria. Comparison of yield criteria, Forming load calculation - Fundamentals of Metal working: Flow curve, Relationship between true stress and true strain, Temperature in metal forming, hot cold and warm working – residual stresses.

UNIT II
Forging: Types of Process & hammers defects & remedies. Forging classification, open die forging, Closed die forging - calculations of forging loads, Defects - causes - remedies.
Rolling: Rolling of blooms billet, Slab & Sheet, types of rolling mills – hot and cold rolling - forces & geometrical relationship in rolling, Analysis of rolling load, torque & power, defects - causes and remedies.

UNIT III
Drawing of rods, wires & tubes : Simple analysis of wire tube drawing . residual stress is rod, wire & tubes .
Extrusion – classification – hot and cold extrusion – deformation, lubrication - simple analysis of extrusion process - hydrostatic extrusion - tube extrusion, production of seamless pipes and tubes - extrusion defects causes and remedies

UNIT IV

UNIT V
High Speed Forming: Basic principle, process variables, Characteristics and application of the following processes: Electro hydraulic forming, electromagnetic forming, explosive forming, fuel combustion process, water hammer forming. Comparison between conventional forming and high speed forming.

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Understand the stresses and component of stresses
2. Expertise different forming process to manufacture near net- shape product
3. Impart basic knowledge on various high speed forming processes
Mapping with Programme Outcomes

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COURSE OBJECTIVES:
- To educate the importance of metallurgical aspects of ferrous and non-ferrous metals and learn the influence of various process parameters during material processing methods.

LIST OF EXPERIMENTS:
1. Effect of section size on hardness
2. Effect of quenching media on hardness
3. Jominy hardenability test
4. Microscopic examination of a metallic specimen and determination of grain size
5. Estimation of creep rate of a given specimen
6. Characteristics of moulding sand
7. Formability of sheet metals by water hammer technique
8. Rolling of metal strips
9. Disc compression test
10. Study on basic weld joints
11. Comparative evaluation of welding performance of arc welding power sources
12. Effect of heat input on bead geometry
13. Effect of electrode polarity on tig welding performance
14. Temperature measurement in arc welding process

COURSE OUTCOMES:
Upon the completion of this course, students would
1. Have practical knowledge about the metallurgical aspects of ferrous and non-ferrous metals
2. Understand the parameters that influencing various material processing methods.
COURSE OBJECTIVES:
- To train the students to make use of finite element analysis software for various applications in the field of manufacturing engineering.

LIST OF EXPERIMENTS:
1. Study on Basic FEA, Nodes, Elements, Boundary Conditions.
2. One Dimensional FEA Problem.
   a. Truss structure analysis.
   b. Cantilever analysis.
3. Two Dimensional FEA Problems.
   a. Plane stress analysis.
   b. Temperature distribution analysis.
   c. Axisymmetric analysis.
   d. Contact element analysis.
4. Non-linear FEA Problem
   a. Nonlinear Beam analysis.
   b. Geometrical nonlinear analysis.
   c. Material nonlinear analysis.
5. Three Dimensional FEA Problems.
   a. 3D Shell Analysis.
   b. 3D Analysis.
6. FEA Application in metal forming, metal cutting, fluid flow process etc.

COURSE OUTCOMES:
Upon successful completion of the course, the students are able to
1. Perform finite element modeling analysis of solid mechanics
2. Perform finite element modeling analysis of heat transfer problems, shell and contact problems in 2D and 3D.

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Mapping with Programme Outcomes
COURSE OBJECTIVES:
- To understand the moral and ethical dimensions in engineering.
- To take balanced decisions.

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V

TEXT BOOKS:

REFERENCE BOOKS:

**COURSE OUTCOMES:**
Upon successful completion of the course, the students are able to
1. Understand the relationship between the engineer and the society.
2. Learn the importance of codes in engineering practice.
3. Acquire knowledge on the legal, moral and ethical aspects in engineering.

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COURSE OBJECTIVES:

- To introduce students the use of quantitative methods and techniques for effective decisions-making.
- To provide an understanding of the systematic approach to solve decision making problems.
- To enhance the decision-making skills through the application of appropriate models.

UNIT I

Linear programming - graphical method - Simplex method - Big M method - Applications – Problems.

UNIT II


UNIT III

Waiting line Problems - cost of waiting and cost of providing service - single channel - single stage type of problems - Monte Carlo simulation for queue problems.


UNIT IV

PERT and CPM - basic steps - rules for constructing the network - Fulkerson's rule - time estimates - PERT calculations - probability of meeting the time schedule - time - cost trade off (crashing) - difference between PERT and CPM – applications.

UNIT V

Decision Theory - Decision making under risk condition - expected value criteria - Decision trees - Decision making under uncertain conditions - Minimax, maximin, maximax, Hurwitz regret criteria.
TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon successful completion of the course, the students are able to
1. Impart the basic characteristics of different types of decision-making environments.
2. Enhances the student’s ability to build and solve various operations research models.
3. Expertise to select appropriate decision making models for the real life problems.

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COURSE OBJECTIVES:
- To provide hands-on experience to the students on the handling various metal machining machine tools used on the shop floor.

LIST OF EXPERIMENTS:
1. Plain milling
2. Spur gear milling
3. Helical gear milling
4. Key way machining on a slotter
5. Convex profile machining on a slotter
6. T-slot milling
7. Keyway machining using a shaper
8. External dovetail machining on a shaper
9. Internal dovetail machining on a shaper
10. Straight tooth clutch milling (3/4 dogs)
11. Flute milling
12. Pantograph milling
13. Study of Single-spindle automatic lathe
14. Study of capstan lathe and turret lathe
15. Study of gear hobbing machine
16. Study of cylindrical grinding machine
17. Study of surface grinding machine

COURSE OUTCOMES:
Upon successful completion of the course, the students are able to
1. Handle various types of metal machining machines available on the shop floor.

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04PV803 PROJECT WORK AND VIVA-VOCE

COURSE OBJECTIVES:
- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
- Take up any challenging practical problems and find solution
- Learn to adopt systematic and step-by-step problem solving methodology

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04PEXXXX MECHANICS OF MATERIALS

COURSE OBJECTIVES:
- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams, twisting bars or combinations of both.
- To study the effect of component dimensions and shape on stresses and deformations are to be understood.
- The study would provide knowledge for use in the design courses

UNIT I
Define of stress – types of stresses: Direct stress (Tensile and compressive), Bending stress, Shear stress, temperature stress, composite stress – Strains: Linear strain, lateral strain, volumetric strain, temperature strains- Hook’s Law- modulus of elasticity- Axial rigidity-

UNIT II


UNIT III


UNIT IV

Torsion-Theory of pure torsion in circular shafts-Variation of shear stress distribution across the solid (Circular), Hollow (Circular), and thin walled sections-saint venant’s torsion- warping torsion- Torque transmitted in circular and hollows shaft Spring-stiffness-linear stiffness and rotary stiffness-types: Helical (Open coiled, close coiled) and leaf spring uses – spring in series and – spring in parallel – load versus deformation ship-spring deflections. Stiffness and shear stress. – Automobile springs

UNIT V


TEXT BOOKS:

REFERENCE BOOKS:
COURSE OUTCOMES:
Upon completion of the course, the student to
1. Develop knowledge on identifying loads, stress, strain and their effects
2. Critically analyses components like beams and twisting bars
3. Understand theories on columns and springs
4. Employ all the knowledge gained in designing of machine components.

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04PEXXX ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE OBJECTIVES:
- To explain the operating principle of DC motors, Transformers, AC induction and synchronous motors.
- To introduce the basic theory of various semiconductor devices and their applications.
- To illustrate the usage of transistorized circuits in different applications including amplifiers and oscillators.

UNIT I - DC Motors

UNIT II - Transformers

UNIT III - Induction and Synchronous Motors

UNIT IV - Electronic Devices
P-N junction – characteristics and uses of semi conductor devices: diode, photo diode, zener diode, BJT, FET, UJT and SCR – half wave, full wave and bridge rectifier circuits – filters – zener voltage regulators.
UNIT V - Amplifiers and Oscillators

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
1. Understand the DC and AC motor operation.
2. Explore the operation and application transformers.
3. Establish the working of semiconductor devices.
4. Suggest the applicability of transistors for amplifiers and oscillators.

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COURSE OBJECTIVES:
- To understand the working principle of hydraulic and pneumatic components and their selection
- To explore the use of different sensors, control valves, controllers and actuators for electro-pneumatic & hydraulic circuits
- To provide a knowledge of trouble shooting and design of hydraulic and pneumatic circuits for different applications

UNIT I - Fluid Power Principles and Hydraulic Pumps
UNIT II - Hydraulic Valves and Accessories
Hydraulic motors Control Components: Direction control, Flow control and Pressure control valves- Types, unloading - sequence valves, counter balance valves - Construction and Operation.
Accessories: Accumulators, Reservoirs, Filters- Fluid Power - ANSI Symbols.

UNIT III - Hydraulic Circuits
Speed control circuits - Accumulator circuits - Regenerative - Pressure Intensifier, Sequence, Reciprocation, Synchronization circuits – Mechanical Hydraulic servo systems.

UNIT IV - Pneumatic Systems
Properties of air– Pneumatic control - Principles - Pneumatic valves - compressors- Filter, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust valves, Pneumatic actuators- cascading system of circuit design.
Introduction to Fluidics: Fluidic control - Logic Elements - Amplifiers - Logic circuits.

UNIT V - Trouble Shooting and Applications

TEXT BOOKS:

REFERENCES BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to
1. Understand the concept and working of hydraulic and pneumatics components
2. Gain ability to design hydraulic and pneumatics circuits
3. Understand the benefits and applications of hydraulics and pneumatics systems
4. Trouble Shoot and provide remedies of hydraulics and pneumatics systems
**Mapping with Programme Outcomes**

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**COURSE OBJECTIVES:**

- To introduce different production tools, including press tools, their design.
- To provide an understanding of design and use of jigs and fixtures.

**UNIT I**


**UNIT II**


**UNIT III**


**UNIT IV**

Elements of Jigs and Fixture – Locating and clamping principles. Locating method and devices – Clamping devices. Types of Jigs: Plate, Template, Latch, Channel Leaf, Box and Indexing.

**UNIT V**


**TEXT BOOKS:**

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to
1. Develop an understanding of the cutting tool nomenclatures
2. Develop and design of progressive and compound dies for simple sheet metal operations
3. Calculate bending force, number of draw for the required cup shape, blank size for forged components.
4. Understand the modern techniques of tool engineering and the various phases in computer aided fixture design
5. Acquire knowledge about the plastic tool materials and development methods

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COURSE OBJECTIVES:
- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components

UNIT I
Introduction: Types of Design factors. Factor of safety , Theories of failure - Curved beam, crane hook and C frames.
Design for fatigue strength: S-N diagram - Endurance limit modifying factors - Stress concentration - Fluctuation stress – Soderberg & Good Man equations

UNIT II
Thin cylinders – Stresses in thin cylindrical shell due to internal pressure – circumferential and longitudinal stresses and deformation in thin cylinders Design of mechanical elements: Shafts – Design for static load – bending and torsion – Equivalent twisting moment. Coupling - Types - Design and selection of coupling - Flange coupling, Bushed pin type, flexible coupling design and selection
UNIT III
Theory of columns: Design of push rod, piston rod and I.C. Engine connecting rods sections.
Wire ropes - Stresses - selection Design procedure-leaf springs - construction equalized stresses in leaves - material and design. Open and closed coiled helical springs stress - Wahl's factor

UNIT IV
Power screws - Thread forms Design consideration and materials - wear and shear - design procedure. Threaded fasteners – Bolted joints – simple and eccentrically loaded bolted joints

UNIT V
Welded joints: Introduction - Strength of transverse and parallel fillet welded joints - Axially loaded unsymmetrical welded sections - Eccentrically loaded welded joints

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to
1. To understand the functions of various machine elements and assemblies
2. To design various machine components according to the requirement as per the prescribed standards
3. To apply the knowledge of materials and their properties
4. To use standard design data book

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Mapping with Programme Outcomes
COURSE OBJECTIVES:

- To introduce the various drive systems used in machine tools
- To understand the basic design aspects of various of machine tool components and structures

UNIT I & II

Various driving systems for machine tools - Stepper motors - Use of preferred numbers in machine tools - Stepped drives - Graphical representation of speed - structural and ray diagrams - Optimum ray diagram - Ruppert drive - Feed gear boxes - Norton ssdrive - Meander drive. Various stepless regulation systems - principles of self aligning - methods of increasing the range of regulation in modern machine tools

UNIT III


UNIT IV

Machine tool beds - types - constructional and design features - Design of column of drilling and milling Machine - Stiffeners and ribs arrangement.

UNIT V


TEXT BOOKS:


REFERENCE BOOKS:


COURSE OUTCOMES:

Upon completing this course, students should be able to:

1. Develop an understanding of the various drive systems of machine tools
2. Develop an understanding of the constructional and design features of machine beds, columns and guideways
3. Develop and design power screws
Mapping with Programme Outcomes

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04PEXXX | NON-TRADITIONAL MANUFACTURING PROCESSES | L | T | P
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COURSE OBJECTIVES:
- To introduce the fundamentals of Non-Traditional Manufacturing Processes and their methods, applications advantages and disadvantages
- To introduce the concept of nano technology and rapid prototyping

UNIT I
Overview of non-traditional manufacturing – classification of processes under source of energy, transfer media and mechanism
Electric Discharge Machining (EDM): Principles – equipment – power supply, dielectric system, electrodes – process parameters – applications
Wire Electric Discharge Machining (WEDM): Principles – equipment – power supply, dielectric system, electrodes – process parameters – applications

UNIT II

UNIT III
Chemical machining (CHM): Principles – equipment – masks, etchants – process parameters – applications

UNIT IV
Electron Beam Machining (EBM): Principles – equipment – EB gun – power supply – process parameters – applications
Laser Beam Machining (LBM): Principles – equipment – power supply – process parameters – applications

UNIT V

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Distinguish between Traditional and Non-Traditional Manufacturing Processes.
2. Provide better knowledge on the concepts Non-Traditional Manufacturing Processes.
3. Understand the basic principles of nano technology and rapid proto typing.

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04PEXXX ADVANCED MANUFACTURING PROCESSES L 4 T 0 P 0

COURSE OBJECTIVES:
- To acquaint the students with recent developments in modern casting and welding processes.
- To introduce students to the scientific principles underlying material behaviour during manufacturing processes.
- To make students aware of the necessity to manage manufacturing processes and systems for the best use of material.

UNIT I
Advanced casting processes - plaster mold and ceramic mold casting – vacuum casting – Evaporative pattern casting, ceramic shell investment casting, slush casting, squeeze casting and semisolid metal forming-Rapid solidification for Amorphous alloys.
UNIT II
Advanced welding processes: Basic principle, Process variables, Chief characteristics and applications of the following processes: Laser beam welding, Electron beam welding, Plasma arc welding, Friction stir welding, Explosive welding, Ultrasonic welding and diffusion welding.

UNIT III

UNIT IV

UNIT V

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. The student will be able to understand the latest processes in the field of Manufacturing Technology.
2. An understanding of Powder metallurgy processes, Welding processes, Processes for plastics will be applied in the industry.
3. Realize the need and place for rapid prototyping approach.
4. Ability to develop a project on design and product development, considering advanced production technologies.
COURSE OBJECTIVES:
This course will enable the student
- To familiarize the basic concepts of Surface Engineering and Tribology
- To introduce the various aspects of wear, its mechanism and control.
- To introduce the fundamentals of various surface modification processes.
- To introduce the concepts of thick film and thin film coatings.

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Provide engineering knowledge on the importance of methods of Surface Engineering
2. Understand the various aspects of thick film coatings and thin film coatings for manufacturing products
3. Provide better knowledge on the concepts on surface characterization.
4. Understand the usage of implementation on testing of coatings and inspection of surface on surface engineering.

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04PEXXX | NON DESTRUCTIVE TESTING |
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COURSE OBJECTIVES:
- To introduce the various aspects of destructive testing and Non destructive testing
- To introduce the fundamentals of advanced materials testing methods

UNIT I - Liquid Penetrant and Magnetic Particle Inspection

UNIT II - Radiography

UNIT III - Eddy Current Inspection
UNIT IV - Ultrasonic Testing
Production of ultrasonic waves – Different types of waves-Normal beam inspection – Angle beam inspection-Thickness measurements –Applications.

UNIT V - Recent Techniques
Principle of acoustic emission- Instrumentation for Non destructive testing- Principles of holography-Applications of holographic techniques Non destructive inspection-Advantages and limitations- Other techniques.

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. To provide better understanding of the principles of various Non destructive testing methods
2. To impart knowledge on the advantages and disadvantages of the processes
3. Able to select appropriate NDT method for testing of defects

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04EPXXX CAD / CAM LABORATORY L T P
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COURSE OBJECTIVES:
• To impart hands on experience to students in Geometric Modeling, Assembly and Engineering Drafting.
• To introduce the concepts of CNC programming and simulation on CNC turning, CNC Milling machines

LIST OF EXPERIMENTS:
1. SKETCHER
   Introduction- Basic sketch, Constraints – Geometry & Dimensional.

2. SOLID MODELING
   Extrude, Revolve, Sweep, Loft, Datum plane creation etc
3. SURFACE MODELING  
Extrude & Revolve surfacing, Advance surfacing technique – Ruled & Loft surfacing, Mesh of curves, Free form surfaces, Surface operations – trim, merge, intersect, etc.

4. FEATURE MANIPULATION  
Copy, Edit, Pattern, Suppress, History operations etc

5. ASSEMBLY  
Constraints, Patterns, Exploded views, Interference check, creating components from assembly, mass property calculations, and assembly cut sections.

6. DRAFTING  
Standard view, Sectional views and Detailing.

COURSE OUTCOMES:  
Upon successful completion of the course, the students are able to  
1. Gain practical experience in handling 2D drafting and 3D modeling using modeling software systems.  
2. Understand and apply the concepts G and M codes and manual part programming of turning and milling processes

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04EPXXX | MECHATRONICS AND CNC LABORATORY | L | T | P |
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COURSE OBJECTIVES:  
- To provide some hand on experience in the use of hydraulic & pneumatic components.  
- To formulate simple circuits which enable the students to understand the concept of mechatronics.

LIST OF EXPERIMENTS:  
1. Study of various pneumatic and electro-pneumatic components.  
2. Study of pneumatic and electro-pneumatic symbols, circuits.  
4. Study of characteristics of sensors.  
5. Study of image processing technique.  
6. Modelling and analysis of pneumatic and electrical circuits using FluidSim/P Software.  
7. Application on Pneumatics  
   a. Actuating a cylinder using Direction Control Valves  
   b. Actuating a cylinder using Non-Return Valves.  
   c. Actuating a cylinder using Flow Control Valves.  
   d. Actuating a cylinder using Pressure Control Valves.
e. Actuating a cylinder using Shut-off Valves.

8. Application on Electro Pneumatics
   a. Actuating a cylinder using Logic Functions
   b. Actuating a cylinder using 3/2, 5/2, Solenoid Valves
   c. Actuating a cylinder using Electrical Limit Switches
   d. Actuating a cylinder using Sensors, Pressure Control Valves

9. Application on Programming Logic Control (PLC)
   a. Actuating a cylinder using Logic Functions
   b. Actuating a cylinder using 3/2, 5/2, Solenoid Valves
   c. Actuating a cylinder using Electrical Limit Switches
   d. Actuating a cylinder using Sensors, Counters, Pressure Control Valves

COURSE OUTCOMES:
Upon successful completion of the course, the students are able to
1. Understand the functional aspects of different pneumatic and hydraulic components and its use in circuits.
2. Construct and demonstrate pneumatic, electro pneumatic and PLC circuits for various applications

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COURSE OBJECTIVES:
- To understand the properties of fluids and fluid statics, methods for determination of co-efficient of discharge.
- To study the characteristic features of pumps and turbines.
- To understand the significance and role of such utilities in their further course of study.

LIST OF EXPERIMENTS:
1. Determination of Co-efficient of discharge of Mouth Piece
2. Determination of Co-efficient of discharge of Venturimeter
3. Determination of Co-efficient of Head loss due to Sudden Change in Section
4. Determination of Co-efficient of Head loss due to Friction in Pipe
5. Determination of Co-efficient of discharge of Rectangular Notch
6. Study of Performance characteristics of Elmo Pump (Centrifugal Pump)
7. Study of Performance characteristics of Sump Pump (Centrifugal Pump)
8. Study of Performance characteristics of Submersible Pump (Centrifugal Pump)
9. Study of Performance characteristics of Gould’s Pump (Reciprocating Pump)
10. Study of Performance characteristics of Pelton Turbine (Constant Speed method)
11. Study of Performance characteristics of Francis Turbine (Constant Head method)
12. Determination of Metacentric Height of a floating vessel (Demo Only)
COURSE OUTCOMES:
After completion of this course, student will be able to:
1. Determine the properties of fluids, pressure and their measurements
2. Measure flow in pipes and determine frictional losses
3. Compute forces on immersed plane and curved plates applying continuity equation and energy equation in solving problems on flow through conduits
4. Develop Characteristics of pumps and turbines

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COURSE OBJECTIVES:
- To provide hands on experience in some basic mathematical and statistical operations using various softwares.

LIST OF EXPERIMENTS:
1. Simulation basics, dealing with matrices, Graphing- Functions of one variable and two variables.
2. Response of under damped single degree of freedom systems to initial excitations.
3. Response of single degree freedom to harmonic and pulse excitations.
4. 2D, 3D plots, Control Charts, Frequency response plots
5. Solving of Linear Algebraic Equations, Quadratic Function and Discrete Function
7. T-test
8. ANOVA
9. Correlation and Regression Analysis
10. Cluster Analysis, Factor Analysis
11. DOE - Response Surface Methodology

COURSE OUTCOMES:
Upon successful completion of the course, the students are able to
1. Perform mathematical calculation such a matrix, graphing and random generations using computer software
2. Perform some statistical analysis such DOE, ANOVA, Regression and correlation analysis using computer software
COURSE OBJECTIVES:

- To study the applications of the conservation laws to flow through pipes and hydraulic machines.
- To understand the importance of dimensional analysis.
- To understand the importance of various types of flow in pumps and turbines

UNIT I - Properties of Fluid

Introduction to fluid mechanics - Real and ideal fluids – Properties of fluid – Pressure in a fluid – Manometers — compressible and incompressible fluids – Pressure measurements — Hydrostatic forces on surfaces - Total pressure and Centre of pressure on different surfaces – Buoyancy and static stability – Metacentre.

UNIT II - Flow Characteristics

Types of flows and flow pattern (stream lines, stream tube, Path lines and streak line)– one dimensional flow analysis – General continuity equation – steady flow equation of continuity – Euler’s equation- Bernoulli’s equation and its applications.(Orifice meter, Venturimeter and pitot tube).

UNIT III - Boundary Layer Concept, Evaluation of Frictional Losses in Pipe and Dimensional Analysis

Boundary layer – laminar and turbulent flow separation – Transition- types of Boundary layer thickness – Flow through pipes- Weisbach equation and chezy’s for friction loss in pipe- Major and minor losses – Buckingham $\pi$ theorem – non – dimensional numbers – Reynolds number – Froude numbers, Weber number, Euler's number and Mach number.

UNIT IV - Turbines


UNIT V - Pumps

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Apply mathematical knowledge to predict the properties and characteristics of a fluid.
2. Critically analyse the performance of pumps and turbines.
3. Identify hydraulic component
4. Ability to design hydraulic circuits
5. Visualize how the hydraulic circuit will work to accomplish the function.

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COURSE OBJECTIVES:
- To provide basic knowledge about functioning of different control systems, the mechanical and electrical actuation systems.
- To familiarize the students the performance of different types of sensors and transducers, the principle of signal conditioning.
- To illustrate the concepts real time interfacing and advanced application and data acquisition and control systems of mechatronics in manufacturing.

UNIT I
UNIT II

UNIT III

UNIT IV

UNIT V

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Understand the construction and working principles mechatronics control systems, Electrical and Mechanical actuation systems.
2. Distinguish between sensors and Transducers.
3. Identify suitable mechatronics control system for manufacturing processes.
4. Develop new mechatronics control system for different manufacturing processes.
COURSE OBJECTIVES:
- To introduce the concepts and applications of CAD
- To introduce the various concepts and techniques used for Product design.
- To develop product design skills.

UNIT I
Introduction to Engineering Design – Various phases of systematic design – sequential engineering and concurrent engineering – Computer hardware & Peripherals – software packages for design and drafting.

UNIT II

UNIT III

UNIT IV

UNIT V

TEXT BOOKS:
REFERENCE BOOKS:
   McGraw Hill.

COURSE OUTCOMES:
1. Upon completing this course, students should be able to:
2. Understand fundamentals of 2D and 3D drawing.
3. Able to apply Geometric modeling principles of design.
4. Able to manage the product data and apply product life cycle management to
   Industrial Components.
5. Understand and apply the product modeling.

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COURSE OBJECTIVES:
- To provide an understanding of modern techniques and tools of quality
  management
- To impart the knowledge and on the application of the statistical quality control
  techniques which are used in manufacturing and service industries.
- To provide knowledge and understanding of the modern manufacturing strategies
  and to present a broad conceptual framework for the management of the
  operations function across the supply chain.

UNIT I
Concepts of TQM – Definition of quality – Dimensions of quality - Deming, Crosby
and Juran's philosophies – Barriers to TQM - Quality system – ISO 9000:2000 - ISO 14000 –
QS 9000 Quality system standards - Quality costs, Seven tools for Quality Control, Seven
tools for Quality management, Quality Function Deployment (QFD) - Taguchi Loss function.

UNIT II
Objectives of statistical quality control - inspection and its importance – Introduction
  to Single sampling plan – OC Curve - differences between inspection and quality control -
  Causes and types of variations - Theory of control charts, Control charts for attributes - p, np,
c and u charts.
UNIT III
Control charts for variables, X - R charts, standard deviation charts - Moving range chart. Relationship between statistical control limits and specification limits - modified control chart, process capability studies (Cp and Cpk) – concept of six sigma.

UNIT IV

UNIT V

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Understand the core features of the Total quality management in terms of various dimensions of quality.
2. Measure the cost of poor quality and process effectiveness and efficiency to track performance quality and to identify areas for improvement
3. Develop an understanding on quality management philosophies and frameworks
4. Develop the ability to apply the tools of quality control and quality management.
5. Understand proven methodologies to enhance management processes, such as benchmarking and business process reengineering, lean manufacturing.

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Mapping with Programme Outcomes
COURSE OBJECTIVES:
- To introduce the student to the cost implications of the various decisions that may have to be made in a manufacturing environment.

UNIT I
Basic concepts, terms, demand – supply relationship, Role of engineering economics in decision making, Interest calculation (simple & compound), cash (IN/OUT) flows.

UNIT II
Principle of money – Factors and their uses – single payment factors, uniform series present worth factor - capital recovery factor, sinking fund factor present worth, future worth and equivalent uniform annual worth calculation.

UNIT III
Application of money – time relationships: present worth, capitalized cost evaluation, equivalent uniform annual worth calculation, rate of return components for single projects, rate of return evaluation for multiple alternatives. Minimum attractive rate of return.

UNIT IV
Replacement strategies and Policies: Basic concepts of replacement analysis, economic service life, opportunity costs - cash flow approaches to replacement analysis - Replacement analysis using specified study period - probabilistic replacement models.

UNIT V

TEXT BOOKS:

REFERENCE BOOKS:
Mapping with Programme Outcomes

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04OEXXX  SENSORS AND CONTROL SYSTEMS IN MANUFACTURING  

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COURSE OBJECTIVES:
- To equip the students with concepts of sensor performance, product monitoring and control applications in robotics.
- To acquaint the student with the elements of CIM, FMS and the integration of manufacturing functions.
- To provide students with a sound understanding of the use of advance instrumentation and sensing methods.
- Understand the various components of sensor network architecture, networks in manufacturing and PLC.
- To provide an exposure to current trends in areas related to fiber optics in sensor and biomedical technology.

UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
Fiber Optics in Sensor and Control System- Fibre Optics Parameters, Configurations, Photo Electric Sensor for Long Distance, Sensor Alignment Techniques, Sensors for Biomedical Technology.
TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
Upon completing this course, students should be able to:
1. Learn the basics of sensor requirement in product monitoring.
2. Provide an introduction to condition monitoring procedures and system integration
3. Know about Identification of manufactured Components and applications in Robotics.
4. Provide understanding of the use of advanced instrumentation and sensing methods.

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03OEXXX AUTOMOTIVE ENGINEERING  L  T  P

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COURSE OBJECTIVES:
• To impart the knowledge about the engine chassis, transmission, steering, suspension systems, rear axles and final drive of Automobiles.
• To Study the concept of electrical system, sensors and fuel injection system in automobiles

UNIT I

UNIT II

UNIT III
Front axle and steering geometry - Principle of power steering - steering mechanism – Re-circulating ball mechanism - cam & double pin steering gear boxes - Camber angle, Caster angle, King pin inclination - Types of frames and suspension systems. Independent suspension - Rear suspension - Pneumatic suspension.
UNIT IV


UNIT V


TEXT BOOKS:

REFERENCE BOOKS:
5. Heitner, Automobile Engines.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Identify the different systems in an automobile
2. Understand different auxiliary, sensors, fuel injection and transmission systems in automobiles.

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COURSE OBJECTIVES:

- The course acts as a bridge between engineering and biology to provide basic understanding of biological mechanisms of living systems from engineering perspective.
- It will illustrate the many possible means to utilize living things’ relevance to engineering principles.
- With substantial knowledge and continuing interest will make a student into a specialist in the technical diversity.

UNIT I - Requirements of Biological Systems

Biological Units Need Water; Biological Units Need the Right Amount of Oxygen; Biological Units Need Food and Nutrients; Biological Units Become Ill in the Presence of Wastes; Biological Units Need Heat Sources and Sinks.

UNIT II - Behaviour of Biological Systems

Biological Units Adapt to Their Environments; Biological Units Modify Their Environments; Adaptations Require Extra Energy and Resources; Biological Units, If Possible, Move to Friendlier Environments; Biological Units Evolve under Environmental Pressures.

UNIT III - Response to Stress by Biological Systems

Crowding of Biological Units Produces Stress; Biological Units Are Affected by Chemical Stresses; Biological Units Respond to Mechanical Stresses; Optimization Is Used to Save Energy and Nutrient Resources; Biological Units Alter Themselves to Protect against Harsh Environments.

UNIT IV - Existence of Biological Systems

Biological Units Cooperate with Other Biological Units; Biological Units Compete with Other Biological Units; Biological Units Reproduce; Biological Units Coordinate Activities through Communication; Biological Units Maintain Stability with Exquisite Control; Biological Units Go through Natural Cycles; Biological Units Need Emotional Satisfaction and Intellectual Stimulation; Biological Units Die.

UNIT V - Scaling Factors and Biological Engineering Solutions

Allometric Relationships from Evolutionary Pressure; Dimensional Analysis; Golden Ratio; Fractal Scaling within an Organism; Self-Similarity for Tissues and Organs; Self-Similarity in Populations; Systems Approach; Relationships between Engineering and Biology; The Completed Design.

TEXT BOOKS:


REFERENCE BOOKS:

1. Aydin Tözeren, Stephen W. Byers, New Biology for Engineers and Computer Scientists, Pearson/Prentice Hall, 2004

COURSE OUTCOMES:
1. The ability to understand the information known about familiar living systems.
2. The ability to anticipate the properties of an unfamiliar group of living things from knowledge about a familiar group.
3. The ability to demonstrate the relevance of engineering to biological systems.
4. The knowledge about the biological responses and it is scaling with respect to scientific principles that cannot be related back.
5. The knowledge of biological principles and generalizations that can lead to useful products and processes.

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02OEXXX DISASTER MANAGEMENT  L T P
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COURSE OBJECTIVES:
- This course helps in providing the basic concepts of disasters and also gives a thorough knowledge and experience to reduce disaster risks.

UNIT I


UNIT II

Earthquake - Cause of Earthquake- General characteristics - Measuring Earthquakes - Distribution pattern of Earthquakes in India - Earthquake prone areas- case studies of important Indian earthquakes - Forecasting techniques and risk analysis - Possible risk reduction measures - earthquake resistance buildings and re-engineering techniques in India.
UNIT III

Tsunamis- Causes of a Tsunami- General Characteristics- Tsunami warning system-
Distribution pattern of Tsunami in India- Possible risk reduction measures- Integrated coastal
zone management.
Landslides- Rock falls- Avalanches- Mud flows and glaciers- Landslides and rock falls -
landslide hazard zonation- Instrumentation and monitoring- Techniques for reducing
landslide hazards.

UNIT IV

Tropical cyclones- Structure of tropical cyclones- Nature of tropical cyclones-
Cyclone experience in India and Tamilnadu- Preparedness- Tropical cyclones and their
warning systems- Tropical cyclone warning strategy in India special nature of the problem in
the region- Classification- Protection of buildings from cyclones of India- Precautions during
and before cyclones.

UNIT V

Coastal floods- Intensification of hazards due to human interference- Management-
River and coastal floods- Temperature extremes and wild fires- Physiological hazards- Flood
forecasting-mitigation- planning- management- flood prone areas the Indian scenario- Flood
experience in India and Tamilnadu.
Environmental hazards- Typology- Assessment and response- Strategies -The scale of
disaster-Vulnerability- Disaster trends- Paradigms towards a balanced view- Chemical
hazards and toxicology-Biological hazards- Risk analysis- Other technological disasters.

TEXT BOOKS:

REFERENCE BOOKS:

COURSE OUTCOMES:
1. Develop an understanding of the key concepts, definitions key perspectives of all Hazards Emergency Management
2. Develop a basic under understanding of Prevention, Mitigation, Preparedness, Response and Recovery
Mapping with Programme Outcomes

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**COURSE OBJECTIVES:**
- Develop an entrepreneurship spirit
- Help to identify business opportunities within an organization or independently
- Initiate action on the business plan from the prospective business through EDC

**UNIT I**

**UNIT II**

**UNIT III**
Meaning and nature of direction – Principles of directing – Leadership and leadership style – Motivation – Communication – Need and feedback in communication – Importance of communication – Channels of communication – Types of communication – Forms of communication.

**UNIT IV**
Evolution of concept of entrepreneur – Concept of entrepreneur – Characteristics of entrepreneur – Distinction between entrepreneur and manager – Technical entrepreneur – Charms of being an entrepreneur – Types of entrepreneur – Role of entrepreneurship in economic development – Barriers in entrepreneurship.

**UNIT V**

**TEXT BOOKS:**
REFERENCE BOOKS:
1. “Creativity, innovation, entrepreneurship and enterprise in construction and development”, University of Reading, Alan Barrell – Entrepreneur in Residence Entrepreneur in Residence, University of Xiamen, Xiamen 2012.

COURSE OUTCOMES:
At the end of this course the student should have,
1. An understanding about entrepreneurship.
2. Knowledge about the principles of business Plan.

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COURSE OBJECTIVES:
- Understand the community in which they work and their relation
- Identify the needs and problems of the community and involve them in problem-solving
- Develop capacity to meet emergencies and natural disasters
- Practice national integration and social harmony and
- Utilize their knowledge in finding practical solutions to individual and community problems.

UNIT I - NATIONAL SERVICE SCHEME
A. History and its Objectives
B. Organizational structure of N.S.S. at National, State, University and College Levels
C. Advisory committee and their functions with special reference to college principal, Programme officer, N.S.S. group leader and N.S.S. volunteers in the implementation.

UNIT II - NATIONAL INTEGRATION
A. Need of National integration
B. Various obstacles in the way of National Integration; such as caste, religion, language and provisional problems etc.

UNIT III - SPECIAL PROGRAMME
A. Legal awareness
B. Health awareness
C. First-aid
D. Career guidance
E. Leadership training - cum - Cultural Programme
UNIT IV - SPECIAL CAMPING PROGRAMME
A. Nature and its objectives
B. Selection of camp site and physical arrangement
C. Organization of N.S.S. camp through various committees and discipline in the camp.
D. Activities to be undertaken during the N.S.S. camp.
E. Use of the mass media in the N.S.S. activities.

UNIT V - N.S.S. REGULAR ACTIVITIES
A. Traffic regulation
B. Working with Police Commissioner's Office
C. Working with Corporation of Chennai
D. Working with Health Department
E. Blind assistance
F. Garments collection
G. Non-formal education
H. 'Environmental Education, Awareness and Training (EEAT)'
I. Blood donation

REFERENCE BOOKS:
2. Training Programme on National Programme scheme, TISS.
3. Orientation Courses for N.S.S. Programme officers, TISS.
4. Case material as Training Aid for field workers, Gurmeet Hans.
5. Social service opportunities in Hospitals, Kapil K. Krishan, TISS.

02EXXX | HUMAN RIGHTS | L | T | P
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COURSE OBJECTIVES:
- At the end of this course the student is expected to understand what is human rights, how to obey the rights, what is the role of a human being in making a good society for the future generations.

UNIT I

UNIT II

UNIT III
UNIT IV

UNIT V

TEXT BOOKS:

REFERENCE BOOKS:
2. Human Rights, Questions and Answers, UNESCO, 1982
3. Mausice Cranston- What is Human Rights
5. Human Rights, A Selected Bibliography, USIS.
6. Cheous K (Ed) - Social Justice and Human Rights (Vols 1-7).