PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

I. Be employed in jobs related to designing, modeling, analyzing and managing modern complex systems, implementing and improving systems in manufacturing sectors at local, regional, national and global levels.

II. Have engaged in life-long learning, such as graduate studies and research, certification from professional organizations, fundamentals of engineering certification, or active participation in professional societies/activities.

III. Demonstrate professional success as evidenced by, among others, increased job responsibilities and leadership role at the place of employment and in greater society

IV. Become product and process design professionals for sustainable manufacturing.

V. Become entrepreneurs in Design and Manufacturing Engineering sector.

PROGRAM OUTCOMES (POs)

PO GRADUATE ATTRIBUTE

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

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

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

4 Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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

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

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

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

9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

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

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

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

1. Engineering/Foundational Knowledge in mathematics, engineering sciences, applied probability, computer science, humanities, and social science.
2. Professional Skills to communicate in both oral and written forms and to be proficient in working in diverse teams of individuals.
4. Confidence in Engineering and professional skills.
5. Understanding of Professional and Ethical Behavior to be prepared for ethical decision making, service to the engineering profession, and have the means to continue in the acquisition of knowledge.

**PEO’s – PO’s & PSO’s MAPPING**:

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### ANNA UNIVERSITY, CHENNAI  
NON-AUTONOMOUS AFFILIATED COLLEGES  
REGULATIONS 2021  
CHOICE BASED CREDIT SYSTEM  
B. E. MANUFACTURING ENGINEERING  
CURRICULUM FOR SEMESTERS I TO VIII AND SYLLABI FOR SEMESTERS I TO IV  

#### SEMESTER I

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*Skill Based Course*

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$\text{°}$ NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.  

$\text{°}$ Skill Based Course
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§ Skill Based Course

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§ NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.
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**TOTAL**                                      | 24

*Two weeks Summer Internship carries one credit and it will be done during IV semester summer vacation and same will be evaluated in V semester.*

* Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC- I)

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#### PRACTICALS

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**TOTAL**                                      | 19

*Open Elective – I shall be chosen from the emerging technologies.*

* Mandatory Course-II is a Non-credit Course (Student shall select one course from the list given under MC- II)

* NCC Credit Course level 3 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA*
<table>
<thead>
<tr>
<th>S. No.</th>
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<th>Course Title</th>
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| PRACTICALS |             |                                      |          |                  |                       |         |
| 7.    | MF3711      | Additive Manufacturing Laboratory    | PCC      | 0 0 4            | 4                     | 2       |
| 8.    | MF3712      | Summer Internship*                   | EEC      | 0 0 0            | 0                     | 1       |
|       |             |                                       |          |                  |                       |         |
|       |             | TOTAL                                |          | 17 0 4           | 21                    | 20      |

#Two weeks Summer Internship carries one credit and it will be done during VI semester summer vacation and same will be evaluated in VII semester.

*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII.

**Open Elective – II shall be chosen from the emerging technologies.

***Open Elective III and IV (Shall be chosen from the list of open electives offered by other Programmes).

#Elective – management shall be chosen from the Elective – Management Courses

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Category</th>
<th>Periods per week</th>
<th>Total Contact Periods</th>
<th>Credits</th>
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*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII

TOTAL CREDITS: 166
## ELECTIVE – MANAGEMENT COURSES

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<thead>
<tr>
<th>SL. NO.</th>
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<th>COURSE TITLE</th>
<th>CATEGORY</th>
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<tr>
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<td>GE3751</td>
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## MANDATORY COURSES I

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<th>COURSE TITLE</th>
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<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
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<tbody>
<tr>
<td>1.</td>
<td>MX3081</td>
<td>Introduction to Women and Gender Studies</td>
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## MANDATORY COURSES II

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<tbody>
<tr>
<td>1.</td>
<td>MX3085</td>
<td>Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)</td>
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<td>History of Science and Technology in India</td>
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<td>4.</td>
<td>MX3088</td>
<td>State, Nation Building and Politics in India</td>
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**Registration of Professional Elective Courses from Verticals:**

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a particular area of specialisation / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2021, Clause 4.10.

<table>
<thead>
<tr>
<th>Vertical 1</th>
<th>Vertical 2</th>
<th>Vertical 3</th>
<th>Vertical 4</th>
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</thead>
<tbody>
<tr>
<td><strong>PRODUCT DESIGN AND DEVELOPMENT</strong></td>
<td><strong>TOOL ENGINEERING</strong></td>
<td><strong>QUALITY, MANAGEMENT AND PROCESS CONTROL</strong></td>
<td><strong>MANUFACTURING PROCESSES</strong></td>
</tr>
<tr>
<td>Design of Machine Elements</td>
<td>Design of Jigs and Fixtures</td>
<td>Non Destructive Testing and Evaluation</td>
<td>Unconventional Machining Processes</td>
</tr>
<tr>
<td>Design for Manufacture, assembly and Environments</td>
<td>Design of Press Tools</td>
<td>Reliability Engineering</td>
<td>Micro and Precision Engineering</td>
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<tr>
<td>Plastics Product Design</td>
<td>Design of Cutting Tools</td>
<td>Safety Engineering</td>
<td>Composite Materials and Processing</td>
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<tr>
<td>Reverse Engineering</td>
<td>Design of Tooling for Thermoplastics</td>
<td>Statistical Quality Control</td>
<td>Process Planning and Cost Estimation</td>
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<tr>
<td>Product Development Process</td>
<td>Design of Tooling for Die Casting</td>
<td>Engineering Management</td>
<td>Surface Engineering</td>
</tr>
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<td>Engineering Failure Analysis</td>
<td>Design of Tooling for Thermosets</td>
<td>Supply Chain Management</td>
<td>Plant and Machinery Maintenance</td>
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<tr>
<td>Applied design for industries</td>
<td>Design of Gauges</td>
<td>Operations Research</td>
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### PROFESSIONAL ELECTIVE COURSES: VERTICALS

**VERTICAL 1: PRODUCT DESIGN AND DEVELOPMENT**

<table>
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**VERTICAL 2: TOOL ENGINEERING**

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<tr>
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### VERTICAL 3: QUALITY, MANAGEMENT AND PROCESS CONTROL

<table>
<thead>
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<tr>
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### VERTICAL 4: MANUFACTURING PROCESSES

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**OPEN ELECTIVES**
(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories).

**OPEN ELECTIVE I AND II**  
(EMERGING TECHNOLOGIES)
To be offered other than Faculty of Information and Communication Engineering

<table>
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47. OEC354 Industrial IoT and Industry 4.0 OEC 2 0 2 4 3
48. OBM353 Wearable devices OEC 3 0 0 3 3
49. OBM354 Medical Informatics OEC 3 0 0 3 3
ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes. Moreover, for minor degree the student can register for courses from any one of the following verticals also.

Complete details are available in clause 4.10 of Regulations 2021.

VERTICALS FOR MINOR DEGREE
(In addition to all the verticals of other programmes)

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(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

**VERTICAL 1: FINTECH AND BLOCK CHAIN**

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<tr>
<td>1.</td>
<td>CMG331</td>
<td>Financial Management</td>
<td>PEC</td>
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<td>3.</td>
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<td>4.</td>
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<td>Introduction to Blockchain and its Applications</td>
<td>PEC</td>
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<td>5.</td>
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<td>6.</td>
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<td>Introduction to Fintech</td>
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**VERTICAL 2: ENTREPRENERUSHIP**

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<td>CMG338</td>
<td>Team Building and Leadership Management for Business</td>
<td>PEC</td>
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<td>3.</td>
<td>CMG339</td>
<td>Creativity and Innovation in Entrepreneurship</td>
<td>PEC</td>
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<td>Financing New Business Ventures</td>
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<td>Constitution of India</td>
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<td>Administrative Theories</td>
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<td>Indian Administrative System</td>
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<td>CMG348</td>
<td>Public Policy Administration</td>
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**VERTICAL 4: BUSINESS DATA ANALYTICS**

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<tr>
<td>1.</td>
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<td>Statistics for Management</td>
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<td>3.</td>
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<td>Human Resource Analytics</td>
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<td>4.</td>
<td>CMG352</td>
<td>Marketing and Social Media Web Analytics</td>
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<td>5.</td>
<td>CMG353</td>
<td>Operation and Supply Chain Analytics</td>
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<td>1.</td>
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<td>Sustainable infrastructure Development</td>
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<td>Sustainable Agriculture and Environmental Management</td>
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<td>CES333</td>
<td>Sustainable Bio Materials</td>
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<td>4.</td>
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<td>Materials for Energy Sustainability</td>
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<td>Green Technology</td>
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<td>6.</td>
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<td>Environmental Quality Monitoring and Analysis</td>
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<td>7.</td>
<td>CES337</td>
<td>Integrated Energy Planning for Sustainable Development</td>
<td>PEC</td>
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<td>8.</td>
<td>CES338</td>
<td>Energy Efficiency for Sustainable Development</td>
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This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. “

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.
(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/ Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:
Guide to Induction program from AICTE

HS3151 PROFESSIONAL ENGLISH - I

OBJECTIVES:
- To improve the communicative competence of learners
- To learn to use basic grammatic structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners’ ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C’s of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?
UNIT I  INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 8
Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Why/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II  NARRATION AND SUMMATION 9
Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III  DESCRIPTION OF A PROCESS / PRODUCT 9
Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV  CLASSIFICATION AND RECOMMENDATIONS 9
Reading – Newspaper articles; Journal reports –and Non Verbal Communication (tables, pie charts etc.). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal (chart, graph etc, to verbal mode) Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V  EXPRESSION 9
Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL : 45 PERIODS

LEARNING OUTCOMES :
At the end of the course, learners will be able
- To use appropriate words in a professional context
- To gain understanding of basic grammatic structures and use them in right context.
- To read and infer the denotative and connotative meanings of technical texts
- To write definitions, descriptions, narrations and essays on various topics

TEXT BOOKS :
1. English for Engineers & Technologists  Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021.  Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

ASSESSMENT PATTERN
Two internal assessments and an end semester examination to test students’ reading and writing skills along with their grammatical and lexical competence.
COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT - I                  MATRICES  9 + 3

UNIT - II                  DIFFERENTIAL CALCULUS  9 + 3

UNIT - III                  FUNCTIONS OF SEVERAL VARIABLES  9 + 3

UNIT - IV                  INTEGRAL CALCULUS  9 + 3
Definite and Indefinite integrals - Substitution rule - Techniques of Integration: Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications: Hydrostatic force and pressure, moments and centres of mass.

UNIT - V                  MULTIPLE INTEGRALS  9 + 3

COURSE OUTCOMES:

At the end of the course the students will be able to

- Use the matrix algebra methods for solving practical problems.
- Apply differential calculus tools in solving various application problems.
- Able to use differential calculus ideas on several variable functions.
- Apply different methods of integration in solving practical problems.
- Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXT BOOKS:

3. James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:

PH3151  ENGINEERING PHYSICS

COURSE OBJECTIVES
- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I  MECHANICS

UNIT II  ELECTROMAGNETIC WAVES
The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III  OSCILLATIONS, OPTICS AND LASERS

UNIT IV  BASIC QUANTUM MECHANICS
Photons and light waves - Electrons and matter waves – Compton effect - The Schrödinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization – Free particle - particle in an infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V  APPLIED QUANTUM MECHANICS
The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch’s theorem for particles in a periodic potential – Basics of Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

COURSE OUTCOMES
After completion of this course, the students should be able to
- Understand the importance of mechanics.
• Express their knowledge in electromagnetic waves.
• Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
• Understand the importance of quantum physics.
• Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.

REFERENCES:

CY3151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

COURSE OBJECTIVES:
• To inculcate sound understanding of water quality parameters and water treatment techniques.
• To impart knowledge on the basic principles and preparatory methods of nanomaterials.
• To introduce the basic concepts and applications of phase rule and composites.
• To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
• To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I WATER AND ITS TREATMENT

UNIT II NANOCHEMISTRY
Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III PHASE RULE AND COMPOSITES
Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule: Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process. Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites.
Hybrid composites - definition and examples.

UNIT IV  Fuels and Combustion  9
 Fuels: Introduction; Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.
 Combustion of fuels: Introduction; Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO₂ emission and carbon footprint.

UNIT V  Energy Sources and Storage Devices  9
 Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead-acid battery and lithium-ion-battery; Electric vehicles – working principles; Fuel cells: H₂-O₂ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES
At the end of the course, the students will be able:
- To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
- To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
- To apply the knowledge of phase rule and composites for material selection requirements.
- To recommend suitable fuels for engineering processes and applications.
- To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I  COMPUTATIONAL THINKING AND PROBLEM SOLVING  9

UNIT II  DATA TYPES, EXPRESSIONS, STATEMENTS  9
Python interpreter and interactive mode, debugging: values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III  CONTROL FLOW, FUNCTIONS, STRINGS  9
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitable functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV  LISTS, TUPLES, DICTIONARIES  9
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V  FILES, MODULES, PACKAGES  9
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter’s age validation, Marks range validation (0-100).

COURSE OUTCOMES:
Upon completion of the course, students will be able to
CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

REFERENCES:
5. https://www.python.org/
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

### GE3152 HERITAGE OF TAMILS

<table>
<thead>
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<th>UNIT I LANGUAGE AND LITERATURE</th>
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<tr>
<th>UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE</th>
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<table>
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<tr>
<th>UNIT III FOLK AND MARTIAL ARTS</th>
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<tbody>
<tr>
<td>Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.</td>
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<tr>
<th>UNIT IV THINAI CONCEPT OF TAMILS</th>
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<tbody>
<tr>
<td>Flora and Fauna of Tamils &amp; Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.</td>
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<tr>
<th>UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE</th>
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</thead>
<tbody>
<tr>
<td>Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions &amp; Manuscripts – Print History of Tamil Books.</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL : 15 PERIODS**

### TEXT-CUM-REFERENCE BOOKS

1. தமிழ் மாராட்டார் – மூத்தக்கவை பாதையார் – ததொல்லி (இலங்கை: தமிழ் மாராட்டார் மூத்தக்கவை பாதையார் ததொல்லி).
2. தவளியீடு தமிழ் – தவளியீடு தின்கூடம். (இலங்கை: தவளியீடு தமிழ்).
3. தவளியீடு – தவளியீடு தின்கூடம் தட்டக்கவை தொன்றுத்தொல்லி (இலங்கை: தவளியீடு தவளியீடு தின்கூடம் தொன்றுத்தொல்லி).
4. தவளியீடு – தவளியீடு தின்கூடம் தொன்றுத்தொல்லி (இலங்கை: தவளியீடு தவளியீடு தின்கூடம் தொன்றுத்தொல்லி).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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GE3171 PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY L T P C 0 0 4 2

COURSE OBJECTIVES:
- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To practice various computing strategies for Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

EXPERIMENTS:
Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building – operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc. – operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 60 PERIODS

COURSE OUTCOMES:
On completion of the course, students will be able to:
CO1: Develop algorithmic solutions to simple computational problems
CO2: Develop and execute simple Python programs.
CO3: Implement programs in Python using conditionals and loops for solving problems.
CO4: Deploy functions to decompose a Python program.
CO5: Process compound data using Python data structures.
CO6: Utilize Python packages in developing software applications.
TEXT BOOKS:

REFERENCES:
5. https://www.python.org/

BS3171 PHYSICS AND CHEMISTRY LABORATORY

PHYSICS LABORATORY: (Any Seven Experiments)

COURSE OBJECTIVES:
- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young’s modulus
4. Uniform bending – Determination of Young’s modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre - Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Photovoltaic effect
12. Michelson Interferometer.
13. Melde’s string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the students should be able to
- Understand the functioning of various physics laboratory equipment.
- Use graphical models to analyze laboratory data.
- Use mathematical models as a medium for quantitative reasoning and describing physical reality.
- Access, process and analyze scientific information.
- Solve problems individually and collaboratively.
CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

1. Preparation of Na₂CO₃ as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
- Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler’s method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.
10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
13. Preparation of nanoparticles (TiO₂/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

COURSE OUTCOMES:

- To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
- To determine the amount of metal ions through volumetric and spectroscopic techniques
- To analyse and determine the composition of alloys.
- To learn simple method of synthesis of nanoparticles
- To quantitatively analyse the impurities in solution by electroanalytical techniques

TEXT BOOK:


GE3172 ENGLISH LABORATORY

OBJECTIVES:

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students’ English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.
UNIT I  INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION

Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies- making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions( filling out a bank application for example).

UNIT II  NARRATION AND SUMMATION

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk- describing requirements and abilities.

UNIT III  DESCRIPTION OF A PROCESS / PRODUCT

Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product-explaining uses and purposes- Presenting a product- describing shapes and sizes and weights- talking about quantities(large & small)-talking about precautions.

UNIT IV  CLASSIFICATION AND RECOMMENDATIONS

Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNIT V  EXPRESSION

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions- understanding a website-describing processes

LEARNING OUTCOMES:
At the end of the course, learners will be able
- To listen and comprehend complex academic texts
- To speak fluently and accurately in formal and informal communicative contexts
- To express their opinions effectively in both oral and written medium of communication

ASSESSMENT PATTERN
- One online / app based assessment to test listening /speaking
- End Semester ONLY listening and speaking will be conducted online.
- Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.

TOTAL : 30 PERIODS
OBJECTIVES:
- To engage learners in meaningful language activities to improve their reading and writing skills
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placements

UNIT I  MAKING COMPARISONS  6
Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phases

UNIT II  EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING  6
Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds

UNIT III  PROBLEM SOLVING  6
Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences

UNIT IV  REPORTING OF EVENTS AND RESEARCH  6

UNIT V  THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY  6
Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.

OUTCOMES:
At the end of the course, learners will be able
- To compare and contrast products and ideas in technical texts.
- To identify cause and effects in events, industrial processes through technical texts
- To analyse problems in order to arrive at feasible solutions and communicate them orally and in the written format.
- To report events and the processes of technical and industrial nature.
- To present their opinions in a planned and logical manner, and draft effective resumes in context of job search.

TEXT BOOKS:
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:
ASSESSMENT PATTERN
Two internal assessments and an end semester examination to test students’ reading and writing skills along with their grammatical and lexical competence.

MA3251 STATISTICS AND NUMERICAL METHODS

COURSE OBJECTIVES:
- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
- To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS
Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION
Lagrange’s and Newton’s divided difference interpolations – Newton’s forward and backward difference interpolation – Approximation of derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson’s 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

TOTAL: 60 PERIODS

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to:
- Apply the concept of testing of hypothesis for small and large samples in real life problems.
- Apply the basic concepts of classifications of design of experiments in the field of agriculture.
- Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.
PH3251 MATERIALS SCIENCE

COURSE OBJECTIVES:
- To make the students to understand the basics of crystallography and its importance in studying materials properties.
- To understand the electrical properties of materials including free electron theory, applications of quantum mechanics and magnetic materials.
- To instil knowledge on physics of semiconductors, determination of charge carriers and device applications.
- To establish a sound grasp of knowledge on different optical properties of materials, optical displays and applications.
- To inculcate an idea of significance of nano structures, quantum confinement and ensuing nano device applications.

UNIT I CRYSTALLOGRAPHY

UNIT II ELECTRICAL AND MAGNETIC PROPERTIES OF MATERIALS

UNIT III SEMICONDUCTORS AND TRANSPORT PHYSICS
UNIT IV
OPTICAL PROPERTIES OF MATERIALS

UNIT V
NANOELECTRONIC DEVICES

COURSE OUTCOMES:
At the end of the course, the students should be able to
- know basics of crystallography and its importance for varied materials properties
- gain knowledge on the electrical and magnetic properties of materials and their applications
- understand clearly of semiconductor physics and functioning of semiconductor devices
- understand the optical properties of materials and working principles of various optical devices
- appreciate the importance of functional nanoelectronic devices.

TEXT BOOKS:

REFERENCES:
UNIT II  ELECTRICAL MACHINES  9

UNIT III  ANALOG ELECTRONICS  9

UNIT IV  DIGITAL ELECTRONICS  9
Review of number systems, binary codes, error detection and correction codes, Combinational logic -representation of logic functions-SOP and POS forms, K-map representations - minimization using K maps (Simple Problems only)

UNIT V  MEASUREMENTS AND INSTRUMENTATION  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After completing this course, the students will be able to
1. Compute the electric circuit parameters for simple problems
2. Explain the working principle and applications of electrical machines
3. Analyze the characteristics of analog electronic devices
4. Explain the basic concepts of digital electronics
5. Explain the operating principles of measuring instruments

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
1. Drawing engineering curves.
2. Drawing freehand sketch of simple objects.
3. Drawing orthographic projection of solids and section of solids.
4. Drawing development of solids
5. Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)
Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT I   PLANE CURVES 6+12
Basic Geometrical constructions, Curves used in engineering practices: Conics — Construction of ellipse, parabola and hyperbola by eccentricity method — Construction of cycloid — construction of involutes of square and circle — Drawing of tangents and normal to the above curves.

UNIT II  PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III  PROJECTION OF SOLIDS AND FREEHAND SKETCHING 6+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.
Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT IV  PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6 +12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.
Practicing three dimensional modeling of simple objects by CAD Software (Not for examination)

UNIT V   ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12
Principles of isometric projection — isometric scale - Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.
Practicing three dimensional modeling of isometric projection of simple objects by CAD Software (Not for examination)

COURSE OUTCOMES:
On successful completion of this course, the student will be able to
• Use BIS conventions and specifications for engineering drawing.
• Construct the conic curves, involutes and cycloid.
• Solve practical problems involving projection of lines.
• Draw the orthographic, isometric and perspective projections of simple solids.
• Draw the development of simple solids.
TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

GE3252  தமிழ் விளைவியான அடையாளம்  L T P C

அனை ஐ தமிழ் வெளிப்புற பார்வக விளையாட்டுப் போராட்டம்:
03 பார்வக கட்டிடக் கட்டமொனையும், பார்வக நொயகர் கட்டிடக் கட்டமொனையும், பார்வக மநசவு கட்டிடக் கட்டமொனையும், பார்வக உருவொக்கும் கட்டிடக் கட்டமொனையும் வரலொற்று.வெளியில் எழுதாது பார்வக கட்டிடக் கட்டமொனையும்.
UNIT I  WEAVING AND CERAMIC TECHNOLOGY
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II  DESIGN AND CONSTRUCTION TECHNOLOGY
Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III  MANUFACTURING TECHNOLOGY
UNIT IV  AGRICULTURE AND IRRIGATION TECHNOLOGY  3
Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries - Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V  SCIENTIFIC TAMIL & TAMIL COMPUTING  3
Development of Scientific Tamil - Tamil computing - Digitalization of Tamil Books - Development of Tamil Software - Tamil Virtual Academy - Tamil Digital Library - Online Tamil Dictionaries - Sorkuvai Project.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலை மக்களும் பண் பொடும் - மகுதியுள்ள பல்லவரிய (தவளியீடு: தமிழ்நொடு பொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் முமனவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. சிதை - தமிழக தகவல் தகவல் தகவல் கணத்தில் (ததொல்லியல் துமற்தவளியீடு).
4. பொருளாதார - கணினித்தமிழ் கல்வி (ததொல்லியல் துமற்தவளியீடு).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TTNB & ESC and RMRL – (in print)
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## NCC CREDIT COURSE LEVEL 1**

**NX3251 (ARMY WING) NCC CREDIT COURSE LEVEL - I**

<table>
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<tr>
<th>Course Area</th>
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<td>NCC GENERAL</td>
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<tr>
<td>NCC 1 Aims, Objectives &amp; Organization of NCC</td>
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<td>NCC 3 Duties of NCC Cadet</td>
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<td>NCC 4 NCC Camps: Types &amp; Conduct</td>
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TOTAL: 30 PERIODS
**NCC CREDIT COURSE LEVEL 1**

NX3252  (NAVAL WING) NCC CREDIT COURSE LEVEL - I  

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**NCC GENERAL**  
6

- **NCC 1** Aims, Objectives & Organization of NCC  
- **NCC 2** Incentives  
- **NCC 3** Duties of NCC Cadet  
- **NCC 4** NCC Camps: Types & Conduct

**NATIONAL INTEGRATION AND AWARENESS**  
4

- **NI 1** National Integration: Importance & Necessity  
- **NI 2** Factors Affecting National Integration  
- **NI 3** Unity in Diversity & Role of NCC in Nation Building  
- **NI 4** Threats to National Security

**PERSONALITY DEVELOPMENT**  
7

- **PD 1** Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving  
- **PD 2** Communication Skills  
- **PD 3** Group Discussion: Stress & Emotions

**LEADERSHIP**  
5

- **L 1** Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code  
- **L 2** Case Studies: Shivaji, Jhasi Ki Rani

**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**  
8

- **SS 1** Basics, Rural Development Programmes, NGOs, Contribution of Youth  
- **SS 4** Protection of Children and Women Safety  
- **SS 5** Road / Rail Travel Safety  
- **SS 6** New Initiatives  
- **SS 7** Cyber and Mobile Security Awareness

TOTAL : 30 PERIODS
# NCC CREDIT COURSE LEVEL 1**
(AIR FORCE WING) NCC CREDIT COURSE LEVEL – I

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## SOCIAL SERVICE AND COMMUNITY DEVELOPMENT

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**TOTAL : 30 PERIODS**
COURSE OBJECTIVES:
The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES PLUMBING WORK:
   a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
   b) Preparing plumbing line sketches.
   c) Laying pipe connection to the suction side of a pump
   d) Laying pipe connection to the delivery side of a pump.
   e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:
   a) Sawing,
   b) Planing and
   c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:
   a) Studying joints in door panels and wooden furniture
   b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES
   a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
   b) Staircase wiring
   c) Fluorescent Lamp wiring with introduction to CFL and LED types.
   d) Energy meter wiring and related calculations/calibration
   e) Study of Iron Box wiring and assembly
   f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
   g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES WELDING WORK:
   a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
   b) Practicing gas welding.

BASIC MACHINING WORK:
   a) (simple)Turning.
b) (simple) Drilling.
c) (simple) Tapping.

ASSEMBLY WORK:
a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an air conditioner.

SHEET METAL WORK:
a) Making of a square tray

FOUNDRY WORK:
a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES

SOLDERING WORK:
a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:
a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:
a) Study an elements of smart phone.
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/laptop

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

TOTAL = 60 PERIODS

BE3271 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY

COURSE OBJECTIVES:
- To train the students in conducting load tests on electrical machines
- To gain practical experience in characterizing electronic devices
- To train the students to use DSO for measurements

LIST OF EXPERIMENTS
1. Verification of ohms and Kirchhoff’s Laws.
2. Load test on DC Shunt Motor.
3. Load test on Self Excited DC Generator
4. Load test on Single phase Transformer
5. Load Test on Induction Motor
6. Characteristics of PN and Zener Diodes
7. Characteristics of BJT, SCR and MOSFET
8. Half wave and Full Wave rectifiers
9. Study of Logic Gates
10. Implementation of Binary Adder and Subtractor
11. Study of DSO

TOTAL: 60 PERIODS

COURSE OUTCOMES:
After completing this course, the students will be able to
1. Use experimental methods to verify the Ohm’s and Kirchhoff’s Laws.
2. Analyze experimentally the load characteristics of electrical machines
3. Analyze the characteristics of basic electronic devices
4. Use DSO to measure the various parameters

GE3272
COMMUNICATION LABORATORY

OBJECTIVES
- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To be able to communicate effectively through writing.

UNIT I
Speaking: Role Play Exercises Based on Workplace Contexts, - talking about competition- discussing progress toward goals-talking about experiences- talking about events in life- discussing past events-Writing: writing emails (formal & semi-formal).

UNIT II
Speaking: discussing news stories-talking about frequency-talking about travel problems- discussing travel procedures- talking about travel problems- making arrangements-describing arrangements-discussing plans and decisions- discussing purposes and reasons- understanding common technology terms-Writing: - writing different types of emails.

UNIT III
Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios- talking about purchasing-discussing advantages and disadvantages- making comparisons- discussing likes and dislikes-discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

UNIT IV
Speaking: discussing the natural environment-describing systems-describing position and movement- explaining rules- (example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.

UNIT V
Speaking: describing things relatively-describing clothing-discussing safety issues (making recommendations) talking about electrical devices-describing controlling actions- Writing: job application (Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

LEARNING OUTCOMES
- Speak effectively in group discussions held in a formal/semi formal contexts.
- Write emails and effective job applications.

Assessment Pattern
- One online / app based assessment to test speaking and writing skills
- Proficiency certification is given on successful completion of speaking and writing.
OBJECTIVES

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I  PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types - Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II  FOURIER SERIES

Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Perceval’s identity – Harmonic analysis.

UNIT III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).

UNIT IV  FOURIER TRANSFORMS


UNIT V  Z-TRANSFORMS AND DIFFERENCE EQUATIONS


TOTAL: 60 PERIODS

OUTCOMES:

Upon successful completion of the course, students should be able to:
- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

REFERENCES:

ME 3392 ENGINEERING MATERIALS AND METALLURGY

COURSE OBJECTIVES

1. To learn the constructing, the phase diagram and using of iron-iron carbide phase diagram for microstructure formation.
2. To learn selecting and applying various heat treatment processes and its microstructure formation.
3. To illustrate the different types of ferrous and non-ferrous alloys and their uses in engineering field.
4. To illustrate the different polymer, ceramics and composites and their uses in engineering field.
5. To learn the various testing procedures and failure mechanism in engineering field.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

UNIT II HEAT TREATMENT

UNIT III FERROUS AND NON-FERROUS METALS

UNIT IV NON-METALLIC MATERIALS

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS

TOTAL : 45 PERIODS
OUTCOMES:
At the end of the course the students would be able to
2. Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
3. Clarify the effect of alloying elements on ferrous and non-ferrous metals.
4. Summarize the properties and applications of non-metallic materials.
5. Explain the testing of mechanical properties.

TEXTBOOKS:

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Low (1) ; Medium (2) ; High (3)

MF3301 MACHINING TECHNOLOGY L T P C 3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students:
- To impart knowledge on basics of metal cutting.
- To solve problems on cutting forces, tool life and analytical methods of estimating cutting temperature.
- To describe the basic principles of machine tools and processes
- To elaborate abrasive and finishing operations.
- To outline basics of automation and structure of machine tools.

UNIT I FUNDAMENTALS OF METAL CUTTING 9 Hours
COURSE OUTCOMES:
Upon the completion of this course the students will be able to

- Apply the knowledge in the basics of metal cutting.
- Apply suitable machining processes based on requirements.
- Distinguish different finishing operations.
- Test the machine tool structure and differentiate various automation.
- solve problems on cutting forces, tool life and analytical methods of estimating cutting temperature.

REFERENCES:
COURSE OBJECTIVES:

1. To introduce the students about properties of the fluids, behaviour of fluids under static conditions.
2. To impart basic knowledge of the dynamics of fluids and boundary layer concept.
3. To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends.
4. To exposure to the significance of boundary layer theory and its thicknesses.
5. To expose the students to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, centrifugal and reciprocating pumps.

UNIT I   FLUID PROPERTIES AND FLOW CHARACTERISTICS 10+3
Properties of fluids – Fluid statics - Pressure Measurements - Buoyancy and floatation - Flow characteristics - Eulerian and Lagrangian approach - Concept of control volume and system - Reynold’s transportation theorem - Continuity equation, energy equation and momentum equation - Applications.

UNIT II   FLOW THROUGH PIPES AND BOUNDARY LAYER 9+3
Reynold’s Experiment - Laminar flow through circular conduits - Darcy Weisbach equation - friction factor - Moody diagram - Major and minor losses - Hydraulic and energy gradient lines - Pipes in series and parallel - Boundary layer concepts - Types of boundary layer thickness.

UNIT III  DIMENSIONAL ANALYSIS AND MODEL STUDIES 8+3
Fundamental dimensions - Dimensional homogeneity - Rayleigh’s method and Buckingham Pi theorem - Dimensionless parameters - Similitude and model studies - Distorted and undistorted models.

UNIT IV   TURBINES 9+3

UNIT V   PUMPS 9+3
Classification of pumps - Centrifugal pumps - Working principle - Heads and efficiencies – Velocity triangles - Work done by the impeller - Performance curves - Reciprocating pump working principle - Indicator diagram and it’s variations - Work saved by fitting air vessels - Rotary pumps.

TOTAL: 60 PERIODS

OUTCOMES: On completion of the course, the student is expected to be able to
1. Understand the properties and behaviour in static conditions. Also to understand the conservation laws applicable to fluids and its application through fluid kinematics and dynamics
2. Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel. Also to understand the concept of boundary layer and its thickness on the flat solid surface.
3. Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies
4. Explain the working principles of various turbines and design the various types of turbines.
5. Explain the working principles of centrifugal, reciprocating and rotary pumps and design the centrifugal and reciprocating pumps

TEXT BOOKS:

REFERENCES:
1. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore,
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Low (1) ; Medium (2) ; High (3)

MF3391 MECHANICS OF MATERIALS LT P C
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare students for:
- Applying the principle concepts behind stress, strain and deformation of solids for various engineering applications.
- Analyzing the transverse loading on beams and stresses in beam for various engineering applications.
- Analyzing the torsion principles on shafts and springs for various engineering applications.
- Analyzing the deflection of beams for various engineering applications.
- Analyzing the thin and thick shells and principal stresses in beam for various engineering applications

UNIT I STRESS AND STRAIN 9 Hours
Introduction, Hooke’s law, Calculation of stresses in straight, Stepped and tapered sections, Composite sections, Stresses due to temperature change, Shear stress and strain, Lateral strain and Poisson’s ratio, Generalized Hooke’s law, Bulk modulus, Relationship between elastic constants

UNIT II ANALYSIS OF STRESS AND STRAIN 9 Hours
Plane stress, Stresses on inclined planes, Principal stresses and maximum shear stress, Principal angles, Shear stresses on principal planes, Maximum shear stress, Mohr circle for plane stress conditions. Cylinders: Thin cylinder: Hoop’s stress, maximum shear stress, circumferential and longitudinal strains, thick cylinders: Lames equations.

UNIT III SHEAR FORCES AND BENDING MOMENTS 9 Hours
Type of beams, Loads and reactions, Relationship between loads, shear forces and bending moments, Shear force and bending moments of cantilever beams, Pin support and roller supported beams subjected to concentrated loads and uniformly distributed constant / varying loads.

Stress in Beams: Pure bending, Curvature of a beam, Longitudinal strains in beams, Normal stresses in Beams with rectangular, circular, ‘I’ and ‘T’ cross sections, Flexure Formula, Bending Stresses, Deflection of beams (Curvature).
UNIT IV  TORSION  
Circular solid and hollow shafts, Torsional moment of resistance, Power transmission of straight and stepped shafts. Twist in shaft sections, Thin tubular sections, thin- w a l l e d sections  
Columns: Buckling and stability, Critical load, Columns with pinned ends, Columns with othersupport conditions, Effective length of columns, Secant formula for columns.

UNIT V  STRAIN ENERGY  
Castigliani’s theorem I and II, Load deformation diagram, Strain energy due to normal stresses, Shear stresses, Modulus of resilience, Strain energy due to bending and torsion.

Theories of Failure: Maximum Principal stress theory, Maximum shear stress theory.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
- Apply the principal concepts behind stress, strain and deformation of solids for various engineering applications.
- Analyze the transverse loading on beams and stresses in beam for various engineering applications.
- Analyze the torsion principles on shafts and springs for various engineering applications.
- Analyze the deflection principles on beams for various engineering applications.
- Understanding the concept of theories of failure.

TEXT BOOKS:

REFERENCES:

MF3302  FOUNDRY TECHNOLOGY  
LT P C  
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare students for:
- To impart the basics of casting and foundry practice.
- To introduce various casting processes.
- To be acquainted with design of gating system and to obtain defect free castings.
- An overview of the designing of molds, casting defects, inspection and testing of castings and modernization of foundries.
- Casting of ferrous and non-ferrous materials.

UNIT I  INTRODUCTION:  
Introduction to moulding and casting processes - steps involved advantages, limitations, application of casting process. Patterns - types, applications, pattern allowances-pattern materials, colour coding as per BIS, pattern making, core and core making, core boxes, core prints, core blowers, core shooters. Sand mould making: Moulding and core sands, ingredients, properties, types of sands, sand selection - machine moulding, types of machines, applications.
UNIT II  CASTING PROCESSES:  
9 Hours  

UNIT III  MELTING, POURING AND TESTING:  
9 Hours  

UNIT IV  GATING, FEEDING AND MECHANIZATION:  
9 Hours  
Elements of gating system, functions, types and design of gating systems, gating ratio, risers, functions, types and designs, methods controlling solidification, solidification time calculations, foundry mechanization.

UNIT V  FERROUS AND NON-FERROUS METALS:  
9 Hours  

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon the completion of this course the students will be able to

- Gain basic knowledge in casting.
- Select suitable casting process for application requirement.
- Apply gating design and mould design knowledge to overcome defects in casting.
- Selecting the type of sand, for molds and cores as well as the molding process.
- Know about the special molding processes and when their use is warranted.
- Have a broad knowledge of casting of ferrous and non-ferrous alloys and of the inspection techniques to detect casting defects.

TEXT BOOKS:

REFERENCES:
COURSE OBJECTIVES:

- To study the mechanical properties of materials when subjected to different types of loading.
- To impart practical knowledge of heat treatment processes.
- To elaborate the effect of various parameters on heat treatment process.
- To get conversant with the microstructural changes.
- To gain practical knowledge on heat treatment of various materials.

LIST OF EXPERIMENTS

A) Strength of Materials Laboratory

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
10. Tempering- Improvement Mechanical Properties Comparison
    (i) Unhardened specimen
    (ii) Quenched Specimen and
    (iii) Quenched and tempered specimen.
11. Microscopic Examination of
    (i) Hardened samples and
    (ii) Hardened and tempered samples.

B) Metallurgy Laboratory

1. Specimen preparation for macro – examination.
2. Specimen preparation for micro examination and study of Micro structure of –
   a) Carbon steel s(High, Medium, and Low)
   b) Cast Iron (Gray, White, Nodular, Malleable)
   c) Brass (70/30), Bronze (tin bronze), Al-Si alloy, Cupro-nickel, Ti alloy.
4. Cooling curves
   a) Pure Metal (Pb or Sn)
   b) Alloy (Pb-Sn or Pb-Sb)
5. study the micro structure before and after the following heat treatments
   a) Annealing
   b) Normalizing
   c) Quench Hardening
   d) Tempering
6. Jominy End Quench Test

TOTAL: 60 PERIODS
MF3361  MACHINING TECHNOLOGY LABORATORY  LT PC 0 0 4 2

COURSE OBJECTIVES:
- To Study and practice the various operations that can be performed in lathe, shaper, drilling, milling machines etc.
- To equip with the practical knowledge required in the core industries.
- To prepare the process planning sheets for all the operations and then follow the sequences during the machining processes.

LIST OF EXPERIMENTS
1. Lathe: Facing, Plain turning, Step Turning
2. Lathe: Taper Turning, Threading, Knurling
3. Lathe: Multi start Threading, Burnishing
4. Shaper: Cube
5. Shaper: Cube, V-Block
6. Drilling: Counter sinking, Counter Boring, Tapping
7. Milling Vertical: Surfacing, Pocket Milling
8. Milling Horizontal: Polygonal shape milling
9. Grinding: Surface & Cylindrical grinding
10. Slotting: Machining an internal spline
11. Tool angle grinding with tool and Cutter Grinder
12. Measurement of cutting forces in Milling / Turning Process

TOTAL : 60 PERIODS

COURSE OUTCOMES:
Upon the completion of this course the students will be able to
- Select appropriate turning process to obtain finished components.
- Select appropriate milling process to obtain finished components.
- Select appropriate shaper and slotting process to obtain finished components.
- Select appropriate grinding process to obtain optimum surface finish.
- Coordinate various machining process in sequence to get desired design in final components.

MF3312  FLUID MACHINERY LABORATORY  LT PC 0 0 4 2

COURSE OBJECTIVES:
- To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.

LIST OF EXPERIMENTS
1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter.
4. Determination of friction factor for a given set of pipes.
5. Conducting experiments and drawing the characteristic curves of centrifugal pump/submergible pump
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine

TOTAL : 60 PERIODS
OUTCOMES:
Upon the completion of this course the students will be able to
- Use the measurement equipment's for flow measurement.
- Perform test on different fluid machinery.
- Verify and apply Bernoulli equation for flow measurement like orifice/venturi meter.
- Measure friction factor in pipes and compare with Moody diagram and verify momentum conservation law.
- Determine the performance characteristics of roto-dynamic pumps.
- Determine the performance characteristics of positive displacement pumps.
- Determine the performance characteristics of turbine.

GE3361 PROFESSIONAL DEVELOPMENT

OBJECTIVES:
- To be proficient in important Microsoft Office tools: MS WORD, EXCEL, POWERPOINT.
- To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the presentability and overall utility value of content.
- To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize,interlink, and utilizing many more critical features offered
- To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, presentability, aesthetics, using media elements and enhance the overall quality of presentations.

MS WORD:
Create and format a document
Working with tables
Working with Bullets and Lists
Working with styles, shapes, smart art, charts
Inserting objects, charts and importing objects from other office tools
Creating and Using document templates
Inserting equations, symbols and special characters
Working with Table of contents and References, citations
Insert and review comments
Create bookmarks, hyperlinks, endnotes footnote
Viewing document in different modes
Working with document protection and security
Inspect document for accessibility

MS EXCEL:
Create worksheets, insert and format data
Work with different types of data: text, currency, date, numeric etc.
Split, validate, consolidate, Convert data
Sort and filter data
Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,)
Work with Lookup and reference formulae
Create and Work with different types of charts
Use pivot tables to summarize and analyse data
Perform data analysis using own formulae and functions
Combine data from multiple worksheets using own formulae and built-in functions to generate results
Export data and sheets to other file formats
Working with macros
Protecting data and Securing the workbook
MS POWERPOINT: 10 Hours
Select slide templates, layout and themes
Formatting slide content and using bullets and numbering
Insert and format images, smart art, tables, charts
Using Slide master, notes and handout master
Working with animation and transitions
Organize and Group slides
Import or create and use media objects: audio, video, animation
Perform slideshow recording and Record narration and create presentable videos

TOTAL: 30 PERIODS

OUTCOMES:
On successful completion the students will be able to
- Use MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.
COURSE OBJECTIVES:

1. Impart knowledge on the basics and application of zeroth and first law of thermodynamics.
2. Impart knowledge on the second law of thermodynamics in analyzing the performance of thermal devices.
3. Impart knowledge on availability and applications of second law of thermodynamics.
4. Teach the various properties of steam through steam tables and Mollier chart.
5. Impart knowledge on the macroscopic properties of ideal and real gases.

UNIT I BASIC, ZEROOTH AND FIRST LAW


UNIT II SECOND LAW AND ENTROPY


UNIT III AVAILABILITY AND APPLICATIONS OF II LAW

Ideal gases undergoing different processes - principle of increase in entropy. Applications of II Law. High- and low-grade energy. Availability and Irreversibility for open and closed system processes - I and II law Efficiency

UNIT – IV PROPERTIES OF PURE SUBSTANCES

Steam - formation and its thermodynamic properties - p-v, p-T, T-v, T-s, h-s diagrams. PVT surface. Determination of dryness fraction. Calculation of work done and heat transfer in non-flow and flow processes using Steam Table and Mollier Chart.

UNIT – V GAS MIXTURES AND THERMODYNAMIC RELATIONS


TOTAL: 45 PERIODS

OUTCOMES: At the end of the course the students would be able to

1. Apply the zeroth and first law of thermodynamics by formulating temperature scales and calculating the property changes in closed and open engineering systems.
2. Apply the second law of thermodynamics in analyzing the performance of thermal devices through energy and entropy calculations.
3. Apply the second law of thermodynamics in evaluating the various properties of steam through steam tables and Mollier chart
4. Apply the properties of pure substance in computing the macroscopic properties of ideal and real gases using gas laws and appropriate thermodynamic relations.
5. Apply the properties of gas mixtures in calculating the properties of gas mixtures and applying various thermodynamic relations to calculate property changes.

TEXTBOOKS:

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Low (1) ; Medium (2) ; High (3)

MF3401 ENGINEERING METROLOGY AND COMPUTER AIDED INSPECTION

COURSE OBJECTIVES:
- To impart the basics of metrology, measurement concepts and perform measurement tasks accurately.
- To identify the right measurement practices for linear and angular measurements.
- To be familiarized with the right instrument and method of measurement for surface finish and form measurements.
- To describe the various measurement techniques using laser metrology.
- To gain knowledge on computer aided inspection and advances in metrology.

UNIT I CONCEPT OF MEASUREMENT 9 Hours
General concept — Generalized 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 9 Hours

UNIT III FORM MEASUREMENT 9 Hours
Measurement of screw threads: Thread gauges, floating carriage micrometer measurement of gear tooth thickness: constant chord and base tangent Method-Gleason gear testing machine – radius measurements-surface finish: equipment and parameters, straightness, flatness and roundness measurements.
UNIT IV  LASER AND ADVANCES IN METROLOGY  9 Hours
Precision instruments based on Laser-Principles- laser interferometer-application in measurements and machine tool metrology- Coordinate measuring machine (CMM): need, construction, types, applications - computer aided inspection- Tool Makers Microscope- Non contact and in-process inspection, Vision system.

UNIT V  IMAGE PROCESSING  9 Hours
Overview, Computer imaging systems, Image Analysis, Pre-processing, Human vision system, Image model, Image enhancement, gray scale models, histogram models, Image Transforms.

OUTCOMES:
Upon completion of this course the student will be able
- Recognize the basics of metrology, measurement concepts and perform measurement tasks accurately.
- Identify the right measurement practices for linear and angular measurements.
- Identify the right instrument and method of measurement for surface finish and form measurements.
- Describe various measurement techniques using laser metrology.
- Recognize the computer aided inspection and advances in metrology.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES:
MF3491   CNC MACHINING TECHNOLOGY   LT P C

3 0 0 3

COURSE OBJECTIVES:
- To introduce the concepts and applications of CAD
- To introduce the various concepts and techniques used for Product design and to develop product design skills.
- To introduce the evolution, types and principles of CNC machine tools
- To familiarize the students with constructional features of CNC machine tools
- To gain knowledge on manual part program and generation of CNC part program using CAM packages

UNIT I   FUNDAMENTALS OF COMPUTER GRAPHICS   9 Hours
Product cycle- Design process- sequential and concurrent engineering- Computer aided design — CAD system architecture- Computer graphics — co-ordinate systems- 2D and 3D transformations homogeneous coordinates - Line drawing -Clipping- viewing transformation

UNIT II   GEOMETRIC MODELING   9 Hours

UNIT III   CNC MACHINES   9 Hours

UNIT IV   CNC PROGRAMMING   9 Hours

UNIT V   FUNDAMENTALS OF CAM   9 Hours
Brief introduction to CAM – Manufacturing Planning, Manufacturing control- Concurrent Engineering-CIM concepts – Computerized elements of CIM system –Types of production - Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of this course the student will be able
- Apply concept of CAD systems for 3D modeling and visual realism.
- Recognize the evolution, types and principle of CNC machine tools
- Acquire knowledge on constructional features of CNC machine tools
- Identify drives and axis measuring system used in CNC machine tools
- Demonstrate competency in manual part program and generation of CNC part program using CAM packages
- Elaborate various tooling and work holding devices used in CNC machine tools

TEXT BOOKS:
REFERENCES:

PR3451 MATERIALS JOINING TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:
1. To study SMAW, GMAW, GTAW, Oxy-acetylene welding and resistance spot welding processes.
2. To study the various types of resistance welding process.
3. To study the various solid state welding process.
4. To study advanced welding process.
5. To study the various welding design and testing methods.

UNIT – I GAS AND ARC WELDING PROCESSES 9
Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, shielded metal arc welding, Submerged arc welding, TIG and MIG welding, Plasma arc welding and Electro slag welding processes - advantages, limitations and applications.

UNIT – II RESISTANCE WELDING PROCESSES 9
Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations and applications.

UNIT – III SOLID STATE WELDING PROCESSES 9
Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.

UNIT – IV OTHER WELDING PROCESSES 9

UNIT – V DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF 9 WELDMENTS
Various weld joint designs – Welding defects – causes and remedies - Weldability of Aluminium, Copper, and Stainless steels. Destructive and nondestructive testing of weldments.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1: To understand the basic working principles SMAW, GMAW, GTAW, Oxy-acetylene welding and resistance spot welding processes
CO2: To know the various types of the resistance welding process
CO3: To familiarize about the various solid state welding process
CO4: To know the advanced welding process
CO5: To apply the various welding design and testing methods
Mapping of COs with POs and PSOs

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1 – Slight, 2 – Moderate, 3 – Substantial

TEXT BOOKS:

REFERENCES:

ML3591 METAL AND POWDER FORMING TECHNIQUES L T P C
3 0 0 3

COURSE OBJECTIVES:
The main learning objective of this course is to prepare students for:
- Describing types of deformations and classification of forming processes.
- Classifying and explain bulk forming processes.
- Describing sheet metal forming processes
- Distinguishing differences between conventional forming and special forming processes.
- Elaborating various stages involved in the powder forming processes.

UNIT I INTRODUCTION
Mechanical behavior of materials- Elastic and plastic deformations - Classification of forming processes - Temperature in metal working: Cold, Warm and hot working - Introduction to the theory of plastic deformation.

UNIT II BULK FORMING
Introduction - Plastic deformation in forging, rolling, extrusion, rod/wire, tube drawing and swaging processes and their applications - Effect of friction, calculation of forces, work done, process parameters, equipment’s and defects - Design for manufacturing - Economics of bulk forming.

UNIT III SHEET METAL FORMING
UNIT IV  
SPECIAL FORMING  
9
Orbital forging - Isothermal forging - Hot and cold Isostatic pressing - High speed extrusion - High speed forming machines - Rubber pad forming - Water hammer forming - Fine blanking - Incremental forming and comparing the above with conventional forming.

UNIT V  
POWDER FORMING  
9
Introduction - Powder production methods - Particle size characterization – Blending – Compacting - Sintering - Secondary and finishing operations - Advantages and applications of powder metallurgy - Design for manufacturing - Powder forging, rolling, extrusion, drawing - Economics of powder forging.

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
1. Illustrate deformation types and classification of forming processes.
2. Describe bulk forming processes and their applications.
3. Elaborate different sheet metal forming processes and their applications.
4. Compare and distinguish conventional and special forming processes.
5. Discuss powder forming processes and its applications.

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UNIT - I: ENVIRONMENT AND BIODIVERSITY

UNIT – II: ENVIRONMENTAL POLLUTION

UNIT – III: RENEWABLE SOURCES OF ENERGY.
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT - IV: SUSTAINABILITY AND MANAGEMENT
Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and Protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT - V: SUSTAINABILITY PRACTICES

TEXT BOOKS:
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.

REFERENCES:
COURSE OBJECTIVES:
- To make the students understand and interpret drawings of machine components
- To prepare assembly drawings both manually and using standard CAD packages
- To familiarize the students with Indian Standards on drawing practices and standard components
- To gain practical experience in handling 2D drafting and 3D modeling software systems
- Preparing standard drawing layout for modeled parts or assemblies with BoM.

A) DRAWING STANDARDS & FITS AND TOLERANCES

B) 2D DRAFTING
- Drawing, Editing, Dimensioning, Layering, Hatching, Block, Array, Detailing, Detailed drawing,
- Bearings - Bush bearing, Plummer block
- Valves – Safety and non-return valves.

C) GEOMETRIC MODELING AND ASSEMBLY
- Couplings – Flange, Universal, Oldham’s, Muff, Gear couplings
- Joints – Knuckle, Gib & cotter, strap, sleeve & cotter joints
- Engine parts – Piston, connecting rod, cross-head (vertical and horizontal), stuffingbox, multi-plate clutch
- Miscellaneous machine components – Screw jack, machine vice, tail stock, chuck, vane and gear pump.
- Design and Assembly of real time industrial products.
- 3D modeling from 2D product drawing
- Preparation of 2D drawing from 3D model for manufacturing

TOTAL : 60 PERIODS

COURSE OUTCOMES:
Upon the completion of this course the students will be able to
- Apply standard drawing practices using fits and tolerances.
- Model orthogonal views of machine components.
- Model orthogonal views of assembled components.
- Re-create part drawings, sectional views and assembly drawings as per standards
- Prepare standard drawing layout for modeled parts or assemblies with BoM.
MF3412 - CNC MACHINING LABORATORY

COURSE OBJECTIVES:

- To introduce the evolution, types and principles of CNC machine tools
- To familiarize the students with constructional features of CNC machine tools
- To familiarize students with manual CNC part programming for milling and turning machines
- To generate part programs using CNC programming and simulation s/w for CNC Lathe, CNC Milling
- To get hands on experience by machining the parts on actual machines like CNC Lathe, CNC milling machine and CNC Wire EDM

LIST OF EXPERIMENTS

1. Study of different types of CNC Machines
2. Study of different control systems and NC codes.
3. Program for Turning, Facing operation and Machining
4. Program for circular interpolation, Taper turning operation and Machining
5. Program for thread cutting operation and Machining
6. Program using Do-Loop and Sub-routine and Machining
7. Program for profile milling operation, circular interpolation and Machining
8. Program for Circular, rectangular pocket milling and Machining
9. Program for drilling cycle and Machining
10. Program for tool compensation and Program offset and Machining
11. NC code generation and Simulation using CAM software packages
12. Simulation of various machining operations using CNC Simulators
13. CAM Programming and CNC milling
14. CAM Programming and CNC Turning
15. Programming and CNC EDM
16. Programming and CNC wire EDM

COURSE OUTCOMES:

Upon the completion of this course the students will be able to

- Recognize the evolution, types and principle of CNC machine tools
- Acquire knowledge on constructional features of CNC machine tools
- Display competency in manual CNC part programming for milling and turning machines
- Exhibit generation of part programs using CNC programming and simulation s/w for CNC Lathe, CNC Milling
- Demonstrate machining the parts on actual machines CNC Lathe, CNC Milling Machine and CNC Wire EDM.

TOTAL: 60 PERIODS