B.E. SAFETY AND FIRE ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

<table>
<thead>
<tr>
<th>PEO</th>
<th>Objective</th>
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<tbody>
<tr>
<td>PEO1</td>
<td>Have a sound knowledge in Safety and Fire Engineering aspects to provide solutions for Potential hazards</td>
</tr>
<tr>
<td>PEO2</td>
<td>Expertise in the area of Thermal, Chemical Reactions, Structural Stability, Environmental Impacts</td>
</tr>
<tr>
<td>PEO3</td>
<td>Practice their Professions through evaluation, communications, ethics and social responsibility</td>
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PROGRAM COURSE OUTCOMES (POs):

<table>
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<tr>
<th>PO#</th>
<th>Graduate Attribute</th>
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<tbody>
<tr>
<td>1</td>
<td><strong>Engineering knowledge:</strong> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</td>
</tr>
<tr>
<td>2</td>
<td><strong>Problem analysis:</strong> Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.</td>
</tr>
<tr>
<td>3</td>
<td><strong>Design/development of solutions:</strong> 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.</td>
</tr>
<tr>
<td>4</td>
<td><strong>Conduct investigations of complex problems:</strong> 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.</td>
</tr>
<tr>
<td>5</td>
<td><strong>Modern tool usage:</strong> Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.</td>
</tr>
<tr>
<td>6</td>
<td><strong>The engineer and society:</strong> 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.</td>
</tr>
<tr>
<td>7</td>
<td><strong>Environment and sustainability:</strong> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.</td>
</tr>
<tr>
<td>8</td>
<td><strong>Ethics:</strong> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.</td>
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</table>
Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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.

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.

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)

| PSO1 | Analyse and assess fire safety of buildings and industries to design and specify fire protection systems. |
| PSO2 | Assess hazards and risks in process and manufacturing industries and devise remedial measures and safety management systems. |
| PSO3 | Assess the occupational health and environmental issues associated with industrial and other activities to design control measures with traditional and modern computational tools based on codes and statutes. |

PEO’s – PO’s & PSO’s MAPPING:

<table>
<thead>
<tr>
<th>PEO</th>
<th>PO</th>
<th>PSO</th>
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<tr>
<td>III.</td>
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## ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
B.E. SAFETY AND FIRE ENGINEERING
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
CURRICULUM FOR SEMESTERS I TO VIII AND SYLLABI FOR SEMESTERS III TO VIII

### SEMESTER I

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<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
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**THEORY**

**PRACTICAL**

**$^\text{Skill Based Course}$**

### SEMESTER II

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$^a$ 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.

$^b$ Skill Based Course
### SEMESTER III

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<sup>a</sup> Skill Based Course

### SEMESTER IV

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<sup>a</sup> 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.
### SEMESTER V

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#### THEORY

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**TOTAL** - - - - 19

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

### SEMESTER VI

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<th>S. NO.</th>
<th>COURSE CODE</th>
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#### PRACTICALS

| 9. SF3611 | Unit Operations Laboratory | PCC | 0 | 0 | 4 | 4 | 2 |

**TOTAL** - - - - 20

\(^*\) Open Elective – I shall be chosen from the emerging technologies.

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

\(^#\) 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.
### SEMESTER VII / VIII*

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*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

### SEMESTER VIII / VII*

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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: 163
### ELECTIVE - MANAGEMENT

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### PROFESSIONAL ELECTIVE COURSES: VERTICALS

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<td>FIRE SAFETY SYSTEMS</td>
<td>HEALTH AND RADIATION SAFETY</td>
<td>SAFETY IN INDUSTRIES</td>
<td>ENVIRONMENTAL SAFETY ENGINEERING</td>
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<td>Industrial Engineering</td>
<td>Fire Engineering</td>
<td>Food and Industrial Bio Safety</td>
<td>Facility Layout and Safety in Material Handling</td>
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<tr>
<td>Safety Management</td>
<td>Fire Risk Analysis and Accident Investigation</td>
<td>Legal Aspects of Health Safety and Environment</td>
<td>Process Instrumentation and Control</td>
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<td>Advanced Safety Engineering and Management</td>
<td>Fire Fighting Installation and Automation</td>
<td>First Aid and Emergency Procedures</td>
<td>Ergonomics in Design</td>
<td>Air and Water Pollution control and regulations</td>
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<td>Hazard Control in Manufacturing Industry</td>
<td>Design of Fire Fighting and Protection System</td>
<td>Radiation Protection</td>
<td>Safety in Petroleum and Petrochemical Industries</td>
<td>Remote Sensing in Environmental safety</td>
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<td>Advanced safety systems in Industry</td>
<td>Building Fire and Smoke Dynamics</td>
<td>Nuclear Safety and Radioactive and Radioactive material</td>
<td>Safety in Construction Industry and Town Planning</td>
<td>Rescue Equipment and Techniques</td>
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<td>Fire Safety Codes and Standardization</td>
<td>Explosive Technology and Safety</td>
<td>Thermal and Fired Equipment design</td>
<td>Safety in Automotive design and Control</td>
<td>Atmospheric Ground and Ocean Dispersion</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.
### VERTICAL 1: HAZARD MANAGEMENT AND SAFETY STANDARD

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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

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<td>Credits Total</td>
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<td>IV</td>
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<td>1. HSMC</td>
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<td>2. BSC</td>
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<td>6</td>
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<td>3. ESC</td>
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<td>7</td>
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<td>4. PCC</td>
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<td>5. PEC</td>
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<td>6. OEC</td>
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<td>7. EEC</td>
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<td>8. Mandatory Course (Non credit)</td>
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<td>✓</td>
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<td>163</td>
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</table>
**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.

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 the all the verticals of other programmes)**

<table>
<thead>
<tr>
<th>Vertical I</th>
<th>Vertical II</th>
<th>Vertical III</th>
<th>Vertical IV</th>
<th>Vertical V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fintech and Block Chain</td>
<td>Entrepreneurship</td>
<td>Public Administration</td>
<td>Business Data Analytics</td>
<td>Environment and Sustainability</td>
</tr>
<tr>
<td>Financial Management</td>
<td>Foundations of</td>
<td>Principles of Public</td>
<td>Statistics for Management</td>
<td>Sustainable Infrastructure</td>
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<tr>
<td></td>
<td>Entrepreneurship</td>
<td>Administration</td>
<td>Management</td>
<td>Development</td>
</tr>
<tr>
<td>Fundamentals of Investment</td>
<td>Team Building and Leadership Management for Business</td>
<td>Constitution of India</td>
<td>Datamining for Business Intelligence</td>
<td>Sustainable Agriculture and Environmental Management</td>
</tr>
<tr>
<td>Banking, Financial Services and Insurance</td>
<td>Creativity and Innovation in Entrepreneurship</td>
<td>Public Personnel Administration</td>
<td>Human Resource Analytics</td>
<td>Sustainable Bio Materials</td>
</tr>
<tr>
<td>Introduction to Blockchain and its Applications</td>
<td>Principles of Marketing Management for Business</td>
<td>Administrative Theories</td>
<td>Marketing and Social Media Web Analytics</td>
<td>Materials for Energy Sustainability</td>
</tr>
<tr>
<td>Fintech Personal Finance and Payments</td>
<td>Human Resource Management for Entrepreneurship</td>
<td>Indian Administrative System</td>
<td>Operation and Supply Chain Analytics</td>
<td>Green Technology</td>
</tr>
<tr>
<td>Introduction to Fintech</td>
<td>Financing New Business Ventures</td>
<td>Public Policy Administration</td>
<td>Financial Analytics</td>
<td>Environmental Quality Monitoring and Analysis</td>
</tr>
<tr>
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<td>-</td>
<td>Integrated Energy Planning for Sustainable Development</td>
</tr>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Energy Efficiency for Sustainable Development</td>
</tr>
</tbody>
</table>
(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**

<table>
<thead>
<tr>
<th>SL. 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>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>CMG331</td>
<td>Financial Management</td>
<td>PEC</td>
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<tr>
<td>2.</td>
<td>CMG332</td>
<td>Fundamentals of Investment</td>
<td>PEC</td>
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<tr>
<td>3.</td>
<td>CMG333</td>
<td>Banking, Financial Services and Insurance</td>
<td>PEC</td>
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<tr>
<td>4.</td>
<td>CMG334</td>
<td>Introduction to Blockchain and its Applications</td>
<td>PEC</td>
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<tr>
<td>5.</td>
<td>CMG335</td>
<td>Fintech Personal Finance and Payments</td>
<td>PEC</td>
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<tr>
<td>6.</td>
<td>CMG336</td>
<td>Introduction to Fintech</td>
<td>PEC</td>
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**VERTICAL 2: ENTREPRENEURSHIP**

<table>
<thead>
<tr>
<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
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<th>PERIODS PER WEEK</th>
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<th>CREDITS</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>CMG337</td>
<td>Foundations of Entrepreneurship</td>
<td>PEC</td>
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<td>2.</td>
<td>CMG338</td>
<td>Team Building and Leadership Management for Business</td>
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<tr>
<td>3.</td>
<td>CMG339</td>
<td>Creativity and Innovation in Entrepreneurship</td>
<td>PEC</td>
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<td>4.</td>
<td>CMG340</td>
<td>Principles of Marketing Management for Business</td>
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<td>5.</td>
<td>CMG341</td>
<td>Human Resource Management for Entrepreneurship</td>
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<tr>
<td>6.</td>
<td>CMG342</td>
<td>Financing New Business Ventures</td>
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### VERTICAL 3: PUBLIC ADMINISTRATION

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<tr>
<th>SL. 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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</thead>
<tbody>
<tr>
<td>1.</td>
<td>CMG343</td>
<td>Principles of Public Administration</td>
<td>PEC</td>
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<tr>
<td>2.</td>
<td>CMG344</td>
<td>Constitution of India</td>
<td>PEC</td>
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<tr>
<td>3.</td>
<td>CMG345</td>
<td>Public Personnel Administration</td>
<td>PEC</td>
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<td>4.</td>
<td>CMG346</td>
<td>Administrative Theories</td>
<td>PEC</td>
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<td>5.</td>
<td>CMG347</td>
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<td>PEC</td>
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<td>6.</td>
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### VERTICAL 4: BUSINESS DATA ANALYTICS

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<th>SL. NO.</th>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
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<tr>
<td>1.</td>
<td>CMG349</td>
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<td>2.</td>
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<td>3.</td>
<td>CMG351</td>
<td>Human Resource Analytics</td>
<td>PEC</td>
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<td>4.</td>
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<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>
<td>PEC</td>
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<td>6.</td>
<td>CMG354</td>
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<td>SL. NO.</td>
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<td>COURSE TITLE</td>
<td>CATEGORY</td>
<td>PERIODS PER WEEK</td>
<td>TOTAL CONTACT PERIODS</td>
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<tr>
<td>1.</td>
<td>CES331</td>
<td>Sustainable infrastructure Development</td>
<td>PEC</td>
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<td>2.</td>
<td>CES332</td>
<td>Sustainable Agriculture and Environmental Management</td>
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<td>3.</td>
<td>CES333</td>
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<td>4.</td>
<td>CES334</td>
<td>Materials for Energy Sustainability</td>
<td>PEC</td>
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<tr>
<td>5.</td>
<td>CES335</td>
<td>Green Technology</td>
<td>PEC</td>
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<td>6.</td>
<td>CES336</td>
<td>Environmental Quality Monitoring and Analysis</td>
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<td>7.</td>
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<td>PEC</td>
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<td>8.</td>
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</table>
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
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 1 INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION
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
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
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
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
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.

MA3151 MATRICES AND CALCULUS

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

UNIT - II DIFFERENTIAL CALCULUS
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

TOTAL: 60 PERIODS

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  L  T  P  C  3  0  0  3

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 be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I  MECHANICS
9

UNIT II  ELECTROMAGNETIC WAVES
9
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
9

UNIT IV  BASIC QUANTUM MECHANICS
9
Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V  APPLIED QUANTUM MECHANICS
9
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:

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 NANOCHMISTRY
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

UNIT IV FUELS AND COMBUSTION 9

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; Fruitful 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).

TOTAL : 45 PERIODS

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/
TEXT-CUM-REFERENCE BOOKS
1. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies).
3. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
5. 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)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)

UNIT I LANGUAGE AND LITERATURE

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE
UNIT III  FOLK AND MARTIAL ARTS  3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV  THINAI CONCEPT OF TAMILS  3
Flora and Fauna of Tamils & 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.

UNIT V  CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE  3
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 & Manuscripts – Print History of Tamil Books.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழக வரலொறு – மக்களும் பண பொடும் – மக, மக, பிளமள (தவளியீடு: தமிழ்நொடு மற்றும் கல்வியி யல் கழகம்).
2. கணினித் தமிழ் – முமனவர் இல, சுந்தரம். (விகடன் பிரசுரம்).
3. சிற்பின் - இன்றை மேற்கொண்டு சென்றவர் தனக் கால வரலொறும் (தகராலயில் கைய வேலொறும்).
4. பொருமந – ஆற்றங்கமர் தரகிகல் (தகராலயில் கைய வேலொறும்).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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)

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)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy, Matplotlib, scipy)
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.

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.

TOTAL: 60 PERIODS

TEXT BOOKS:

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

BS3171 PHYSICS AND CHEMISTRY LABORATORY  L  T  P  C
0  0  4  2

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. Photoelectric 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 6
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 6
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 6
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 6
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 6
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

HS3251 PROFESSIONAL ENGLISH - II L T P C 2 0 0 2

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

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

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.

TOTAL : 30 PERIODS

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.

REFERENCES:

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  9+3
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  9+3
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  9+3

UNIT IV  INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION  9+3
Lagrange’s and Newton’s divided difference interpolations – Newton’s forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson’s 1/3 rules.

UNIT V  NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS  9+3

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.
TEXT BOOKS:

REFERENCES:

PH3251 MATERIALS SCIENCE L T P C
3 0 0 3

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
Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap semiconductors – Carrier concentration in intrinsic semiconductors – extrinsic semiconductors - Carrier concentration in N-type & P-type semiconductors – Variation of carrier concentration with temperature – Carrier

UNIT IV  OPTICAL PROPERTIES OF MATERIALS  9

UNIT V  NANOELECTRONIC DEVICES  9

TOTAL: 45 PERIODS

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:
COURSE OBJECTIVES:
- To introduce the basics of electric circuits and analysis
- To impart knowledge in the basics of working principles and application of electrical machines
- To introduce analog devices and their characteristics
- To educate on the fundamental concepts of digital electronics
- To introduce the functional elements and working of measuring instruments

UNIT I  ELECTRICAL CIRCUITS  9
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm’s Law - Kirchhoff’s Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state)
Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)

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:

GE3251 ENGINEERING GRAPHICS

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
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 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 BOOKS:

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.
TEXT-CUM-REFERENCE BOOKS

1. குறிப்பிட்டு - வரலையம் பாஸ்டரியம் - குறிப்பிட்டு (குறிப்பிட்டு: குறிப்பிட்டு பாஸ்டரியம் குறிப்பிட்டு குறிப்பிட்டு)

2. குறிப்பிட்டு - வரலையம் பாஸ்டரியம் (குறிப்பிட்டு: பாஸ்டரியம்)

3. குறிப்பிட்டு - வரலையம் பாஸ்டரியம் சிற்றகம் (குறிப்பிட்டு: குறிப்பிட்டு குறிப்பிட்டு)

4. வரலையம் - வரலையம் குறிப்பிட்டு (குறிப்பிட்டு: குறிப்பிட்டு வரலையம்)

5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)

6. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu)
GE3252 TAMILS AND TECHNOLOGY L T P C 1 0 0 1

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3
Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3
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 3

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

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS
1. தமிழ் மக்களும் பண பொடும் மக. மக. பிளமள (தவளியீடு: தமிழ்நொடு பொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் முமனவர் இல.சுந்தரம். (விகடன் பிரசுரம்).
3. தமிழ் வரலொறு மக்களும் பண பொடும் மக. மக. பிளமள (தவளியீடு: தமிழ் பொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
4. கீழடி மவமகநதிக்கமரயில் எங்ககொலநகர் நொகரிகம் (தவளியீடு: தமிழ் பொடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
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) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
## NCC CREDIT COURSE LEVEL 1*

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

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**TOTAL: 30 PERIODS**
# NCC CREDIT COURSE LEVEL 1*

**NX3252**

(NAVAL WING) NCC CREDIT COURSE LEVEL - I

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## NATIONAL INTEGRATION AND AWARENESS

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## SOCIAL SERVICE AND COMMUNITY DEVELOPMENT

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**TOTAL : 30 PERIODS**
# NCC CREDIT COURSE LEVEL 1*

**NX3253**

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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  15

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 airconditioner.

SHEET METAL WORK:
  a) Making of a square tray

FOUNDRY WORK:
  a) Demonstrating basic foundry operations.

PART IV  ELECTRONIC ENGINEERING PRACTICES  15

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

TOTAL = 60 PERIODS

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.
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

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 12
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 12
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 12
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.

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.

MA3351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C
3 1 0 4

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 9+3
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 9+3
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval’s identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3
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  9+3

UNIT V  Z-TRANSFORMS AND DIFFERENCE EQUATIONS  9+3

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:
COURSE OBJECTIVES:

1. To Learn the use scalar and vector analytical techniques for analyzing forces in statically
determinate structures
2. To introduce the equilibrium of rigid bodies, vector methods and free body diagram
3. To study and understand the distributed forces, surface, loading on beam and intensity.
4. To learn the principles of friction, forces and to determine the apply the concepts of frictional
forces at the contact surfaces of various engineering systems.
5. To develop basic dynamics concepts – force, momentum, work and energy;

UNIT I  STATICS OF PARTICLES  9
Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of
Particles - Forces in a Plane, Resultant of Forces, Resolution of a Force into Components,
Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle - Newton's First Law of
Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNIT II  EQUILIBRIUM OF RIGID BODIES  9
Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force
about a Point, Varignon's Theorem, Rectangular Components of the Moment of a Force, Scalar
Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis,
Couple - Moment of a Couple. Equivalent Couples, Addition of Couples, Resolution of a Given
Force into a Force-Couple system, Further Reduction of a System of Forces, Equilibrium in Two
and Three Dimensions - Reactions at Supports and Connections.

UNIT III  DISTRIBUTED FORCES  9
Centroids of lines and areas – symmetrical and unsymmetrical shapes. Determination of Centroids
by Integration, Theorems of Pappus-Guldinus, Distributed Loads on Beams, Centre of Gravity of a
Three-Dimensional Body, Centroid of a Volume, Composite Bodies, Determination of Centroids of
Volumes by Integration. Moments of Inertia of Areas and Mass - Determination of the Moment of
Inertia of an Area by Integration, Polar Moment of Inertia, Radius of Gyration of an Area, Parallel-
Axis Theorem, Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of
Inertia of Thin Plates, Determination of the Moment of Inertia of a Three-Dimensional Body by
Integration.

UNIT IV  FRICTION  9
The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction,
Rolling Resistance, Ladder friction.

UNIT V  DYNAMICS OF PARTICLES  9
Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law
of Motion - Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a
Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and
Momentum, Impact of bodies.

TOTAL : 45 PERIODS

OUTCOMES:
At the end of the course the students would be able to
1. Illustrate the vector and scalar representation of forces and moments
2. Analyse the rigid body in equilibrium
3. Evaluate the properties of distributed forces
4. Determine the friction and the effects by the laws of friction
5. Calculate dynamic forces exerted in rigid body
TEXTBOOKS:

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.

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.

TOTAL: 60 PERIODS
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Low (1) ; Medium (2) ; High (3)

SF3301 PRINCIPLES OF SAFETY MANAGEMENT

COURSE OBJECTIVES:
1. Understanding of the principles of safety management.
2. Enable the students to learn about various functions and activities in organization
3. Enable students to conduct safety audit and write audit report effectively in auditing situations.
4. Have knowledge about sources of information for safety promotion and training.
5. Familiarize students with evaluation of safety performance.

UNIT I INTRODUCTION AND NEEDS OF SAFETY


UNIT II SAFETY ORGANIZATION INTRODUCTION

Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer- responsibilities, authority. Safety committee-needs, types, advantages. Accident prevention Methods-Engineering, Education and Enforcement
UNIT III  SAFETY EDUCATION AND TRAINING  

UNIT IV  SAFETY PERFORMANCE MONITORING  

UNIT V  ACCIDENT INVESTIGATION AND REPORTING  

OUTCOMES
Students able to know 
CO 1  To understand the functions and activities of safety engineering departments.
CO 2  To carry out a safety audit and prepare a report for the audit.
CO 3  To prepare an accident investigation report.
CO 4  To estimate the accident cost using supervisors report and data.
CO 5  To identify various agencies, support in situations and government organizations involved in safety training and promotion.

TEXTBOOKS

REFERENCES:

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COURSE OBJECTIVES:
1. Understand the basic principles of operation of rotating electric machines (Generators and Motors), their classification and basic efficiency and performance characteristics.
2. Brief the legislative requirements for electrical safety - national/international laws/codes of practices/ standards and/or regulations.
3. Use a “Status Check” survey to assess the facility’s electrical safety program and where necessary develop strategies for improvement.
4. Identify persons who may be exposed to a source of electrical energy directly or indirectly.
5. Describe the essential parts of a Flash Hazard Analysis and list the data required analysis.

UNIT I ELEMENTARY IDEAS OF DC MACHINES, TRANSFORMERS AND RELAYS

UNIT II SYNCHRONOUS, INDUCTION MOTOR, AND THEIR ELECTRICAL CIRCUIT BREAKERS

UNIT III ELECTRICAL GROUNDING, EARTHLING AND INSULATION

UNIT IV SAFETY DURING INSTALLATION, TESTING AND COMMISSIONING, OPERATION AND MAINTENANCE

UNIT V ELECTRICITY AND FIRE SAFETY
power factor improvement – equipments – Importance of P.F. improvement – Disadvantages of low power factor – Causes of low P.F. –Personal Protective equipments (PPE’s) used in connection with safe use of electricity like Hand Gloves, Rubber Shoes, Waist belt, , earthing rod, Goggles etc., Safe working clearances for different voltage levels, fire extinguishers used for different applications, knowledge of Static electricity, Lightning protection, Electrical Safety Audit, elementary knowledge of first aid.

TOTAL : 45 PERIODS
COURSE OUTCOMES:
Students able to
CO 1 Explain Indian electricity rules and acts and their significance
CO 2 Understand the need of electrical safety in different locations
CO 3 Understand the need of electrical safety during installation of equipment’s
CO 4 Explain the necessity of electrical safety in Hazardous zones
CO 5 Understand electrical safety in distributed systems

TEXT BOOKS:

REFERENCES:

CO’s- PO’s & PSO’s MAPPING

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SF3303 PRINCIPLES OF CHEMICAL ENGINEERING
L T P C
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COURSE OBJECTIVES
Understand the overall view of the chemical engineering subjects

UNIT I
Chemistry, Chemical Engineering and Chemical Technology; Chemical process industries: History and their role in Society; Role of Chemical Engineer; History and Personalities of Chemical Engineering; Greatest achievements of Chemical Engineering.
UNIT II
Components of Chemical Engineering: Role of Mathematics, Physics, Chemistry and Biology; Thermodynamics, Transport Phenomena, Chemical Kinetics and Process dynamics, design and control.

UNIT III
Concept of Unit Processes and Unit Operations; Description of different Unit Processes and Unit Operations; Designing of equipments; Flow sheet representation of process plants, Evolution of an Industry – Sulphuric acid and Soda ash manufacture. Demonstration of simple chemical engineering experiments; Plant visit to a chemical industry

UNIT IV
Role of Computer in Chemical Engineering; Chemical Engineering Software; Visit to Process Simulation Lab; Relation between Chemical Engineering and the reengineering disciplines; Traditional vs. modern Chemical Engineering; Versatility of Chemical Engineering: Role of Chemical Engineers in the area of Food, Medical, Energy, Environmental, Biochemical, Electronics etc. Plant visit to an allied industry.

UNIT V
Paradigm shifts in Chemical Engineering; Range of scales in Chemical Engineering; Opportunities for Chemical Engineers; Future of Chemical Engineering.

OUTCOMES
CO 1 On completion of the course, students will attain knowledge in fluid behavior and solid properties,
CO 2 Understand the concept of chemical engineering principles

TEXT BOOKS
1. SaliK. Ghosal, Siddhartha Datta "Introduction to Chemical Engineering" Tata McGraw-Hill Education

REFERENCES

CO’s- PO’s & PSO’s MAPPING

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COURSE OBJECTIVES:
1. Understand the laws governing electric circuits
2. Study the load and speed characteristics of D.C motors
3. Do load test on single phase transformer

LIST OF EXPERIMENTS
1. Verification of Kirchhoff’s Laws
2. Verification of Superposition Theorem
4. Measurement of power in an A.C. circuit by 3 ammeters and 3 voltmeter method
5. Load test on a DC series motor
6. Speed characteristics of DC shunt motor
7. Regulation of a Transformer
8. Load characteristics of a 3 phase induction motor
10. Study of insulation testing and ground testing.

OUTCOMES:
On completion of this course the student will be able to:
CO1: Understand the laws governing electric circuits
CO2: Study the load and speed characteristics of D.C motors
CO3: Do load test on single phase transformer
CO4: Study the load and speed characteristics of A.C motors
CO5: Understand the functions of protective relays and circuit breakers.
CO6: Impart knowledge on electric circuits, DC motors, single phase transformers, AC motors, Protective relays and circuit breakers.

TOTAL: 60 PERIODS

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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: 10 Hours
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: 10 Hours
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.
OBJECTIVES

- To introduce the basic notions of vector spaces which will then be used to solve related problems.
- To understand the concepts of vector space, linear transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.
- To provide necessary basics in probability and random processes that are relevant in applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.

UNIT I PROBABILITY AND RANDOM VARIABLES

Axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions - Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III VECTOR SPACES

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT IV LINEAR TRANSFORMATION AND DIAGONALIZATION

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations - Eigenvalues and eigenvectors – Diagonalization.

UNIT V INNER PRODUCT SPACES

Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

OUTCOMES:

Upon successful completion of the course, students should be able to:

- Explain the fundamental concepts of advanced algebra and their role in modern mathematics and applied contexts.
- Demonstrate accurate and efficient use of advanced algebraic techniques.
- Demonstrate their mastery by solving non-trivial problems related to the concepts and by proving simple theorems about the statements proven by the text.
- Understand the fundamental concepts of probability with a thorough knowledge of standard distributions that can describe certain real-life phenomenon.
- Understand the basic concepts of one and two dimensional random variables and apply them to model engineering problems.

TEXT BOOKS

REFERENCES

SF3401 OCCUPATIONAL HEALTH AND HYGIENE

COURSE OBJECTIVES:
1. Anticipate, recognize, evaluate and control hazardous conditions and practices affecting people, property and the environment.
2. Communicate and interact effectively with technical and non-technical audiences.
3. Integrate ethical, social, current, and global issues and responsibilities in their practice as a professional in the field.
4. Work individually or on a team to critically analyze, interpret, and provide leadership to address and manage problems in occupational safety and health.
5. Recognize that the practice of occupational safety and health requires ongoing learning, and undertake appropriate activities to address this need.

UNIT I OCCUPATIONAL HAZARD AND CONTROL PRINCIPLES

Concept and spectrum of health- functional units and activities of occupational health services occupational and work related disease- Levels of prevention of diseases - notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, and anthrax - Lead-Nickel, chromium and manganese toxicity- gas poisoning (such as CO, ammonia, coal and dust ), their effects and prevention - Industrial toxicology - local and systemic and chronic effects, temporary and cumulative effects - threshold limit values, calculation of TLVs - carcinogens, mutagens, teratogens. Instruments for Radiation detection and measurement. Early recognition of radiation hazard. Personal monitoring devices, Medical support. Hazards associated with the following radiations and preventive measures- Laser, infra-red, ultra violet and ELF.

UNIT II PHYSICAL HAZARD MEASUREMENT, EVALUATION AND CONTROL

UNIT III  PRINCIPLES OF FIRST AID

UNIT IV  FIRST-AID PRACTICE IN INDUSTRY

UNIT V  OCCUPATIONAL AND PSYCHOLOGICAL HAZARDS

OUTCOMES:
Students able to
CO 1 An ability to identify, formulate, and solve broadly defined technical or scientific problems by applying knowledge of mathematics and science and/or technical topics to areas relevant to occupational safety and health.
CO 2 An ability to develop and conduct experiments or test hypotheses, analyze and interpret data and use scientific judgment to draw conclusions.
CO 3 An ability to communicate effectively with a range of audiences.
CO 4 An ability to understand ethical and professional responsibilities and the impact of technical and/or scientific solutions in global, economic, environmental, and societal contexts.
CO 5 An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

TEXT BOOKS:

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CE3491 STRENGTH OF MATERIALS

COURSE OBJECTIVES:
- To understand the concepts of stress, strain, principal stresses and principal planes.
- To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
- To determine stresses and deformation in circular shafts and helical spring due to torsion.
- To compute slopes and deflections in determinate beams by various methods.
- To study the stresses and deformations induced in thin and thick shells.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses - Deformation of simple and compound bars – Thermal stresses – Elastic constants - Volumetric strains – Stresses on inclined planes – Principal stresses and principal planes – Mohr’s circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM

UNIT III TORSION
Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – Combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel – Closed and Open Coiled helical springs – springs in series and parallel.

UNIT IV DEFLECTION OF BEAMS

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS
Stresses in thin cylindrical shell due to internal pressure - circumferential and longitudinal stresses - Deformation in thin cylinders – Spherical shells subjected to internal pressure – Deformation in spherical shells – Thick cylinders - Lame’s theory.

TOTAL: 45 PERIODS
OUTCOMES:
At the end of the course the students would be able to
1. Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
2. Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
3. Apply basic equation of torsion in designing of shafts and helical springs.
4. Calculate slope and deflection in beams using different methods.
5. Analyze thin and thick shells for applied pressures.

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COURSE OBJECTIVES:
1. Anticipate, identify and evaluate hazardous conditions and practices.
2. Develop hazard control designs, methods, procedures, and programs.
3. Illustrate the basic concepts and techniques of modern reliability engineering tools.
4. To provide the students an illustration of significance of the Fire Engineering profession in the protection life, property and environment.
5. To understand the importance of life safety in building fire and method of evacuation.

UNIT I PROPERTIES OF COMBUSTION
Introduction- temperature, heat, specific heat, flash point, fire point, ignition, combustion; Ignition-pilot ignition, spontaneous ignition, Types of combustion-rapid, spontaneous, explosion.; Development of fire- incipient, smoldering, flame and heat stages; Diffusion flames-zones of combustion, smoldering combustion.; Premixed flames-burning velocity, limits of flammability, explosion and expansion ratios, deflagration and detonation, characteristics of premixed flame; Explosion- physical explosion, chemical explosion; Special kinds of combustion- Flash fire, Pool fire, Deep seated fire, Spillover, Boil over, Dust explosion, BLEVE, UVCE; Classification of fire based on material.
UNIT II   BEHAVIOUR OF BUILDING ELEMENTS UNDER ACTION OF FIRE 9
Product of combustion-flame, heat, smoke, fire gases; spread of fire in rooms and buildings; Effect of heat exposure to human body Smoke - constituents of smoke, quantity and rate of production of smoke, quality of smoke, smoke density, visibility in smoke, smoke movement in buildings, modeling of smoke movement; Smoke control in buildings natural and mechanical ventilation, pressurization; Design principles of smoke control using pressurization technique; Principles of smoke vent design. Toxicity of smoke- effect of harmful agents preventing escape and causing injury or death - CO, CO2, HCN, SO2, NH3, Nitrogen oxide.

UNIT III   OPERATION HANDLING AND MAINTENANCE OF FIRE SERVICE EQUIPMENTS AND ACCESSORIES 9
Introduction to fire fighting vehicles and appliances- Pumps, primers, crash tenders, rescue tenders, hose laying tenders, control vans, hydraulic platforms - Delivery Hose, Hose reel, Hose fittings- coupling, adapters, branches, branch holders, radial branches, collecting heads, stand pipe, monitors, hydrants;; Ladders- Uses and maintenance of small gear and miscellaneous equipments used during fire fighting; Lamps and lighting sets; Ropes and Lines- Types-wire and rope lines used in fire service. Use and testing of lines, knots, Bends and hitches; General rope work.

UNIT IV   HYDRAULIC SYSTEM 9
Fire stream-path, range; nozzles-types, calculation of discharge capacity, nozzle reaction; friction losses in pipes, fire hoses and fixtures, parallel and series connections; Flow in pipes and fire hoses, branching lines; water relay techniques; Estimation of fire protection water requirements, pump capacity and other parameters relating to fire hydraulics. Fire ground operations - preplanning, action on arrival and control, methods of rescue, methods of entry. Personnel safety. Control procedure and use of other safety equipment. Ventilation and salvage operations.

UNIT V   FIRE SUPPRESSION & PROTECTION 9
Introduction, Definitions, Water as an extinguishing agent, Basic Components of a Fire Protection system, Classification of fire protection systems-Active & Passive: Active FPS Definitions, classifications- Water Based (Vs) Non water based & Fixed (Vs) Portable/Mobile, Types:- Fire Extinguishers, Fire hydrants, Sprinklers, standpipe systems, Fire detectors, water spray systems - definitions, types, operation, applications & limitations, selection, installation & maintenance as per relevant national and international standards(IS, OISD, NFPA etc)

COURSE OUTCOMES:
Students able to
CO 1 Explain the basics of fire engineering.
CO 2 Classify the types of combustion and its products.
CO 3 Demonstrate the operation of fire service equipment’s and practical fire fighting.
CO 4 Categorize the buildings and design the evacuation methods
CO 5 Apply acquired knowledge on real life problems

TEXT BOOKS:

REFERENCES:
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SF3403 SAFETY IN CONSTRUCTION L T P C 3 0 0 3

OBJECTIVES:
1. know causes of accidents related to construction activities and human factors associated with these accident
2. Understand the construction regulations and quality assurance in construction
3. Have the knowledge in hazards of construction and their prevention methods
4. know the working principles of various construction machinery
5. gain knowledge in health hazards and safety in demolition work Course

UNIT I INTRODUCTION 9
Introduction to construction industry and safety issues in construction-Human factors in construction safety management- Roles of various groups and stake-holders in ensuring safety in construction industry -Framing of contract conditions on safety and related matters –Relevance of ergonomics in construction safety.

UNIT II SAFETY IN CONSTRUCTION OPERATIONS 9

UNIT III CONSTRUCTION MACHINERY 9

UNIT IV CONSTRUCTION ACT AND CODE OF PRACTICES 9
UNIT V SAFETY IN DEMOLITION WORK

Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement, site supervision, safe clearance zone, health hazards from demolition - Indian standard - trusses, girders and beams – first aid – fire hazards and preventing methods–Case studies in construction sites against the fire accidents.

TOTAL: 45 PERIODS

OUTCOMES

On completion of this course, the student will be able to
CO 1 Visualize the safety issues at different stages of construction activity.
CO 2 Understand the safety requirements in various construction operation and develop guidelines to ensure safety at construction site.
CO 3 Understand the safety requirements in material handling and Equipments and develop guidelines to ensure safety at construction site.
CO 4 Learn the legal provisions with respect to the health and welfare of workers at construction site.
CO 5 List out construction regulations and Indian standards for construction and demolition work

TEXTBOOKS


REFERENCES:

5. Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and Central Rules.

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GE3451 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY

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
1. Evaluate the different pollutants in the atmosphere using air sampling Equipment
2. Evaluate heat stress in industries.
3. Measure different physical hazards such as noise, illumination etc.

LIST OF EXPERIMENTS:
1. Study of Personal Protective equipment
2. Study of occupational diseases with photographic models.
3. Demonstration of Air sampling equipment.
4. Sampling and estimation of dusts using high volume sampler
5. Sampling and estimation of dust using personal sampler
6. Measurement of Noise
7. Measurement of illumination
8. Vision testing
9. Lung functions testing.

OUTCOMES:
On completion of this course the student will be able to
CO1: The students will be able to Study of Personal Protective equipment
CO2: The students will be able to Study of occupational diseases with photographic models.
CO3: The students will be able to Measurement of Noise.
CO4: The students will be able to Measurement of illumination
CO5: The students will be able to Measurement of thermal stress.

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TOTAL: 60 PERIODS

CE3481 STRENGTH OF MATERIALS AND FLUID MACHINERY LABORATORY
COURSE OBJECTIVE:
1. To study the mechanical properties of metals, wood and spring by testing in laboratory.
2. To verify the principles studied in fluid mechanics and machinery theory by performing experiments in laboratory.

UNIT – I STRENGTH OF MATERIALS

LIST OF EXPERIMENTS
1. Tension test on mild steel rod
2. Torsion test on mild steel rod
3. Hardness test on metal (Rockwell and Brinell Hardness)
4. Compression test on helical spring
5. Deflection test on carriage spring

UNIT – II FLUID MECHANICS AND MACHINES LABORATORY

LIST OF EXPERIMENTS

1. (a) Determination of coefficient of discharge of a venturimeter
   (b) Determination of friction factor for flow through pipes
2. (a) Determination of metacentric height
   (b) Determination of forces due to impact of jet on a fixed plate
3. Characteristics of centrifugal pumps
4. Characteristics of reciprocating pump
5. Characteristics of Pelton wheel turbine

TOTAL: 60 PERIODS

OUTCOMES:
On completion of the course, the student is expected to be able to

1. Determine the tensile, torsion and hardness properties of metals by testing
2. Determine the stiffness properties of helical and carriage spring
3. Apply the conservation laws to determine the coefficient of discharge of a venturimeter and finding the friction factor of given pipe
4. Apply the fluid static and momentum principles to determine the metacentric height and forces due to impact of jet
5. Determine the performance characteristics of turbine, rotodynamic pump and positive displacement pump.

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