



**MEDI-CAPS**  
**UNIVERSITY**

**Department of Mechanical Engineering**

**CURRICULUM AND SYLLABUS**

**(2021-2025)**

**B. Tech. Fire Technology**



# **Fire Technology**

## **B. Tech. (FT)**

### **CURRICULUM AND SYLLABUS**



**MEDI-CAPS**  
**UNIVERSITY**

### **Vision Statement of University**

Be an internationally acclaimed University recognised for its excellent teaching, research, innovation, outreach and creating top class technocrats and professionals who can serve the mankind as multi skilled global citizen.

### **Mission Statement of University**

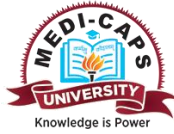
- Establish state-of-the-art facilities for world class education and research.
- Conduct scholarly research and creative endeavours that impact quality of life.
- Attract quality staff and students to cater for diverse needs and preferences and widen participation.
- Build a foundation for students to be successful at all levels through high-quality, innovative programs.
- Collaborate with institute, industry, and society to address current issues through research and align curriculum.
- Involve in societal outreach programs to identify concerns and provide sustainable ethical solutions.
- Encourage life-long learning and team-based problem solving through an enabling environment.

### **Vision of the Department:**

To develop engineers of par excellence to meet the ever-changing requirements of industries, motivated towards innovation, entrepreneurship and research in mechanical and allied engineering along with strong human values and ethics for the benefit of society and nation at large.

### **Mission of the Department:**

- To offer a platform to the students where they will be able to groom themselves technically as industry ready professionals.
- To develop research environment where students will be motivated to enhance their knowledge to undertake research in mechanical and allied engineering.
- To collaborate with industries, education institutes of excellence and aluminus to share and exchange latest technology and innovation.
- To design curriculum to motivate and sensitize students towards environmental issues and respect for human values and ethics.
- To develop conducive academic environment in the department to attract qualified faculties members from all around the country.



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## Department of Mechanical Engineering

### Program Education Objectives (PEOs)

|                         |   |
|-------------------------|---|
| <b>PEO<sub>01</sub></b> | To inculcate to students with technical and practical knowledge of fire technology and safety engineering.  |
| <b>PEO<sub>02</sub></b> | To equip students for designing and developing fire safety systems for different industrial applications.   |
| <b>PEO<sub>03</sub></b> | To enhance analytical skills of students for decision making in complex engineering problems  |
| <b>PEO<sub>04</sub></b> | To prepare graduates with an outstanding knowledge of mathematical, scientific, engineering, technology, management, humanities and various other interdisciplinary subjects for a successful career. |



## Department of Mechanical Engineering

### PROGRAMME OUTCOMES (POs)

|                        |   |
|------------------------|---|
| <b>PO<sub>01</sub></b> | Engineering knowledge: Apply the knowledge of mathematics, science, engineering, fundamentals, and an engineering specialization to the solution of complex engineering problem.  |
| <b>PO<sub>02</sub></b> | Problem analysis: Identify, formulate, review, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences   |
| <b>PO<sub>03</sub></b> | Design / development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.       |
| <b>PO<sub>04</sub></b> | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.  |
| <b>PO<sub>05</sub></b> | Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.   |
| <b>PO<sub>06</sub></b> | The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.   |
| <b>PO<sub>07</sub></b> | Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.   |
| <b>PO<sub>08</sub></b> | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.  |
| <b>PO<sub>09</sub></b> | Individual and teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.  |
| <b>PO<sub>10</sub></b> | 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. |
| <b>PO<sub>11</sub></b> | 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.   |



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|                        |  |
|------------------------|--|
| <b>PO<sub>12</sub></b> | 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. |
|------------------------|--|



**MEDI-CAPS**  
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**Department of Mechanical Engineering**  
**PROGRAMME SPECIFIC OUTCOMES (PSOs)**

|                         |  |
|-------------------------|--|
| <b>PSO<sub>01</sub></b> | Develop the research acumen through project work and contribute to recent scenario in automotive industries like hybrid and electric vehicles. |
| <b>PSO<sub>02</sub></b> | Apply and gain practical knowledge through project work and participations in different competitive events.                                    |



Semester I

| S.No. | Course Code | Course Name                  | L         | T        | P         | Credits   |
|-------|-------------|------------------------------|-----------|----------|-----------|-----------|
| 1     | EN3BS11     | Engineering Mathematics-I    | 3         | 0        | 0         | 3         |
| 2     | EN3BS13     | Engineering Physics          | 3         | 0        | 2         | 4         |
| 3     | EN3ES17     | Basic Electrical Engineering | 3         | 0        | 2         | 4         |
| 4     | EN3NG01     | Enviornmental Science*       | 2         | 0        | 0         | 2         |
| 5     | EN3ES19     | Engineering Graphics         | 2         | 0        | 2         | 3         |
| 6     | EN3ES21     | Programming-I                | 0         | 0        | 4         | 2         |
| 7     | EN3ES01     | Basic Civil Engineering      | 3         | 0        | 2         | 4         |
|       |             | <b>Total</b>                 | <b>16</b> | <b>0</b> | <b>12</b> | <b>20</b> |
|       |             | <b>Total Contact Hours</b>   | <b>28</b> |          |           |           |

Semester II

| S.No. | Course Code | Course Name                     | L         | T        | P         | Credits   |
|-------|-------------|---------------------------------|-----------|----------|-----------|-----------|
| 1     | EN3BS12     | Engineering Mathematics-II      | 3         | 0        | 0         | 3         |
| 2     | EN3BS14     | Engineering Chemistry           | 2         | 0        | 2         | 3         |
| 3     | EN3ES18     | Basic Mechanical Engineering    | 3         | 0        | 2         | 4         |
| 4     | EN3ES22     | Programming-II                  | 0         | 0        | 4         | 2         |
| 5     | EN3HS02     | Communication Skills            | 2         | 0        | 2         | 3         |
| 6     | EN3ES16     | Basic Electronics Engineering   | 3         | 0        | 2         | 4         |
| 7     | EN3ES20     | Engineering Workshop - I        | 0         | 0        | 2         | 1         |
| 8     | EN3HS01     | History of Science & Technology | 2         | 0        | 0         | 2         |
|       |             | <b>Total</b>                    | <b>15</b> | <b>0</b> | <b>14</b> | <b>22</b> |
|       |             | <b>Total Contact Hours</b>      | <b>29</b> |          |           |           |





SEMESTER – III

| Sr.No. | Course Code | Course Name                                | L         | T        | P        | Credits   |
|--------|-------------|--|-----------|----------|----------|-----------|
| 1      | EN3BS15     | Engineering Mathematics -III               | 3         | 0        | 0        | 3         |
| 2      | FT3CO24     | Manufacturing Processes                    | 3         | 0        | 0        | 3         |
| 3      | FT3CO25     | Mechanics of Materials                     | 4         | 0        | 0        | 4         |
| 4      | FT3CO26     | Engineering Thermodynamics                 | 4         | 0        | 0        | 4         |
| 5      | FT3CO27     | Fuel Technology                            | 3         | 0        | 0        | 3         |
| 6      | FT3CO28     | CAD LAB                                    | 0         | 0        | 2        | 1         |
| 7      | FT3CO29     | Fire Fighting & Field Training -I          | 0         | 0        | 2        | 1         |
| 8      | FT3CO30     | Materials and Material Testing Lab         | 0         | 0        | 2        | 1         |
| 9      | FT3CO31     | Python Programming for Safety Engineers -I | 0         | 0        | 2        | 1         |
| 10     | EN3ES25     | Engineering Materials                      | 3         | 0        | 0        | 3         |
| 11     | EN3NG03     | Soft Skills -I                             | 2         | 0        | 0        | 2         |
|        |             | <b>Total</b>                               | <b>22</b> | <b>0</b> | <b>8</b> | <b>24</b> |
|        |             | <b>Total Contact Hours</b>                 | <b>30</b> |          |          |           |



**SEMESTER – IV**

| Sr.No. | Course Code | Course Name   | L         | T        | P         | Credits   |
|--------|-------------|---|-----------|----------|-----------|-----------|
| 1      | FT3CO32     | Building Planning & Machine Drawing                 | 4         | 0        | 2         | 5         |
| 2      | FT3CO33     | Python Programming for Safety Engineers -II         | 0         | 0        | 2         | 1         |
| 3      | FT3CO34     | Fluid Mechanics and Machinery                       | 3         | 0        | 2         | 4         |
| 4      | FT3CO35     | Electrical Technology & Safety in Electrical System | 3         | 0        | 0         | 3         |
| 5      | FT3CO36     | Fire Fighting & Field Training -II                  | 0         | 0        | 2         | 1         |
| 6      | EN3HS04     | Fundamentals of Management, Economics & Accountancy | 3         | 0        | 0         | 3         |
| 7      | FT3PC04     | Mini Project -I                                     | 0         | 0        | 4         | 2         |
| 8      | EN3NG02     | Universal Human Values & Professional Ethics        | 2         | 0        | 0         | 2         |
| 9      | EN3NG04     | Soft Skills -II                                     | 2         | 0        | 0         | 2         |
|        |             | <b>Total</b>  | <b>17</b> | <b>0</b> | <b>12</b> | <b>19</b> |
|        |             | <b>Total Contact Hours</b>                          | <b>29</b> |          |           |           |

**SEMESTER – V**

| Sr.No. | Course Code | Course Name                          | L         | T        | P        | Credits   |
|--------|-------------|--------------------------------------|-----------|----------|----------|-----------|
| 1      | FT3CO37     | Fire Prevention & Protection System  | 3         | 0        | 0        | 3         |
| 2      | FT3CO38     | Fire Engineering -I                  | 4         | 0        | 2        | 5         |
| 3      | FT3CO39     | Occupational Health & Hygiene System | 3         | 0        | 2        | 4         |
| 4      | FT3CO40     | Fire Fighting & Field Training -III  | 0         | 0        | 2        | 1         |
| 5      | FT3CO41     | Paramedics                           | 4         | 0        | 0        | 4         |
| 6      |             | Program Elective - I                 | 3         | 0        | 0        | 3         |
| 7      |             | Program Elective - II                | 3         | 0        | 0        | 3         |
| 8      |             | Open Elective I                      | 3         | 0        | 0        | 3         |
|        |             | <b>Total</b>                         | <b>23</b> | <b>0</b> | <b>6</b> | <b>26</b> |
|        |             | <b>Total Contact Hours</b>           | <b>29</b> |          |          |           |



SEMESTER – VI

| Sr.No. | Course Code | Course Name                             | L         | T        | P         | Credits   |
|--------|-------------|---|-----------|----------|-----------|-----------|
| 1      | FT3CO42     | Nuclear Safety & Radioactive Materials  | 4         | 0        | 0         | 4         |
| 2      | FT3CO43     | Fire Engineering -II                    | 4         | 0        | 2         | 5         |
| 3      | FT3CO44     | Fire Fighting & Field Training -IV      | 0         | 0        | 2         | 1         |
| 4      | FT3CO45     | Hazard Identification & Risk Assessment | 3         | 0        | 0         | 3         |
| 5      |             | Program Elective - III                  | 3         | 0        | 0         | 3         |
| 6      |             | Program Elective - IV                   | 3         | 0        | 0         | 3         |
| 7      |             | Open Elective II                        | 3         | 0        | 0         | 3         |
| 8      | FT3PC05     | Mini Project -II                        | 0         | 0        | 4         | 2         |
| 9      | EN3NGxx     | Sports/Club Activities/NSS/NCC/Yoga     | 0         | 0        | 2         | 1         |
|        |             | <b>Total</b>                            | <b>20</b> | <b>0</b> | <b>10</b> | <b>24</b> |
|        |             | <b>Total Contact Hours</b>              | <b>30</b> |          |           |           |

SEMESTER – VII

| Sr. No. | Course Code | Course Name                         | L         | T        | P         | Credits   |
|---------|-------------|-------------------------------------|-----------|----------|-----------|-----------|
| 1       |             | Program Elective - V                | 3         | 0        | 0         | 3         |
| 2       |             | Program Elective - VI               | 3         | 0        | 0         | 3         |
| 3       |             | Open Electives III                  | 3         | 0        | 0         | 3         |
| 4       | FT3PC06     | Minor Project                       | 0         | 0        | 8         | 4         |
| 5       | FT3PC03     | Industrial Training                 | 0         | 0        | 4         | 2         |
| 6       | EN3NG06     | Open Learning courses               | 1         | 0        | 0         | 1         |
| 7       | EN3NGxx     | Sports/Club Activities/NSS/NCC/Yoga | 0         | 0        | 2         | 1         |
|         |             | <b>Total</b>                        | <b>10</b> | <b>0</b> | <b>14</b> | <b>15</b> |
|         |             | <b>Total Contact Hours</b>          | <b>24</b> |          |           |           |



SEMESTER VIII

| Sr. No. | Course Code | Course Name                | L         | T        | P         | Credits   |
|---------|-------------|----------------------------|-----------|----------|-----------|-----------|
| 1       | FT3PC07     | Major Project              | 0         | 0        | 20        | 10        |
|         |             | <b>Total</b>               | <b>0</b>  | <b>0</b> | <b>20</b> | <b>10</b> |
|         |             | <b>Total Contact Hours</b> | <b>20</b> |          |           |           |

Summary of Credits

| S.NO                 | Course Work                         | Total Credits (CS) | Credits as per Modal scheme (176) |
|----------------------|-------------------------------------|--------------------|-----------------------------------|
| 1                    | Basic Sciences (BS)                 | 16                 | 10-15% (16-24)                    |
| 2                    | Engineering Sciences (ES)           | 28                 | 15-20% (24-32)                    |
| 3                    | Humanities and Social Sciences (HS) | 8                  | 5-10% (8-16)                      |
| 4                    | Core (CO)                           | 61                 | 30-40%(48-64)                     |
| 5                    | Program Electives (EL)              | 18                 | 10-15%(16-24)                     |
| 6                    | Open Electives (OE)                 | 9                  | 5-10%(8-16)                       |
| 7                    | Project Work, Seminar               | 20                 | 10-15%(16-24)                     |
| 8                    | Non Grading                         | 11                 |                                   |
| <b>Total Credits</b> |                                     | <b>171</b>         |                                   |



**Choice Based Credit System Scheme- B. Tech FT**

**Batch 2021-2025**

**Scheme (2021-25 Batch)**

**SEMESTER I**

| <b>SNo.</b> | <b>Course Code</b> | <b>Courses</b>               | <b>L</b>  | <b>T</b> | <b>P</b>  | <b>Credit</b> |
|-------------|--------------------|------------------------------|-----------|----------|-----------|---------------|
| 1           | EN3BS11            | Engineering Mathematics-I    | 3         | 0        | 0         | 3             |
| 2           | EN3BS13            | Engineering Physics          | 3         | 0        | 2         | 4             |
| 3           | EN3ES17            | Basic Electrical Engineering | 3         | 0        | 2         | 4             |
| 4           | EN3NG01            | Environmental Science*       | 2         | 0        | 0         | 2             |
| 5           | EN3ES19            | Engineering Graphics         | 2         | 0        | 2         | 3             |
| 6           | EN3ES21            | Programming-I                | 0         | 0        | 4         | 2             |
| 7           | EN3ES01            | Basic Civil Engineering      | 3         | 0        | 2         | 4             |
|             |                    | <b>Total</b>                 | <b>16</b> | <b>0</b> | <b>12</b> | <b>22</b>     |
|             |                    | <b>Total Contact Hours</b>   | <b>28</b> |          |           |               |

\* Non-gradual Courses



| Course Code | Course Name             | Hours per Week |   |   | Credits |
|-------------|-------------------------|----------------|---|---|---------|
|             |                         | L              | T | P |         |
| EN3BS11     | Engineering Mathematics | 3              | 0 | 0 | 3       |

**Course Learning Objectives (CLOs):**

CLO01 To impart analytical ability of using concepts of matrices in various fields of engineering.

CLO02 To explain the concept of Differential Calculus.

CLO03 To discuss the concept of Integral Calculus and its applications.

CLO04 To impart analytical ability in solving Ordinary Differential Equations of first and Higher order.

CLO05 To impart basics of complex number and variables including concepts of analytical functions.

**Unit I Matrices and Linear Systems**

Rank and Nullity of a Matrix by reducing it into Echelon and Normal Forms, Solution of Simultaneous equations by elementary transformation methods, Consistency and Inconsistency of Equations, Eigen Values and Eigen Vectors.

**Unit II Differential Calculus**

Introduction to limit continuity, differentiability, Rolle's theorem, Mean value theorem, Taylors and Maclaurin's series expansions. Functions of Several variables, Partial differentiation, Euler's Theorem, Total Derivative, Maxima and Minima of function of two variables.

**Unit III Integral Calculus**

Definite Integral as a limit of sum and its application in summation of series, Beta and Gamma functions (Definitions, Relation between Beta and Gamma functions without proof, Duplication formula without proof). Multiple Integral (Double and Triple Integrals), Change the Order of Integration, Applications of Multiple Integral in Area, Volume.

**Unit IV Ordinary Differential Equations**

First order differential equations (Separable, Exact, Homogeneous, Linear), Linear differential Equations of second and higher order with constant coefficients, Homogeneous linear differential equations, Simultaneous linear differential equations.

**Unit V Complex Variable**

Basics of Complex number, Functions of complex variable: Analytic functions, Harmonic Conjugate functions, Cauchy-Riemann Equations, Complex Line Integral, Cauchy's Theorem, Cauchy's Integral Formula.



### **Textbooks**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi.
2. H.K. Dass, Higher Engineering Mathematics, S. Chand & Company Pvt LTD., New Delhi

### **References:**

1. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill Pub.Co.Ltd., New Delhi.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. R.K. Jain and S.K. Iyengar, Advanced Engineering Mathematics, Narosa Pub. House, New-Delhi.

### **Web Source:**

1. <http://nptel.ac.in/courses/111108066/>
2. <http://nptel.ac.in/courses/111104085/>
3. <https://swayam.gov.in/courses/public>
4. <http://nptel.ac.in/course.ph>

### **Course Outcomes (COs):**

After completion of this course the students shall be able to:

CO01 To illustrate the tools of matrices in solving the system of simultaneous equations,

CO02 To investigate the tools of differential calculus to relevant fields of engineering and can implement the concept of several variables.

CO03 To relate the integral calculus to relevant fields of engineering and can translate the concept of multiple integrals in finding area of regions and volume of solids.

CO04 To solve Ordinary Differential Equations using different methods.

CO05 To relate the knowledge of complex numbers and categorize it in solving functions of several complex numbers.

| Course Code | Course Name         | Hours per Week |   |   | Credits |
|-------------|---------------------|----------------|---|---|---------|
|             |                     | L              | T | P |         |
| EN3BS13     | Engineering Physics | 3              | 0 | 2 | 4       |

### Course Learning Objectives (CLOs):

- CLO01 They will be able to understand the concept of Laser devices.
- CLO02 An ability to understand the phenomena occurs in optical fibre.
- CLO03 Students came to know about the optical phenomenon like Interference, diffraction, and polarization with their use in daily life.
- CLO04 They will be able to learn about the quantum physics.
- CLO05 They will be able to understand the concept of modern physics
- CLO06 An ability to recognise the crystal structure and their basics.
- CLO07 An ability to adapt the classical concept of oscillations.
- CLO08 They will be able to use the acoustics nature in practical applications.
- CLO09 Students learn the advanced concept of the superconductivity.

#### Unit-I Laser and Fibre Optics

Lasers: Properties of lasers, Spontaneous and Stimulated emission of radiation, Einstein's A & B co-efficient, Population inversion, Components of Laser, Ruby Laser, He-Ne Laser, Engineering applications of lasers. Fibre Optics: Fundamental idea about optical fibre, propagation of light through optical fibre acceptance angle, numerical aperture, fractional refractive index changes, V number, Classification of fibre, Engineering applications of fibre.

#### Unit-II Wave Optics

Interference: Fresnel's biprism experiment, Newton's ring experiment. Diffraction of light: Fraunhofer diffraction for single slit, N-slits diffraction (grating), Missing orders and Rayleigh criterion of Resolution. Polarization: General concept of Polarization, double refraction, Engineering Applications of Polarization.

#### Unit-III Quantum mechanics

Limitations of Classical Mechanics, De-Broglie hypothesis for matter waves, Phase and group velocity, wave packet, Heisenberg's uncertainty principle, Compton scattering, wave function, Schrodinger's Time dependent and time independent wave equation, Particle in a box problem.

#### Unit-IV Solid State Physics

Crystal Physics: Unit cell, Crystal System, Types of Unit cell: Simple cubic, Face centered cubic, Body centered cubic Crystal, Number of atoms per unit cell, Packing fraction in different cubical lattices, Miller indices. Band theory of solids: Free Electron model, Band Model, Fermi level for Intrinsic and Extrinsic Semiconductors, Hall effect. Superconductivity: Zero resistance, persistent currents, superconducting



transition temperature ( $T_c$ ), Meissner effect, Type-I and Type-II superconductors, Engineering applications of superconductivity.

#### Unit- V Oscillations and acoustics

Oscillations: Concept of Simple, Periodic & harmonic Oscillation with illustrations; Differential equation of harmonic oscillator; Kinetic and potential energy of Harmonic Oscillator, compound pendulum. Acoustics: Introduction, Reverberation, Sabine's Formula, Eyring's Formula, Absorption Coefficient, Conditions for good acoustical design, Production and detection of ultrasonic waves and their applications.

#### Textbooks:

1. A Text book of Optics, N. Subramanyam and Brij Lal, S. Chand , New Delhi, 2010 .
2. Engineering Physics, H. K. Malik and A. K. Singh, Tata McGraw Hill New Delhi, 2010
3. Concepts of Modern Physics A. Beiser, Tata McGraw Hill New Delhi.
4. Engineering Physics, Gaur and Gupta, Dhanpat Rai Publications.

#### References:

1. An Introduction to Lasers- Theory and Applications. Dr. M N. Avadhanulu, Dr. R. S. Hemne S. Chand Publications.
2. Optics, A. Ghatak: 4th Edition, Tata McGraw-Hill, New Delhi 2009.
3. An Introduction to Fiber Optics, Ghatak and Thiagarajan, Cambridge University Press.
4. Solid State Physics by Kittel, Wiley India
5. A Text book of Physics – N. Gupta & S.K. Tiwary, Dhanpat Rai & Co., Delhi
6. Quantum Mechanics by Ghatak & Loknathan, Macmillian India Ltd-new Delhi Revised Edition 2019.

#### Course Outcomes (COs):

After completion of this course the students shall be able to:

- CO01 Understand and analyse the different types of lasers and optical fibres, operation, and its characteristics.
- CO02 Understand and apply various phenomenon of Interference, diffraction and polarization and their applications.
- CO03 Understand and apply the concept of Quantum Mechanics.
- CO04 Understand and examine the crystal structures and acquire the basic knowledge of various semiconductor devices.
- CO05 Evaluate and apply the applications of superconductivity in technology and real world.
- CO06 Apply basic concepts of oscillations in harmonic oscillator and compound pendulum.
- CO07 To analyse and design acoustics applications.

#### List of Practical's

List of suggestive core experiments (Any 10 experiments from the list of 16)

### **Laser and Fiber Optics**

1. To measure the beam divergence and beam waist of laser beam.
2. To measure the numerical aperture of an optical fiber by scanning method.
3. To find the thickness of thin wire using laser.
4. To study the working of laser using PhET simulation module.
5. To establish a fiber optic analog link and study of bending loss in optical fiber.

### **Wave Optics**

1. To determine the radius of curvature of plano convex lens using Newton's ring experiment.
2. To determine wavelength of spectral lines of mercury vapor lamp with the help of grating and spectrometer.
3. To determine the specific optical rotation of sugar solution by biquartz polarimeter.
4. To determine the wavelength of given sodium vapor lamp using Fresnel's Biprism.

### **Quantum Mechanics**

1. Determination of Planck's constant ( $h$ ) using light emitting diode (LED) of various colors.
2. To study black body Radiation by PhET Simulation.

### **Solid State Physics**

1. To study the Hall Effect experiment and calculate the charge carrier concentration (density) of given semiconductor diode.
2. To determine the energy band gap of semiconductor diode.
3. To study V-I characteristics of semiconductor diode and Zener diode.

### **Oscillations and Acoustics**

1. To find the frequency of AC Mains using Melde's method in longitudinal and transverse arrangement.
2. To determine the value of acceleration due to gravity ( $g$ ) using compound pendulum

| Course Code | Course Name                   | Hours per Week |   |   | Credits |
|-------------|-------------------------------|----------------|---|---|---------|
|             |                               | L              | T | P |         |
| EN3ES16     | Basic Electronics Engineering | 3              | 0 | 2 | 4       |

### Course Learning Objectives (CLOs):

- CLO01 To learn the basics of semiconductor materials and their usage in variety of PN junction diodes and applications of diodes
- CLO02 To study transistor in different modes of configuration and basic biasing techniques, FET.
- CLO03 To study of the fundamental concepts and various types of analog communication systems
- CLO04 To study of the concept of number systems and Boolean Algebra, minimization, Logic gates and other Combinational circuits and their designing.
- CLO05 To learn about basic Measurement & Instrument components.

### Unit-I SEMI CONDUCTOR DIODE

Semiconductor basics, PN Junction diode construction & working, Volt-amp characteristics, Diode current equation, half wave rectifier, Full wave rectifier: Bridge and center tapped rectifier, Clipper and Clamper. Zener diode and Zener diode-based voltage regulator, LED

### Unit-II BIPOLAR JUNCTION TRANSISTOR

Construction and working of transistor, characteristics of transistor, transistor as an amplifier and switch, transistor configurations, transistor biasing and biasing methods, basic amplifier configurations, Basic principle and working of FET and MOSFET.

### Unit-III BASICS OF COMMUNICATION SYSTEMS

Block schematic of communication system, Simplex and duplex systems, Modes of communication: Broadcast and point to point communication, Necessity of modulation, Classification of modulation: Amplitude, phase, frequency modulation, sampling theorem and pulse amplitude modulation.

### Unit-IV DIGITAL SYSTEM

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, Excess 3, Gray, Boolean theorems, Min terms and Max terms, Sum of products and products of sums, Karnaugh map Minimization, Logic gates: NOT, AND, OR, NAND, NOR, EX-OR and EX-NOR, half adder and full adder. Function and Structure of a Computer System, Von Neumann Architecture, and modern computers.

## Unit-V ELECTRONICS MEASUREMENT

Introduction, Basics of Measurements, Ammeter, Voltmeter, multimeter, Signal Generators, Cathode Ray Oscilloscope: Block diagram of CRO, Construction of CRT, Deflection sensitivity and various controls, Measurement of voltage, current frequency and phase angle using CRO

### Textbooks:

1. Millman and Halkias: Integrated electronics, MH.
2. D Roy Choudhury, Digital Electronics, Vol-I&II, TMH Publication.
3. A.K.Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai.
4. Simon Haykins, Communication System, John Willy.
5. Andrew S. Tanenbaum, Structured Computer Organization, Upper Saddle River.

### References:

1. Sedra and Smith: Microelectronics, Oxford Press.
2. Millman and Taub, Pulse, Digital and Switching Waveforms, MGM.
3. A.Anand Kumar: Digital Circuits, PHI.
4. Salivahanan: Electronic Circuits Analysis and Design, TMH
5. Boylestad and Nashelsky: Electronic Devices and Circuit Theory, Pearson Education.
6. B.P.Lathi, Modern Digital & Analog Communication System, TMH

### Course Outcomes (COs):

After completion of this course the students shall be able to:

- CO01 Should have the knowledge of basic semiconductor materials and their usage in variety of PN junction diodes and applications of diodes
- CO02 Should be able to understand the concept operation of transistors and its configuration.
- CO03 Understand and identify the fundamental concepts and various components of analog communication systems
- CO04 Should have the knowledge of number systems and Boolean Algebra, minimization, Logic gates and other Combinational circuits and their designing.
- CO05 Should have understood the basics of Measurement & Instrument components.

### List of Experiments:

1. To verify V-I characteristic of semiconductor & Zener diode.
2. To verify input and output waveform of half wave rectifier.
3. To verify input and output waveform of full wave rectifier.
4. To verify Input and output characteristic of BJT in CB and CE configurations.
5. Implementation of basic logic gates using Universal gates (NAND, NOR).
6. To verify half adder & full adder.

7. Study of computer system structure and main peripheral devices.
8. Study of Frequency Division Multiplexing with sinusoidal inputs / audio inputs.
9. Study of CRO and its demonstration kit.
10. Study of voltmeter and multimeter.

| Course Code | Course Name           | Hours per Week |   |   | Credits |
|-------------|-----------------------|----------------|---|---|---------|
|             |                       | L              | T | P |         |
| EN3NG01     | Environmental Science | 2              | 0 | 0 | 2       |

### Course Learning Objectives (CLOs):

CLO01 To impart knowledge of Environment and its basic components.

CLO02 To build basic understanding of various effects of human activities to the environment.

CLO03 To understand concepts of water pollution

CLO04 To understand function of solid waste management

CLO05 To learn concepts of disaster management

#### Unit-I Ecosystem and Biodiversity

Concept of Ecosystem, Food Chains, Food Webs, Energy flow in an ecosystem.

Biodiversity: Introduction, Types, Significance and Conservation.

#### Unit-II Air Pollution

Causes, Effects and Control of Air Pollution, Greenhouse Effect - Climate changes and Global warming, Ozone layer depletion, Acid Rain.

Case studies on recent cases of air pollution and management.

#### Unit-III Water Pollution

Causes, Effects and Control of Water Pollution, DO, BOD and COD, Water sampling, Municipal water treatment.

#### Unit-IV Solid Waste Management

Introduction, Types of solid waste, Harmful effects of solid waste, Methods to manage and modern techniques for solid waste management.

#### Unit-V Disaster Management

Concept of Disaster, Types of Disaster, Pre-disaster risk and vulnerability reduction, Post disaster recovery and rehabilitation.

Case studies on recent disasters and management.

**Textbooks:**

1. Preeti Jain, S.L.Garg, K.G.Garg, Energy, Environment, Ecology and Society, Variety Publication.
2. Surinder Deswal, Environmental Science, Dhanpat Rai & Co. publication.
3. R. Rajgopalan , Environmental Studies, Oxford IBH Publication.

**References:**

1. G. M. Masters, Introduction to Environmental Science and Engineering, Pearson Education Pvt. Ltd.
2. K. De, Environmental Chemistry, New Age International.
3. Daniel D. Chiras, Environmental Science, Jones & Bartlett Ltd.

**Course Outcomes (COs):**

After completion of this course the students shall be able to:

- CO01 Gain knowledge of Ecosystem & Biodiversity.
- CO02 Develop basic understanding of air pollution and its control method
- CO03 Develop basic understanding of water pollution and its control method
- CO04 Gain knowledge of Solid waste management and its importance.
- CO05 Gain knowledge of Disaster Management.

| CourseCode | CourseName           | Total Hours per week |   |   | Total |         |
|------------|----------------------|----------------------|---|---|-------|---------|
|            |                      | L                    | T | P | Hours | Credits |
| EN3ES19    | Engineering Graphics | 2                    | 0 | 2 | 4     | 3       |

### Course Learning Objectives (CLOs):

- CLO01 To familiarize with the construction of geometrical figures.
- CLO02 To familiarize with the projection of 1D, 2D and 3D elements
- CLO03 To familiarize with the projection and sectioning of solids.
- CLO04 To familiarize with the Preparation and interpretation of building drawing.
- CLO05 To familiarize with the Upgraded Drawing Software and their use.

#### Unit -I

Drawing scales: Engineering scale, graphical scale, plain scale, diagonal scale, scale of chord.

Orthographic Projections: Reference planes, types of orthographic projections—First angle projections, Third angle projections.

#### Unit-II

Projections of points: Including points in all four quadrants

Projections of lines: Line parallel to reference plane, perpendicular to reference plane, inclined to one reference plane, inclined to both reference planes, traces of line.

#### Unit-III

Projections of Planes: Projections of Planes in different Positions, Auxiliary planes, Auxiliary Vertical Plane (AVP), Auxiliary Inclined Plane (AIP)

Projection of Solids: Classification of solid. Projections in simple and complex positions of the axis of the solid.

#### Unit-IV

Sections of Solids: Sectional views and true shape of the section.

Isometric Projections: Isometric view, Isometric scale to draw Isometric projection, non-Isometric lines, construction of isometric view from given orthographic views and to construct Isometric view of a Pyramid, Cone, Sphere.

#### Unit V



Computer Aided Drawing (CAD): Introduction to AutoCAD ,2D & 3D Basics, Modify & Draw Commands Using AutoCAD, Points, Lines planes and Solids and their projections.

**Textbooks:**

1. N.D. Bhatt, Elementary Engineering Drawing, Chartor Publishing House.
2. D. N. Johle, Engineering Drawing, Tata McGraw-Hill Publishing Co.Ltd.
3. P.S. Gill, Engineering Graphics, S.K. Kataria and Sons.
4. Warren J. Luzzader, Fundamentals of Engineering Drawing, Prentice Hall of India, New Delhi.
5. F. E. Giesecke, A. Mitchell & others, Principles of Engineering Graphics, Maxwell McMillan Publishing.
6. K.C. John, Engineering Graphics for Degree, PHI Learning Pvt. Ltd.

**Reference Books**

1. Engineering Drawing- Basant Agarwal, TMH
2. D. M. Kulkarni, A. P. Rastogi, and A. K. Sarkar (2009), Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi
3. Venugopal (2010), Engineering Drawing and Graphics, 2nd edition, New Age Publications, New Delhi.
4. Trymbaka Murthy (2007), Computer Aided Engineering Drawing, I.K. International Publishers, New Delhi.
5. R.B. Choudary (2005), Engineering graphics with Auto CAD, Anuradha Publishers, New Delhi

**Course Outcomes (COs):**

After completion of this course the students shall be able to:

- CO01 Familiarize with different drawing equipment's and technical standards and Know purpose, procedures, materials and conventional symbols used. Create and read an engineering drawing using standard views and have ability to Convert pictorial (3D) drawings to orthographic (2-D) drawings and vice versa
- CO02 Understand the projection of points, straight lines and have the ability to convert the practical problems in to projections
- CO03 To understand and apply concepts of the projection of simple planes & solids.
- CO04 Understand and apply the concepts of Projection & Sections of solids & development of surfaces
- CO05 Convert simple 2D orthographic projections into 3D isometric projections with the help of auto cad commands

**List of Experiments**

1. Preparation of drawing sheets containing the drawings for topics covered in theory.
2. List of Drawing Sheets (Manual)
3. Orthographic Projections
4. Projections of points & Projections of straight lines
5. Projections of planes & Projections of solids
6. Projections of sections of solids & isometric projections
7. Drawing scales

## **List of CAD Sheets**

1. To study about special features, advantages and applications of CAD in detail.
2. To study and practice basic draw commands, modifying commands exist in the CAD.
3. To construct a diagonal scale.
4. To draw orthographic projection of given pictorial views.
5. To construct the isometric views of given geometries.

| Course Code | Course Name   | Hours per Week |   |   | Total   |
|-------------|---------------|----------------|---|---|---------|
|             |               | L              | T | P | Credits |
| EN3ES22     | Programming-I | 0              | 0 | 4 | 2       |

### Course Learning Objectives (CLOs):

CLO01 Analyse Basics of Computers, programming environment and about different types of Programming languages.

CLO02 Application of various basic concepts required to create programs, use good problem solving approach.

CLO03 Use different control structures for conditional programming.

CLO04 Use of Arrays and string in different problems and also to apply different operations on arrays and strings

CLO05 Use the functions and procedures to solve different problems..

### Unit-I Introduction to Computer and Problem Solving Methodology

Computer System, Computing Environments, Software, Types of Software and Features of Software.

Design Tools (Algorithm, Flow-Chart, Pseudo-Code).Types and Generations of Programming Languages. Compiler, Interpreter, Linker, Loader, Execution of Program. Develop an Algorithm for Simple Problems.

### Unit-II Basics of Language

Character set, Identifier, Keywords, Constants, Data Types, Preprocessor Directives, Variables and Declaration, White Space and Escape Sequence, Operators and Expressions, Type Conversions, Operator Precedence and Associativity, Expression Evaluation, Input and Output Functions. Computational Problems Solving Based on above Constructs.

### Unit-III Control Statements

Selection (If, Else), Conditional Operator, Iteration (For, While, Do-While), Branching (Switch, Break, Continue, Goto), Nesting of Control Statements. Problem Solving Based on Control Statements.

### Unit-IV Arrays and Strings

Defining an Array, One Dimensional Array, Two-Dimensional Array, Multi-Dimensional Array. Basic Array Operations and Matrix Manipulation Operations (Addition, Subtraction, and Multiplication).Problem Solving Based on Array.

Strings Definition, String Operations and String Functions. Problem Solving Based on Strings.

## Unit-V Functions

Introduction, Functions Declaration, Definition, Calling, Return Statement, Parameter Passing (By Value), Recursion, Library Functions. Problem Solving Based on Functions.

### Text Books:

1. Herbert Schildt, C: The complete Reference, Fourth Edition, Mc-GrawHill.
2. R. Sethi, Programming Language Concepts and Constructs, Pearson Education.
3. V. Rajaraman, Computer Programming in 'C', PHI.
4. M. Sprankle, Programming and Problem Solving, Pearson Education.
5. R.G. Dromey, How to solve it by Computer, Pearson Education.
6. E. Balguruswamy, Programming in ANSI C by, Tata Mc-GrawHill.
7. Yashavant Kanetkar, Let Us C, BPB.
8. E. Balagurusamy, Fundamentals of Computers, TMH.

### References:

1. Kernighan and Ritchie , The 'C' programming language, PHI
2. Programming With C, Schaum Series.
3. AN Kamthane, Programming with ANSI and Turbo C, Pearson Education.

### Course Outcomes (COs):

After completion of this course the students shall be able to:

- CO01 Understand Basics of Computers and Programming languages.
- CO02 Understand basic concepts of C programming language required to create programs.
- CO03 Apply different types of control structures in problem solving.
- CO04 Use of Arrays and string in different problems and also to apply different operations on arrays and strings.
- CO05 Apply and use the functions and procedures to solve different problems.

### List of Practical

1. Write a program to print hello user on output screen.
2. Write a program to perform arithmetic operation on two numbers.
3. Write a program to find sum of individual digits of any three digits number.
4. Write a program to print any three digit number in reverse order.
5. Write a program to swap any two numbers using third variable and without using third variable.
6. Write a program to check given number is even or odd.

7. Write a program to check given char is vowel or consonant.
8. Write a program to check given number is positive or negative.
9. Write a program to check given year is leap year or not.
10. Write a program to check given number in range of 100-200 or not.
11. Write a program to check given number is palindrome or not.
12. Write a program to print grade of student on the basis of percentage:
13. If per greater than or equal to 75 → A grade
14. If per between 60-75 → B grade
15. If per between 50-60 → C grade
16. If per between 40-50 → D grade
17. If per less than 40 → Fail
18. Write a program for addition subtraction multiplication division using switch case.
19. Write a program to print table of any number.
20. Write a program to calculate factorial of any number.
21. Write a program to print series of alphabet.
22. Write a program to print Fibonacci series.
23. Write a program to check given number is perfect or not
24. Write a program to check given number is prime or not.
25. Write a program to check given number is Armstrong or not
26. Write a program to print number in word in between 1-5. Like (1 =one)
27. Write a program to check given char is vowel or consonant.
28. Write a program to print name of month according to number.
29. Write a program for convertor
30. For currency convertor
31. For temperature convertor
32. For weight convertor
33. For length convertor
34. For time convertor
35. For energy convertor
36. Write a program to print series of number from 1-100 without using loop.
37. Write a program to find maximum & minimum number from array.
38. Write a program to check how many numbers is prime & not prime in a list
39. Write a program to check how many digits at each index of array.
40. Write a program to check (search) given number is present or not present in list.
41. Write a program to arrange (sort) array elements in ascending or descending order.

42. Write a program to print a 2\*2 matrix.
43. Write a program to find sum of two matrix.
44. Write a program to find multiplication of two matrix.
45. Write a program of string functions.
46. Write a function to find sum of two numbers.
47. Write a function to calculate factorial of any number.
48. Write a function for call by value to find sum of two numbers.
49. Write a function to pass an integer array as an arguments and find sum of array elements
50. Write a function to pass a char array as an argument and find length of string.
51. Write a recursive function to calculate factorial of any number.
52. Write a program to find the no of char no of word and no of lines from given text input.

| Course Code | Course Name             | Hours per Week |   |   | Credits |
|-------------|-------------------------|----------------|---|---|---------|
|             |                         | L              | T | P |         |
| EN3ES01     | Basic Civil Engineering | 3              | 0 | 2 | 4       |

### Course Learning Objectives (CLOs):

- CLO01 To give the knowledge of various building and general construction materials such as bricks, stones, timber, cement, steel and concrete & their properties and application.
- CLO02 To provide basic understanding of the forces and its components, stresses, strains and the modulus of elasticity of the different construction materials.
- CLO03 To understand the components of the building such as beams, columns, foundations, slabs and different types of soils and their bearing capacities.
- CLO04 To provide basic knowledge about principles of surveying for a location, and its application in execution of engineering projects, various instruments used for surveying such as chains, tapes, compass, theodolite and auto level.
- CLO05 To understand various aspects of structural members and application of loads, shear force & bending moment in the field of civil engineering.

### Unit-I Building Construction Material

Role of Civil Engineer in the construction of buildings, dams, expressways, and infrastructure projects for 21st century. Importance of an inter- disciplinary approach in engineering Building Materials: Bricks composition, classifications, properties and uses. Stone classification of rocks, quarrying, and Dressing properties uses. Timber properties uses plywood. Cement: grades, types, properties, uses. Steel: types, mild steel, medium steel, hard steel, properties, uses, market forms. Concrete: grade designation, properties, uses.

### Unit-II Surveying and levelling

Surveying-classification, general principles of surveying–Basic terms and definitions of chain, Chain survey, Compass survey and Levelling, Uses of surveying, Contours their characteristics and uses.

### Unit-III Building Components

Site selection, General Classification and building components. Soils: types and bearing capacity of soils, Foundation: functions and classifications. Flooring: requirements and selection types, Roof - types and requirements.

### Unit-IV Forces & Properties of Material

Forces and its components, Resolution and summation of forces, Lami's Theorem, Stress, Strain types, Hook's law, Three moduli of elasticity, poissons ratio, relationship, factor of safety.

### Unit-V Shear force and Bending moment

Introduction of shear force and bending moment and their sign conventions, Types of loads, Types of beams, Types of supports; Shear force and bending moment diagrams for simply supported, overhang and

cantilever beams subjected to any combination of point loads, uniformly distributed load and point moment; Relationship between load, shear force and bending moment.

### **Text Books**

1. S.C. Rangwala, Building materials, Charotar Publishing House, Pvt. Limited.
2. S.Ramamrutham , Basic Civil Engineering and Engineering Mechanics, Dhanpat Rai.
3. K.K.Dwivedi& K.K. Shukla, Basic Civil Engineering & Engineering Mechanics, Dhanpat Rai & Co.(Revised).

### **References**

1. I.K.V.B. Raju and P.T. Ravichandran, Basics of Civil Engineering, Ayyappa Publications, Chennai.
2. S.Gopi, Basic Civil Engineering, Pearson Publishers.
3. M.S. Palanichamy, Basic Civil Engineering, Tata Mc Graw Hill

### **Course Outcomes (COs):**

After completion of this course the students shall be able to:

- CO01 Students will be able to recognize the civil engineering works and conversant about different construction materials and their uses.
- CO02 Student will be able to differentiate force, pressure and stresses.
- CO03 Students will be able to know the different building component and its importance.
- CO04 Students will be conversant about vertical and horizontal variation of different terrains.
- CO05 Students will be able to apply the theoretical knowledge about structural elements in practical manner.

### **List of Experiments**

1. To determine particle size distribution & fineness modulus of coarse and fine aggregates.
2. To determine standard consistency of cement paste. -
3. To determine initial and final setting times for cement by using Vicat's apparatus.
4. To determine the workability of fresh concrete of given proportion by slump cone test.
5. To determine the area of land by chain surveying.
6. To perform traverse surveying with prismatic compass check for local attraction and determine corrected bearing and to balance the traversing by Bowditch's rule.
7. To perform levelling by height of Instrument method.
8. To perform levelling by rise and Fall method.
9. To perform Plane Table Surveying work by (A) Radiation method and (.B) Intersection methods.
10. To measure horizontal and vertical angle in the field by using Theodolite.



## SEMESTER II

| <b>SNo.</b> | <b>Course Code</b> | <b>Courses</b>                    | <b>L</b>  | <b>T</b> | <b>P</b>  | <b>Credit</b> |
|-------------|--------------------|-----------------------------------|-----------|----------|-----------|---------------|
| 1           | EN3BS12            | Engineering Mathematics-II        | 3         | 0        | 0         | 3             |
| 2           | EN3BS14            | Engineering Chemistry             | 2         | 0        | 2         | 3             |
| 3           | EN3ES18            | Basic Mechanical Engineering      | 3         | 0        | 2         | 4             |
| 4           | EN3ES22            | Programming-II                    | 0         | 0        | 4         | 2             |
| 5           | EN3HS02            | Communication Skills              | 2         | 0        | 2         | 3             |
| 6           | EN3ES16            | Basic Electronics Engineering     | 3         | 0        | 2         | 4             |
| 7           | EN3ES20            | Engineering Workshop – I          | 0         | 0        | 2         | 1             |
| 8           | EN3HS01            | History of Science and Technology | 2         | 0        | 0         | 2             |
|             |                    | <b>Total</b>                      | <b>15</b> | <b>0</b> | <b>14</b> | <b>22</b>     |
|             |                    | <b>Total Contact Hours</b>        | <b>29</b> |          |           |               |

| Course Code | Course Name                | Hours per week |   |   | Total |        |
|-------------|----------------------------|----------------|---|---|-------|--------|
|             |                            | L              | T | P | Hours | Credit |
| EN3BS12     | Engineering Mathematics-II | 3              | 0 | 0 | 3     | 3      |

### Course Learning Objectives (CLOs):

CLO01 To illustrate knowledge of Laplace Transform and investigate its application.

CLO02 To explain the concept of Fourier Series and Fourier Transform.

CLO03 To illustrate the concept of Partial Differential Equations.

CLO04 To impart the knowledge of Vector Calculus.

CLO05 To discuss numerical methods and to outline its application in solving algebraic, transcendental equations and system of linear equations.

#### Unit-I Laplace Transform

Introduction of Laplace Transform, Laplace Transform of elementary functions, properties of Laplace Transform, Inverse Laplace transform and its properties, Convolution theorem, Applications of Laplace Transform to solve the Ordinary Differential Equation, Laplace transform of Unit step function and Impulse function.

#### Unit-II Fourier Series and Fourier Transform

Introduction of Fourier series, Fourier series for Discontinuous functions, Fourier series for Even and Odd function, Half range series, Fourier Transform, Sine and Cosine Transform.

#### Unit-III Partial Differential Equations

Definition, Formulation, Solution of Partial Differential Equations (By Direct Integration Method and Lagrange's Method), Non-Linear Partial Differential Equations of First order {Standard form I, II, III&IV}, Charpit's method. Partial Differential Equations with Constant Coefficients (Higher Orders Homogeneous), Method of Separation of Variables.

#### Unit-IV Vector Calculus

Scalar and Vector fields, Vector Differentiation, Laplacian operator, Gradient, Divergence and Curl, Line and surface integrals, Green's theorem, Gauss Divergence theorem, Stoke's theorem.

#### Unit-V Numerical Analysis

Errors and Approximations, Solution of Algebraic and Transcendental Equations (Regula Falsi, Newton-Raphson and Iterative methods), Solution of Simultaneous linear equations by Gauss Elimination, Gauss Jordan, Jacobi's and Gauss-Siedel Iterative methods.

**Textbooks:**

1. B.S.Grewal, Higher Engineering Mathematics, Edition-43, Khanna Publishers, New Delhi.
2. H.K.Dass, Higher Engineering Mathematics, S.Chand & Company Pvt LTD., New Delhi

**References:**

1. B.V. Ramana, Higher Engineering Mathematics, Tata McGrawHill Publishing Company Ltd., New Delhi.
2. Shanti Narayan, A textbook of Vector Calculus, S.Chand & Co., New Delhi.
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons 1999.

**WebSource:**

1. [nptel.ac.in/courses/111103021/15](http://nptel.ac.in/courses/111103021/15)
2. [nptel.ac.in/courses/111105035/22](http://nptel.ac.in/courses/111105035/22)
3. <https://swayam.gov.in/courses/public>
4. <http://nptel.ac.in/course.php>

**Course Outcomes (COs):**

After completion of this course the students shall be able to:

CO1 To impact mathematical models involving ordinary and partial differential equations with given boundary condition which is helpful in all engineering and research work.

CO2 To examine the general mathematical concepts required for the field regarding Laplace and Fourier Transform.

CO3 To compare and contrast importance of partial differential equations in physical problems.

CO4 To prioritize derivatives of vector- point functions, gradient functions, evaluate integral of functions over curves, surfaces and domains in two and three dimensional.

CO5 To examine numerical techniques and investigate its application in solving algebraic and transcendental equations.

| Course Code | Course Name           | Hours per Week |   |   | Credits |
|-------------|-----------------------|----------------|---|---|---------|
|             |                       | L              | T | P |         |
| EN3BS14     | Engineering Chemistry | 2              | 0 | 2 | 3       |

### Course Learning Objectives (CLOs):

- CLO01 To gain fundamental knowledge of the principles related to, so as to meet the challenging requirements of students in chemistry studies.
- CLO02 To attain awareness in students about current & new issues in the fields of chemistry.
- CLO03 To make students understand about the present needs without compromising on the ability of future generations to meet their own needs for proper engineering, relevant education efficient management of resources.
- CLO04 To increase curiosity and give them awareness about practical knowledge of various laboratory methods among the students regarding the course.

#### Unit-I Lubricants

Introduction, Classification of lubricants, Mechanism of lubrication, Properties and Testing of lubricating oils (Flash and Fire point, Cloud and Pour point, Viscosity and Viscosity Index, Neutralization number, Saponification Number, Steam Emulsification Number, Aniline Point, Iodine Value), Numerical problems based on testing methods.

#### Unit -II Polymer

Introduction and Classification of polymer, Preparation, Properties and Uses of the following- Polythene, PVC, Teflon, Nylon 66, Bakelite, Silicone resin, Natural and Synthetic Rubber, Vulcanization of Rubber, Biopolymers, Biodegradable polymers.

#### Unit -III New Engineering Materials

Introduction, Properties and Applications of - Superconductors, Optical Fiber, Fullerenes, Graphene, Carbon nanotubes, Nanowires.

#### Unit -IV Instrumental Techniques in Chemical Analysis

Spectroscopy, Electromagnetic spectrum, Beer & Lambert's Law and its limitations, Principle, Instrumentation and Applications of-UV-Visible Spectroscopy, IR Spectroscopy, Gas Chromatography.

#### Unit- V Electrochemistry

Concept of Enthalpy, Entropy and Free energy, EMF, Applications of EMF measurements, Corrosion- Definition, Types, Causes and Protection from corrosion.

### Text Books:

1. Preeti Jain, Anjali Soni, Jeetendra Bhawsar, A text book of Engineering Chemistry, 1st edition, Manthan Publication, 2016.
2. Preeti Jain, S L Garg, Engineering Chemistry, 4th edition, Variety Publication.
3. Shashi Chawla, Engineering Chemistry, 11th edition, Dhanpat Rai Publications.

#### **Reference Books:**

1. P C Jain, Monika Jain, Engineering Chemistry, Dhanpat Rai Publications.
2. S. S.Dara, A Text Book of Engineering Chemistry, S. Chand & Company.

#### **Course Outcomes (COs):**

After completion of this course the students shall be able to:

- CO01 To Understand the lubricants, their mechanism and practically analyze the properties of lubricants.
- CO02 Will acquire betterment in lifestyle by understanding the need of bio polymers in the current scenario and replacing synthetic polymers with its bio-polymer substitute.
- CO03 Will get familiarised with new engineering materials and their commercial applications.
- CO04 Will get knowledge of using instrumental techniques and their applications for determination of chemical structure of any compound.
- CO05 Identify various types of corrosion and methods to protect the metallic structures from corrosive environment.

#### **List of Practical:**

##### **Volumetric Analysis:**

1. To determine Hardness of given water sample by Complexometric titration.
2. To determine total and mixed Alkalinity of given water sample using phenolphthalein and methyl orange as indicator.
3. To determine strength of unknown FAS solution by Redox titration using N- Phenyl anthranilic acid as internal indicator.
4. To determine strength of unknown CuSO<sub>4</sub> solution by Iodometric titration using Starch as internal indicator.
5. To determine Chloride content of water sample by Mohr's method (Argentometric titration).

##### **Fuel Testing:**

1. To determine moisture content in given sample of coal by proximate analysis.
2. To determine volatile content in given sample of coal by proximate analysis.
3. To determine as content in given sample of coal by proximate analysis.
4. To determine percentage carbon content of coal by proximate analysis.

### **Lubricant Testing:**

1. To determine penetration number of grease by Cone Penetrometer apparatus.
2. To determine flash and fire point of given oil sample by Cleveland's open cup apparatus.
3. To determine flash point of given oil sample by Penskey Marten's close cup apparatus.
4. To determine flash point of given oil sample by Abel's Closecup apparatus.
5. To determine Steam emulsification number of given lubricant.
6. To determine Aniline point of given oil sample.
7. To determine Cloud and Pour point of given lubricating sample.
8. To study rate of change of viscosity with temperature of the given lubricating oil by means of Redwood Viscometer no.1
9. To study rate of change of viscosity with temperature of the given lubricating oil by means of Redwood Viscometer no.2.

### **Electrochemistry:**

1. Variation of cell potential in  $Zn/Zn^{2+}/Cu^{2+}/Cu$  with change in concentration of electrolytes ( $CuSO_4$  or  $ZnSO_4$ ) at room temperature.

### **Kinetics:**

1. Effect of concentration and temperature on the rate of reaction between sodium thiosulphate and hydrochloric acid.

| Course Code | Course Name                  | Hours per Week |   |   | Total |         |
|-------------|------------------------------|----------------|---|---|-------|---------|
|             |                              | L              | T | P | Hours | Credits |
| EN3ES18     | Basic Mechanical Engineering | 3              | 0 | 2 | 5     | 4       |

### Course Learning Objectives (CLOs):

- CLO01 To understand the properties of materials and their behavior with variation in temperature and Load. To understand different measuring instruments used in engineering applications.
- CLO02 To understand the basic laws of thermodynamics and their applications in engineering, refrigeration cycles and properties of refrigerants.
- CLO03 To understand Construction and Working of I. C. Engines.
- CLO04 To understand Construction and Working of Steam Generators
- CLO05 To understand the concepts of Centroid & Moment of Inertia and of plane areas and different theorems of moment of Inertia

#### Unit-I Materials & their mechanical properties

Classification of Engineering material and their mechanical properties, Composition of cast iron and carbon steels and their application. Stress-strain diagram, Hooks law and modulus of elasticity. Tensile, shear, hardness, and fatigue testing of materials.

#### Unit-II Thermodynamics

Thermodynamic properties and systems, First law of thermodynamics, thermal processes at constant pressure, volume. Second law of thermodynamic, enthalpy, entropy, heat engine, heat pump, refrigerator and their numerical.

#### Unit-III I.C.Engines

Description and working of four stroke petrol engines, two stroke petrol engines, four stroke diesel engines and two stroke diesel engines, and its efficiency relative merits and demerits.

#### Unit-IV Steam generators

Definition, Classification, general study of Cochran, Lancashire and Locomotive boilers, boilers mountings and accessories. Steam properties and boiler performance. Draught Classification, Calculation of Chimney height, boiler efficiency and numerical. Unit V: Centroid & Moment of Inertia Location of centroid and Moment of Inertia of plane areas, Perpendicular Axis and Parallel Axis theorems.

#### Unit V Centroid & Moment of Inertia

Location of centroid and Moment of Inertia of plane areas, Perpendicular Axis and Parallel Axis theorems.

**Textbooks:**

1. R.K. Rajput, Basic Mechanical Engineering, Laxmi Publication.
2. P.K. Nag, Engineering Thermodynamics, McGraw Hill.
3. R.K. Bansal, Engineering Mechanics, Laxmi publications.

**References:**

1. Anand K Bewoor, Vinay A Kulkarni, 1st edition, Metrology & Measurement, McGraw Hill.
2. Cengel and Boles, Thermodynamic, An Engineering Approach in S.I Unit, McGraw Hill.
3. S.S. Bhavikatti and K.G.Rajashekarappa, Engineering Mechanics, New age international limited.

**Course Outcomes (COs):**

After completion of this course the students shall be able to:

- CO01 Students will be able to understand the engineering materials, their properties, Iron-Carbon Diagram and Stress-Strain Curve, Measuring Equipment's and Testing Machines.
- CO02 Student will be thorough with the basic laws of thermodynamics and their applications in engineering also know about Refrigeration cycles and properties of refrigerants.
- CO03 Students will be able to understand the construction and working of I.C. Engines .
- CO04 Students will be able to understand the construction and working of Steam Generators
- CO05 Students will be able to determine the Centroid & Moment of Inertia of areas/composite sections.

**List of Experiments**

1. Measurements using Vernier calliper & micrometer.
2. Measurements using dial gauges and combination set.
3. Measurements using slip gauges & sine-bar.
4. Tensile Testing of standard mild steel specimen on UTM.
5. To determine the hardness number by using Brinell Hardness Testing Machine.
6. Study of 2-stroke petrol and diesel engine.
7. Study of 4-stroke petrol and diesel engine.
8. Study of different type of boilers.
9. Study of different type of boilers mounting & accessories.
10. To find the centroid of different plane laminas.



| Course Code | Course Name    | Hours per Week |   |   | Total   |
|-------------|----------------|----------------|---|---|---------|
|             |                | L              | T | P | Credits |
| EN3ES22     | Programming-II | 0              | 0 | 4 | 2       |

### Course Learning Objectives (CLOs):

CLO01 Understand Pointer variables. Declaring and dereferencing pointer variables. Pointer Arithmetic. Accessing arrays, strings through pointers.

CLO02 Declaration and use structures, perform operations on structures, passing structures as function arguments. type defining structures.

CLO03 Use Function declaration, function definition, function call, Passing arguments to a function, by value, by reference. Scope of variable names, creation of header files

CLO04 Use calloc, malloc, realloc dynamic memory.

CLO05 Apply Input-output using files in C, Opening, closing and reading from files. Programming for command line arguments.

CLO06 Apply graphics functions to create pictorial representation and animations

#### Unit-I Pointers

Introduction to Pointers (Declaration and Initialization), Double Pointer, Pointers and Array, Pointers and Functions, Operations on Pointers.

#### Unit-II User Defined Data Types

Defining a Structure, Declaration of Structure Variables, Initialization of Structure Variables, Accessing Structure Members, Storage of Structures in Memory Array within a Structure, Array of Structure, Pointer Structure, Passing Structure to a Function, Structure within a Structure. Define Union, Structure versus Union, Working with Union, Initializing Union, Enumerated Data Type.

#### Unit-III Pre-processor and Memory Allocation

Pre-processor Directives, Macro and Macro Expansions, File Inclusions, Conditional Compilation, Stringification (#) and Token Passing Operator (##), Type Def, Command Line Argument, Dynamic Memory Allocation. malloc(), calloc(), realloc(), free(), Core Dump, Memory Leak, Dynamic 1D and 2D Arrays. Header Files and Their Creations.

#### Unit-IV File Handling

File Concept, File Pointer and File Handling Operations Using files in C, Buffer and Streams, Working with Text Files and Binary Files, File Operations using std. Library and System Calls, File Management I/O Functions, Random Access Files.

#### Unit-V Graphics Programming

C Header Files for handling graphics and initializing graphics mode, Understand Coordinate system, Function to Draw Lines, Circle, Arc, Ellipse, pieslice, sector, Rectangle, Bar, 3-D Bars & Polygon, Color

Spraying: filling Ellipse, polygons and flooding the fills, Filling Styles and Patterns, Understand Animation, Function to create Animation, Traffic Light and Moving Car Simulation.

### **Text Books**

1. Herbert Schildt, C: The complete Reference, Fourth Edition, Mc-Graw Hill.
2. R. Sethi, Programming Language Concepts and Constructs, Pearson Education.
3. V. Rajaraman, Computer Programming in 'C', PHI.
4. M. Sprankle, Programming and Problem Solving, Pearson Education.
5. R.G. Dromey, How to solve it by Computer, Pearson Education.
6. E. Balguruswamy, Programming in ANSI C by, Tata Mc-Graw Hill.
7. Yashavant Kanetkar, Let Us C, BPB.
8. E. Balagurusamy, Fundamentals of Computers, TMH.
9. AL Stevens, C Database Development, MIS Press.

### **References:**

1. Kernighan and Ritchie, The 'C' programming language, PHI.
2. Programming With C, Schaum Series.
3. AN. Kamthane, Programming with ANSI and Turbo C, Pearson Education.

### **Course Outcomes (COs):**

After completion of this course the students shall be able to:

- CO01 Apply Pointers, Pointer Arithmetic and Accessing arrays, strings through pointers.
- CO02 Use different user defined data types like structures, union and enum.
- CO03 Understand and Use of dynamic memory allocation and preprocessor directives.
- CO04 Use the concepts of file handing.
- CO05 Use Graphics programming to draw and use different shapes.

### **List of Practical**

1. Program to create, initialize, assign and access a pointer variable.
2. Program to swap two numbers using pointers.
3. Program to change the value of constant integer using pointers.
4. Program to print a string using pointer.
5. Program to count vowels and consonants in a string using pointer.
6. Program to find sum of elements of array using pointer.
7. Program to swap two numbers using pointers.
8. Compare strings using pointer
9. Find smallest number in array using pointer.
10. Find largest element in array using pointer.
11. Find sum of all matrix elements using pointer.
12. Program to create a pointer array store elements in it and display.

13. Program to demonstrate function pointers.
14. Program to perform Addition Subtraction Multiplication Division using array of function pointers.
15. Program to display details of student two (Name, roll no, marks) using structure.
16. Program to display details of employee using array of structure.
17. Program to access member of structures using pointers.
18. Program for passing structure to a function.
19. Program for returning a structure from a function.
20. Program to display details of student two (Name, roll no, marks) with the help of union.
21. Program to demonstrate the memory allocation in structure and union.
22. Program to demonstrate malloc and calloc.
23. Program to allocate memory of array at run time.
24. Program to print the day of week.
25. Program to print month of a year.
26. Program to calculate area of circle using macro.
27. Program to calculate area of circle using macro function.
28. Program to create a header file and use it in a program.
29. Program to demonstrate file operation.
30. Creating a new file
31. Opening an existing file
32. Closing a file
33. Reading from and writing information to a file
34. Program to count number of words, number of character and number of lines from a given text file.
35. Program in C to delete a specific line from a file.
36. Write a program in C to append multiple lines at the end of a text file.
37. Write a program in C to copy a file in another name.
38. Write a program in C to merge two files and write it in a new file.
39. Write a program in C to encrypt a text file.
40. Write a program in C to decrypt a previously encrypted file.
41. Write a program in C to remove a file from the disk.
42. Write a program to draw a circle and fill blue color in it.
43. Write a program to draw a rectangle with diagonal and fill different colors in both halves.
44. Write a program to move a circle using suitable animations.
45. Write a program to implement traffic signal.
46. Write a program to simulate a moving car. Draw car using simple shapes like line, circle and polygon.

| Course Code | Course Name          | Hours per Week |   |   | Credits |
|-------------|----------------------|----------------|---|---|---------|
|             |                      | L              | T | P |         |
| EN3HS02     | COMMUNICATION SKILLS | 2              | 0 | 2 | 3       |

### Course Learning Objectives (CLOs):

- CLO01 To develop, enhance and demonstrate LSRW Skills.
- CLO02 To enable students to acquire oral presentation skills.
- CLO03 To prepare students to become more confident and active participants in all aspects of their undergraduate programs
- CLO04 To enable students with good vocabulary, grammar and writing skills.
- CLO5 To enable students to distinguish between general and technical communication and understand its importance

#### Unit-I

Grammar and Vocabulary Development: Applied Grammar and usage, Parts of Speech, Articles, Tenses, Subject-Verb Agreement, Prepositions, Active and Passive Voice, Clauses, modals, Reported Speech: Direct and Indirect, Sentence Structure, Punctuations, common errors.

#### Unit-II

Using Dictionaries and Thesaurus, Synonyms, Antonyms, Homophones, One Word Substitution, Affixation: Prefixes & Suffixes, Basic Grammar & Vocabulary Practice, Synonyms, Antonyms, Analogies, Sentence Completion, Correctly Spelt Words, Idioms, Proverbs, and Derivation from root words, Jargon, Scientific Jargon, Vocabulary Practice.

#### Unit-III

Developing Reading and Listening Skills: Reading Comprehension, Process, Active & Passive Reading, Reading Speed Strategies, Benefits of effective reading, note making, note - taking, Reading comprehension of technical material and SQ3R reading technique. Listening Skills: Meaning, process hearing and listening, types, barriers, importance.

#### Unit-IV

Developing Writing Skills: Planning, Drafting & Editing, Writing with style, right words selection, writing effective sentences, developing logical paragraphs, art of condensation, précis, essay, technical definition and technical description. Formal and Informal Letters: Letter to the Editors, Municipal corporation, Bank Managers etc.

#### Unit-V

Speaking Skills Oral Presentation: Preparation, Delivery using Audio – Visual Aids with stress on body language and voice modulations. (Topics to be selected by the Instructor.) Phonetic Symbols, Pronunciations.

**Text Books:**

1. P.C, Wren and N.D.V. Prasada Rao, High School English Grammar & Composition, S Chand and Co Pvt Ltd.
2. S. Kumar and P. Lata, English for Effective Communication, Oxford UP, New Delhi.
3. A.J. Thompson and A. V. Martinet, A Practical English Grammar, Oxford UP, New Delhi.
4. U. S. Rai and S.M, Rai, Effective Communication, Himalaya Publishing House.

**References:**

1. A.C. Gimson, An introduction to the Pronunciation of English, ELBS.
2. S. Greenbaum, The Oxford English Grammar, Oxford University Press.
3. K. Mohan and M. Raman, Effective English Communication, Tata Mc-Graw Hill.

**Course Outcomes (COs):**

After completion of this course the students shall be able to:

- CO01 The students will be able to enhance confidence in their ability to read, comprehend, organize, and retain written and oral information.
- CO02 The students will be able to distinguish between general and technical communication and understand its importance
- CO03 The students will be able to improve upon their language skills, communication skills, group discussion, and personality development and confidence level.
- CO04 The students will be able to bridge the language gap which is vital to their success
- CO05 Students will be able to communicate effectively.

**List of Experiments (if applicable): List of Practicals:**

JAM

Debates

Role plays

GDs

Extempore

Story writing

Picture description

Symposium

Oral presentation

Phonetics practice

Book Reviews

| Course Code | Course Name                   | Hours per Week |   |   | Credits |
|-------------|-------------------------------|----------------|---|---|---------|
|             |                               | L              | T | P |         |
| EN3ES16     | Basic Electronics Engineering | 3              | 0 | 2 | 5       |

### Course Learning Objectives (CLOs):

- CLO01 To learn the basics of semiconductor materials and their usage in variety of PN junction diodes and applications of diodes
- CLO02 To study transistor in different modes of configuration and basic biasing techniques, FET.
- CLO03 To study of the fundamental concepts and various types of analog communication systems
- CLO04 To study of the concept of number systems and Boolean Algebra, minimization, Logic gates and other Combinational circuits and their designing.
- CLO05 To learn about basic Measurement & Instrument components.

#### Unit-I SEMICONDUCTORDIODE

Semiconductor basics, PN Junction diode construction & working, Volt-amp characteristics, Diode current equation, Halfwave rectifier, Full wave rectifier: Bridge and center tapped rectifier, Clipper and Clamper. Zener diode and Zener diode-based voltage regulator, LED

#### Unit-II BIPOLARJUNCTION TRANSISTOR

Construction and working of transistor, characteristics of transistor, transistor as an amplifier and switch, transistor configurations, transistor biasing and biasing methods, basic amplifier configurations, Basic principle and working of FET and MOSFET

#### Unit-III BASICS OFCOMMUNICATION SYSTEMS

Block schematic of communication system, Simplex and duplex systems, Modes of communication: Broadcast and point to point communication, Necessity of modulation, Classification of modulation: Amplitude, phase, frequency modulation, sampling theorem and pulse amplitude modulation.

#### Unit-IV DIGITALSYSTEM

Number Systems – Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes –Binary, BCD, Excess 3, Gray, Boolean theorems, Minterms and Maxterms, Sum of products and products of sums, Karnaugh map Minimization, Logic gates: NOT, AND, OR, NAND, NOR, EX-OR and EX-NOR, half adder and full adder. Function and Structure of a Computer System, Von Neumann Architecture, and modern computers.

## Unit-V ELECTRONICS MEASUREMENT

Introduction, Basics of Measurements, Ammeter, Voltmeter, multimeter, Signal Generators, Cathode Ray Oscilloscope: Block diagram of CRO, Construction of CRT, Deflection sensitivity and various controls, Measurement of voltage, current frequency and phase angle using CRO

### Textbooks:

1. Millman and Halkias: Integrate delectronics, TMH.
2. Droy Choudhury, Digital Electronics, Vol-I&II, TMH Publication.
3. A.K.Sawhney, A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai.
4. Simon Haykins, Communication System, John Willy.
5. Andrew S.Tanenbaum, Structured Computer Organization, Upper Saddle River.

### References:

1. Sedra and Smith: Microelectronics, Oxford Press.
2. Millman and Taub, Pulse, Digital and Switching Waveforms, MGM.
3. A.Anand Kumar: Digital Circuits, PHI.
4. Salivahanan: Electronic Circuits Analysis and Design, TMH
5. Boylestad and Nashelsky: Electronic Devices and Circuit Theory, Pearson Education.
6. B.P.Lathi, Modern Digital & Analog Communication System, TMH

### Course Outcomes (COs):

After completion of this course the students shall be able to:

- CO01 Should have the knowledge of basic semiconductor materials and their usage in variety of PN junction diodes and applications of diodes
- CO02 Should be able to understand the concept operation of transistors and its configuration.
- CO03 Understand and identify the fundamental concepts and various components of analog communication systems
- CO04 Should have the knowledge of number systems and Boolean Algebra, minimization, Logic gates and other Combinational circuits and their designing.
- CO05 Should have understood the basics of Measurement & Instrument components.

### List of Experiments:

1. To verify V-I characteristic of semiconductor & Zener diode.
2. To verify input and output waveform of half wave rectifier.
3. To verify input and output waveform of full wave rectifier.
4. To verify Input and output characteristic of BJT in CB and CE configurations.
5. Implementation of basic logic gates using Universal gates (NAND, NOR).

6. To verify half adder & full adder.
7. Study of computer system structure and main peripheral devices.
8. Study of Frequency Division Multiplexing with sinusoidal inputs / audio inputs.
9. Study of CRO and its demonstration kit.
10. Study of voltmeter and multimeter.



| Course Code | Course Name             | Total Hours per week |   |   | Total |         |
|-------------|-------------------------|----------------------|---|---|-------|---------|
|             |                         | L                    | T | P | Hours | Credits |
| EN3ES20     | Engineering Workshop -I | 0                    | 0 | 2 | 2     | 1       |

### Course Learning Objectives (CLOs):

- CLO01 Familiar with Lathe, Drilling, Milling and shaping machines.
- CLO02 The basic law of physics and their utilization in engineering.
- CLO03 To understand different primary manufacturing process.
- CLO04 To understand different metal joining process.
- CLO05 To identify different tools used in basic manufacturing process.

### Unit-I Introduction and Demonstration: -

Introduction to various shops / sections and workshop layouts. Safety norms to be followed in a workshop.

Carpentry Shop: Introduction of Tools & operations, Types of woods & their applications, Types of Carpentry tools and their uses, Carpentry Joints, carpentry operations such as marking, sawing, planing, chiseling, grooving, boring, joining, types of woods and carpentry hardware.

Unit-II Fitting Shop: Introduction of Tools & operations, Types of Marking tools & their uses, Types of fitting cutting tool & their uses, fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping

Unit-III Foundry Shop: Pattern Making: Study of Pattern materials, pattern allowances and types of patterns. Core box and core print. Use and care of tools used for making wooden patterns.

Molding: Properties of good mould & Core sand, Composition of Green, Dry and Loam sand. Methods used to prepare simple green sand mould using single piece and split patterns.

Black Smithy Shop: Use of various smithy tools. Forging operations: Upsetting, drawing down, Fullering Swaging and Cutting down.

Unit-IV: Welding Shop: Study and use of tools used for Brazing, Soldering, Gas & Arc welding. Preparing Lap & Butt joints using gas and arc welding methods, Study of TIG & MIG welding processes. Safety precautions.

Unit V: Machine Shop: Study of machine tools in particular Lathe machine (different parts, different operations, study of cutting tools). Demonstration of different operations on Lathe machine, Practice of Facing, Plane Turning, step turning, taper turning, knurling, and parting. Demonstration and applications of drilling machine, Demonstration of CNC Machines

**Textbooks:**

2. B.S. Raghuwanshi, Workshop Technology Vol. I & II, Dhanpath Rai & Sons.
3. R.S. Khurmi, Workshop Technology, S. Chand and Co.
4. S.K. Hajra Choudhary, A.K. Hajra Choudhary and Nirjhar Roy, Elements of Workshop Technology, vol. I Media promoters and Publishers Pvt. Ltd
5. R.K. Bansal, Engineering Mechanics, Laxmi publications.

**Reference Books:**

1. W. A.J. Chapman, Workshop Technology, 1998, Part -1, 1st South Asian Edition, Viva Book Pvt. Ltd.
2. P.N. Rao, 2009, Manufacturing Technology, Vol.1, 3rd Ed., Tata McGraw Hill Publishing Company.
3. Dr. S.K. Sinha , CNC programming — Golgotia publication.

**Course Outcomes (COs):**

After completion of this course the students shall be able to:

- CO01 Understand the engineering materials, their properties, and their utilization in manufacturing tool and other equipment's.
- CO02 Understand the primary manufacturing process.
- CO03 Understand the basic operation involve in casting.
- CO04 Understand the basic process of forging.
- CO05 Basic knowledge of simple cutting, holding. Marking and striking tool.

| Course Code | Course Name                       | Hours per Week |   |   | Credits |
|-------------|-----------------------------------|----------------|---|---|---------|
|             |                                   | L              | T | P |         |
| EN3HS01     | History of Science and Technology | 2              | 0 | 0 | 2       |

**Course Learning Objectives (CLOs):**

- CLO01 To know the historical perspective of science and technology in India, its roots and its role.
- CLO02 To know how research and development field is progressing in India.
- CLO03 To know what the policies and plans were proposed after independence to be technologically sound.
- CLO04 To Know what the developments were done in major areas of science & technology.
- CLO05 To know the relationship between the technologies.

**Unit-I Historical Perspective**

Nature of science and technology, Roots of science and technology in India, Role of Science and Scientists in society, Science and Faith.

**Unit-II Research and Development(R&D) in India**

Science and Technology Education, Research activities and promotion of technology development, Technology mission, Programs aimed at technological self-reliance, activities of council of scientific and industrial research (CSIR).

**Unit-III Policies and Plans after Independence**

Nehru's vision of science for independent India, Science and technology developments in the new era, science and technology developments during the Five-Year Plan Periods and science and technology policy resolutions.

**Unit-IV Science and Technological Developments in Major Areas**

Space–Objectives of space programs, Geostationary Satellite Services–INSAT system and INSAT services remote sensing applications, Launch Vehicle Technology. Ocean Development. Objectives of ocean development, marine research. Biotechnology-Applications of biotechnology in medicine, agriculture, food, and fuel. Energy – Research and development in the field of non-conventional energy resources, India's nuclear energy program.

**Unit-V Nexus between Technologies**

Transfer of Technology – Types, Methods, Mechanisms, Process, Channels and Techniques, Appropriate technology, Technology assessment, Technological forecasting, Technological innovations and barriers of technological change.

### **Textbooks:**

1. K. Rajaram, Science and Technology in India, Published and Distributed by Spectrum Books(P) Ltd., New Delhi.
2. M. Srinivasan, Management of Science and Technology (Problems & Prospects), East-West Press (P) Ltd., New Delhi.
3. G.R. Kohili, The Role and Impact of Science and Technology in the Development of India, Surjeet Publications.
4. Government of India, Five Year Plans, Planning Commission, New Delhi.
5. K.D. Sharma, and M.A. Qureshi, Science, Technology and Development, Sterling Publications(P) Ltd., New Delhi.

### **References:**

1. Suvobrata Sarkar , History of Science, Technology, Environment, and Medicine in India, Published by Routledge India.
2. Sabareesh P.A. , A Brief History Of Science In India. Published by Garuda Prakashan.
3. G. Kuppuram, K. Kumudamani, History of Science and Technology in India, Published by Sundeep Prakashan.

### **Course Outcomes (COs):**

After completion of this course the students shall be able to:

- CO01 Student will be aware about the ancient India & the existence of science & technology in that era & how it is reciprocated.
- CO02 Student will be aware about the upliftment done in the field of R & D after independence.
- CO03 Student will come to know about the plans and policies that brought about radical changes for the growth of science in India.
- CO04 Students will come to know about the major areas of the applied science and their existence. And can set the relationship between the technologies.
- CO05 Students will understand the need of technology transfer, its types and processes.

## SEMESTER – III

| Sr.No. | Course Code | Course Name                                | L         | T        | P        | Credits   |
|--------|-------------|--|-----------|----------|----------|-----------|
| 1      | EN3BS15     | Engineering Mathematics -III               | 3         | 0        | 0        | 3         |
| 2      | FT3CO24     | Manufacturing Processes                    | 3         | 0        | 0        | 3         |
| 3      | FT3CO25     | Mechanics of Materials                     | 4         | 0        | 0        | 4         |
| 4      | FT3CO26     | Engineering Thermodynamics                 | 4         | 0        | 0        | 4         |
| 5      | FT3CO27     | Fuel Technology                            | 3         | 0        | 0        | 3         |
| 6      | FT3CO28     | CAD LAB                                    | 0         | 0        | 2        | 1         |
| 7      | FT3CO29     | Fire Fighting & Field Training -I          | 0         | 0        | 2        | 1         |
| 8      | FT3CO30     | Materials and Material Testing Lab         | 0         | 0        | 2        | 1         |
| 9      | FT3CO31     | Python Programming for Safety Engineers -I | 0         | 0        | 2        | 1         |
| 10     | EN3ES25     | Engineering Materials                      | 3         | 0        | 0        | 3         |
| 11     | EN3NG03     | Soft Skill-I                               | 2         | 0        | 0        | 2         |
|        |             | <b>Total</b>                               | <b>22</b> | <b>0</b> | <b>8</b> | <b>26</b> |
|        |             | <b>Total Contact Hours</b>                 | <b>30</b> |          |          |           |

| Course Code | Course Name                 | Hours per Week |   |   | Total   |
|-------------|-----------------------------|----------------|---|---|---------|
|             |                             | L              | T | P | Credits |
| EN3BS15     | Engineering Mathematics-III | 3              | 0 | 0 | 3       |

### Course Learning Objectives (CLOs):

- CLO01 To understand the structure, function and characteristics of computer system
- CLO02 To understand the design of the various functional units and components of computers
- CLO03 To identify the elements of modern instructions sets and their impact on processor design.
- CLO04 To explain the function of each element of a memory hierarchy
- CLO05 To identify and compare different methods for computer I/O.

#### Unit I: Numerical Interpolation techniques:

Difference Operators, Interpolation (Newton Forward and Backward Formulae), Central Interpolation Formulae (Gauss, Bessel's and Sterling's formula), Lagrange's and Divided Difference formulae, Numerical Differentiation.

#### Unit-II Numerical Differentiation and integration:

Numerical Integration (Simpson's, Weddle's, Trapezoidal rules), Numerical Solution of Ordinary Differential Equations (Taylor's Series, Picard's, Euler's Modified, Runge-Kutta, Milne's Predictor and Corrector methods)

#### Unit III: Probability Distribution:

Discrete Distribution: Binomial, Poisson Distribution with mean variance, Moment generating function.

Continuous Distribution: Normal and Exponential Distribution with mean variance, moment generating function.

#### Unit IV: Curve fitting, Correlation, Regression:

Curve fitting (Method of Least Square), linear and nonlinear curves, Correlation, Karl Pearson's Coefficient of Correlation, Spearman's Rank Correlation Coefficient, Linear Regression, Regression coefficients, Properties of regression curve.

## Unit V: Testing of Hypothesis:

Introduction to testing of hypothesis, Statistical assumptions, Level of significance, Confidence level, Type I Error, Type II error, Critical value, Power of the test, sampling distribution, Chi-Square test, small sample test – t test for one and two sample mean, F test, Large Sample test, Z test for equality of single mean, equality of two sample.

### Textbooks

1. Higher Engineering Mathematics, B .V. Ramana, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2006.
2. Probability and Statistics, Ravichandran, Wiley India.

### Reference Books

1. Sheldon M. Ross, “Introduction to Probability Models”, Elsevier Publication, Academic Press, UK
2. Numerical Methods for Scientific and Engineering Computation, M .K. Jain, Iyengar and R. K. Jain, New Age International Publication.

### Course Outcomes (COs):

After completion of this course the students shall be able to:

- CO01 Student will understand the Evolution of Computers and Computer Generations, Measuring Computer, Technology Trends, Measuring Computer Performance, MIPS.
- CO02 Students will learn about Fundamental concepts of– Execution of a complete instruction Design of Basic computer, addressing modes, Instruction formats, stack organization.
- CO03 Students will be able solve questions on Number systems, Arithmetic operations on binary numbers, Floating Point Representation.
- CO04 Students will able to understand basics of Storing data and Program in Memory, Memory Hierarchy in a Computer, Semiconductor RAMs–ROMs, Cache memories, and virtual memory.
- CO05 Students will able to understand pipelining, vector processing, Multiprocessor Architecture organization, Performance, characteristics of Multiprocessors

| Course Code | Course Name             | Hours per Week |   |   | Total   |
|-------------|-------------------------|----------------|---|---|---------|
|             |                         | L              | T | P | Credits |
| FT3CO24     | Manufacturing Processes | 3              | 0 | 0 | 3       |

#### UNIT-I MOULDING:

Introduction of moulding, Moulding sand: types, properties and its constituents, testing of moulding sand, Pattern: types allowances, Pattern design, Cores, Core Prints, Core boxes. moulding and core making machines, use of chaplets, CO<sub>2</sub> - Process, fluid sand process, shell moulding, cold curing process, hot-box method, high pressure and flask less moulding, Design of metal moulds, Die Design for die Casting.

#### UNIT II CASTING

Introduction of casting and its types. Solidification of casting, types of gating systems, Pouring time and temperature. Design criteria of pouring basin, screw, runner, gate and riser design, gating ratio, chill and its uses. Selection of melting furnaces, Crucible furnaces, Electric furnaces, Induction furnace. Casting defects, Causes and remedies.

#### UNIT-III FORGING

Classification of forging processes - forging processes - forging defects and inspection. Rolling: Classification of rolling processes - rolling mill - rolling of bars and shapes.

Extrusion: Classification of extrusion drawing of rods, wires and tubes.

Sheet Metal Working: Sheet metal forming methods: Shearing, Blanking, Bending, Stretch Forming, deep forming. Spinning: Spinning processes. Load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes

#### UNIT-IV WELDING

Welding: Principle, classification, advantages, limitations and applications, Tungsten Inert Gas welding, Metal Inert Gas welding, Electro - slag welding, Electro - Gas Welding, Explosive Welding, Ultrasonic Welding, Electron Beam Welding, Laser Beam Welding, Friction Welding, Cold Welding, Thermit Welding, Codification of Electrodes, Welding Defects-causes and remedies.

#### UNIT- V POWDER METALLURGY

Definition, advantages, limitations and applications, Powder metallurgy processes and operations, Compaction – Sintering and Finishing – Design considerations for powder metallurgy and Process capability – Shaping of ceramics –Forming and shaping of glass – Design considerations for ceramics and glass – Processing of superconductors.

#### TEXTBOOKS



1. Rao P.N., "Manufacturing Technology", Vol. 1, Tata McGraw Hill.
2. Sharma P.C., "A Text Book of Production Engineering", Vol.1, S. Chand Publication, New Delhi.
3. Hajra Choudhry, Elements of Workshop Technology, Vol I & II Media Promoters

## **REFERENCE BOOKS**

1. Production Technology by HMT, Tata McGraw Hills
2. Chapman W.A.J, Workshop Technology , Volume II , Oxford and IVH Publishing Company Ltd
3. Lindberg RA , Processes and Materials of Manufacture, Prentice Hall Publications

| Course Code | Course Name            | Hours per Week |   |   | Total | Total   |
|-------------|------------------------|----------------|---|---|-------|---------|
|             |                        | L              | T | P | Hrs.  | Credits |
| FT3CO25     | Mechanics of Materials | 4              | 0 | 0 | 4     | 4       |

## UNIT I

### Stress and Strain:

Stress, strain and its types, stresses in members of a structure, axial loading, normal stress, shear stress, analysis of simple structures, stepped rods, members in series and parallel: stress strain diagram, Hooke's law, modulus of elasticity, elastic and plastic behaviour of materials, deformation under axial loading, statically indeterminate problems, stress due to temperature, Poisson's ratio, Bulk modulus, shear strain, relation among elastic constants, residual stress, fibre reinforced composite materials, strain energy under axial loads and stresses due to impact of falling weights.

## UNIT II

### Principle stress and Strain:

Principle stresses, Principle Planes, Mohr's circle and its application to two- and three-dimensional analysis, stresses in thin-walled pressure vessels, wire winding

## UNIT III

### Shear force and BM diagram:

Freebody diagrams, Types of support reactions, types of loads, shear force and BM diagram, relationship between load, shear force and bending moment

Shear and Bending Stresses: Pure bending, symmetric member, deformation and stress, bending in beams of composite sections, eccentric axial loading, shear stresses in beams, strain energy in bending,

Deflection of beams, equation of elastic curve, Macaulay's method and Area moment method for deflection of beams.

## UNIT IV

### Torsion in shafts

Torsion Equation, stresses in a circular shaft, deformation in circular shaft, angle of twist, stepped-hollow Shaft, thin walled-hollow transmission shafts. Strain Energy in shafts

## UNIT V

Columns and struts: Stability of structures, Euler's formula for columns with different end conditions, Rankin's formula.

## **TEXTBOOKS**

1. Beer FP, Johnson ER, DewolfJT : Mechanics of Materials; TMH
2. Rattan; Strength of materials; TMH
3. Nash William; Schaum's Outline Series; Strength of Materials; TMH.
4. Negi ; strength of materials; TMH

## **REFERENCE BOOKS:**

1. Singh Arbind K; Mechanics of Solids; PHI
2. Sadhu Singh; Strength of Materials; Khanna Pub.
3. Kamal K and Ghai RC; Advanced Mechanics of Materials; Khanna Pub.

| Course Code | Course Name                | Hours per Week |   |   | Total | Total   |
|-------------|----------------------------|----------------|---|---|-------|---------|
|             |                            | L              | T | P | Hrs.  | Credits |
| FT3CO26     | Engineering Thermodynamics | 4              | 0 | 0 | 4     | 4       |

### Unit- I

#### LAWS OF THERMODYNAMICS:

Applications of first law and SFEE in calculation of heat and work in various processes. Applications of second law, calculation of entropy in various processes, performance of thermal machines. Availability, reversibility and irreversibility, Clausius inequality, Carnot's theorem, Third Law

### Unit- II

#### PROPERTIES OF PURE SUBSTANCES:

Phase transformation of water and applications, P-v, T-q, T-v charts, Calorimetry, Use of steam tables and Mollier Chart.

### Unit- III

#### VAPOUR CYCLES:

Vapor Power Cycles, Carnot cycle, Rankine cycle, Comparison of Carnot cycle and Rankine cycle, Efficiency of Rankine cycle, Relative efficiency, Effect of superheat, boiler and condenser pressure on performance of Rankine cycle. Reheat & Regenerative cycle, Binary Vapor Cycle.

### Unit-IV

#### BOILERS, STEAM CONDENSERS AND COOLING TOWERS:

Classification of high-pressure boilers, Performance evaluation of boilers; Equivalent evaporation, Boiler efficiency by direct and indirect method Energy balance. Introduction, types of condensers, back pressure and its effect on plant performance air leakage and its effect on performance of condensers, various types of cooling towers, design of cooling towers.

### Unit- V

#### RECIPROCATING AIR COMPRESSORS AND NOZZLES :

Working of reciprocating compressor, work input for single stage compression, effect of clearance, volumetric efficiency, isentropic isothermal and mechanical efficiency, multi stage compression, inter cooling, condition for minimum work input. Types of nozzles, Stagnation and Critical properties, Velocity of sound in perfect gas.

**Text Books:**

1. P.K.Nag; Engineering Thermodynamics; TMH
2. B K Sarkar; Thermal Engineering; TMH
3. R K Rajput; Thermal Engineering; Laxmi Publications

**Reference Books:**

1. Van GJ; Thermodynamics; Willey Publication
2. Cengel Y; Thermodynamics; TMH
3. Moran & Shapiro; Engineering Thermodynamics, Willey Publication

| Course Code | Course Name     | Hours per Week |   |   | Total   |
|-------------|-----------------|----------------|---|---|---------|
|             |                 | L              | T | P | Credits |
| FT3CO27     | Fuel Technology | 3              | 0 | 0 | 3       |

#### Unit I

Solid Fuels: Coal & lignite reserves in India, classifications of coal, washing of coal, analysis of coal, proximate and ultimate analysis.

#### Unit II

Coal Carbonization: Mechanism of low temperature carbonization and high temperature carbonization, by product recovery from coke oven; properties of coke coal; grinding, pulverization, briquetting of solid fuels. Combustion calculation with respect to safety aspects.

#### Unit III

Liquid Fuels: Origin of petroleum production, Indian petroleum resources and their nature, petroleum processing, distillation, cracking thermal & catalytic, coaking, reforming, Isomerisations, Crude oil classification, reserves of Hydrocarbon in INDIA, introduction to Petroleum refining & processing, atmospheric & vacuum crystallization.

#### Unit IV

Petroleum product and their utilization: Blending of petrol for octane number boosting, Transport fuels: Diesel, Petrol, AVL (Aviation Liquid Fuel), Kerosene, fuel & furnace oil, Testing of petroleum product: Flash Point, pore point, Fire point, Octane number, Cetane number, viscosity and viscosity index, API.

#### Unit V

Gaseous fuels: Natural gas, Synthetic gases, their composition & properties, producer gas, Water gas, Coal Gas, LPG, CNG, Hydrogen as a fuel.

#### TextBooks:

1. Gupta OP; Fuel and Combustion; Khanna Pub.
2. Sarkar S; Fuel and Combustion; Orient Long men Ltd.

#### References Books:

1. Gary; Refining of Petroleum Technology.
2. Fuels and Fuel Technology: Volume 1 by Wilfrid Francis , Martin C. Peters, M. C. Peters
3. Handbook of Alternative Fuel Technologies, Second Edition, Sunggyu Lee, James G. Speight, Sudarshan K. Loyalka

| Course Code | Course Name | Hours per Week |   |   | Total   |
|-------------|-------------|----------------|---|---|---------|
|             |             | L              | T | P | Credits |
| FT3CO28     | CAD LAB     | 0              | 0 | 2 | 1       |

#### Part-A: Introduction to Machine Drawing

Conventional representation of Machine Components

Sectional views of Machine Components

Dimensioning of Machine Components

Surface finish, GD & T symbols

#### Part-B: Application of Computer Aided Drafting

Getting familiar with Drafting, Draw Toolbar , Hatching & Gradient

Modify Toolbar, Array Tool, Status Bar toggle keys , Object Properties, Important drawing Tools , Dimension Toolbar , Isometric Drafting ,Creating Multileader, Geometric Drawing & Tolerances, Text, Table

Managing Drawing with layers, Parametric Drawing , External References, Layout Printing & Plotting

#### Part-C: Introduction to the 3D Modeling Workspace

Basic 3D Viewing Tools ,3D Navigation Tools Introduction to the User Coordinate System (UCS)

Working with Solid Primitives, Solid Primitive Types, Working with the User Coordinate System

Extruded Solids and Surfaces, Swept Solids and Surfaces, Revolved Solids and Surfaces, Lofted Solids and Surfaces, NURBS Surfaces

3D Modify Commands, Editing Components of Solids, Editing Faces of Solids Fillets and Chamfers, Creating a Shell, Imprinting Edges of Solids, Slicing a Solid along a Plane

Converting Objects to Surfaces, Converting Objects to Solids,

#### Part-D: Refining the View

Working with Sections, Working with Cameras, Managing Views in 3D

Creating Visual Styles, Working with Materials Specifying Light Sources Rendering Concepts, Working Drawings from 3D Models Creating Multiple Viewports, 2D Views from 3D Solids.

## Part-E: Drawing Practice: 2D & 3D

### Individual Projects:

Shift Lever

Form Roll Leaver

Nut, bolt & washer assembly

Knuckle Joint Assembly

Cotter Joint

Universal Joint

Solid muff coupling

Bush Type Coupling

Crosshead

Cam shaft

Connecting rod

Piston

Piston and connecting rod

Plumber block

Bush Bearing

Journal Bearing

### **Text Books:**

1. AutoCAD 2021 For Beginners. By Cadfolks
2. Mastering AutoCAD 2019 and AutoCAD LT 2019 By George Omura
3. Discovering AutoCAD 2020 By Mark Dix

### Reference Books:

1. AutoCAD 2020 A Project-Based Tutorial By Tutorial books
2. AutoCAD Exercises for Beginners: Designers Workbook for Practice By Shameer S.A.
3. Beginning AutoCAD® 2022 Exercise Workbook: For Windows® Kindle Edition by Cheryl R. Shrock, Steve Heather



| Course Code | Course Name                        | Hours per Week |   |   | Total   |
|-------------|------------------------------------|----------------|---|---|---------|
|             |                                    | L              | T | P | Credits |
| FT3CO30     | MATERIALS AND MATERIAL TESTING LAB | 0              | 0 | 2 | 1       |

## List of Experiment

### Experiments

1. Preparation of specimen for Metallographic examination of different engineering materials for analysis of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & Composites.
2. Study of determination of structures of simple crystals by x-ray diffraction. and microscope.
3. Brinell, Rockwell and Vickers's Hardness tests on untreated and heat treated specimens.
4. Tensile and compression tests of steel, aluminum and cast iron specimens using Universal Testing Machine.
5. To conduct Shear test on Mild steel and Cast Iron using Universal Testing Machine.
6. Bending Test on steel and wood specimens.
7. Izod and Charpy Tests on Mild steel and C.I Specimen
8. Impact test by falling dart method on PVC pipe.
9. To study the wear and fracture characteristics of ferrous and non-ferrous materials under different parameters.
10. Fatigue Test (demonstration only).

| Course Code | Course Name          | Hours per Week |   |   | Total | Total   |
|-------------|----------------------|----------------|---|---|-------|---------|
|             |                      | L              | T | P | Hrs.  | Credits |
| EN3ES25     | Engineering Material | 3              | 0 | 0 | 3     | 3       |

#### UNIT I: STRUCTURES:

Atomic structure and bonding in materials. Crystal structure of materials, crystal systems, unit cells and space lattices, miller indices of planes and directions, packing geometry in metallic, ionic and covalent solids. Imperfections in crystalline solids and their effect various properties.

#### UNIT II MATERIAL BEHAVIOR & MECHANICAL PROPERTIES:

Elasticity in metals, mechanism of plastic deformation, strengthening mechanisms, stress-strain diagrams of metallic, ceramic and polymeric materials. Ductile to brittle transition, creep failure mechanism, fatigue mechanism. Mechanical properties of material.

#### UNIT III PHASE DIAGRAMS & HEAT TREATMENT:

Introduction - Solid solutions, Hume-Rothery rules for solid solutions, Phase rules, Phase diagrams - Binary phase diagrams - tie line and lever rule; Iron-Iron carbide metastable diagram, development of microstructures in iron-carbon alloys. Isothermal transformation diagrams, TTT curves, various heat treatment processes.

#### UNIT IV METALLIC MATERIALS:

Stainless and tool steels, HSLA, Maraging steels, TRIP steel – Cast Irons, Properties and applications of Cu and its alloys, Al and its alloys, Age hardening, Ti and its alloys, Ni-based alloys- super alloys.

#### UNIT V NON-METALLIC MATERIALS:

Introduction, properties Types and applications of Polymers, Composites and its types, and Ceramics - advanced structure ceramics, Shape memory alloy, Nano-materials - its important properties at nanoscale and applications-carbon nano-tubes.

#### TEXTBOOKS:

1. Raghavan V; Material Science and Engineering, PHI Publication.
2. W.D. Callister, Jr., Materials Science and Engineering: An Introduction, Wiley & Sons
3. Krishnan K. Chawla, Composite materials, Science and Engineering Springer.

**REFERENCE BOOKS:**

1. J.C. Anderson, K.D. Leaver, P. Leavers and R.D. Rawlings, (2003), Materials Science for Engineers, 5th edition, Tata McGraw Hill Publishers.
2. William F. Smith and Javad Hashemi (2004), Foundations of Materials Science and Engineering 4th ed., Mc Graw Hill.
3. Sidney H Avner, (2005) "Introduction to Physical Metallurgy, Tata McGraw Hill Publishing Company Limited.
4. Lawrence E.Murr (2000), Failure analysis, Marcel Dekker Inc. Publications.
5. Askeland; The science and engineering of material, Cengage learning.

| Course Code | Course Name                               | Hours per Week |   |   | Total | Total   |
|-------------|---|----------------|---|---|-------|---------|
|             |   | L              | T | P | Hrs.  | Credits |
| FT3CO31     | Python Programming for Safety Engineers-I | 0              | 0 | 2 | 2     | 1       |

### Unit-I Introduction

Introduction to Python and its history, how python is different from other programming languages and similarities. Application and uses. Python Installation, Installing the Anaconda, Python IDE, Toolbars, working area, sub menus, working modes.

### Unit-II Basic constructs of Python :

Variables in python Input and Output in Python, Basic commands. Tokens Basic program structure-quotation and indentation, Operator, Basic data types and In-built objects.. Basics Expressions, Assignment Statement, Arithmetic Operators, Operator Precedence, Boolean Expression.

### Unit-III Conditional Statement and Looping in python :

If-else , for loop, while loop, break, pass, continue, creating Functions, functions with arguments, returning values from functions, lambda expressions, recursion, global and local variables, Importing other modules/packages and using their functions.

### Unit-IV Object Oriented Programming in Python:

Class and Object. Defining variables and functions inside class. Creating objects, Inheritance, Multiple and MultiLevel Inheritance, Function overriding, the concept of composing objects of a different class in an object, problems on object composition. Encapsulation, Polymorphism, Constructors.

Unit-V Libraries in Python : Use of libraries in python like Numpy , Panda etc., Arrays, Matrices in python. Matplotlib library for plotting the data, Figures and axes Subplots, Grid Spaces, Contour Plots, Surface Plots, Polar Plots and Seaborn.

### Text Book:

1. Dr.R.Nageswara Rao, Core Python Programming, dreamtech press.
2. Paul Barry, Head First Python, O'REILLY.

### Reference Book:

1. Mark Luiz, Learning Python, O'REILLY.
2. Jamie Chan, Learn Python in One Day, LCF Publishing.

### List of Experiments

1. Write a program to print hello user on the output screen.

2. Write a program using various operators.
3. Write a program to perform arithmetic operations on two numbers.
4. Write a program stating which number is greater using conditional statements.
5. Write a program to check whether a number is even or odd
6. Write a program by the use of for loop and nested for loop.
7. Print the table of 2 using a while loop.
8. Write a program to reverse an integer.
9. Write a program to determine whether a number is palindrome or not.
10. Write a program using strings and extract the individual character.
11. Write a program using various functions of strings in it.
12. Write a program using tuples and perform various functions of tuples in it.
13. Write a program using list and perform various functions of list in it.
14. Prepare a program for dictionary consisting of various key element and perform various operations in it.
15. Write a program using normal function and lambda function.
16. Write a program with Class name Phone and add the various parameter of class.
17. Write a class program using a constructor.
18. Write a program using inheritance.
19. Write a program using Numpy to demonstrate array creation techniques.
20. Write a program on football data using Numpy , Panda and Seaborn libraries.

**Medi-Caps University, Indore**  
**Scheme of B. Tech. -Fire Technology & Safety Engineering**  
**For the candidates admitted in session 2021 - 2025**

SEMESTER – IV

| <b>Sr. No.</b> | <b>Course Code</b> | <b>Course Name</b>                                  | <b>L</b>  | <b>T</b> | <b>P</b>  | <b>Credits</b> |
|----------------|--------------------|---|-----------|----------|-----------|----------------|
| 1              | FT3CO32            | Building Planning & Machine Drawing                 | 4         | 0        | 2         | 5              |
| 2              | FT3CO33            | Python Programming for Safety Engineers -II         | 0         | 0        | 2         | 1              |
| 3              | FT3CO34            | Fluid Mechanics and Machinery                       | 3         | 0        | 2         | 4              |
| 4              | FT3CO35            | Electrical Technology & Safety in Electrical System | 3         | 0        | 0         | 3              |
| 5              | FT3CO36            | Fire Fighting & Field Training -II                  | 0         | 0        | 2         | 1              |
| 6              | EN3HS04            | Fundamentals of Management, Economics & Accountancy | 3         | 0        | 0         | 3              |
| 7              | FT3PC04            | Mini Project -I                                     | 0         | 0        | 4         | 2              |
| 8              | EN3NG02            | Universal Human Values & Professional Ethics        | 2         | 0        | 0         | 2              |
| 9              | EN3NG04            | Soft Skills –II                                     | 2         | 0        | 0         | 2              |
|                |                    | <b>Total</b>  | <b>17</b> | <b>0</b> | <b>12</b> | <b>19</b>      |
|                |                    | <b>Total Contact Hours</b>                          | <b>29</b> |          |           |                |

| Course Code | Course Name                         | Hours per Week |   |   | Total Credits |
|-------------|-------------------------------------|----------------|---|---|---------------|
|             |                                     | L              | T | P |               |
| FT3CO32     | Building Planning & Machine Drawing | 4              | 0 | 2 | 5             |

## Building Drawing

### UNIT I

Drawing of various elements of buildings like various types of footing, open foundation, raft, grillage, pile and well foundation, Drawing of frames of doors, window, various types of door, window and ventilator, lintels and arches, stairs and staircase, trusses, flooring, roofs etc. Building Planning: Provisions of National Building Code, Building bye - laws, open area, setbacks, FAR terminology, principle of architectural composition (i.e. unity, contrast, etc.), principles of planning, orientation.

### UNIT II

Building Services: Introduction of Building Services like water supply and drainage, electrification, ventilation and lightening and staircases, fire safety, thermal insulation, acoustics of buildings.

### UNIT III

Design and Drawing of Building: Design and preparation of detailed drawings of various types of buildings like residential building, institutional buildings and commercial buildings, detailing of doors, windows, ventilators and staircases etc. Perspective Drawing: Elements of perspective drawing involving simple problems, one point and two point perspectives, energy efficient buildings.

### Machine Drawing:

### UNIT IV

Machine Drawing: Limits, fits & tolerances: IS 919 code, cylindrical fits, tolerance symbols, standard preferred sizes and fits, hole based dimensioning, symbology for form, location and runout, tolerancing for position, concentricity, location, roundness, perpendicular and ronout.( 2 sheets ).

### UNIT V

Drawings of joints: Welded joints, types, welding symbols, drawing of welded machine parts with details of welding. Brackets, blocks, base plate and crankshaft. Pipe joints: Coupler joints, nipple joints, union, socket and spigot, integral flanged joints and hydraulic joints. (6 sheets). Screwed fastenings: Screw thread forms, vee and square threads, conventional representation of threads, hexagonal headed bolt and nut, square

headed bolt, nut locking arrangements, various types of machine screws and set screws, foundation bolts, lock bolt bolt with square plate, ray bolt and Lewis foundation bolt (3 sheets). Cotter and Pin joints: socket and spigot joints ,gib and cotter joint for rectangular rods, sleeve and cotter joints, knuckle joint. (3 sheets)

### **TEXT BOOKS:**

1. Building Planning and Drawing 7/e Paperback – 2013 N. Kumara Swamy , A. Kameswara Rao )
2. Building Planning Designing And Scheduling Paperback – 2009 by Gurcharan Singh
3. Practical Handbook on BUILDING CONSTRUCTION Paperback – 2014 by Nabhi
4. Malik &Meo; Building Design and Drawing
5. Bhat, ND; Machine Drawing; Charotar

### **REFERENCE BOOKS:**

1. Shah, Kale & Patki; Building Design and Drawing; TMH
2. Singh A; Machine Drawing; TMH
3. Narayana and Reddy; Machine Drawing; New age, Delhi.
4. Agarwal and agrawal; Engineering Drawing; TMH
5. John KC; Text Book Of Machine Drawing; PHI Learning

### **LIST OF PRACTICAL:**

1. Sketches of various building components.
2. One drawing sheet of various building components containing doors, windows ventilators, lintels and arches stairs foundations etc.
3. One drawing sheet each for services and interiors of buildings.
4. One drawing sheet containing detailed planning of one/two bed room residential building (common to all student)
5. One drawing sheet each of residential and institutional building (Each student perform different drawing).
6. Use of AutoCAD for preparation of drawings.
7. Computer Aided Drafting of simple machine parts
8. 3D modeling of simple solid shapes
9. Drawing of parts contained in the syllabus



| Course Code | Course Name                                 | Hours per Week |   |   | Total Credits |
|-------------|---|----------------|---|---|---------------|
|             |   | L              | T | P |               |
| FT3CO33     | Python Programming for Safety Engineers -II | 0              | 0 | 2 | 1             |

#### Unit-I PROGRAMS ON MECHANICS & MACHINE DESIGN -I

Projectile Motion, Failure theory plot, Shear force, Bending Moment analysis,

#### Unit-II PROGRAMS ON MECHANICS & MACHINE DESIGN -II

Kinematic Analysis, Fatigue Criteria, Simple spring Mass system, SciPy Odeint,

#### Unit-III PROGRAMS ON THERMAL ENGINEERING-I:

Streamlines of fluid flow, Otto Cycle and Diesel Cycle Analysis,

#### Unit-IV PROGRAMS ON THERMAL ENGINEERING-II

One dimensional heat equation, Two dimensional heat equation, flow pressure distribution

#### Unit-V ADDITIONAL ENGINEERING PROBLEMS:

Newton Raphson method, Linear Differential Problem, Data Interpretation, Data Filter Application

#### **LIST OF EXPERIMENTS:**

1. To make a program for projectile motion and plot on graph.
2. To draw Von Mises plot and locate stress points on it.
3. To draw Shear force diagram and Bending Moment diagram for given load conditions.
4. To perform kinematic analysis using python.
5. To draw streamlines for given velocity.
6. To perform analysis of Otto cycle using python.
7. To perform analysis of Diesel cycle using python.
8. To solve one dimensional heat equation using python.
9. To solve a mathematical problem by Newton Raphson Method using Python.
10. To solve linear programming problem using python.

| Course Code | Course Name                   | Hours per Week |   |   | Total Credits |
|-------------|-------------------------------|----------------|---|---|---------------|
|             |                               | L              | T | P |               |
| FT3CO34     | Fluid Mechanics and Machinery | 3              | 0 | 2 | 4             |

#### UNIT-I FLUID PROPERTIES AND HYDROSTATICS:

Introduction, Fluid Properties- mass density, weight density, viscosity, specific gravity, specific volume, Newton's law of viscosity, Hydrostatic forces on plane – inclined and curved surfaces – buoyancy – centre of buoyancy – metacentre.

#### UNIT-II KINEMATICS AND DYNAMICS OF FLOW:

**KINEMATICS:** Types of flow-ideal & real, steady & unsteady, uniform & non uniform, one, two, and three-dimensional flow, path lines, streak-lines, streamlines; continuity equation for one- and three-dimensional flow, rotational & irrotational flow, velocity potential, stream function, Vortex Flow.

**DYNAMICS:** Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, linear momentum equation for steady flow. The moment of momentum equation, forces on fixed and moving vane and other applications. Head Losses in pipes

#### UNIT III HYDRAULIC TURBINES:

Hydraulic Turbines, classification, Hydraulic, volumetric, mechanical and overall efficiencies, Pelton and Francis Turbines, their velocity triangles, calculation of power and efficiency, draft tube and its applications.

#### UNIT IV HYDRAULIC PUMPS:

Centrifugal pumps, classification, advantage over reciprocating type, definition of manometric head, gross head, static head, vector diagram and work done. Main and operating characteristics of the machines, cavitations, priming of pumps.

#### UNIT V DIMENSIONAL ANALYSIS:

Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers, similarity laws.

#### TEXTBOOKS

1. M. M. Rathore, Thermal Engineering, TMH
2. R.K. Bansal, Fluid Mechanics & Fluid Machines, Lakshmi Pub.
3. Congel; Fluid Mechanics; TMH

## **REFERENCE BOOKS**

1. B.K. Venkanna, Turbomachinery, PHI
2. K.L. Kumar, Fluid Mechanics, S. Chand Pub.
3. White; Fluid Mechanics; TMH

## **LIST OF PRACTICAL:**

1. To Verify Bernoulli's Theorem.
2. Determination of meta-centric height
3. Calibration of Orifice meter and Venturi meter and Rotameter.
4. To determine the local point pressure with the help of pitot tube
5. Determination of Friction Factor of a pipe (Major Losses) and fittings (Minor Losses).
6. Reynolds experiment for demonstration of streamline & turbulent flow
7. Verification of Impulse momentum principle.
8. To conduct an experiment on Pelton turbine test rig.
9. To conduct an experiment on Francis's turbine test rig.
10. To study the effect of a draft tube on reaction turbines.
11. To conduct a test on Centrifugal Pump and plot its characteristics.

| Course Code | Course Name   | Hours per Week |   |   | Total Credits |
|-------------|---|----------------|---|---|---------------|
|             |   | L              | T | P |               |
| FT3CO35     | Electrical Technology & Safety in Electrical System | 3              | 0 | 0 | 3             |

#### UNIT I ELEMENTARY IDEAS OF ELECTRICAL EQUIPMENT'S:

Transformers, DC Machines, Alternators, Induction machines- characteristics - construction - applications. Protective relays: Requirements of relay- types of protection-classification - Distance relay, differential relay, state relays - Definition - types.

#### UNIT II CIRCUIT BREAKERS:

Function of switch gear - Arc phenomenon - Initialization of an arc – arc interruption - Recovery voltage and Restriking voltage - classification - working. MCB and ELCB Faults in power system - causes – types Fuses: Definition - types of fuses - selection of fuse - advantages and disadvantages. Grounding - Neutral grounding - Solid grounding Resistance grounding - Arc suppression coil grounding Equipment grounding for safety - Grounding substation - Grounding of line structure – Earthing.

#### UNIT III EFFECT OF ELECTRIC AND MAGNETIC FIELDS:

Human Safety aspects - Effect of Current and voltage on human being - distance from the source - Typical V-I characteristics of skin - Nervous system. Electrical shocks and their prevention Insulation - classes of insulation - FRLS insulation - Continuity test.

#### UNIT IV SAFETY DURING INSTALLATION OF EQUIPMENT IN THE PLANT.

Safe sequences in installation – risk during installation. Safety during testing and commissioning- steps. Test on relays- Protection and interlock system on safety.

#### UNIT V HAZARDOUS ZONES –

classification of hazardous zones. Intrinsically safe and explosion proof electrical apparatus. Selection of equipment's in hazardous area. Electrical fires - hazards of static electricity - Safety procedures in electrical maintenance, statutory requirements from Electrical Inspectorate. Introduction to Indian Electricity Act & Rules.

#### TEXTBOOKS

1. Electrical Safety Handbook, Fourth Edition John Cadick, P.E., Mary Capelli-Schellpfeffer, M.D., M.P.A., Dennis K. Neitzel, C.P.E., Al Winfield,
2. Electric Safety: Practice and Standards
3. Mohamed A. El-Sharkawi

4. Electrical Appliances and Materials Safety Act Statutory Operations Implementation Guide Product Safety Division Ministry of Economy, Trade and Industry
5. Standard for Electrical Safety in the Workplace 70 E , N.F.P.A.

**REFERENCES BOOKS :**

1. Electricity Fire Risks – G.S. Hodges
2. J.P. Handbook.

**LIST OF PRACTICALS :**

1. To study the various methods of earthing
2. To study the safety procedures in electrical maintenance work and also classify hazards
3. To study the static electricity
4. To study the salient features of Transformer oil
5. To study the various causes of electrical fire
6. To study the firefighting and rescue in the presence of radiation hazards
7. To study the radioactive waste management

| Course Code | Course Name                        | Hours per Week |   |   | Total Credits |
|-------------|------------------------------------|----------------|---|---|---------------|
|             |                                    | L              | T | P |               |
| FT3CO36     | Fire Fighting & Field Training -II | 0              | 0 | 2 | 1             |

Field training based on following

Squad Drill: Attention, stand at easy, Quick March and slow march, right turn, left turn, about turn, inclined turn, right dressing, left dressing and middle dressing, different types of salute, halt position, double up

Ladder Drill: Aluminium extension ladder (four men), hook ladder drill, hook ladder drill (one men), hook ladder drill (two men), ladder drill (four men), getting a branch to work upon escape ladder.

Hose Drill: hose pickup drill, remove the kink, unrolling the delivery hose, connecting and disconnecting the hose, connecting and disconnecting the branch pipe

Ropes and knots: Different types of knots, hitches and blends, rope rescue

Breathing Apparatus Set Drill: open circuit compressed air, donning, doffing and running

Fire Extinguisher Drill: Operation and its maintenance

| Course Code | Course Name   | Hours per Week |   |   | Total Credits |
|-------------|---|----------------|---|---|---------------|
|             |   | L              | T | P |               |
| EN3HS04     | Fundamentals of Management, Economics & Accountancy | 3              | 0 | 0 | 3             |

#### UNIT I CONCEPTS OF MANAGEMENT:

Definition, characteristics and importance of management; Management: Science or Art, Difference between Management and Administration, Levels of management, Functions of Management, Managerial Roles, Managerial skills and competencies; Decision Making: Definition, process and types; Decision making under certainty, uncertainty and risk; Cross cultural issues in management and challenges.

#### UNIT II FUNDAMENTALS OF MARKETING AND HUMAN RESOURCE MANAGEMENT:

Introduction to Marketing: Definition, importance, function and scope of marketing, Core concepts of marketing, Marketing concepts and orientations, Marketing environment, Marketing-mix, Holistic marketing concept, Customer Relationship Management (CRM). Introduction to Human Resource Management (HRM): Nature, Scope, Objectives and Functions; Role of HR manager, Process and need for Human Resource Planning, Human resource policies, Changing role of Human Resource in India, Globalization and its impact on Human Resource.

#### UNIT III FUNDAMENTALS OF ECONOMICS:

Definition, nature, scope and significance; Difference between micro and macro economics; Time value of money, Law of diminishing marginal utility; Theory of Demand and Supply, Price elasticity of demand; Meaning and types of costs, Law of variable proportions; Types of market structure; National income and related aggregates; Meaning and types of Inflation; Meaning and phases of business cycle.

#### UNIT IV BASIC ACCOUNTING PRINCIPLES:

Accounting Principles and Procedure, Double entry system, Journal, Ledger, Trail Balance, Cash Book; Preparation of Trading, Profit and Loss Account; Balance sheet; Cost Accounting: Introduction, Classification of costs, Methods and Techniques of costing, Cost sheet and preparation of cost sheet; Breakeven Analysis: Meaning and its application.

#### UNIT V FUNDAMENTALS OF FINANCIAL MANAGEMENT:

Introduction of Business Finance: Meaning, Definition of Financial Management, Goals of Financial Management (Profit Maximization and Wealth Maximization), Modern approaches to Financial Management — (Investment Decision, Financing Decision and Dividend Policy Decisions).

#### TEXTBOOKS:

1. R. D. Agarwal, Organization and Management, McGraw Hill Education.

2. P. C. Tripathy and P. N. Reddy, Fundamentals of Management, Economics and Accountancy Tata McGraw Hill
3. Kotler Philip and Keller Kevin Lane, marketing Management Pearson

**REFERENCE BOOKS:**

1. Peter F Drucker, The Practice of Management McGraw Hill
2. Harold Koontz, Essentials for Management, Tata McGraw Hill
3. M Y Khan and P K Jain, Management Accounting Tata McGraw Hill



| Course Code | Course Name     | Hours per Week |   |   | Total Credits |
|-------------|-----------------|----------------|---|---|---------------|
|             |                 | L              | T | P |               |
| FT3PC04     | Mini Project –I | 0              | 0 | 4 | 2             |

1. Mini Project can be an individual or a group activity depending on the depth and scope of the topic.
2. The project work can be any of the form given below :
  - a) Making physical working models, prototypes, scaled models, of a concept machine.
  - b) Making virtual / CAD models of a sufficiently complex machines / concepts.
  - c) Making study, modeling, analysis, programming and simulation of a system / machine /operation / process.
  - d) Making study / teaching modules of a sufficiently complex topic for pedagogy purposes.
3. Group formation, discussion with faculty advisor, formation of the Semester Mini Project statement,resource requirement, if any should be carried out in the earlier part of the Semester.
4. The students are expected to utilize the laboratory resources before or after their contact hours as perthe prescribed module.
5. A complete Assembly and Details drawings of the project should be submitted along with a detailedproject report, where applicable.
6. A Detailed Background / field / literature survey, related to the topic must be made and presented inthe report.

| Course Code | Course Name                                  | Hours per Week |   |   | Total Credits |
|-------------|--|----------------|---|---|---------------|
|             |  | L              | T | P |               |
| EN3NG02     | Universal Human Values & Professional Ethics | 2              | 0 | 0 | 2             |

#### UNIT-I

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

#### UNIT-II

Understanding Harmony in the Human Being- Harmony in Myself:

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body'- Sukhand Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

#### UNIT-III

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship:

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

#### UNIT- IV

Understanding Harmony in the Nature and Existence- Whole existence as Co-existence:

Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature – recyclability and self-regulation in nature, Understanding Existence as Concourse Code Course

Name Hours per Week Total L T P Credits EN3MC15 Universal Human Values and Professional Ethics 2 0 0 0 existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

#### UNIT-V

Implications of the above Holistic Understanding of Harmony on Professional Ethics:

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

#### TEXTBOOKS:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics. References: 1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Susan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth—Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. AN Tripathy, 2003, Human Values, New Age International Publishers. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
8. EG Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press
9. MG Govindrajran, SNatrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
9. BP Banerjee, 2005, Foundations of Ethics and Management, Excel Books. BL Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

| Course Code | Course Name     | Hours per Week |   |   | Total Credits |
|-------------|-----------------|----------------|---|---|---------------|
|             |                 | L              | T | P |               |
| EN3NG04     | Soft Skills -II | 2              | 0 | 0 | 2             |

#### UNIT I Body Language and professionalism:

To make participants aware of the importance of Body language trains them to project a better outlook of themselves. This helps in presenting themselves in Personal interview and Group discussions. Grooming and presenting oneself are the main focus. Interview dress code, facial expressions, body language, handshake etiquettes etc., are dealt in the session. Worksheets, anecdotes, videos and role-plays are some of the important components of the session. Interpersonal skills: Effective interpersonal skills are crucial to increase employment opportunities and to compete in the business environment. This session makes the participants understand different barriers to proper interpersonal communication and to tackle them head-on. Activities are an integral component of the session. Reporter: The aim of the session is to make every student ask rational questions and make diplomatic replies. The session is a pressmeet like group activity session.

#### UNIT II Team Building:

To make every student intermingle within a team and contribute to the team's success. To make them understand the importance of working as a team. Importance of complimentary skill sets, and synergy effects of a team are proved using real-life examples and classroom activities. Picture connector: To make the students participate in group interactions, create dialogue and present on the stage. Students link various pictures from newspaper to come up with a pictorial representation of a story or idea and narrate/present the same. Creativity and presentation skills are concentrated. Students also learn to connect various variables and come up with concrete ideas.

#### UNIT III Time and work:

Work with different efficiencies, Pipes and cisterns, Work equivalence, Division of wages Goal Setting: • To make students goal oriented and to help them realise and sketch their personal and professional goals. SMART goal technique for goal setting is taught and explained using examples. Students will be encouraged to set a personal and career goal based on the SMART technique. Tactics to deal with hurdles for attaining the goals are dealt. Famous goal setting success stories are shared to boost confidence.

#### UNIT IV Time Management:

To make students understand the value of time and effective management of their time. Paper tower activity helps students practically experience the importance of managing time and to improve at it. Time management grid helps students understand the importance of prioritizing. Tourism pitch: The session makes students present and promotes their choice of tourist spot or their favourite city in order to convince the client (trainer) to visit the city. Presentation skills are enhanced. Teamwork is practised during the preparation phase of the activity.

## UNIT V Shopping role play:

To enable students to frame dialogues for their day-to-day life scenarios. A shopping scenario has to be mimicked by the students with impromptu conversation. This helps them in practising speaking in English in their daily conversations. Sample everyday conversations are presented for practical learning. Shipwreck: The main objective of this is to enhance the skill capacity of the students to think out of the box and try to enhance the cognitive thinking capability. Play teacher: The session makes students understand the different values and virtues like empathy- by which they will try to enact the scenario given to them try solving the problem like an adviser.

| Scheme of B.Tech. -Fire Tech Engineering 2021 Batch |             |                                      |           |          |          |           |
|---|-------------|--------------------------------------|-----------|----------|----------|-----------|
| SEMESTER – V  |             |                                      |           |          |          |           |
| Sr.No   | Course Code | Course Name                          | L         | T        | P        | Credits   |
| 1   | FT3CO37     | Fire Prevention & Protection System  | 3         | 0        | 0        | 3         |
| 2   | FT3CO38     | Fire Engineering -I                  | 4         | 0        | 2        | 5         |
| 3   | FT3CO39     | Occupational Health & Hygiene System | 3         | 0        | 2        | 4         |
| 4   | FT3CO40     | Fire Fighting & Field Training -III  | 0         | 0        | 2        | 1         |
| 5   | FT3CO41     | Paramedics                           | 4         | 0        | 0        | 4         |
| 6   |             | Program Elective - I                 | 3         | 0        | 0        | 3         |
| 7   |             | Program Elective - II                | 3         | 0        | 0        | 3         |
| 8   |             | Open Elective I                      | 3         | 0        | 0        | 3         |
|   |             | <b>Total</b>                         | <b>23</b> | <b>0</b> | <b>6</b> | <b>26</b> |
|   |             | <b>Total Contact Hours</b>           | <b>29</b> |          |          |           |

| Program Elective |             |  |   |   |   |        |
|------------------|-------------|--|---|---|---|--------|
| S. No.           | Course Code | Course Title                                   | L | T | P | Credit |
| 1                | FT3EL06     | Measurement & Instrumentation                  | 3 | 0 | 0 | 3      |
| 2                | FT3EL11     | Safety in Petroleum & Petrochemical Industries | 3 | 0 | 0 | 3      |

| Course Code | Course Name                          | Hours per Week |   |   | Total Credits |
|-------------|--------------------------------------|----------------|---|---|---------------|
|             |                                      | L              | T | P |               |
| FT3CO37     | Fire Prevention & Protection Systems | 3              | 1 | 0 | 4             |

**Course Learning Objectives (CLOs):**

- CL01. To enable the students to know about basics of Fire Prevention Measures
- CLO02. To provide knowledge about building planning system
- CLO03. To provide knowledge about water supply system
- CLO04. To learn about lighting arrangements.
- CLO05. To learn about different fire organization

Unit I

General Principles of Fire Prevention and Protection Measures: Planning and Construction of the Building: Site Planning considering the nature of the plant, building, equipment and processes from the standpoint of safety and fire protection, where corrosive, poisonous, explosive and easily combustible materials are handled and processed. Type of construction fire walls, barricades etc. Fire separation, fire steps, segregation, isolation.

Unit II

Internal Planning and Combustion of Plants and Buildings: Layout of hazardous pipe lines, vessels and equipment, planning of strategic points and selection of fire extinguishing device, Automatic, fire doors, fire, doors, wire glass windows, fire walls, parapeted to prevent spread of Fire through roofs, vertical cut offs, Exits, Guards and Guarding, floor platforms, path roadways, stairs, ventilation. Protection and devices for fire due to lightning.

Unit III

Water Supply and System: Installations using water:

1. Sprinklers
2. Drenchers,
3. Water spray projector systems
4. Rising mains wet and dry.

Unit IV

Lighting: Lighting arrangement and minimum light required in domestic, commercial, Industrial and public assembly occupancies etc. Emergency lighting systems. Fire Protection Arrangement: Fire appliances; Fire Warning system (Manual and Automatic) fixed fire fighting installations: I. Foam System; II. Gas/ Vapor System, III. Dry Powder System; Special Safety Protection Equipment-Explosion detection, venting and suppression system, Inergen clean agent system and F.M. 200.

## Unit V

Safety and Fire Protection Organization :(a) House -Keeping and management; (b) Plant Fire Brigade and fire -fighting facilities, petrol, systems. Detailed analysis of fire case studies, especially those fires where large number of people have been involved. Interaction and relative value of the components of escape route design, especially smoke movement and control.

### **Text Books:**

1. General Fire Hazards and Fire Protection by J.J. Williams.
2. Fire Prevention Notes for Industrial Premises by F.P.A.
3. Fire Prevention Hand Book by Kesteren Fire Brigade
4. Fire Prevention Standard Re commendations by Earnest Beam Ltd.
5. Automation A challenge to Fire Protection Engineers by Warre J. Baker.
6. Fire Protection Technical Information and Useful General Knowledge by Mather and Platt.
7. Hand Book of Fire Protection by N.F.P.A.

### **References Books:**

1. Fire Protection in Factory Buildings by H.M.S.O.
2. Fire Safety in Building by Adam and Chalres Black
3. Cros by Fiske Forster Hand Book of Fire Protection.
4. Industrial Fire Hazards by Danna and Milne
5. Fire Protection for the Design Professional by Rolf Jensen
6. Introduction to Fire Science and Fire Protection by William K. Bare

### **Course Outcomes (COs):**

- CO01. Understand the fire and their protection measures
- CO02. Understand the importance of passive fire protection methods
- CO03. Understand the water-based fire suppression system
- CO04. To know about dry based suppression system
- CO05. To know about escape route and design



| Course Code | Course Name          | Hours per Week |   |   | Total Credits |
|-------------|----------------------|----------------|---|---|---------------|
|             |                      | L              | T | P |               |
| FT3CO38     | Fire Engineering - I | 3              | 1 | 2 | 5             |

### Course Learning Objectives (CLOs):

- CL01. To enable the students to know about basics of fire
- CLO02. To provide knowledge about heat transfer method
- CLO03. To provide knowledge about Dust explosion
- CLO04. To learn about different types nozzles
- CLO05. To learn about safety culture in industries.

#### Unit I

Introduction -Chemistry of fire - Combustion - Composition of Combustion - Flame, heat, fire gases, smoke - Dimensions, Structure, Intensity and velocity of flames. Heat transfer from flames-Ignition temperature - LFL-UFL-Flash point Fire point-spontaneous combustion-Flash over. Dust explosion classification, of fires. Flammability principles. Ignition. Rate of burning.

#### Unit II

Fire hazards-health-flammability -reactivity (stability) Air contaminants generally found in fires-toxic effects of fire gases. Electrical fires, causes, protective system prevention of failure, fire prevention measures,

#### Unit III

Fire prevention-handling and storing flammable and combustible liquids. Elimination of ignition sources. Grounding and bonding. Fire protection in plants and factories. Fire walls, fire doors, and means of egress.

#### Unit IV

Fire detection-smoke detection-types of ionization-photo electric-light intensity-scattered light detectors. Heat detectors-Fixed temperature detector -rate of rise detectors pneumatic detectors. Flame detectors -infra red detector - ultra violet flame detector.

## Unit V

Fire suppression. Fixed automatic sprinklers. Sprinkler system-sprinkler design -water supply. Wet system-Dry System-Fixed manual application-sprinkler alarm stand pipes. Portable fire extinguishers-Types-extinguisher location Inspection - testing.

### Text Books:

1. General Fire Hazards and Fire Protection by J.J. Williams.
2. Fire Prevention Notes for Industrial Premises by F.P.A.
3. Fire Prevention Hand Book by Kesteren Fire Brigade
4. Fire Prevention Standard Recommendations by Earnest Beam Ltd.
5. Automation –A challenge to Fire Protection Engineers by Warre J. Baker.

### Reference Books:

1. Fire Protection –Technical Information and Useful General Knowledge by Mather and Platt.
2. Hand Book of Fire Protection by N.F.P.A.
3. Fire Protection in Factory Buildings by H.M.S.O.
4. Fire Safety in Building by Adam and Chalres Black
5. Crosby –Fiske –Forster Hand Book of Fire Protection.
6. Industrial Fire Hazards by Danna and Milne
7. Fire Protection for the Design Professional by Rolf Jensen
8. Introduction to Fire Science and Fire Protection by William K. Bare
9. Principles of Fire Behavior& Combustion by Richard Gann, Raymond Friedman , Jones & Bartlett Publishers

### List of Practical:

1. Determination of amount of gases released after combustion (Combustion Calculations)
2. To study the major component of hydrant system on the basis of discharge rate, pressure requirement & percentage of piping.
3. The study of Water distribution network.
4. The study of classification of fire.
5. Determination of various gases present in the atmospheric air.
6. To Study :
  - a. Water Type Extinguisher
  - b. Mechanical Foam Type Extinguisher
  - c. CO2 Type Extinguisher
  - d. DCP Type Extinguisher
7. Based on working principle, IS Code, mode of Operation & Maintenance.
8. Based on working principle, IS cod, mode of operation & maintenance of different types of fire extinguisher's
9. To study the general requirement of different type of occupancy.

**Course Outcomes (COs):**

CO01. Understand the fire

CO02. Understand the importance of classification fire

CO03. Understand the different types of flammable limit

CO04. To know about handling of flammable material

CO05. To know about safety audit and safety culture in industries.

| Course Code | Course Name                           | Hours per Week |   |   | Total Credits |
|-------------|---------------------------------------|----------------|---|---|---------------|
|             |                                       | L              | T | P |               |
| FT3CO39     | Occupational Health & Hygiene Systems | 3              | 0 | 2 | 4             |

### Course Learning Objectives (CLOs):

CLO1. Understand the anatomical terms related to the human body.

CLO2. Understand the importance of various injuries in industries.

CLO3. Understand the different industrial toxicology.

CLO4. Understand the rule of nine and degree of burn and methods to control it.

CLO5. Develop basic awareness of paramedical care and emergencies related to heat and cold.

#### Unit I

Recognition, Evaluation and Control of Physical Hazards- Noise and Vibration - Effects and Control Measures- Thermal Stress - Parameter Control, Radiation - Types - Source - Effect and Control- Illumination & Lighting. Recognition, Evaluation and Control of Chemical Hazards- Types - Dust-Fumes - Mist -Vapor-Fog etc., Air Contaminants- Evaluation Types of Sampling-Air Sampling System-Method Analysis-Control Measures

#### Unit II

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--Aluminosis and Anthrax. Lead-Nickel, Chromium and Manganese Toxicity-Gas Poisoning (such as CO, Ammonia, Coal Dust etc.,) their effects and Prevention -Cardio Pulmonary Resuscitation Audiology-Hearing Conservation Programme-Effects of Ultra Violet Radiation and Infrared Radiation on Human Systems.

#### Unit III

Industrial Toxicology-Local and Systemic and Chronic Effects Temporary and Cumulative Effects- Carcinogens Entry into Human System Ergonomics, Personnel Protective Equipment, Personnel Monitoring.

#### Unit IV

Hygiene Concepts-Correct and Clean Dresses-Clean Body - Washing - Good Habits-Oral and Stomach Hygiene-Cleaning - Compressed Air and Degreasing Agents-Long Hair and Nails and Torn and loosely Hanging Clothes-Smoking - Lavatories Maintenance- Living in Unhygienic Areas.

## Unit V

First aid concept- -First Aid Boxes-Legal Requirements, Industrial Hygiene, Medical Surveillance, Medical Surveillance Program Development, Recommended Medical Programme, Emergency Treatment, Non-Emergency Treatment, Exposures to Hazardous Materials.

### **Textbooks:**

1. Fundamentals of Industrial Hygiene by Barbara A. Plog & Patricia J. Quinlan.
2. Safety at work by John Ridby & John Channing.
3. Occupational Health & Safety in manufacturing Industries – M K Potty.

### **References Books:**

1. Diseases of occupation – D. Hunter.
2. Code of Practice for Hazardous goods by NFPA
3. Dangerous properties of Industrial materials by Irvin Sex.
4. Handbook of occupation Health & Safety NSC Chicago 1982
5. Encyclopedia of occupational Health & Safety Vol I & II I.L.O. Geneva 1985.
6. Human Factors in Engineering & Design Tata McGraw-Hill 1982

### **List of Practical (Please Expand it)**

1. Sampling of air monitoring
2. Study of gas detection system
3. Study of chlorine detection & control measures
4. Study of ammonia detection & control measures
5. Study of portable gas monitoring equipments
6. Study of flammable gas detection monitor
7. Study of dust monitoring System

### **Course outcomes**

- CO1. To enable the students to know about hazards in industry.
- CO2. To provide knowledge about the occupational health & hygiene system.
- CO3. To provide knowledge about the first aid concepts.
- CO4. To provide knowledge about the Internal & External Bleeding.
- CO5. To learn about physical fitness & casualty lifting techniques.

| Course Code | Course Name | Hours per Week |   |   | Total Credits |
|-------------|-------------|----------------|---|---|---------------|
|             |             | L              | T | P |               |
| FT3CO41     | Paramedics  | 2              | 0 | 0 | 2             |

**Course Learning Objectives (CLOs):**

CLO01 To

attain knowledge about first aid.

CLO02 To provide knowledge about the nervous system and its chart.

CLO03 To provide knowledge about the CPR techniques.

CLO04 To provide knowledge about the Internal & External Bleeding.

CLO05 To learn about physical fitness & casualty lifting techniques.

### Unit I

Aims and Objectives: First Aid Principles-Role of the first aider-sequence of action on arrival at scene. Vital signs-breathing -pulse. Introduction to the body-basic anatomical terms-body cavities-head- cranium - thorax-abdomen and pelvis.

### Unit II

The Nervous System: Functions-components -brain - cerebrum - cerebellum – medulla oblongata -cerebro - spinal fluid-spinal cord-autonomic nervous system. Unconsciousness-causes-level of consciousness-management of unconscious casualty problems of unconsciousness. Fainting-recognition-management-aftercare. Diabetes, hypoglycemia, hyperglycemia management. Seizures (epileptic fits, convulsions) features- management, stroke. Head injuries-fractures of the base-vault and sides of skull.

### Unit III

The Respiratory system: Respiratory failure - asphyxia-abdominal thrust in Heimlich manoeuvre. Chest injuries-types-fractured ribs –pneumothorax hemothorax. The circulatory system-heart attack-chest compression- CPR Shock -causes - signs and symptoms - management of shock.

### Unit IV

Eye injuries: Foreign body in eye, eye-trauma, corrosive chemical in eye, arc eye. Wounds-bleeding-classification-types of wounds-case of wounds -bleeding from special sites. Broad and narrow fold bandages-hand bandages-slings.

### Unit V

Fractures: Classification of fractures-principles of immobilization-sprains & dislocation. The skin. Burns - rule of nines-pure thermal burns. Electric burns. Chemical burns. Radiation burns-cold burns. Poisoning. Occupational health dermatitis-noise. Radiation ionizing. Physical fitness. Lifting - casualty handling. Use of stretchers.

### **Textbooks:**

1. Gray's Anatomy
2. Cunningham's Manual of Practical Anatomy
3. Hamilton, Boyal and Messmani: Human Embryology
4. Morri's Human Anatomy
5. B.N. Ghosh: A Treatise of Hygiene and Public Health
6. Nash :Surgical Physiology
7. Watson Jones : Fractures and Joint Injuries
8. Mercer : Orthopaedics Surgeon
9. Grey Turner : Operative Surgery

### **References Books:**

1. Bainbridge and Mansions: Principles of Physiology, Essentials of Human Physiology
2. McDowell: Halliburton's Handbook of Physiology and Biochemistry
3. Parson: Biochemistry in Relation to Human Physiology.
4. Burns: Introduction to Bipysics.
5. Findlay: Physical Chemistry for students of Medicine
6. Boyg: Textbook of Pathology
7. Wintrobe: Haematology
8. Ghosh: Materia Medica
9. Burn: Practical Pharmacology
10. Medi: Medical Jurisprudence and Toxicology
11. Tayler's Medical Medical Jurisprudence, Vols. I & II
12. S. Smith: Forensic Medicine
13. Glaister: Medical Jurisprudence and Toxicology
14. Mamilton Boiley : Physical signs in Clinical Surgery
15. Romani's and Nirhiner of Rose and Careless : Text Book of Surgery.
16. R.W. Jones Tone: A Test Hook of Midwifery.

### **Course Outcomes (COs):**

- CO01 Understand the anatomical terms related to human body.
- CO02 Understand the importance of various injuries related to head, chest, abdominal, electrical and blast.
- CO03 Understand the different techniques of cardio pulmonary resuscitation and tissue injuries.
- CO04 Understand the rule of nine and degree of burn and methods to control it.
- CO05 Develop basic awareness of paramedical care and emergencies related to heat and cold

| Course Code | Course Name                   | Hours per Week |   |   | Total Credits |
|-------------|-------------------------------|----------------|---|---|---------------|
|             |                               | L              | T | P |               |
| FT3EL06     | Measurement & Instrumentation | 3              | 0 | 0 | 3             |

**Course Objectives (CLOs):**

- CLO1 Understand the fundamental principles and concepts of measurement and instrumentation, including various measurement techniques and instruments used in engineering.
- CLO2 Develop the ability to select and use appropriate measurement instruments for different engineering applications.
- CLO3 Acquire knowledge of different types of sensors and transducers used for measuring physical quantities.
- CLO4 Gain practical skills in calibration, measurement accuracy, and uncertainty analysis.
- CLO5 Enhance critical thinking and problem-solving abilities by analyzing and interpreting measurement data and making informed decisions based on the results.

**Unit I**

General concepts of measurement: General measurement system, Definition-standards of measurement, Errors in measurement, various systems of limits, fits and tolerance, ISI and ISO, Calibration: Static calibration, dynamic calibration, static sensitivity, range, accuracy and precision, Introduction to uncertainty, zero order, first order, and second order system.

**Unit II**

Force Measurement: Displacement measurement: Potentiometers, Linear variable differential transformers, rotary variable differential transformer.

Strain Measurement: Stress and strain, resistance strain gauges, gauge factor, strain gauge electrical circuits and multiple gauge bridge.

Torque measurement: Measurement of torque on rotating shafts.

**Unit III**

Measurement of Temperature: Measurement of temperature, liquid in glass thermometer, resistance thermometers – constructional details, resistance thermometer circuits, laws of thermocouples, pyrometers.



Pressure Measurement: Standards of pressure, measurement of high pressure, measurement of low pressure – The McLeod Gauge.

Flow measurement: Pressure differential meters: Orifice meter, Venturi meter.

#### Unit IV

Linear and Angular Measurements: Slip gauges, micrometres, verniers, dial gauges, surface plates, comparators- mechanical, angular measuring instruments- sine bar, angle gauges, spirit level, autocollimators.

Measurement of surface finish: Definitions, terminology, types of surface texture, surface roughness measurement methods, comparison, profile-meters.

Metrology of screw threads and gears: Internal/external screw thread, terminology, measurement of various elements of threads, Gears: terminology, constant chord method, base tangent method. CMM – Types, Construction and measurements.

#### Unit V

Transducers and data acquisition systems: Classification of transducers, Resistive, capacitive & inductive Transducers, Elements of data acquisition system – Analog to digital (A/D) and Digital to analog (D/A) converters.

Electrical instruments: Principle and types of analog and digital voltmeters, Single and three phase wattmeters.

Storage and display devices: Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, LED, LCD.

#### **Textbooks:**

1. S.P. Venkateshan, Mechanical Measurements, John Wiley & Sons. Second Edition: 2015.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Edition: 13, 2007.
3. R. K. Jain, Engineering Metrology, Khanna Publishers, New Delhi. Edition :19, 2018.

#### **Reference Books:**

1. I.C. Gupta, Engineering Metrology, Dhan pat Rai Publications. Eight Edition: 2016.
2. Robert J. Hocken, Paulo H. Pereira, Coordinate Measuring Machines and Systems, CRC Press. Second Edition: 2012.
3. U.A.Bakshi, A.V.Bakshi, Measurements and Instrumentation, Technical Publications, Pune. First Edition: 2009.
4. Nakra and Chowdhry, Measurement and Control, Tata McGraw Hill. Second Edition: 2006

#### **Course Outcomes:**

- CO1 Students will be able to apply the principles of measurement to select and use appropriate instruments for measuring physical quantities such as temperature, pressure, flow, and electrical signals.
- CO2 Students will gain an understanding of different types of sensors and transducers and their working principles, and will be able to select and implement suitable sensors for specific measurement tasks.
- CO3 Students will develop practical skills in calibration techniques, measurement accuracy assessment, and uncertainty analysis, ensuring reliable and accurate measurement results.
- CO4 Students will be able to design and implement measurement systems, including signal conditioning, data acquisition, and signal processing techniques.
- CO5 Students will enhance their problem-solving abilities by analyzing measurement data, identifying sources of error, and making informed decisions based on the results, thereby improving the overall quality of engineering processes and systems.

| Course Code | Course Name                                    | Hours per Week |   |   | Total Credits |
|-------------|--|----------------|---|---|---------------|
|             |  | L              | T | P |               |
| FT3EL11     | Safety in Petroleum & Petrochemical Industries | 3              | 0 | 0 | 3             |

### Course Learning Objectives (CLOs):

CLO1 To attain knowledge about Crude oil, its properties & Characteristics

CLO2 To provide knowledge about the Refining Processes:

CLO3 To provide knowledge Fire protection & emergency planning

CLO4 To provide knowledge about Fighting refinery & petrochemical fires.

CLO5 To learn about Statutory provisions pertaining to refineries.

#### Unit I

Crude oil, its properties & Characteristics, Classification of petroleum & its products, MSDS of crude oil, diesel, gasoline, kerosene, LPG, Nature l Gas, nylon, Naphtha, Ammonia, Benzene, toluene, Acetylene.

#### Unit II

Refining Processes: - Primary Distillation, catalytic cracker, polymerization, reforming, steam cracking, Sulphur recovery, Lubricating oil treating. Process units such as desalter, ADU, VDU, FCC, hydrocracker, catalytic reformer etc. Storage tanks & its types. Layout of Refineries - simplified flow diagram of a typical refinery.

#### Unit III

Fire protection & emergency planning: - Major fire risks, design criteria for selection of fire water network, fire fighting installations such as hydrant, mobile water monitors, foam pourer, DCP fixed, subsurface injection & steam snuffing systems. Storage tanks protection.

Use of various media in petroleum & gas fires such as water, foam, DCP.

#### Unit IV

Fighting refinery & petrochemical fires: - Potential fire hazards, precautionary measures in case of non-ignited releases, oil & gas leaks. Fire fighting facilities for depots, terminals, on-shore, off-shore drilling platforms, and pipelines for transportation of petroleum products & Gas. Fighting Gas terminal fires: - Fire fighting& procedures in case of BLEVE, LPG hazards, spillage, vehicles using LPG & CNG as a fuel. Fire fighting facilities at LPG bottling plants. Water Injection into LPG vessel (water bottoming)

## Unit V

Statutory provisions pertaining to refineries, petrochemical plants & gas terminals: - Oil Industry Safety Directorate (OISD), Petroleum Act 1934, Petroleum Rules 2002, Petroleum & Natural Gas Regulatory Board (PNGRB) drafts, Explosive Act 1884, Explosive Rules 1983 and Gas cylinders Rules 2004. Application of advance technologies used in refineries & petrochemical plant, Application of advance technologies used in refineries & petrochemical plants such as SCADA, SAP and various simulation modeling.

### **Textbooks:**

1. Fire Service Manual (Volume 2) Fire Service Operations – Petrochemical Incidents
2. Manual of Firemanship, Part 6-A by H.M.S.O.
3. Oil Industry Safety Directorate (OISD) Norms & Rules

### **References Books:**

1. Petroleum & Natural Gas Regulatory Board (PNGRB) drafts
2. Loss prevention in Process of Industries, Vol 1,2, & 3, Frank P. Lees.
3. NFPA Codes

### **Course Outcomes (COs):**

- CO1 Understand the Classification of petroleum & its products.
- CO2 Understand the importance of refining process
- CO3 Understand the Major fire risks.
- CO4 Understand the Firefighting facilities for depots
- CO5 Understand the advance technologies used in refineries

| Course Code | Course Name                        | Hours per Week |   |   | Total Credits |
|-------------|------------------------------------|----------------|---|---|---------------|
|             |                                    | L              | T | P |               |
| FT3CO40     | Fire Fighting & Field Training III | 0              | 0 | 2 | 1             |

**Course Learning Objectives (CLOs):**

- CLO1 To attain knowledge about Hose
- CLO2 To provide knowledge about the hydrant line
- CLO3 To provide knowledge operation of fire pump
- CLO4 To provide knowledge about ladder drill
- CLO5 To learn about foam drill

The field training based on the following is to be performed

Hose Drills General movements to be noted for handling delivery hose, hydrant Drill (3-Men)

Hydrant Drill (4-Men).

Pump Drills Trailer Pump Drill (Four Men), Trailer Pump Drill (Six Men), Motor Fire Engine (without escape)/Water Tender Drill (Six Men), First Aid Hose reel Drill (Three Men).

Ladder Drills: Extension Ladder (Four Men), Hook Ladder Drill, Hook Ladder Drill (One Men), Hook Ladder Drill (Two Men), Hook Ladder Drill (Three Men), Fire escape Ladder Drill (Six Men), is getting a Branch to work up on Escape Ladder, getting a Branch to work from an escape Ladder, Turn Table, Ladder Drill (Six Men), Hydraulic Platform. Drill (Six Men).

Foam Drill (F.B.-2) Foam Drill with inline inductor (Six Men)

The field training based on the following should be given

Rescue Drill

Rescue from fire.

Rescue from the accidents (Road side, railway accident & Aircraft),

Rescue from electrocution and Rescues from well.

**Course Outcomes (COs):**

- CO1 Understand how to operate hose in case of fire
- CO2 Understand the importance of hydrant system and their operations
- CO3 Understand the principle working of fire pumps.
- CO4 Understand the practical exposure working with ladders
- CO5 Understand the advance foam fighting system

## SEMESTER – VI

| Sr.No. | Course Code | Course Name                             | L         | T        | P        | Credits   |
|--------|-------------|---|-----------|----------|----------|-----------|
| 1      | FT3CO42     | Nuclear Safety & Radioactive Materials  | 4         | 0        | 0        | 4         |
| 2      | FT3CO43     | Fire Engineering -II                    | 4         | 0        | 2        | 5         |
| 3      | FT3CO44     | Fire Fighting & Field Training -IV      | 0         | 0        | 2        | 1         |
| 4      | FT3CO45     | Hazard Identification & Risk Assessment | 3         | 0        | 0        | 3         |
| 5      |             | Program Elective - III                  | 3         | 0        | 0        | 3         |
| 6      |             | Program Elective - IV                   | 3         | 0        | 0        | 3         |
| 7      |             | Open Elective II                        | 3         | 0        | 0        | 3         |
| 8      | FT3PC05     | Mini Project -II                        | 0         | 0        | 4        | 2         |
| 9      | EN3NG09     | Soft Skills -III                        | 2         | 0        | 0        | 2         |
|        |             | <b>Total</b>                            | <b>22</b> | <b>0</b> | <b>8</b> | <b>26</b> |
|        |             | <b>Total Contact Hours</b>              | <b>30</b> |          |          |           |

| Course Code | Course Name                            | Hours Per Week |   |   | Total Hrs. | Total Credits |
|-------------|--|----------------|---|---|------------|---------------|
|             |  | L              | T | P |            |               |
| FT3CO42     | Nuclear Safety & Radioactive Materials | 4              | 0 | 0 | 4          | 4             |

### COURSE LEARNING OBJECTIVES (CLOS)

In this course students will learn:

- CLO 01 To enable the students to know about radioactive materials.
- CLO 02 To provide knowledge about measurements of half-life and dosimeter.
- CLO 03 To provide knowledge about techniques of personnel radiation.
- CLO 04 To provide knowledge about case studies related to nuclear disaster.
- CLO 05 To learn about safety devices used during nuclear radiation

### UNIT I INTRODUCTION

Introduction, Binding energy fission process radioactivity alpha, beta and gamma rays radioactive decay, decay schemes effects of radiation, neutron interaction cross section reaction rate neutron moderation multiplication scattering collision fast fission resonance escape thermal utilization criticality.

### UNIT II REACTOR CONTROL

Reactor control, Control requirements in design considerations means of control, control and shut down rods their operation and operational problems control rod worth control instrumentation and monitoring online central data processing system.

### UNIT III TYPES OF REACTORS

Reactor types, Boiling water reactors radioactivity of steam system direct cycle and dual cycle power plants pressurized water reactors and pressurized heavy water reactors fast breeder reactors and their role in power generation in the Indian context conversion and breeding doubling time liquid metal coolants nuclear power plants in India.

### UNIT IV SAFETY OF NUCLEAR REACTORS

Safety of nuclear reactors, Safety design principles, engineered safety features site related factors safety related systems heat transport systems reactor control and protection system fire protection system quality assurance in plant components operational safety, safety regulation process public awareness and emergency preparedness. Accident Case studies Three Mile island & Chernobyl accident.

## UNIT V RADIATION CONTROL

Radiation control Radiation shielding radiation dose, dose measurements units of exposure exposure limits barriers for control of radioactivity release control of radiation exposure to plant personnel health physics surveillance –waste management and disposal practices –environmental releases.

### TEXTBOOKS

1. M. M.E.L.Wakil, “Nuclear Power Engineering”, International Text Book Co.
2. Sterman U.S.Thermal and Nuclear Power Stations, MIR Publications, Moscow, 1986
3. REFERENCE BOOKS
4. Radioactive Materials, B.M. Rao, Himalaya Publishing House (2001) (in press)
5. Principles of Radiation Dosimetry, G.W. Whyte, John Wiley and Sons, New York (1969)
6. Radiation Hygiene Handbook, Henson Blat. 2 (Ed.) McGraw Hill, New York (1959)
7. Radioactive Wastes, their Treatment and disposal, J.C. Collins, E.F.N. Spon Ltd., London

### LIST OF EXPERIMENTS:

1. Study of Storage of Radioactive Material
2. Study of PPE for Handling RAM
3. Study of measuring effects of RAM
4. Working principle of Dose meter
5. Rescue technique in RAM expose
6. Study of Type of reactors
7. Preparation of process plant Safety Manual
8. Study of MSDS of Radioactive materials
9. Study of Heat Exchangers
10. Study of the safety regulation process for public awareness.

### Course Outcomes (COs):

CO 01 Understand the waves and radiation related to nuclear.

CO 02 Understand the importance of using instruments to measure radiation

CO 03 Understand the techniques of personnel radiation.

CO 04 Understand the genetic hazards of radiation.

CO 05 To know about fire zones in case of nuclear disaster.



| Course Code | Course Name         | Hours Per Week |   |   | Total Hrs. | Total Credits |
|-------------|---------------------|----------------|---|---|------------|---------------|
|             |                     | L              | T | P |            |               |
| FT3CO43     | Fire Engineering II | 4              | 0 | 2 | 6          | 5             |

### Course Learning Objectives (CLOs)

In this course students will learn:

- CLO 01 To enable the students to know about fire fighting vehicles.
- CLO 02 To provide knowledge about various types of hoses and hose fittings.
- CLO 03 To provide knowledge about different types of ladders in fire services.
- CLO 04 To learn about different types of breathing apparatus used during an emergency.
- CLO 05 To learn about safety culture in industries.

#### UNIT I FIRE FIGHTING VEHICLES AND APPLIANCES

Fire fighting vehicles and appliances: - Pumps, primers and cooling system - use, Layout of firefighting. Vehicles and appliances: - Crash tenders, rescue tenders, hydraulic platforms, turntable ladders, hose laying tenders, control vans, fire boats.

#### UNIT II FIRE SERVICE EQUIPMENT

Fire Service Equipment: Use and maintenance, hydrants and standpipes. Hose reels hose fittings -coupling, Branches, Branch holders, Radial branches, Monitors, Nozzles, Collecting heads, suction, hose fittings, adopters and ramps.

#### UNIT III ROPES AND LINES

Ropes and Lines: Types-wire and rope lines used in fire service. Use and testing of lines, knots, Bends and hitches, General rope work. Ladders: features of Extension ladders, wheels escape, hook ladder, turn-table, Snorkel, safety devices, uses and maintenance. Small gear and miscellaneous equipment- General purpose tools and equipment, Lamps and lighting sets.

#### UNIT IV BREATHING APPARATUS

Breathing apparatus and associated equipment, resuscitation apparatus, foam making equipment, hydraulic rescue equipment. Types and operational use of modern oxygen breathing apparatus, modern compressed air -breathing apparatus. Identification of cylinders used with their apparatus.

#### UNIT V FIRE GROUND OPERATIONS

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. Investigations of fire - causes.

### **TEXTBOOKS**

1. The manual of fire ship – 6 – A by HMSO
2. Elementary principles of rescue by Got. Of India , ministry of Home Affairs
3. Rescue Service Manual by HMSO

### **REFERENCES BOOKS**

1. Rescue –Civil defence handbook by HMSO
2. Rescue tender for Airfields by ISI
3. Relevant ISI special appliances and equipments
4. Manual of firemanship book no. 24

### **LIST OF EXPERIMENTS:**

1. To study the Rescue Tender and Foam Tender
2. To study Personal Protective Equipments
3. To study different types of Ropes, Knots & Hitches
4. To study different types of Ladders
5. To study the Breathing Apparatus

### **Course Outcomes (COs):**

CO01 Understand the fire fighting vehicles and appliances used in fire services.

CO02 Understand the importance of fire service equipment and how to use them.

CO03 Understand the different types of ladders used in fire services.

CO04 To know about breathing apparatus and gas masks for firefighting purposes.

CO05 To know about safety audits and safety culture in industries.

| Course Code | Course Name                             | Hours Per Week |   |   | Total Hrs. | Total Credits |
|-------------|---|----------------|---|---|------------|---------------|
|             |   | L              | T | P |            |               |
| FT3CO44     | Hazard Identification & Risk Assessment | 4              | 0 | 2 | 6          | 5             |

### Course Learning Objectives (CLOs)

- CLO 01 To understand the types of hazards and their analysis methods.
- CLO 02 To understand the various methods for the plant availability and reliability.
- CLO 03 To understand the methods of logic tree approach.
- CLO 04 To understand the consequences of various industrial incidents.
- CLO 05 To understand the importance of risk acceptance theory in industries.

### UNIT I HAZARD AND RISK

Hazard and risk, Types of hazards – fire, explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards : Inventory analysis, Fire and explosion hazard rating of process plants -The Dow Fire and Explosion Hazard Index, The Mond Index, Plant layout and unit hazard rating, Preliminary hazard analysis, Hazard and Operability study (HAZOP), What If analysis, Case studies.

### UNIT II PLANT AVAILABILITY

Plant availability and process reliability : ways of improving plant availability, MTBF and MTTF, the reliability function, failure rate, bathtub curve, probability relationships, simple reliability estimation, Estimation of frequency of occurrence of a hazard : The logic tree approach, set theory and Boolean algebra, application to probability, Boolean manipulation.

### UNIT III FAULT TREE ANALYSIS

Fault tree analysis – logic symbols, minimal cut set, logic gates, fault tree quantification Event tree analysis – notation, event tree construction, advantages and disadvantages of ETA. Failure mode and Effect Analysis (FMEA) – methodology, criticality analysis, corrective action and follow-up.

### UNIT IV CONSEQUENCE MODELLING

Consequence modelling : Source models – discharge rate models, flash and evaporation, dispersion models. Explosions and fires – vapour cloud explosions, flash fires, physical explosions, BLEVE and fireball, confined explosions, pool fires, jet fires. Effect models –dose-response functions, probit functions, toxic gas effects, thermal effects, explosion effects – Software application for effect and damage calculations.

### UNIT V QUANTIFICATION OF RISK

Quantification of risk : QRA, Vulnerability analysis, accepted and imposed risk, perception of risk, risk indices, individual risk and societal risk, acceptance criteria for risk, ALARP, Presentation of measures of risk – risk contour, F-N curve.

### **TEXTBOOKS**

1. High-Rise Fire & Life Safety by B. Hagan.
2. National Building Code of India.

### **REFERENCE BOOKS**

1. Fire Protection and Maintenance of Aircraft by N.F.P.A.
2. The Fire Hazards of Fuelling Aircraft in the Open by D.S.I.R., H.M.S.O. London.
3. High-Rise building fires and fire safety – NFPA.

### **LIST OF EXPERIMENTS**

1. Study of Airport Fire Hazard and Categorization of Airports.
2. Study of Protection of Hangers.
3. Study of General Requirements of CFT.
4. Study of Emergency Landing, Belly Landing, Aircraft Engine.
5. Study of Fundamentals of Fire & Safety Building Design. Grading System 2012- 13
6. Life Safety plan in High Rise Buildings.
7. Study of working principle of Pilot Ejection Seat

### **Course Outcomes (COs):**

CO 01 Students will be able to understand the analysis methods for identifying the hazards.

CO 02 Students will become well conversant with basic laws related to the plant availability and reliability of the plants.

CO 03 Students will be able to understand the methods of logical approach for the industrial incidents.

CO 04 Students will be able to determine the potential threats in the processes.

CO 05 Students will be able to develop the basic understanding of various acceptable levels of risks in industries.

| Course Code | Course Name                       | Hours Per Week |   |   | Total Hrs. | Total Credits |
|-------------|-----------------------------------|----------------|---|---|------------|---------------|
|             |                                   | L              | T | P |            |               |
| FT3EL07     | Rescue Equipment's and Techniques | 3              | 0 | 0 | 3          | 3             |

### Course Learning Objectives (CLOs)

In this course students will learn:

- CLO 01 To enable the students to know about hand and electrically operated tools.
- CLO 02 To provide knowledge about various types of knots and hitches.
- CLO 03 To provide knowledge about different types of tender in fire services.
- CLO 04 To provide knowledge about drag and lifting of casualty.
- CLO 05 To learn about different types of breathing apparatus.

### UNIT I TOOLS AND EQUIPMENTS

Hydraulic Jack, Hydraulic Cutter, Hydraulic Expander. Air Lifting Bags, Electric Power Tools: - Electric Cutter, Electric Saw, Chain Saw etc. Small Gears: - Their types, Applications and working principle  
Ladders: Constructional features, their types, Material and applications Ropes: - Their types, material and applications.

### UNIT II GENERAL INTRODUCTION

Emergency Rescue Tender, Water Tender, Foam tender, Multipurpose Tender Hydraulic Platform, Turntable Ladder, Canteen Van and Ambulance; Fire Extinguishers: - Their types and Applications. Rescue by Ordinary Means.

### UNIT III DIFFERENT TYPES OF KNOTS & HITCHES

Fireman carry, two men carry, three man carry, four man carry, chair carry, stretcher carry and different types of Drags. Rescue problems and their remedies, Rescue from High rise buildings, Rescue from major disasters Earthquake, Flood, Drought, Tsunami etc. Rescue from Fire incident

### UNIT IV RESPIRATORY EQUIPMENTS

Respiratory Physiology, Composition of Air, Breathing, Breathing Rate, Calculation of the capacity & time duration of the B.A.Set. Artificial Respiration and their techniques, Renunciatory, B.A. Set: - Their types, Constructional features, Working Principle and Applications.

### UNIT V

Gas masks: Their types, Constructional features, Working Principle and Applications.

### **TEXTBOOKS**

1. Rescue Service Manual by HMSO
2. Relevant ISI special appliances and equipment manual of firemanship book no. 244

### **REFERENCE BOOKS**

1. The manual of fire ship- 6- A by HMSO.
2. Elementary principles of rescue by Got. Of India, ministry of Home Affairs.
3. Rescue - Civil defence handbook by HMSO.
4. Rescue tender for Airfields by ISI.

### **COURSE OUTCOMES:**

- CO 01 Understand the small gears and tools used in fire services.
- CO 02 Understand the importance of ladders and how to use them.
- CO 03 Understand the different types of fire tender used in fire services.
- CO 04 Understand the types of lifting and drags used by fire services.
- CO 05 To know about breathing apparatus and gas masks for firefighting purposes.

| Course Code | Course Name                           | Hours Per Week |   |   | Total Hrs. | Total Credits |
|-------------|---------------------------------------|----------------|---|---|------------|---------------|
|             |                                       | L              | T | P |            |               |
| FT3EL11     | Fire Safety Codes and Standardization | 3              | 0 | 0 | 3          | 3             |

### Course Learning Objectives (CLOs)

In this course students will learn:

- CLO 01 To understand the various types of firefighting appliances.
- CLO 02 To understand the rescue and salvage operations during the fire fighting.
- CLO 03 To understand the safety guidelines for the construction of buildings.
- CLO 04 To understand the codes related to the construction of temporary structures.
- CLO 05 To understand the importance of municipal bye-laws

### UNIT ISPECIFICATION OF RESCUE AND FIRE

Fighting equipment and appliances viz., TP, Water Tender C. F. T. and I.S. Standard ( IS 948, IS 950 IS 6067, IS 10460 ,IS 4989 (PART-1) IS -4989 (PART-3),IS -949,IS 951,IS 944', IS 2930,IS-947 IS 6070, IS 957 ,IS-946 ,942 , IS-8090, IS-2190, IS-903 IS-636

### UNIT II TENDER

Salvage Tender, Emergency Tender, Rescue tender, DCP Tender IS-10993, IS-949

### UNIT III CODES CONSTRUCTION

Code concerning construction and design of buildings. NBC -1983

### UNIT IV CODES TEMPORARY CONSTRUCTION

Code of practice for construction of temporary structures and pandals IS -8758 Codes relating to fire ratings of materials used.

### UNIT V MUNICIPAL BYE- LAWS

Municipal Bye- Laws relating to fire prevention, industrial fire Prevention and Protection enforcement.

## **REFERENCES**

1. National Buildings code by Indian Standard institution
2. All relevant INDIAN Standard Specification and code of practices
3. Related N. F. P.A. Codes, Standard and recommended Practice.
4. DGMS (Indian) Director General of Mine Safety Mines regulations.
5. U.L. Standard, Specification
6. Factory Act.

## **COURSE OUTCOMES (COs):**

- CO 01 Understand the functional requirements of various firefighting appliances.
- CO 02 Conversant with emergency rescue operations during the incidents.
- CO 03 Understand the minimum safety requirements for the construction of the buildings.
- CO 04 Determine the potential threats in construction of temporary structures.
- CO 05 Develop the basic understanding of laws for protection and prevention of fire.



## SEMESTER – VII

| Sr. No. | Course Code | Course Name           | L  | T | P | Credits |
|---------|-------------|-----------------------|----|---|---|---------|
| 1       |             | Program Elective - V  | 3  | 0 | 0 | 3       |
| 2       |             | Program Elective - VI | 3  | 0 | 0 | 3       |
| 3       |             | Open Elective III     | 3  | 0 | 0 | 3       |
| 4       | FT3PC12     | Project-1             | 0  | 0 | 8 | 4       |
| 5       | FT3PC03     | Industrial Training   | 0  | 2 | 0 | 2       |
| 6       | EN3NG06     | Open Learning courses | 1  | 0 | 0 | 1       |
|         |             | Total                 | 10 | 2 | 8 | 16      |
|         |             | Total Contact Hours   | 20 |   |   |         |

| Course Code | Course Name                               | Hours per Week |   |   | Total   |
|-------------|---|----------------|---|---|---------|
|             |   | L              | T | P | Credits |
| FT3EL01     | Fire Fighting Installation and Automation | 3              | 0 | 0 | 3       |

**Unit I**  
Grouping  
of Fixed-  
Fire-

fighting Installations, Provisions of First Aid Fire- Fighting Arrangements, External Hydrants, Ring- Mains. Rising Mains: Down Corner, Dry- rises, Wet- rises and specification of each types, their relevant code of practices.

### Unit II

Water Supply & Hydrants System: Grading, Requirement of water supply. Total requirement of water for different hazards pressure tanks water supply, designing of Fire Hydrant Sustum for different occupancies; designing of HVWSS/MVWSS/Sprinklers System: Types of Sprinklers system and its specification New Standard for the installation of Sprinklers and Hazard classification. Multiple et-Drenchers, Rules for spacing Sprinklers and drencher's heads.

### Unit III

Mechanical Foam installation: Determination of foam compound for fire-fighting in oil tanks, Methods of application. Top application Base injection, Sub-surface Injection. Foam inlets and Risk for which foam is used. Premix foams, Installation characteristics of foam. Different types of foam, Low expansion, Medium expansion and High expansion foam, their special application, advantage and disadvantage of various types and the storage of foam concentrates.

### Unit IV

Installations Involving Carbon-di-oxide and Dry powder: Their special features, characteristics, designing, arrangements, operation, extinguishing action, risk and specification

### Unit V

Fire Alarm & Detection System: Designing, Calculations, Testing and Maintenance, Working principle of smoke detectors, heat detectors, Flame detectors & optical beam type detectors.

### Reference Books:

1. Standard Installation of sprinklers system by NFPA.

2. A study of Performance of Automatic sprinklers system by NFPA.
3. National Fire Code of sprinklers by NFPA.
4. Care and Maintenance of sprinklers system by NFPA.
5. Fire and Fire by UNISEF Publication.
6. Relevant Indian Standard and Code of Practices.

| Course Code | Course Name                                      | Hours per Week |   |   | Total Credits |
|-------------|--|----------------|---|---|---------------|
|             |  | L              | T | P |               |
| FT3EL13     | Program Elective VII-1<br>Safety in Construction | 3              | 0 | 0 | 3             |

### Unit I

Introduction to Construction Industry- Safety issues in construction- Human factors in construction safety management. Roles of various groups in ensuring safety in construction industry. Framing Contract conditions on safety, and related matters. Relevance of ergonomics in construction safety.

### Unit II

Safety in various construction operations- Excavation- under- water works- under-pinning & shoring Ladders and Scaffolds- Tunneling- Blasting- Demolition- Pneumatic caissons- confined Space Temporary Structures. Indian Standards on construction safety- National Building Code Provisions on construction safety.

### Unit III

Safety in material handling and equipments- Safety in storage & stacking of construction materials. Safety in the use of construction equipments- Vehicles, Cranes, Tower Cranes, Lifting gears, Hoists & Lifts, Wire Ropes, Pulley blocks, Mixers, Conveyors, Pneumatic and hydraulic tools in construction. Temporary power supply

### Unit IV

Contract Labour(R&A) Act and Central Rules: Definitions, Registration of Establishments, Licensing of Contractors, Welfare and Health provisions in the Act and the Rules, Penalties, Rules regarding wages.

### Unit V

Building & Other Construction Workers (RE & CS) Act, 1996 and Central Rules, 1998: Applicability, Administration, Registration, Welfare Board & Welfare Fund, Training of Building workers, General Safety, Health & Welfare provisions, Penalties.

### Text Books:

1. K.N. Vaid, Construction Safety Management.

2. Linger L, Modern Methods of Material Handling
3. V.J. Davies and K. Tomasin, Construction Safety Handbook.
4. R.T. Ratay, Handbook of Temporary Structures in Construction.

**Reference Books:**

1. James B. Fullman, Construction Safety, Security & Loss Prevention
2. National Building Code of India
3. Relevant Indian Standards published by BIS
4. Contract Labour Act and Central Rules

| Course Code | Course Name                                | Hours per Week |   |   | Total Credits |
|-------------|--|----------------|---|---|---------------|
|             |  | L              | T | P |               |
| FT3EL15     | Program Elective VII-1<br>Transport Safety | 3              | 0 | 0 | 3             |

### Unit I

**Transportation Of Hazardous Goods:** Transport emergency card (TREM) – driver training-parking of tankers on the highways-speed of the vehicle – warning symbols – design of the tanker lorries -static electricity-responsibilities of driver –inspection and maintenance of vehicles-check list- loading and decanting procedures –communication.

### Unit II

**Road Transport:** Introduction – factors for improving safety on roads – causes of accidents due to drivers and pedestrians-design, selection, operation and maintenance of motor trucks-preventive maintenance check lists-motor vehicles act – motor vehicle insurance and surveys.

### Unit III

**Driver And Safety:** Driver safety programme – selection of drivers – driver training-tacho-graph-driving test-driver’s responsibility-accident reporting and investigation procedures-fleet accident frequency-safe driving incentives-slogans in driver cabin-motor vehicle transport workers act- driver relaxation and rest pauses – speed and fuel conservation – emergency planning and Haz mat codes.

### Unit IV

**Road Safety:** Road alignment and gradient-reconnaissance-ruling gradient-maximum rise per k.m.- factors influencing alignment like tractive resistance, tractive force, direct alignment, vertical curves-breaking characteristics of vehicle-skidding-restriction of speeds-significance of speeds- Pavement conditions – Sight distance – Safety at intersections – Traffic control lines and guide posts-guard rails and barriers – street lighting and illumination overloading-concentration of driver Plant railway: Clearance-track-warning methods-loading and unloading-moving cars-safety practices.

### Unit V

**Shop Floor And Repair Shop Safety :**Transport precautions-safety on manual, mechanical handling equipment operations-safe driving movement of cranes-conveyors etc., servicing and maintenance

equipment-grease rack operation wash rack operation-battery charging-gasoline handling-other safe practices-off the road motorized equipment.

**Text Books:**

1. Popkes, C.A. "Traffic Control and Road Accident Prevention" Chapman and Hall Limited, 1986.
2. Babkov, V.F., "Road Conditions and Traffic Safety" MIR Publications, Moscow, 1986.

**Reference Books:**

1. Kadiyali, "Traffic Engineering and Transport Planning" Khanna Publishers, New Delhi, 1983.
2. Motor Vehicles Act, 1988, Government of India.
3. "Accident Prevention Manual for Industrial Operations", NSC, Chicago, 1982.
4. Pasricha, "Road Safety guide for drivers of heavy vehicle" Nasha Publications, Mumbai, 1999.
5. K.W.Ogden, "Safer Roads – A guide to Road Safety Engineering"

| Course Code | Course Name                               | Hours per Week |   |   | Total Credits |
|-------------|---|----------------|---|---|---------------|
|             |   | L              | T | P |               |
| FT3EL10     | Program Elective VII-1<br>Safety in Mines | 3              | 0 | 0 | 3             |

### Unit I

**Opencast Mines:** Causes and prevention of accident from: Heavy machinery, belt and bucket conveyors, drilling, hand tools-pneumatic systems, pumping, water, dust, electrical systems, fire prevention. Garage safety –accident reporting system-working condition-safe transportation – handling of explosives.

### Unit II

**Underground Mines:**Fall of roof and sides-effect of gases-fire and explosions-water flooding-warning sensors-gas detectors-occupational hazards-working conditions-winding and transportation.

### Unit III

**Tunnelling:**Hazards from: ground collapse, inundation and collapse of tunnel face, falls from platforms and danger from falling bodies. Atmospheric pollution (gases and dusts) – trapping –transport-noise electrical hazards-noise and vibration from: pneumatic tools and other machines – ventilation and lighting – personal protective equipment.

### Unit IV

**Risk Assessment:**Basic concepts of risk-reliability and hazard potential-elements of risk assessment – statistical methods – control charts-appraisal of advanced techniques-fault tree analysis-failure mode and effect analysis – quantitative structure-activity relationship analysis-fuzzy model for risk assessment.

### Unit V

**Accident Analysis And Management:**Accidents classification and analysis-fatal, serious, minor and reportable accidents – safety audits recent development of safety engineering approaches for mines-frequency rates-accident occurrence investigation- measures for improving safety in mines-cost of accident-emergency preparedness –disaster management.

### Text Books:

1. “Mine Health and Safety Management”, Michael Karmis ed., SME, Littleton, Co.2001.



**Reference Books:**

1. Kejriwal, B.K. Safety in Mines, Gyan Prakashan, Dhanbad, 2001.
2. DGMS Circulars-Ministry of Labour, Government of India press, OR Lovely Prakashan-DHANBAD, 2002.

| Course Code | Course Name   | Hours per Week |   |   | Total Credits |
|-------------|---|----------------|---|---|---------------|
|             |   | L              | T | P |               |
| FT3EL12     | Program Elective VII-2<br>Safety in Chemical Industries | 3              | 0 | 0 | 3             |

### Unit I

**Safety In Process Design And Pressure System Design:** Design process, conceptual design and detail design, assessment, inherently safer design- chemical reactor , types, batch reactors, reaction hazard evaluation, assessment, reactor safety, operating conditions, unit operations and equipments, utilities. Pressure system, pressure vessel design, standards and codes- pipe works and valves- heat exchangers- process machinery- over pressure protection, pressure relief devices and design, fire relief, vacuum and thermal relief, special situations, disposal- flare and vent systems- failures in pressure system.

### Unit II

**Plant Commissioning And Inspection:** Commissioning phases and organization, pre-commissioning documents, process commissioning, commissioning problems, post commissioning documentation Plant inspection, pressure vessel, pressure piping system, non destructive testing, pressure testing, leak testing and monitoring- plant monitoring, performance monitoring, condition, vibration, corrosion, acoustic emission- pipe line inspection.

### Unit III

**Plant Operations:** Operating discipline, operating procedure and inspection, format, emergency procedures- hand over and permit system- start up and shut down operation, refinery units- operation of fired heaters, driers, storage- operating activities and hazards- trip systems- exposure of personnel

### Unit IV

**Plant Maintenance, Modification And Emergency Planning:** Management of maintenance, hazards- preparation for maintenance, isolation, purging, cleaning, confined spaces, permit system- maintenance equipment- hot works- tank cleaning, repair and demolition- online repairs- maintenance of protective devices- modification of plant, problems controls of modifications. Emergency planning, disaster planning, onsite emergency- offsite emergency, APELL

### Unit V

**Storages:** General consideration, petroleum product storages, storage tanks and vessel- storages layout segregation, separating distance, secondary containment- venting and relief, atmospheric vent, pressure, vacuum valves, flame arrestors, fire relief- fire prevention and protection- LPG storages, pressure storages, layout, instrumentation, vaporizer, refrigerated storages- LNG storages, hydrogen storages, toxic storages, chlorine storages, ammonia storages, other chemical storages- underground storages- loading and unloading facilities- drum and cylinder storage- ware house, storage hazard assessment of LPG and LNG

**Text Books:**

1. Lees, F.P. "Loss Prevention in Process Industries" Butterworths and Company, 1996.

**Reference Books:**

1. "Quantitative Risk Assessment in Chemical Process Industries" American Institute of Chemical Industries, Centre for Chemical Process safety.
2. Fawcett, H.h. and Wood, "Safety and Accident Prevention in Chemical Operations" Wiley inters, Second Edition.
3. "Accident Prevention Manual for Industrial Operations" NSC, Chicago, 1982.
4. GREEN, A.E., "High Risk Safety Technology", John Wiley and Sons,. 1984.
5. Petroleum Act and Rules, Government of India.
6. Carbide of Calcium Rules, Government of India.

| Course Code | Course Name                           | Hours per Week |   |   | Total Credits |
|-------------|---------------------------------------|----------------|---|---|---------------|
|             |                                       | L              | T | P |               |
| FT3CO21     | Fire Fighting and Field Training<br>V | 0              | 0 | 2 | 1             |

**List of Practicals:**

1. To study the General Requirements of Different type of Occupancy as per NFPA 101-Life
2. Safety Code.
3. To study the fixed DCP Installation as per NFPA Code 17.
4. To study the Fire Fighting Properties of Foam Concentrate a. Fuel Tolerance b. burn back resistance c. Induction Ratio d. Fluidity e. Film Formation
5. To study the CO2 Total flooding System as per IS Specification

| Course Code | Course Name    | Hours per Week |   |   | Total Credits |
|-------------|----------------|----------------|---|---|---------------|
|             |                | L              | T | P |               |
| FT3PC01     | Project Work I | 0              | 0 | 8 | 4             |

1. Project-I can be an individual or a group activity depending on the depth and scope of the topic.
2. The project work can be any of the form given below:
  - a) Making physical working models, prototypes, and scaled models of a concept machine.
  - b) Making virtual / CAD models of a sufficiently complex machines / concepts.
  - c) Making study, modeling, analysis, programming and simulation of a system / machine /operation / process.
  - d) Making study / teaching modules of a sufficiently complex topic for pedagogy purposes.
3. Group formation, discussion with faculty advisor, formation of the Semester Mini Project statement, resource requirement, if any should be carried out in the earlier part of the semester.
4. The students are expected to utilize the laboratory resources before or after their contact hours as per the prescribed module.
5. A complete Assembly and Details drawings of the project should be submitted along with a Detailed project report, where applicable.
6. A Detailed Background / field / literature survey, related to the topic must be made and presented in the report.

| Course Code | Course Name         | Hours per Week |   |   | Total Credits |
|-------------|---------------------|----------------|---|---|---------------|
|             |                     | L              | T | P |               |
| FT3PC03     | Industrial Training | 0              | 2 | 0 | 2             |

## Objective of Industrial Training

The objective of undertaking industrial training is to provide work experience so that student's engineering knowledge is enhanced and employment prospects are improved. The student should take this course as a window to the real World and should try to learn as much as possible from real life experiences by involving and interacting with industry staff. Industrial training also provides an opportunity to students to select an engineering problem and possibly an industry guide for their Major Project in final semester. **Industrial Training** is a structured program that integrates academic learning with practical industrial experience. It is designed to bridge the gap between theoretical knowledge gained in the classroom and real-world applications in the industry. This program is essential for students in engineering, technology, and related fields as it provides hands-on experience and exposure to actual working environments.

## Objectives of Industrial Training:

1. **Skill Development:** Enhance practical skills and technical knowledge that are crucial for industry-specific tasks.
2. **Workplace Experience:** Provide firsthand experience of the professional work environment, including workplace culture, practices, and expectations.
3. **Application of Knowledge:** Enable students to apply academic concepts and theories to real-world industrial problems and projects.
4. **Professional Networking:** Offer opportunities to build connections with industry professionals, which can be valuable for future career prospects.
5. **Career Insight:** Help students gain insights into potential career paths and make informed decisions about their professional future.

## Key Components of Industrial Training:

1. **Orientation:** Introduction to the company, its operations, safety protocols, and expectations during the training period.
2. **Hands-on Projects:** Participation in live projects and tasks relevant to the student's field of study, under the guidance of experienced professionals.
3. **Mentorship:** Regular interaction with mentors and supervisors who provide guidance, feedback, and support throughout the training.
4. **Evaluation:** Continuous assessment of the student's performance through reports, presentations, and evaluations by industry mentors.
5. **Reflection:** Opportunities for students to reflect on their experiences, challenges faced, and lessons learned during the training.

| Course Code | Course Name           | Hours Per Week |   |   | Total Credits |
|-------------|-----------------------|----------------|---|---|---------------|
|             |                       | L              | T | P |               |
| EN3NG06     | Open learning Courses | 1              | 0 | 0 | 1             |
|             |                       |                |   |   |               |

**Open Learning Courses** are educational programs designed to be accessible to a broad audience, often offered online and available to anyone with an internet connection. These courses aim to make education more inclusive and flexible, allowing learners to study at their own pace and according to their own schedules.

**Objectives of Open Learning Courses:**

1. **Accessibility:** Provide educational opportunities to learners regardless of their geographical location, financial situation, or prior educational background.
2. **Flexibility:** Allow learners to study at their own pace and on their own schedule, accommodating diverse learning styles and life commitments.
3. **Lifelong Learning:** Encourage continuous personal and professional development by providing access to a wide range of subjects and skill sets.

**Inclusivity:** Promote equal access to high-quality education for all, reducing barriers related to cost, location, and time.

### SEMESTER VIII

| Sr.No. | Course Code | Course Name         | L         | T        | P         | Credits   |
|--------|-------------|---------------------|-----------|----------|-----------|-----------|
| 1      | FT3PC13     | Project-2           | 0         | 0        | 20        | 10        |
|        |             | <b>Total</b>        | <b>0</b>  | <b>0</b> | <b>20</b> | <b>10</b> |
|        |             | Total Contact Hours | <b>20</b> |          |           |           |

1. Project-II can be an individual or a group activity depending on the depth and scope of the topic.
2. The project work can be any of the form given below:
  - a) Making physical working models, prototypes, and scaled models of a concept machine.
  - b) Making virtual / CAD models of a sufficiently complex machines / concepts.
  - c) Making study, modeling, analysis, programming and simulation of a system / machine /operation / process.
  - d) Making study / teaching modules of a sufficiently complex topic for pedagogy purposes.
3. Group formation, discussion with faculty advisor, formation of the Semester Mini Project statement, resource requirement, if any should be carried out in the earlier part of the semester.
4. The students are expected to utilize the laboratory resources before or after their contact hours as per the prescribed module.
5. A complete Assembly and Details drawings of the project should be submitted along with a Detailed project report, where applicable.
6. A Detailed Background / field / literature survey, related to the topic must be made and presented in the report.