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# UNIVERSITY OF PETROLEUM & ENERGY STUDIES

## B. TECH (FIRE & SAFETY ENGINEERING)
### w.e.f 2017

| SEMESTER I | | | SEMESTER II | | |
|---|---|---|---|---|---|
| **Subject Code** | **Subject** | **Credits** | **Subject Code** | **Subject** | **Credits** |
| MATH 1001 | Mathematics I | 4 | MATH 1004 | Mathematics II | 4 |
| PHYS 1001 | Physics I | 4 | PHYS 1004 | Physics II | 4 |
| HBOC 1001 | Design Thinking | 4 | HSFS 1001 | Environmental Studies | 3 |
| COMM 1001 | English Communication | 4 | MECH 1002 | Engineering Mechanics | 3 |
| MECH 1001 | Engineering Graphics | 2 | MEPD 1001 | Workshop Technology | 2 |
| ECEG 1001 | Basic Electrical and Electronics | 3 | CHEM 1001 | Chemistry | 4 |
| CSEG 1001 | Computer Programming | 3 | | | |
| **PRACTICAL** | | | **PRACTICAL** | | |
| PHYS 1101 | Physics Lab I | 1 | PHYS 1104 | Physics II Lab | 1 |
| ECEG 1101 | Electrical and Electronics Lab | 1 | MEPD 1101 | Engineering Workshop Lab | 1 |
| CSEG 1101 | Computer Programming Lab | 1 | CHEM 1101 | Chemistry Lab | 1 |
| | **TOTAL** | **27** | | **TOTAL** | **23** |
| **SEMESTER III** | | | **SEMESTER IV** | | |
| **Subject Code** | **Subject** | **Credits** | **Subject Code** | **Subject** | **Credits** |
| MATH 2001 | Mathematics III | 4 | MATH 2002 | Applied Numerical Methods | 4 |
| HSFS 2001 | Chemical Engineering I (Thermodynamics & Measuring Analytical Instruments) | 3 | HSFS 2004 | Chemical Engineering II (Unit Operations) | 3 |
| MECH 2016 | Fluid Mechanics & Fluid Flow Machines | 4 | MECH 2018 | Strength of Materials | 3 |
| MECH 2017 | Elements of Machine Drawing | 4 | HSFS 2005 | Fire Engineering I (Basic Concepts) | 4 |
| HSFS 2002 | Behaviour Based Safety | 3 | HSFS 2006 | Electrical System Safety and its Design | 3 |
| HSFS 2003 | First Aid and Emergency Procedures | 3 | | Open Elective - II | 3 |
| | Open Elective - I | 3 | LNPS 1013 | Venture Ideation | 2 |
| **PRACTICAL** | | | **PRACTICAL** | | |
| MECH 3104 | Fluid Mechanics & Machinery Lab | 1 | MECH 2101 | Material Testing Lab | 1 |
| | | | HSFS 2106 | Electrical Technology Lab | 1 |
| | **TOTAL** | **25** | | **TOTAL** | **24** |
| **SEMESTER V** | | | **SEMESTER VI** | | |
| **Subject Code** | **Subject** | **Credits** | **Subject Code** | **Subject** | **Credits** |
| HSFS 3001 | Chemical Engineering III (Process Technology) | 2 | HSFS 3007 | Legal Aspects of Safety, Health & Environment | 3 |
| HSFS 3002 | Principles of Engineering Design | 2 | HSFS 3008 | Chemical Process Safety | 3 |
| HSFS 3003 | Fire Engineering II (Equipment) | 3 | ECEG 3009 | Process Instrumentation and Control Engineering | 3 |
| HSFS 3004 | Occupational Health & Hygiene Management | 2 | HSFS 3009 | Fire Engineering III (Materials & Fire Control) | 4 |
| HSFS 3005 | Safety in Construction | 2 | HSFS 3010 | Environmental Engineering & Management | 3 |
| | Open Elective-III | 3 | | Program Elective II | 3 |
| | Program Elective I | 3 | | | |

| | | | | | |
|---|---|---|---|---|---|
| HSFS 3006 | Leadership in Safety | 1 | | | |
| **PRACTICAL** | | | **PRACTICAL** | | |
| HSFS 3102 | Safety Engineering Lab | 1 | HSFS 3110 | Environmental Engineering & Management Lab | 1 |
| HSFS 3101 | Chemical Engineering Lab | 1 | PROJ 3102 | Minor Project II | 3 |
| PROJ 3101 | Minor Project I | 3 | INDT 3101 | Industrial Visit | 1 |
| | **TOTAL** | **23** | | **TOTAL** | **24** |
| | **PE I** | | | **PE II** | |
| HSFS 3011 | Safety in Petroleum Exploration | | HSFS 3013 | TMP and TQM | |
| HSFS 3012 | Drilling and Storage | | HSFS 3014 | Water Supply, Sanitation and Refugee Health in Emergency Situation | |
| **SEMESTER VII** | | | **SEMESTER VIII** | | |
| **Subject Code** | **Subject** | **Credits** | **Subject Code** | **Subject** | **Credits** |
| HSFS 4002 | Hazard Identification and Computer Aided Risk Analysis | 3 | HSFS 4006 | Human Factors Engineering | 2 |
| HSFS 4003 | Safety in Rail and Road Transport | 2 | HSFS 4007 | Fundamental of Sustainable Development | 3 |
| HSFS 4004 | Safety in Engineering Industry | 2 | | | |
| HSFS 4005 | Fire Engineering IV (Risk Assessment & Planning) | 3 | | Program Elective V | 3 |
| | Program Elective III | 3 | | | |
| | Program Elective IV | 3 | | | |
| **PRACTICAL** | | | **PRACTICAL** | | |
| HSFS 4105 | Fire Engineering Lab | 1 | PROJ 4102 | Major Project II | 8 |
| HSFS 4104 | Industrial Hygiene Lab | 1 | | | |
| VIVA 4101 | Comprehensive Viva | 1 | | | |
| PROJ 4101 | Major Project I | 4 | | | |
| SIIB 4101 | Summer Internship | 2 | | | |
| HSFS 4103 | Fire Safety Field Training | 1 | | | |
| | **TOTAL** | **26** | | **TOTAL** | **16** |
| | **PE III** | | | **PE V** | |
| HSFS 4010 | Environmental Management in Power Industry | | HSFS 4007 | Fundamental of Sustainable Development | |
| HSFS 4011 | Reliability Engineering | | HSFS 4014 | Global Disaster Scenario | |
| | **PE IV** | | | | |
| HSFS 4012 | Principles of Safety Management | | | | |
| HSFS 4013 | Remediation Service & Site Restoration | | | | |
| **Total Credits of B.Tech. Fire & Safety Engineering 2017** | | | | | **188** |

**PROGRAM OUTCOMES (POs) for FSE (Fire and Safety Engineering)**

PO1- Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2-Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3- 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.
PO4- 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.
PO5- 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.
PO6- 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.
PO7-Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8-Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10-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.
PO11- 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.
PO12- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

**PROGRAM SPECIFIC OUTCOMES (PSOs) for FSE (Fire and Safety Engineering)**

PSO1- Develop analytical skills to solve problems related to fire, safety, occupational health and environment in various industries/organization.

PSO2- Design and operation of various firefighting, safety, and environmental monitoring, analysis and control tools

PSO3- Apply basic fire and safety concepts to design, operation, legal compliance and develop safety culture in various industries.

| MATH 1001 | MATHEMATICS I | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 1 | 0 | 4 |
| Pre-requisites/Exposure | Mathematics up to class XII | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. To enable students to apply matrix theory in engineering problems.
  2. To help the students understand the technique to expand functions of one and two variables and to trace the curves.
  3. To develop students' skills to calculate the area, volume, mass, centroid and moments of inertia of plane and solid regions using the principles of multiple integration.
  4. To enable students to compute Fourier series of periodic functions.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Find the Eigen values, Eigen vectors and solution of system of linear algebraic equations using the techniques of matrix theory.

  CO2. Apply the principles of differentiation to the problems related to extreme values, curve tracing and expansion of functions.

  CO3. Calculate the area, volume, mass, centroid and moment of inertia of plane and solid regions using the principles of multiple integration.

  CO4. Represent periodic functions of a single variable as Fourier series.

- **CATALOG DESCRIPTION**

  Mathematics is a necessary subject to a clear and complete understanding of virtually all phenomena. It helps us to develop logical thinking and also to find the right way to solve problems. This course covers Matrix theory, Differential calculus, Multiple integrals and Fourier series. This course is designed in such a way that it enables the students to cope confidently with the mathematics needed in their future subjects and the curriculum aims at developing student's ability to conceptualize, reason and to use mathematics to formulate and solve problems in their core subjects. .

## Course Content

- **UNIT I: MATRICES** **9 LECTURE HOURS**

  Introduction: Revision of Prerequisites, Elementary Row and Column Transformations(Reduction of a Matrices into Echelon and Normal form), Linear Dependence of Columns and Rows, Rank of a Matrix, Consistency of System of Linear Equations and its Solution, Characteristic Equation, Eigen values and Eigenvectors, Applications of Cayley-Hamilton Theorem, Diagonalisation.

- **UNIT II: DIFFERENTIAL CALCULUS** **16 LECTURE HOURS**

  Higher order derivatives, Successive Differentiation, Leibnitz Theorem, Maclaurin's and Taylor's Theorem, Expansion of Functions of one variable, Partial Differentiation, Euler's Theorem and its

Applications, Jacobian, Expansion of Functions of two variables, Extrema of Functions of two variables, Asymptotes, Curve Tracing (Cartesian, Polar & Parametric Curves).

- **UNIT III: MULTIPLE INTEGRALS** **10 LECTURE HOURS**

  Double and Triple Integrals, Change of Order of Integration, Change of Variable, Beta and Gamma Functions, Applications of I (Area, Volume, Center of Gravity & Moment of Inertia).

- **UNIT IV: FOURIER SERIES** **7 LECTURE HOURS**

  Introduction to Periodic Functions, Fourier Series Expansion of Functions of Period 2π, Change of Interval, Half Range Sine and Cosine series.

**Text Books**


1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publications. ISBN: 9788184875607.
2. E. Kreyszig, Advanced Engineering Mathematics, Wiley Publications. ISBN: 9788126531356.
3. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill. ISBN: 9780071070089.


**Reference Books**


1. M. D. Greenberg, Advanced Engineering Mathematics, Pearson Education, India. ISBN: 9788177585469.
2. S. Narayan, Differential Calculus, Shyamlal Charitable Trust, New Delhi. ISBN: 9788121904711.
3. N. Piskunov, Differential and Integral Calculus, CBS, New Delhi, India. ISBN: 8123904932.
4. J. Stewart, Essential Calculus: Early Transcendentals, Cengage Learning India Pvt. Ltd. ISBN: 8131503453.
5. D. G. Zill, Advanced Engineering Mathematics, Jones & Bartlett, India. ISBN: 9789384323271.


**Modes of Evaluation: Class tests/Assignment/Tutorial Assessment/Written Examination**
**Examination Scheme:**

| Components | Tutorial/Faculty Assessment | Class Tests | MSE | ESE |
|---|---|---|---|---|
| Weightage (%) | 15 | 15 | 20 | 50 |

**Relationship between the Program Outcomes (POs), Program Specific Outcomes and Course Outcomes (COs)**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO2 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | | 0 | 0 |
| CO3 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO4 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Average | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

1. WEAK 2. MODERATE 3. STRONG

| PHYS 1001 | Physics I | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 1 | 0 | 4 |
| Pre-requisites/Exposure | $12^{th}$ level Physics | | | | |
| Co-requisites | $12^{th}$ level Mathematics | | | | |

- **COURSE OBJECTIVES**
  1. To help students to develop an insight of optics with deep understanding of LASERs and Holography, which have revolutionized modern technology significantly.
  2. To enable students develop an understanding of crystal structure and X-ray diffraction which has widespread applications in material analysis/characterization and instrumentation.
  3. To give the students perspective of electromagnetic theory keeping in view, its widespread applications in signal transmission and electric circuit theory. This in itself is a prerequisite for solving many core engineering problems.
  4. To enable students in grasping concepts related to acoustics and vibrations with applications in building and machine design.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1: To understand the physics of crystals, working of LASER and optical fiber propagation mechanism electromagnetic waves and ultrasonic waves.

  CO2: To calculate various physical parameters related to crystals, electromagnetic and ultrasonic waves and working of LASER and optical fiber.

  CO3: To apply the concepts of electromagnetic and ultrasonic waves; crystal structure in understanding of materials and LASER in fiber optics and holography;

  CO4: To analyze the behavior of electromagnetic waves and effect of medium, application of ultrasonic waves in Acoustic of buildings and properties of LASER in optical fibers.

- **CATALOG DESCRIPTION**

  Physics is the backbone of every engineering stream. It is helpful in investigating the mysteries of nature and how this understanding facilitates the explanation of all the physical processes which affect us in almost every possible manner. The Physics I curriculum provides direct coherence of concepts and applications which adhere to the need of understanding engineering in a generic and dynamic manner. The course plan starts with an introduction to optics to develop an understanding of optics which helps to understand subsequent topics related to the working of Lasers, Holography, Fiber optics communication system and optical instrumentation. These topics form the backbone of communication technologies employed nowadays. The understanding of crystal structure and X-ray diffraction is a prerequisite for material analysis/characterization which is very important in probing physical properties of elements and

compounds. Thereafter an understanding of electromagnetic theory is emphasized, which will be helpful in conceptualizing the signal communication techniques and it also forms the basis of electric signal theory. This is indeed a prerequisite for any technology under development. At the end, the topic on acoustics will help the students foray into the Science of sound & vibrations. This topic will develop an understanding of building and machine design by improving their acoustic properties.

## Course Content

- **UNIT I: LASER AND FIBER OPTICS: 12 LECTURE HOURS**

  Introduction to wave optics: Interference, Diffraction and Polarization

  Laser: Spontaneous and Stimulated emission of radiation, Einstein's A and B coefficients, Population inversion & types of pumping, Properties of laser beam, Construction & working of Ruby and Helium-Neon laser and their application, Elementary idea of holography; construction and reconstruction of hologram

  Optical Fiber: Fundamental ideas about optical fiber, Types of fibers, Acceptance angle and cone, Numerical aperture, Propagation mechanism and communication in optical fiber

- **UNIT II: CRYSTAL STRUCTURE AND X-RAYS: 10 LECTURE HOURS**

  Unit cell, Bravais Lattices, crystallographic planes, Miller indices, inter planar distance in cubic lattice, Calculation of number of atoms per unit cell, atomic radius, coordination number, packing factor for SC, BCC, FCC and HCP structures.

  Origin of X-rays, Continuous X-ray Spectra, Production of Characteristic X-Ray spectra, Moseley's law, X-ray diffraction and its applications in crystallography

- **UNIT III: ELECTROMAGNETIC WAVES AND PROPAGATION: 8 LECTURE HOURS**

  Displacement current, Maxwell's correction in Ampere's law, Maxwell's Equations (Integral and Differential Forms) and Equation of continuity, EM-Wave equation and its propagation characteristics in free space and in conducting media, Poynting theorem and Poynting vectors.

- **UNIT IV: ACOUSTIC AND ULTRASONIC WAVES: 10 LECTURE HOURS**

  Characteristics of sound, Classification of sound, Weber-Fechner Law, Sabine's reverberation formula: rate of growth and decay of sound energy, Absorption coefficient and its determination, factors affecting acoustic of buildings and their remedies.

  Production of ultrasonic waves by magnetostriction and piezoelectric methods: acoustic grating, Detection of ultrasonic waves, properties of ultrasonic waves, Non Destructive Testing: pulse echo system through transmission and reflection modes: Applications

## Text Books


1. Vasudeva A.S. (2013) Modern Engineering Physics, S. Chand. ISBN: 978-8121917575
2. Malik H.K., Singh A.K. (2010) Engineering Physics, Tata Mc Graw Hill Education Pvt Ltd. ISBN: 978-0070671539
3. Sadiku M.N.O. (2008) Elements of Electromagnets, Oxford University Press. ISBN: 978-0195692075

**Reference Books**


1. Griffiths D.J. (2012) Introduction to Electrodynamics, PHI Learning Pvt. Ltd. ISBN: 978-8120347762.
2. Kittel C. (2012) Introduction to Solid State Physics, Willey. ISBN: 978-8126535187.
3. Ghatak A. (2012) Optics, McGraw Hill Education. ISBN: 978-1259004346.
4. Beiser A., Mahajan S. (2009) Modern Physics, McGraw Hill Education. ISBN: 978-0070151550
5. Pillai S.O. (2015) Solid State Physics, New Age International Pvt Ltd. ISBN: 978-8122436976


**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | CCT | Tutorials/Assignments | MSE | ESE |
|---|---|---|---|---|
| Weightage (%) | 15 | 15 | 20 | 50 |

**Relationship between the Program Outcomes (POs), Program Specific Outcomes and Course Outcomes (COs)**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO2 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO4 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Average | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

1. WEAK 2. MODERATE 3. STRONG

| HBOC 1001 | DESIGN THINKING | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 4 | 0 | 0 | 4 |
| Pre-requisites/Exposure | Knowledge of analyzing society problems and product usage problems and a zeal to improve the current situation , in addition to knowing to using laptop/computers, internet, social media interaction, file sharing and uploading, email and communication etiquettes. | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**

  1. Increase ability to communicate with people.
  2. Enhance knowledge, imagination and be more assertive on opinions on problems in society.
  3. Learn basics of research, data collection, analysis, brainstorming to find solutions to issues.
  4. Apply Design Thinking methodologies to problems in field of study and other areas as well.
  5. Prepare the student for future Engineering positions with scope of understanding dynamics of working between Inter departments of an a typical OEM.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Understand Design Thinking?

  CO2. Understand the Design Thinking Model and various stages of the same.

  CO3. Understanding stages of Discovery, Defining a real time problem through primary and secondary research and discovery canvas.

  CO4. Attempting to find solutions through concept development and simple prototyping .

  CO5. Testing the developed prototype and iterating to perfect out the solutions for chosed problem.

- **CATALOG DESCRIPTION**

  Design thinking course is a completely online course offered to the first year B.Tech across all streams. The course is offered by Laureate Design University for UPES Students along with Domus Academy Milan and New School of Architecture & Design, San Diego. The Design Thinking Model introduced in this course helps us to understand the steps followed in the process of designing a solution to a problem. The online course has 8 modules to be completed in 8 weeks. Hence each module is allotted a week for understanding and assignment submissions.

## Course Content

- **UNIT 1: WHAT IS DESIGN THINKING**

  Designers seek to transform problems into opportunities. Through collaboration, teamwork, and creativity, they investigate user needs and desires on the way to developing human0centered products and/or services. This approach is at the very heart of design thinking.

- **UNIT II: THE DESIGN THINKING MODEL**

A tool that helps guide you along a design thinking path. The model does this by providing a series of activities that that will help you effectively design a product, service or solution to a user's need. The model presents the approach as a process, allowing us to look at each step – or phase – along the journey to the development of a final design.

- **UNIT III: PHASE 1: DISCOVER**

  Begin the design thinking process with the Discover phase, where you will identify the specific problem your design is intended to solve, as well as important usability aspects from those who will use your design. Discovery can be performed through a variety of different research methods which you will learn in this module.

- **UNIT IV: PHASE 2: DEFINE**

  In the Define phase, you come to understand the problem. We often refer to this as framing the problem. You can do this by using a variety of tools, including storytelling, storyboarding, customer journey maps, personas, scenarios, and more.

- **UNIT V: PHASE 3: DEVELOP**

  Turn your attention to solving the problem. In this phase you brainstorm custom creative solutions to the problems previously identified and framed. To do this, you conceptualize in any way that helps, putting ideas on paper, on a computer, or anywhere whereby they can be considered and discussed.

- **UNIT VI: PHASE 4: DELIVER**

  This phase is all about testing and building concepts. Here you take all of the ideas that have been discussed to this point and bring them a little closer to reality by building a concept; something that makes it easier for a user to experience a design. This concept is referred to as a prototype.

- **UNIT VII: PHASE 5: ITERATE**

  You will test the prototype of your design solution, collecting and acting on feedback received. These actions may mean minor or major revisions to your design, and are repeated as often as necessary until a solution is reached. Tools such as focus groups and questionnaires are used to help you collect feedback that can help with your final design.

- **UNIT VIII: BEYOND DESIGN THINKING**

  The Design Thinking Model is a tool that helps guide you along a design thinking path. The model does this by providing a series of activities that that will help you effectively design a product, service or solution to a user's need. The model presents the approach as a process, allowing us to look at each step – or phase – along the journey to the development of a final design.

## Text Books

1. All the references are available to download in the online course.

**Reference Books**


1. Brown, Tim. “What We Can Learn from Barn Raisers.” Design Thinking: Thoughts by Tim Brown. Design Thinking, 16 January 2015. Web. 9 July 2015.
2. Knapp, Jake. “The 8 Steps to Creating a Great Storyboard.” Co.Design. Fast Company & Inc., 21 Dec. 2013. Web. 9 July 2015.
3. van der Lelie, Corrie. “The Value of Storyboards in the Product Design Process.” Journal of Personal and Ubiquitous Computing 10.203 (2006): 159–162. Web. 9 July 2015. [PDF].
4. Millenson, Alisson. “Design Research 101: Prototyping Your Service with a Storyboard.” Peer Insight. Peer Insight, 31 May 2013. Web. 9 July 2015.


**Modes of Evaluation: online discussion and assignments**

**Examination Scheme: Continuous evaluation**

All evaluation on the online course is done based on continuous basis for each of the 8 units/modules through out the semester. The assignment submission formats are in the form of qualitative discussion boards and online submissions of research data and developed product lifecycle and originally designed/redesigned prototype images.

| **Components** | **Internal Assessment** | **MSE** | **ESE** |
|---|---|---|---|
| **Weightage (%)** | 0 | 0 | 100 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 0 | 0 | 2 | 2 | 2 | 1 | 1 | 0 | 1 | 1 | 1 | 3 | 0 | 1 |
| CO2 | 0 | 0 | 2 | 2 | 2 | 2 | 1 | 0 | 1 | 1 | 1 | 3 | 0 | 0 |
| CO3 | 1 | 1 | 3 | 2 | 2 | 1 | 3 | 1 | 2 | 2 | 3 | 3 | 1 | 1 |
| CO4 | 0 | 0 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 3 | 0 | 1 |
| Average | 0 | 0 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | 1 | 2 | 3 | 0 | 1 |

1. WEAK 2. MODERATE 3. STRONG

1=Weakly mapped 2= Moderately mapped 3=Strongly mapped

| HSFS 1001 (online course) | Environmental Studies | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | Basics of Chemistry, Biology and Physics<br>General Observation, Discipline & Adaptability | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. To provide knowledge required to understand environmental issues in multidisciplinary model.
  2. To enable student to comprehend natural environment and its relationships with human activities and their impact.
  3. The student should be capable to understand structural and functional aspects of ecosystem, energy flow within the ecosystem using water, carbon, oxygen and nitrogen cycle and the types of ecosystems,
  4. To provide knowledge required to understand the renewable and nonOrenewable resources, estimate the biological diversity of the environment and the threats to this biological diversity.
  5. Provide knowledge pertaining to the various types of pollution; identify the causes of various types of pollution and their harmful effects. In addition, various treatment methods and pollution control techniques.
  6. To provide knowledge required to explain on global environmental issues

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1: Recall and recognize information, ideas, and principles in the various aspects of environmental science and ecology that are particularly valuable to society.

  CO2: Distinguish and relate different types of biodiversity and natural resource and their impact on sustainable development.

  CO3: Assesses and analyze various aspect and types of pollution and will be able to adopt ecofriendly technologies to facilitate conservation and regeneration of natural resource.

  CO4: To Create a pro- environmental attitude and behavioral pattern in the student that is based creating sustainable life styles.

- **CATALOG DESCRIPTION**

  Environmental Science, it is important for the students to have a knowledge about what is happening to the earth and its resources. "The interdisciplinary course will be helpful in imparting knowledge to undergraduates from all educational backgrounds."It will not only give them a better understanding of environmental issues at the local, regional and global levels but also help them develop lateral thinking in this area.

  The subject gives a direct contact with nature and the knowledge of it: The subject environmental science gives students an ample scope for ‘application’. They will get some

real0time knowledge and skill, which required when they are actually dealing with environmental problems and the possible solutions. They can actually see the knowledge of physics and chemistry and for that matter even biology helps them to protect environment. This could give the student community a sense of 'empowerment'.

EVS encompasses many other science domains: In EVS we find a classic amalgamation of many other branches of science. This will expose students to a variety of theories and practical approaches thus enriching their knowledge.

EVS encourages collaborative studies: When we talk about environmental issues, we immediately realize that they are complex in nature. Such a thing will certainly chisel the analytical and problem solving skills of the students. Since the nature of environmental problems is both complex and critical, besides being huge, it demands team and collaborative work. This helps students to improve their interpersonal skills and they will emerge great leaders and team players in the future.

Conscientizes students to the problems of the planet earth: The study of EVS could itself be conscientizing instrument in making students realize the peril of survival. Students might become aware of the danger that many may be unknowingly or ignorantly unleashing upon the planet we are living. In some ways it could be related to something called as "emancipator pedagogy" which makes students more insightful.

## Course Content

- **UNIT I: MULTIDISCIPLINARY NATURE OF ENVIRONMENT STUDIES 4 LECTURE HOURS**

  Multidisciplinary nature of Environmental Studies, scope, importance of environment & need of public awareness. Institutions in Environment, People in Environment

- **UNIT II: ECOSYSTEM 5 LECTURE HOUR**

  Concept of Ecosystem, Structure of ecosystem (Biotic and Abiotic) Biotic ( Producer, Consumer and Decomposer), Abiotic ( Physical factors & Chemical Factors) Functions of ecosystem Food Chain, Food Web, Trophic Level, Ecological Pyramid ( Pyramid of energy, biomass, number) Energy flow in an Ecosystem, Biogeochemical cycle ( cycling of nutrients )0, Carbon Cycle, Nitrogen cycle, Water Cycle, Oxygen Cycle, Carbon Cycle, Phosphorus cycle, Ecological Succession – Definition , Types of Succession, (Hydrosere and Xerosere) and Process of Succession.

  **Major Ecosystem Types:** Terrestrial Ecosystem: Taiga, Tundra, Deciduous, Grassland, Tropical Rain Forest, Desert, Aquatic Ecosystem: Fresh Water, (Lentic and Lotic Ecosystem) and Marine, Ecosystem

- **UNIT III: NATURAL RESOURCES AND MANAGEMENT 5 LECTURE HOUR**

  Introduction of natural resources, Renewable and non0renewable resources, Renewable Energy: Wind, Power, Geothermal, Hydropower, Biomass, Biofuel, Non0Renewable Energy: Petroleum, Natural Gas, Coal, Nuclear energy, Forest, Use of forest, Deforestation & Afforestation. Causes of

Deforestation, Equitable use of resources for sustainable life style: Current and Future Global Challenges, Water (Surface water and ground water), Mineral resources

- **UNIT IV: BIODIVERSITY & ITS CONSERVATION 05 LECTURE HOUR**

  Introduction of biodiversity, types of biodiversity (Genetic, Species and Ecosystem Biodiversity), Biogeographic Classification of India, Four Level Biogeographical Classification, (a) The Biogeographic Zone (b) The Biotic Province, (c) The Land Region (d) The Biome, India0 A Mega0 diversity nation, Ecoregion, Terrestrial Biome, Hot0 Spots Biodiversity, Threats to Biodiversity, conservation of biodiversity (In 0 situ & Ex0situ), Case Study Project Tiger

- **UNIT V: ENVIRONMENTAL POLLUTION AND ITS CONTROL METHODS 05 LECTURE HOUR**

  Environmental Pollution, Types of Pollution, Causes, Effects and Control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Radioactive pollution, Solid waste management0 Causes, Effects and Control measures, Disaster Management (Flood, Earth Quake, Cyclone & Landslide)

- **UNIT VI: SOCIAL ISSUES AND ENVIRONMENT 06 LECTURE HOUR**

  Concept of sustainable development, (Concept, Principle and measures to Promote Sustainable Development), Climate changes, Global warming, Acid rain, ozone layer depletion, Carbon Foot Print, Ecological Foot Print, Environmental Impact Assessment, Environmental Protection Act, Air Prevention Act, The Water Prevention Act, The Wild Life Protection Act, Forest Conservation Act

- **UNIT VII: HUMAN POPULATION & ENVIRONMENT 06 LECTURE HOUR**

  Population growth, Variation among Nations, Family Welfare Programme Global Population Growth, Population Explosion, Urbanization, HIV AIDS, Environment & Human Health, Value Education, Women & Child Welfare, Role of IT in Environment & Human Health, Case Studies

- **PROJECT WORK (FIELD WORK)**

## Text Books


1. *Text Book of Environmental Studies (Erach Bharucha) UGC, New Delhi*


## Reference Books


1. *Text Book of Environmental Studies (Erach Bharucha) UGC, New Delhi*
2. *Principles of Environmental Science & R.Pannir Selvam SPGS, Chennai0600 088 Engineering*
3. *Encyclopaedia of Ecology, Environment Swaroop. R,Mishra, S.N. Mitlal, New Delhi Jauri, V.P.*
4. *Environmental Concerns Saigo & Cunningham*
5. *Air Pollution by M. N. Rao*
6. *Environmental Studies: Kaur.H Pragati Prakashan, Meerut*

**Modes of Evaluation: Quiz/Test/ Assignment / Written Examination**

**Examination Scheme:**

| **Components** | **IA** | **MSE** | **ESE** |
|---|---|---|---|
| **Weightage (%)** | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

| PO/CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | 2 | 2 | - | - | 2 | - | - | - | - | - | - | - | - |
| CO2 | 2 | - | 3 | - | - | 3 | 1 | - | - | - | - | - | - | - |
| CO3 | - | 3 | - | - | - | 1 | 3 | - | - | - | 1 | - | - | - |
| CO4 | 1 | - | 1 | - | - | 1 | 3 | - | - | - | - | - | - | - |
| Average | 1 | 3 | 2 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

1=weakly mapped 2= Moderately mapped 3=Strongly mapped

| CHEM 1001 | Chemistry | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 2 | 0 | 4 |
| Pre-requisites/Exposure | $12^{th}$ level Chemistry | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**

  Objectives of the course are:

  1. To make students familiar with the fundamental concepts of chemistry.
  2. To make the students understand the various basic chemical reactions, related calculations and reasoning.
  3. To prepare the students for studying advanced subjects with required knowledge of chemistry.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to:

  1. To know the basic concepts of chemistry w.r.t thermochemical reactions, reaction dynamics, organic reaction, electrolysis, electrochemical reactions, polymers and Nanomaterials
  2. To explain preparation, properties, mechanism and case based reasoning in various chemical reactions and compounds/materials
  3. To apply the concepts of chemistry in reaction dynamics, corrosion related problems and selecting suitable fuel for various domestic/industrial applications
  4. To analyze the results of various analytical/chemical procedures

- **CATALOGUE DESCRIPTION**

  Chemistry is present everywhere around us. It is existing in everything we see, feel or imagine. It is one of the very fundamental basics behind every structure, building, bridge, refinery and industry. In this course, focus will be on firming the basic knowledge of students about chemistry. Students will learn how to use the concepts correctly through prescribed syllabus. They will be taught various types of fuels. Different processes used to improve the quality of fuels in refineries will also be discussed. Combustion calculations related to oxygen or air required will help them to get an effective fuel:O2 ratio to result in proper and complete combustion. Kinetics will help them to understand the mechanism of reaction. This knowledge will make them able to control the factors to move the reaction in desired direction. Corrosion is based on electrochemical cells. For any engineer, it is quite mandatory to have an understanding to select the suitable metal and also the methods to protect it from decaying. They will also be discussed about various types of polymers and nanomaterials so that they can correlate their properties to their various application areas. Course delivery will be made by classroom teaching, Blackboard, presentations, videos and tutorial classes.

## Course Content

- **UNIT I: FUELS & THERMOCHEMISTRY** **8 LECTURE HOURS**

  **Prerequisite:** Enthalpy of formation, Enthalpy of neutralization and Enthalpy of combustion, Hess's law of constant heat summation and its application, bond energy

  **Contents:** Kirchoff's equation, Fuels - Introduction, Classification and Characteristics, Important properties of a good fuels, Distillation of crude oil and petroleum composition, Important reactions for petroleum industries (isomerization, dimerization, aromatization, cracking), Calorific value, Determination of calorific value by Bomb calorimeter and Boys gas calorimeter, Combustion and its calculations, Flue gas calculations, Analysis of coal- proximate, Ultimate analysis, Octane number, cetane number

- **UNIT II: REACTION DYNAMICS** **9 LECTURE HOURS**

  **Prerequisite:** Rate of reaction and rate constant, factors affecting rate of a reaction, order and molecularity of a reaction, Rate expression for zero and first order

  **Contents:** Second (2A & A+B) and third (3A) order reaction, Methods of determining order of a reaction, Effect of temperature on reaction rate, Steady state approximation, Concept of activation energy and energy barrier, Collision theory, Kinetics of complex reactions- reversible, parallel, consecutive and chain reaction, Equilibrium and rate of reaction, Kinetics of polymerization reactions (step growth, chain growth, cationic, anionic and free radical polymerization)

- **UNIT III: ELECTROCHEMISTRY AND CORROSION** **6 LECTURE HOURS**

  **Prerequisite:** Galvanic cell, Single electrode potential, Nernst equation, ECS and its applications

  **Contents:** Conductance and its types, Variation of conductance with dilution, Transport number (determination by Hittorf method & moving boundary method and application in batteries), application of electrochemistry in corrosion (Introduction, dry theory, Wet theory, acid theory, types, Factors, prevention)

- **UNIT IV: ORGANIC CHEMISTRY** **8 LECTURE HOURS**

  **Prerequisite:** Inductive effect, Electromeric effect, Resonance and Hyperconjugation, Types of fission, Reactive intermediates Carbonium ion, Carbanions, Free radicals

  **Contents:** Types of organic reactions, Aliphatic nucleophilic substitution-SN1 and SN2, stereochemistry, Electrophilic substitution with energy profile- Halogenation, Nitration, sulphonation and Friedel craft reaction (comparison also), Addition reactions – electrophilic and nucleophilic, Elimination- E1 and E2, Elimination vs. substitution, mechanism of isomerization, Wolf-Kischner reduction and Clemmenson reduction, Fischer Trophs Synthesis.

- **UNIT V: POLYMERS** **6 LECTURE HOURS**

  **Prerequisite:** Introduction

  **Contents:** History, Classification, Physical properties, Types of polymerization, Copolymers, mechanism of polymerization (cationic, anionic and free radical), vulcanization, average molecular weight of polymers (end group analysis and osmotic pressure), biopolymers, conducting polymers, Polymeric electrolyte plastic hazards, plastic used in daily life applications

- **UNIT VI: NANOMATERIALS** **3 LECTURE HOURS**

  **Contents:** Introduction, Methods of preparation, Effect on important properties, Application areas, BET Surface area, XRD

## Text Books


1. Bapna, Renu, Engineering Chemistry - New Delhi MacMillan 2010 – 431, ISBN:0230330762.
2. Text book of Engineering Chemistry, By: Chawla, Shashi, Book Publisher: Delhi: Dhanpat Rai, 2014. ISBN 13: 123456755036.
3. Engineering Chemistry, By: Krishnamoorty, P, Publisher: New Delhi: McGraw Hill, 2012, Edition: 1.ISBN: 9780071328753.


## Reference Books


1. Encyclopedic dictionary of organic chemistry, By Milton, Jules K., Publisher: New Delhi Pentagon Press 2004Description: 208p., ISBN: 818274167–X; 9788182741676.
2. Crude oil chemistry, By: Simanzhenkov, Vasily, BookPublisher: New York: Marcel Dekker, 2003 Description: 409p.ISBN: 082474098.
3. Atkins' physical chemistry, By: Atkins, Peter, Paula, Julio De, BookPublisher: New Delhi Oxford University Press 2014, Edition: 10th. ISBN: 9780198728726; 0198728727.
4. Essentials of Physical Chemistry by Bahl & Tuli, Publisher: S.Chand & Co., ISBN 13: 978-8121929783.
5. Organic Chemistry for engineers, By: Mallick, Abhijit, Book Publisher: New Delhi: Viva Books, 2012, ISBN: 9788130920580.


**Modes of Evaluation: Quiz/Assignment/ Common Class Tests/ Tutorial classes/ Written Examination Scheme:**

| Components | MSE I | IA (30) | | ESE |
|---|---|---|---|---|
| | | CCTs | Tutorials/Assignment/ etc. | |
| Weightage (%) | 20 | 15 | 15 | 50 |

**Relationship between the Program Outcomes (POs), Program Specific Outcomes and Course Outcomes (COs)**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO2 | 3 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO3 | 3 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO4 | 3 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Average | 3 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

1. WEAK 2. MODERATE 3. STRONG

| MECH 1002 | Engineering Mechanics | L | T | P | C |
|---|---|---|---|---|---|
| Version 3.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | Basic Knowledge of physics.<br>Basic Knowledge of Mathematics & trigonometry | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. Develop in the engineering student the ability to analyse any problem in a simple and logical manner and to apply to its solution a few.
  2. Analyze system of forces in statics.
  3. Understand the effect of friction on various engineering applications.
  4. Analyze the dynamics of a body under the action of various types of forces.
  5. Compute the kinematics of connected bodies.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Apply basic engineering mechanics concepts.

  CO2. Analyze static structures using good free-body diagrams and accurate equilibrium equations.

  CO3. Analyze various types of loading and support conditions that act on structural systems.

  CO4. Analyze the pin joint structure.

  CO5. Understand the concepts of centroid and moments of Inertia.

  CO6. Apply the concepts of friction in engineering problems.

  CO7. Understand the laws of motion of particles

- **CATALOG DESCRIPTION**

  The course covers the fundamental background in the statics and dynamics of rigid bodies, with a special emphasis on applications of laws of rigid body mechanics, as relevant to engineering sciences in general and automotive engineering in particular. The course begins with a description of basic laws of mechanics, resultant of system of forces and equilibrium of system. The aim is to develop in the engineering student the ability to analyze any problem in a simple and logical manner and to apply to its solution a few, well understood, basic principles. The application of concepts of mechanics further is elaborated in analysis of pinned joint structure and dynamics of bodies. Students will learn to understand the concepts of dealing problems with friction like belt, wedge and ladder friction. The understanding of centre of gravity and moment of inertia and its calculations are also explored in this course. Further, being a rigorous course on problem-solving, it will acquaint students with engineering problem-solving approaches and the effective use of commercial software packages to answer engineering questions.

**Course Content**

- **UNIT I: RESULTANT AND EQUILIBRIUM OF COPLANAR FORCES** **6 LECTURE HOURS**

  Basic Concept and Principles of Mechanics, Types of force system, Composition and Resolution of Forces, Moments, Couple, Varignon's Theorem, Equivalent Force System ,Type of body constraints, structural loads & supports , Free body diagrams, Condition of Equilibrium, Resultant and Equilibrium of Co-planner forces. Support reaction of simple & compound beams, Principle of virtual work

- **UNIT II: CENTROID & MOMENT OF INERTIA** **6 LECTURE HOURS**

  Introduction, Centroid and Moment of Inertia of composite plane figures

- **UNIT III: PIN-JOINTED STRUCTURE** **6 LECTURE HOURS**

  Introduction, perfect & imperfect frame, analysis of perfect frame by method of joint, method of section and graphical method

- **UNIT IV: FRICTION & LIFTING MACHINE** **6 LECTURE HOURS**

  Introduction, Law of friction, simple contact friction on horizontal and inclined plane, Screw and Nut friction, Ladder, belt and wedge friction, Friction in journal collar bearings, Lifting Machines.

- **UNIT V: KINEMATICS** **6 LECTURE HOURS**

  Kinematics of Particle in Cartesian, polar and path co-ordinates, under uniform and non-uniform acceleration, Motion under gravity, Projectile Motion, Rotational motion

  Kinematics of rigid bodies in two and three dimension, Instantaneous center of rotation

- **UNIT VI: KINETICS** **6 LECTURE HOURS**

  Kinetics of Particle, Motion under constant force, Momentum and Energy principles, D-Alembert's principle, Impulses and angular momentum, Motion under constant torque, Collision of Elastic bodies. Kinetics of general plane motion of body

**Text Books:**


1. Tayal, A. K. *"Engineering Mechanics Statics and Dynamics"* 14th Edition, UmeshPublications
2. Bhavikatti, S. S. (2008) *"Engineering Mechanics"* New Age International (P) Limited, Publishers.


**Reference Books:**


1. Timoshenko, S., Young, D. H. and Rao, J. V. (2007) *"Engineering Mechanics"* Tata McGraw Hill Publishing Company Limited, New Delhi
2. Beer, F. P., Johnston, E. R., Mazurek, D. F., Cornwell, P. J., Eisenberg, E. R. and Sanghi, S. (2011) *"Vector Mechanics for Engineers: Statics and Dynamics"* 9th Edition, Tata McGraw Hill Education Pvt. Ltd., New Delhi
3. Shames, I. H. and Rao, G. K. M. (2006) *"Engineering Mechanics: Statics and Dynamics"* 4th Edition, Pearson Education Inc.


Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 3 | | 3 | - | - | 2 | | | 3 | - | 2 | 1 |
| CO2 | 3 | 3 | 3 | | 3 | - | - | 2 | | | 3 | - | 2 | 1 |
| CO3 | 3 | 3 | 3 | 1 | 3 | - | - | 2 | 1 | | 3 | - | 2 | 1 |
| CO4 | 3 | 3 | 3 | 1 | 3 | - | - | 2 | 1 | 1 | 3 | - | 2 | 1 |
| CO5 | 3 | 3 | 3 | 1 | 3 | - | - | 2 | 1 | 1 | 3 | - | 2 | 1 |
| CO6 | 3 | 3 | 3 | | 3 | - | - | 2 | | | | - | 2 | 1 |
| CO7 | 3 | 3 | 3 | | 3 | - | - | 2 | | | | - | 2 | 1 |
| Engineering Mechanics | 3 | 3 | 3 | 1 | 3 | - | - | 2 | 1 | 1 | 3 | - | 2 | 1 |

1=Weakly mapped
2=Moderately mapped
3=Strongly mapped

| MEPD 1001 | Workshop Technology | L | T | P | C |
|---|---|---|---|---|---|
| Version 3.0 | | 3 | 0 | 1 | 3 |
| Pre-requisites/Exposure | Basic Knowledge of physics, chemistry & Mathematics | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. This course aims at imparting knowledge and skill components in the field of basic workshop technology
  2. It deals with different hand and machine tools required for manufacturing simple metal components and articles.
  3. To impart the knowledge regarding the various basic manufacturing processes required in day to day life.
  4. To familiarize the students with the properties and selection of different engineering material.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Identify the different materials according to their properties and application.

  CO2. Select the suitable welding process for manufacturing of a component.

  CO3. Apply knowledge of a suitable heat treatment process to improve the mechanical properties of a component.

  CO4. Understand the use of different types of tools used in Fitting shop, Carpentry Shop and sheet metal process.

  CO5. Learn the applications of Forging Process, Foundry Process & Machining Process.

- **CATALOG DESCRIPTION**

  Workshop technology is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the engineers working in the various engineering industries and workshops. This course intends to impart basic know-how of various hand tools and their use in different sections of manufacturing. Irrespective of branch, the use of workshop practices in day to day industrial as well domestic life helps to dissolve the problems. The workshop experiences would help to build the understanding of the complexity of the industrial job, along with time and skills requirements of the job. The students are advised to undergo each skill experience with remembrance, understanding and application with special emphasis on attitude of enquiry to know why and how for the various instructions and practices imparted to them in each shop.

## Course Content

- **UNIT I: ENGINEERING MATERIALS, ITS CLASSIFICATION** **03 LECTURE HOURS**

Fundamental learning about Metals/Non Metals, Ferrous and Non Ferrous, properties and Heat Treatment

- **UNIT II: HOT AND COLD WORKING** **03 LECTURE HOURS**

  Forging Shop, Introduction of Various Forging Operations; Drawing, Upsetting, Bending, Fullering, Swaging and Flattening.

- **UNIT III: FOUNDRY SHOP** **03 LECTURE HOURS**

  Introduction to Simple Pattern, Molding- Materials, Types, procedure of Mould preparation, use of Cores, Melting Furnaces, Tools and Equipment used in Foundry. NDT of castings.

- **UNIT IV: WELDING SHOP** **03 LECTURE HOURS**

  Introduction to Different Welding Methods, Welding Equipment, Electrodes, Welding Joints, Awareness of Welding Defects. Gas/Electric Arc/Resistance & Special Types of wildings, Soldering and Brazing.

- **UNIT V: FITTING SHOP** **03 LECTURE HOURS**

  Description of Fitting Tools and their uses, i.e. Hammers, Chisels, Files, Vices, Drills, Taps, Dies & Drilling machines.

- **UNIT VI: SHEET METAL SHOP** **03 LECTURE HOURS**

  Knowledge of Tools and Equipment used in making of Sheet Metal Components and parts. Different joining Techniques.

- **UNIT VIII: CARPENTRY SHOP** **03 LECTURE HOURS**

  Introduction to various types of timber, Ply-wood and Particle Boards, Defects in Timber, Seasoning of wood. Description and use of Carpenter's Tools,

- **UNIT VII: MACHINE SHOP** **03 LECTURE HOURS**

  Introduction to various parts of Lathe, Lathe Tools and Lathe Operations. Demonstration of Thread Cutting, Drilling, Boring, Taper Turning and Knurling on the Lathe.

**Text Books**


1. *Hajra Choudhury, S. K. and Hajra Choudhury, A. K. (2015) "Elements of Workshop Technology Vol 1& Vol 2"* Media Promoters & Publishers Pvt Ltd.
2. Khurmi, R. S. and Gupta, J. K. (2010) *"Workshop Technology"* S Chand Publisher


**Reference Books**


1. Raghuvanshi, B. S. (2015) *"Workshop Technology Vol I &II"* –Dhanpat Rai & Publications Pvt Ltd
2. Kalpakjian, S. (2014) *"Manufacturing Engineering and Technology"* Pearson Publisher


Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

| CO vs PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | | 2 | | 3 | | | | | | | | 2 | |
| CO2 | 2 | | 2 | | 3 | | | | | | | | 2 | |
| CO3 | 2 | | | | 3 | | | | | | | | | |
| CO4 | 2 | | 2 | | 3 | | | | | | | | 2 | |
| CO5 | 2 | | | | 3 | | | | | | 1 | | 2 | |
| Workshop Technology | 2 | - | 2 | - | 3 | - | - | - | | | 1 | | 2 | |

1=Weakly mapped
2=Moderately mapped
3=Strongly mapped

| MECH 1001 | Engineering Graphics | L | T | P | C |
|---|---|---|---|---|---|
| Version 3.0 | | 1 | 0 | 2 | 1 |
| Pre-requisites/Exposure | The knowledge of simple geometrical theorem and procedures is essential. | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**

  1. Increase ability to communicate with people.
  2. Enhance knowledge, imagination and drawing skill.
  3. Learn basics of design software Solid works skills.
  4. Draw the accurate and precise line drawing.
  5. Prepare the student for future Engineering positions.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Remember the conventions of engineering graphics such as types of lines, dimensioning, method of projection etc.

  CO2. Demonstrate understanding of fundamental concepts of engineering graphics.

  CO3. Apply knowledge of orthographic and isometric projections to solve problems related to points, lines, planes and solids.

  CO4. Analyze the basic Engineering drawings

- **CATALOG DESCRIPTION**

  Engineering graphics builds the foundation of analytical capabilities for solving a great variety of engineering problems involving diagrams. It also has numerous real time application in almost all branches of engineering. This subject helps the students to enhance their knowledge, imagination and drawing skills. The purpose of the study of the engineering graphics is to develop the ability to visualize an object with physical and dimensional configurations. With its extensive coverage, the step-by-step approach and handy drawing tips. The subject support for students to draw the accurate and precise line drawing.

## Course Content

- **UNIT I: INTRODUCTION OF ENGINEERING DRAWING, LINES, LETTERING AND DIMENSIONING**
  **1 LECTURE HOURS**

  Introduction, Drawing instruments, Drawing sheet, pencils, Sheet layout, Title Block, Configurations of lines, drafting of lines, Types of lines and their applications, Order of priority of coinciding lines, Lettering, Dimensioning, terminology and method of execution, placing and general rule of dimensioning.

- **UNIT II: ORTHOGRAPHIC PROJECTIONS.** **1 LECTURE HOURS**

Projection, Pictorial view and Multi view, Orthographic Projection, Multi View Projection, Terminologies, First-Angle Projection, Third angle Projection, Second angle and Fourth angle Projection, Symbols of Orthographic Projection

- **UNIT III: PROJECTION OF POINT** **1 LECTURE HOURS**

  Introduction, Conventional Representation, A point situated in first quadrant (above HP and in front of VP), A point situated in second quadrant (above HP and behind VP), Point in the third quadrant (below HP and behind VP), Point in the Fourth quadrant (below HP and in front of VP). Problems

- **UNIT IV: PROJECTION OF LINES** **2 LECTURE HOURS**

  Orientations of straight lines, lines parallel to one or both the planes, line contained by one or both the planes, Line perpendicular to either of the RPs, line inclined to one RP and parallel to other, line inclined to both the RPs, Traces of a line, Methods of determining traces of line.

- **UNIT V: PROJECTION OF PLANES** **2 LECTURE HOURS**

  Introduction, Position of Planes, Terms used in projection of planes, Planes parallel to an RP, Plane inclined to one RP and perpendicular to the other RP, plane perpendicular to both the RPs, Plane inclined to both the RPs, Suspended planes, Traces of planes

- **UNIT VI: PROJECTION OF SOLIDS** **2 LECTURE HOURS**

  Introduction, Basic solids, Frustums and Truncated Solids, position of the solids, solids with Axis perpendicular to an RP, Solid with Axis inclined to one RP and parallel to the other, solid with axis inclined to both the RPs, solid with axis parallel to both the RPs, Rules for deciding the Hidden Lines

- **UNIT VII: SECTION OF SOLIDS** **2 LECTURE HOURS**

  Section planes, Sections, True shape of a section, Section of prisms: section plane parallel to VP, Section plane parallel to the HP, Section plane perpendicular to HP and inclined to the VP, Section plane perpendicular to the VP and inclined to the HP, Sections of Pyramids, Sections of cylinders, sections of cones etc.

- **UNIT VIII: ISOMETRIC PROJECTION** **1 LECTURE HOUR**

  Introduction, Principle of Isometric Projection, Terminology, Isometric Scale, Isometric Projections and Isometric Views.

## Text Books


1. Bhatt, N. D. (2014) *"Engineering Drawing"*, Charol Publication
2. Gill, P. S. (2009) *"Engineering Drawing"*, Kataria Publication
3. Dhawan, R. K. (2011) *"Engineering Drawing"*, S Chand


## Reference Books


1. Morling, K. *"Geometric and Engineering Drawing"*, Third Edition, Elsevier 32 Jamestown Road London NW1 7BY 30 Corporate Drive, Suite 400, Burlington, MA 01803, USA


**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Program Outcomes (POs), Program Specific Outcomes and Course Outcomes (COs)**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 3 | 2 | 3 | | | | | 2 | | | 2 | 2 |
| **CO2** | 3 | 3 | 3 | 2 | 3 | | | | | 2 | | | 2 | 2 |
| **CO3** | 3 | 3 | 3 | 2 | 3 | | | | | 2 | | | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 2 | 3 | | | | | 2 | | | 2 | 2 |
| **CO5** | 3 | 3 | 3 | 2 | 3 | | | | | 2 | | | 2 | 2 |
| **Average** | 3 | 3 | 3 | 2 | 3 | | | | | 2 | | | 2 | 2 |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

| CSEG 1001 | COMPUTER PROGRAMMING | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | - | | | | |
| Co-requisites | -- | | | | |

- **OBJECTIVES OF COURSE:-**

  The objective of this course is to introduce students with the Fundamentals of Computers and the basic concepts of problem solving techniques using C programming. The student understand programming language, programming, concepts of Loops, reading a set of Data, stepwise refinement, Functions, Control structure and Arrays. The main emphasis of the course will be on problem solving aspect i.e. developing proper algorithms.

- **COURSE OUTCOMES FOR B.TECH. EL/ PSE/CHGE/APEG/ASEU:**

  At the end of this course student should be able to:

  CO1. Comprehend the fundamentals of Computers with concepts of algorithm, flowcharts and develop efficient algorithms for solving a problem.

  CO2. Interpret the Control of flow statements and decision constructs with C programming techniques.

  CO3. Identify the various concepts of Programming like Arrays, Structures and Unions and Strings.

  CO4. Apply concepts of functions and pointers to resolve mathematical problems.

  CO5. Analyze the real life problem and write a program in 'C' language to solve the problem.

## Course Content

- **UNIT 1: INTRODUCTION (6 LECTURES)**

  Generation and Classification of Computers & Programming languages, Basic Organization of a Computer, Number System, Number System conversion Problems, Need for logical analysis and thinking: Algorithm, Flowchart, Pseudocode, Solving problem using Algorithm and flowchart

- **UNIT 2: C PROGRAMMING BASIC (10 LECTURES)**

  Problem Formulation, Problem Solving , Introduction to C, Structure of a C program., Compilation and Linking, Constants, variables , datatypes, Expressions using operators in C, Managing Input and Output operations , Decision making. Solving simple scientific and statistical problems

- **UNIT 3: ARRAYS AND STRINGS (6 LECTURES)**

  Definition of Arrays -Types of Arrays, Array Declaration-Accessing Elements of an array-Entering and Reading array elements, Bounds Checking, 2-D Arrays, Memory map of a 2-D array. Matrix Operations, Array programs, Sorting.-Searching.String Definition.-Standard Library String Functions, String Operations and String Arrays,

- **UNIT 4: FUNCTIONS AND POINTER (6 LECTURES)**

Need of Functions , Declaration, Definition Types of functions Passing values between functions, Calling function by value and by reference Recursion Pointers-Definitions-Initailization of Pointers Understanding Pointers with examples

- **UNIT 5: STRUCTURE AND UNION (8 LECTURES)**

  Introduction to Structures.-Need for structure data type. -Structure definition.-Declaration. Accessing and Storing Structure elements. Structure within a structure. Union-Declaration & definition Union Programs-Accessing members of a union. Program using structure and union Storage Classes -Preprocessor Directives

**Text Book References**


1. Introduction to C Programming, Reema Thareja , Oxford University Press 2014.
2. Let Us C Authentic Guide to C Programming, Yashavant Kanetkar.
3. Fundamentals of Computers, Reema Thareja , Oxford University Press 2014.


**Table: Correlation of POs v/s COs**

| | PO1 | PO2 | PO3 | PO 4 | PO 5 | PO6 | PO 7 | PO8 | PO9 | PO10 | Po11 | PO12 | PSo1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | 2 | | | | | | | | | | 1 | |
| CO2 | | | | 1 | | | | | | | | | 1 | |
| CO3 | | | | | 1 | | | | | | | | 1 | |
| CO4 | | | | 1 | | | | | | | | | 1 | |
| CO5 | | | | | | | 2 | | | | | | | |
| Av | 2 | 2 | 2 | 1 | 1 | | 2 | | | | | | 1 | |

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

| ECEG-1001 | Basic Electrical & Electronics | L | T | P | C |
|---|---|---|---|---|---|
| Version 6.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. Visualize the V-I characteristics of the basic electronic components like diode and transistor
  2. Develop the application based circuits like switch, Rectifier by using Diode and transistor and also by logic gates.
  3. Design DC-Power supply by using Rectifiers and Adders & Subtractors by using Logic Gates.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to
  1. Design and construct circuits, take measurements of circuit behaviour and performance, compare with predicted circuit models and explain discrepancies.
  2. Impart the basic knowledge about the Electric and Magnetic circuits.
  3. Inculcate the understanding about the AC fundamentals and understand various Electrical Machines.
  4. Employ electronic components and devices to solve the Engineering problems.
  5. Analyse and make simple Circuits and Systems of Electronics Engineering, Interpret the logics used in the Digital Circuits and Systems.
  6. Design the electronics system with discrete component and to understand the specifications of industrial equipment.

- **CATALOG DESCRIPTION**

  Electrical & Electronics is the integral part of life. The basic circuits used in day to day life are studied in this course. In this course, the main focus will be on the designing of basic electrical and electronics circuits like AC to DC converter by using diode, half adder, full adder etc. in Electronics and three phase system circuits in electrical. Students will learn how to use diode, transistor, Integrated circuit, AC machine and DC Machine in real time and develop circuits buy using them.

  Classroom activities will be designed to encourage students to play an active role in the construction of their own knowledge and in the design of their own learning strategies. We will combine traditional lectures with other active teaching methodologies, such as practical sessions, group discussions, and cooperative group solving problems. Class participation is a fundamental aspect of this course. Students will be encouraged to actively take part in all practical sessions to apply the devices and design the basic circuits.

## Course Content

- **UNIT I: INTRODUCTION: 8 LECTURE HOURS**

  Resistance, inductance and capacitance, open circuit and short circuit, electrical power and energy

  **DC CIRCUIT:** Ohm's law. Kirchhoff's law, series and parallel network, network theorems: Thevenin's, Norton, Maximum Power and Superposition

  **AC CIRCUITS:** Single Phase and Three Phase Circuits, Star Delta connections, Concept of power factor, series and parallel network, resonance,

- **UNIT II: FLUX, 4 LECTURE HOURS**

  Flux density, reluctance, mmf, magnetic field strength Fleming left hand rule, Fleming's right hand rule, faradays law, statically and dynamically induced emf. Eddy current and Hysteresis loss.

- **UNIT III: ELECTRICAL MACHINES CONSTRUCTION, 6 LECTURE HOURS**

  operation, Characteristic and applications of transformer, Induction Motor, DC Machines, Electrical Power Generation, Transmission and Distribution. Basic Layout of Power System and various voltage levels at different sections of Power System.

- **UNIT IV: INTRINSIC AND EXTRINSIC SEMICONDUCTORS; 7 LECTURE HOURS**

  Formation and Fundamental Characteristics of diode: Formation of P-N junction, I-V characteristics, Zener and Avalanche breakdown, half-wave and full-wave rectifier circuits; dc-power supply design and diode applications.

- **UNIT V: TRANSISTOR CONSTRUCTION AND OPERATION, 6 LECTURE HOURS**

  Common-Base (CB) configuration, Transistor amplifying action, Common Emitter (CE) configuration, Amplification factors for CB and CE configurations, Common Collector configuration, Limits of operation, DC-Biasing: Fixed bias, Emitter bias, Voltage divider bias, Applications:

- **UNIT VI: NUMBER SYSTEM AND CODES, 5 LECTURE HOURS**

  Boolean algebra and minimization techniques: Boolean logic operations, Basic laws of Boolean algebra, De Morgan's Theorems; Logic gates: AND, OR, NAND, NOR. Adder and subtractor. K map.

## Text Books


1. Electrical & Electronics Engineering by K R Niazi,Genius Publication.ISBN:9788188870137
2. Basic Electrical and Electronics Engineering, by J B Gupta S K Kataria and Sons.3rd Ed.
3. Electronics Devices and Circuits By Boylestad & Nashelsky 10th ED : PEARSON: ISBN 978-8131727003


## Reference Books


1. Basic Electrical Engineering by Chakrabarti, Tata McGraw Hill. ISBN: 9781259083365
2. Basic Electrical Engineering byU.A.Bakshi, V.U.Bakshi, ISBN: 9788184316940
3. A Text Book of Electrical Machines by Rajput, L P Publications. ISBN: 9788131804469
4. Basic Electronics By Santiram Kal,( 2013): PHI

5. Digital Circuits & Logic Design By Salivahanan: Vikas Publishing House. ISBN 978-9325960411

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | IA | MID SEM | End Sem | Total |
|---|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 | 100 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |
| CO6 | 3 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |
| Average | 3 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |

| Course Code | Course Title | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ECEG-1001 | Basic Electrical & Electronics | 3 | 3 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 | 3 |

1=weakly mapped
2= moderatel y mapped
3=strongly mapped

| COMM 1001 | English Communication | L | T | P | C |
|---|---|---|---|---|---|
| Version 4.0 | | 2 | 0 | 2 | 4 |
| Pre-requisites/Exposure | K12 knowledge of the English Language | | | | |
| Co-requisites | Knowledge of Word processing using MS Word, basic IT skills | | | | |

- **COURSE OBJECTIVES**

The Objectives of this course are:

1. To develop a holistic view of communicating in English Language both written and verbal.
2. To help the second language learners develop the ability to understand spoken language through machine and task based activities.
3. To enable students to communicate with clarity and precision through proper understanding of technical and academic writing techniques.
4. To study and understand applicative grammar and its various structures for correct usage of English Language.

- **COURSE OUTCOMES**

On completion of this course, the students will be able to:

1. Comprehend and summarize various structural principles of English Grammar, prerequisite to English Communication.
2. Evaluate and apply the acquired learning of remedial Grammar for self-expression and diverse communication purposes.
3. Identify and analyze the nuances of English Language prerequisite to Scientific and Technical Writing.
4. Apply appropriate Language skills for developing scientific and technical content using academic and experimental approaches.
5. Comprehend and analyze receptive & productive skills based on various task-based and machine-based activities.
6. Apply and Formulate scenario based forms of Content for English Language learning and presentation.

- **CATALOG DESCRIPTION**

This course focuses on the development of students' English language, Communication and Critical thinking skills through the understanding of Language viz. Listening, Speaking, Reading and Writing. The course enables the students to appreciate the nuances of Academic and Technical writing through an understanding of principles and structures of Applicative Grammar. Students will be assessed on their demonstration based on Language learning skills. The course is offered on blended mode.

## Course Content

- **UNIT I: GRAMMAR+ 12 LECTURE HOURS (ONLINE)**
  - An overview on the basics of Grammar : Different aspects of grammar and usage of correct English
  - Articles and Prepositions: Identification and correct usage in writing
  - Tenses – 1, 2 & 3: Types and correct use of different tenses
  - Simple, Compound and Complex Sentences: Usage and types of sentences
  - Active and Passive Voice: Usage and conversion in different contexts
  - Conditional Sentences : Types and usage of sentences
  - Question Tags: Identify and use correct question tags
  - Phrasal Verbs: Identify and use phrasal verbs correctly
  - Idioms: Usage to enrich expression
  - Blog and online content development
- **UNIT II: TECHNICAL COMMUNICATION 12 LECTURE HOURS (ONLINE)**
  - Scientific English –Pre-requisite to technical writing: Nature, Use of Language, Organization
  - Scientific English – Nuances: Sentence Structure and Paragraph Development
  - Generalization – Nature, Induction and Deduction method
  - Classification – Nature, Writing classifications and generalizations
  - Definition – Nature, Types, Writing definitions and generalizations
  - Comparison & Contrast – Ways of expressing comparison and contrast
  - Instructions – Language and types, Instructions and reporting
  - Descriptions – Description of substances, objects and processes
  - Narratives – Nature, Writing of narratives, Organization
  - Explanations – Nature, Writing explanations
  - Hypotheses – Nature, Hypothesis and predictions, Writing hypothesis
  - Technical Poster Making
- **UNIT III: LANGUAGE WORKSHOP 24 LECTURE HOURS (F2F)**
  - Introduction to Language Workshop Sessions and its usage in improving language proficiency & Self-Expression techniques
  - Listening Skills: Basic Ear Training. Listening to Received Pronunciation, Attention to Accuracy: Situational Conversations/Role Play/Development of Argumentative Skills
  - Speaking Skills: Individual Introduction to IPA symbols, basic training for correct Pronunciation pattern, Official/Public Speaking with emphasis on correct speech patterns, common errors in reading and speaking with emphasis on Para linguistics, developing impromptu Skills in speaking.
  - Reading Skills: Skimming and Scanning: Comprehension Skills based on practice Reading Comprehension.

- Writing Skills: Writing for Purpose (Objective/Subjective) with special emphasis on Grammar and Vocabulary Building Exercises

**Text Books**


1. Mishra. B, Sharma. S (2011) Communication Skills for Engineers and Scientists. PHI Learning Pvt. Ltd. ISBN: 8120337190.
2. Academic Writing: A course in English for Science and Technology – Rizvi, M.H. - TMHMishra. B, Sharma. S (2011)
3. Reddy, S.D.(2009). *Technical English.* Macmilan Publishers: New Delhi. ISBN: 0230639119.
4. Flatley, M.E. (2004). *Basic Business Communication, Skills for empowering the Internet Generation.*Tata McGraw Hills: New Delhi. ISBN: 9780070486942.
5. Wren & Martin, M.E. (2006). High School English Grammar & Composition. Tata S. Chand & Company LTD: New Delhi. ISBN: 9788121924894.


**Reference Books**


1. Pal, Rajendra and Korlahalli, J.S. (2011) Essentials of Business Communication. Sultan Chand & Sons. ISBN: 9788180547294.
2. Kaul, Asha. (2014) Effective Business Communication.PHI Learning Pvt. Ltd. ISBN: 9788120338487.
3. Murphy, R. (2007) Essential English Grammar, CUP. ISBN: 8175960299.
4. C. Muralikrishna and S. Mishra (2011) Communication Skills for Engineers, Pearson education. ISBN: 9788131733844.
5. Essential English Grammar by Raymond Murphy, CUP, 2011
6. Intermediate English Grammar by Raymond Murphy, CUP, 2011
7. Practical English Usage by Michael Swan, OUP, 2013
8. Jones, D. (1909), "The Pronunciation of English", Cambridge: CUP; rpt in facsimile in Jones (2002).
9. Jones, D.(1918), "An Outline of English Phonetics", Leipzig: Teubner; rpt in Jones (2002).
10. Jones, D. (1909) “The Dictionary of English Phonetics” Cambridge: CUP (2002).
11. Bansal, R.K. The Intelligibility of Indian English, Monograph, 4 CIEFL, Hyderabad, Second abridged edition, 1976.
12. Jones, Daniel, English Pronouncing Dictionary, revised by A.C. Gimson, 14th Edition, The English Language Book Society and JM Dent Sons Ltd. London 1977.
13. Senthi. J and P.V. Dhamija, A Course in Phonetics and Spoken English Prentice hall of India Private Ltd. New Delhi, 1989.
14. Taylor, Ken, Telephoning and Teleconferencing Skills. Orient Black Swan, 2008.
15. Dignen, Bob. Presentation Skills in English. Orient Black Swan, 2007.


**Modes of Evaluation: Online Discussion/Quiz/Assignment/Blog/Listening, speaking, reading, writing examination.**

**Examination Scheme:**

| Components | Mid-term (Grammar+) | IA (Technical Communication) | End-term (Language Workshop) |
|---|---|---|---|
| Weightage (%) | 20<br>(3 Online Discussions, 4 Online Quiz) | 30<br>(2 Online Discussion, 1 | 50<br>(4 Continuous Evaluation) |

| | | | |
|---|---|---|---|
| | | Online Assignment, 3 Online Quiz) | |

Relationship between the Course Outcomes (COs) and Program Outcomes (POs)

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | 3 | | | | |
| CO2 | | | | | | | | | | 3 | | 2 | | |
| CO3 | | | | | | | | | | 3 | | | | |
| CO4 | | | | | | | | | | 3 | | | | |
| CO5 | | | | | | | | | 1 | 3 | | | | |
| CO6 | | | | | | | | | 1 | 3 | | | | |
| Average | | | | | | | | | 1 | 3 | | | | |

1=weakly mapped 2= moderately mapped 3=strongly mapped

| MATH 1004 | MATHEMATICS II | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 1 | 0 | 4 |
| Pre-requisites/Exposure | Mathematics upto B.Tech 1st semester. | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. To help the students to solve the differential equations.
  2. To enable the students to understand the basic concepts of Laplace transforms
  3. To enable the students to understand the basic knowledge of vector calculus.
  4. To make the students to develop the basic knowledge of probability and statistics.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Solve the linear ordinary differential equations.

  CO2. Apply Laplace transform for the solution of linear ordinary differential equations and understand the basic properties of Fourier transform.

  CO3. Apply vector calculus techniques to evaluate line, surface and volume integrals.

  CO4. Interpret the engineering and scientific data using fundamental statistical techniques.

- **CATALOG DESCRIPTION**

  Mathematics is necessary subject to a clear and complete understanding of virtually all phenomena. Its precision, depth, and generality support the development of critical thinking and problem-solving skills. This course provides a detailed knowledge of various methods to solve ordinary differential equations of constant as well as variable coefficients. This course also introduces the study of Laplace transform of various important functions. The students will also get insight into the solutions of boundary value problems using Laplace transform. In addition, this course will introduce the calculus of vector valued functions. The evaluation of line, surface and volume integrals has also been given in this course. The students will also get the basic knowledge of probability and statistics which is useful in engineering.

## Course Content

- **UNIT I: ORDINARY DIFFERENTIAL EQUATIONS** **9 LECTURE HOURS**

  Linear Differential Equations with Constant Coefficients, Cauchy-Euler Differential Equations, Solution of Second Order Differential Equations (when a part of complementary function is known, by reduction to Normal Form, by changing the independent Variable and by Variation of Parameters) .

- **UNIT II: INTEGRAL TRANSFORM** **11 LECTURE HOURS**

  Laplace Transform, Unit Step Function and Dirac-Delta Function, Periodic Functions, Differentiation and Integration of Laplace Transform, Inverse Laplace Transform, Convolution Theorem, and Solution of Linear Differential Equations, Fourier Transform.

- **UNIT III: VECTORS** **9 LECTURE HOURS**

  Differentiation of vector valued functions and applications, Gradient, Divergence, Curl, and Integration of vector valued functions: Line, Surface and Volume Integrals, Applications of Green's, Gauss divergence and Stokes Theorems.

- **UNIT IV: STATISTICS** **13 LECTURE HOURS**

  Random Variable: Discrete and Continuous, Probability mass and Probability density Functions, Moments, Skewness and Kurtosis, Moment Generating Functions and their properties, Binomial, Poisson and Normal Distributions, Correlation: Karl-Pearson coefficient and Spearman Brown's Rank correlation, Linear Regression and Chi Square Test.

## Text Books


1. J R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publications. ISBN: 9788184875607.
2. E. Kreyszig, Advanced Engineering Mathematics, Wiley Publications. ISBN: 9788126531356.
3. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill. ISBN: 9780071070089.


**Reference Books**


1. J. Stewart, Essential Calculus: Early Transcendentals, Cengage Learning India Pvt. Ltd. ISBN: 8131503453.
2. A. Jeffery, Advanced Engineering Mathematics, Academic Press, ISBN: 9780080522968.
3. M. D. Greenberg, Advanced Engineering Mathematics, Pearson Education, India. ISBN: 9788177585469.


**Modes of Evaluation: Class tests/Assignment/Tutorial Assessment/Written Examination**

**Examination Scheme:**

| Components | Tutorial/Faculty Assessment | Class Tests | MSE | ESE |
|---|---|---|---|---|
| Weightage (%) | 15 | 15 | 20 | 50 |

## Relationship between the Program Outcomes (POs), Program Specific Outcomes and Course Outcomes (COs)

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO2 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO3 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO4 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Average | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

1. WEAK 2. MODERATE 3. STRONG

| PHYS-1004 | Physics II | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 1 | 0 | 4 |
| Pre-requisites/Exposure | 12th level Physics | | | | |
| Co-requisites | 12th level Mathematics | | | | |

- **COURSE OBJECTIVES**

1. To develop an understanding in the space and time relations and to apply Lorentz transformations to comprehend the outcome of Special Theory of Relativity.
2. To Systematically introduce the basic principles of Quantum mechanics and apply to various systems.
3. To develop working knowledge of elementary statistical mechanics and its application in exploring various Classical and Quantum phenomenon.
4. To demonstrate the fundamentals of Semiconductor Physics that will subsequently enable students to understand the characteristics of Semiconductor devices.
5. Introduce basic principles of dielectric and magnetic properties of solids and their applications.

- **COURSE OUTCOMES**

On completion of this course, the students will be able to

CO1: To understand the need of various mechanics e.g. relativistic, quantum and statistical in addition to physics of semiconducting, dielectric and magnetic properties of materials.

CO2: To calculate various physical parameters related to physics of atomic scale and high speed particles using relevant mechanics and to solve the problems related to semiconducting, dielectric and magnetic materials

CO3: To apply the concepts of relativistic, quantum and statistical mechanics in physics problems and in various physical situations.

CO4: To analyze the behavior of various parameters of various material properties in view of applicable mechanics.

- **CATALOG DESCRIPTION**

Almost all disciplines of engineering and technology have origins in basic principles of Physics. Furthermore special theory of relativity instigates an out-of-box thinking habit among the students. Quantum Mechanics describes physical phenomena in which the wave and particle aspects of matter and radiation are reconciled in a unified manner. The knowledge of the Quantum Mechanics can be applied to the study of optical and electronic sensor as well as to study the behavior at microscopic and nano level. The behavior of system of particles at different physical variables (such as temperature, pressure, volume, velocity etc.) can be understood with the help of statistical mechanics, therefore course provides the information about different types of materials available for various applications. The role of semiconductors in the development of various electronic devices, sensors, computer hardwares, etc., which has

made our lives easier, has been commendable. The course lays a sound foundation to develop an understanding about functioning mechanism of basic components such as diodes, LED, transistors as well as Photovoltaic cells. Photovoltaic cells are nowadays employed to generate clean energy from solar power. The course also provides an emphasis on the materials (such as dielectric, capacitors and magnetic materials) required for storing charges as well as memory devices.

## Course Content

- **UNIT I: MODERN PHYSICS AND INTRODUCTORY QUANTUM MECHANICS- 16 LECTURE HOURS**

  Inertial & Non-inertial frames, Postulates, Lorentz transformations, Length contraction, Time dilation, velocities addition, variation of mass with velocity, Mass-energy equivalence and Energy momentum relation.

  Introduction, photoelectric effect, Compton Effect, Pair production & Annihilation, De-Broglie waves, Waves of probability, phase and group velocities, Thought Experiment; Electron microscope, particle diffraction, Uncertainty principle and its applications, Two-slit interference experiment, Wave function and its interpretation, Normalization, Schrodinger time independent & dependent wave equations, Linearity and superposition, expectation values, operators, Eigen values &Eigen functions, Particle in a 1-D box, generalization to 3-D box.

- **UNIT II: STATISTICAL AND THERMAL PHYSICS- 10 LECTURE HOURS**

  Introduction to Statistical Physics, Statistical Distribution, Maxwell Boltzmann Statistics, Probability function, density of state, Applications of MB Statistics: Average molecular energy, Distribution of molecular speeds vrms, vav, vmp, Quantum Statistics, B-E Statistics, Probability function, density of state, Rayleigh Jeans Formula, Planck Radiation Law & Specific Heat of solids, Fermi Dirac Statistics, Probability function, density of state, Fermi energy, electron-energy distribution.

- **UNIT III: SEMICONDUCTOR PHYSICS- 7 LECTURE HOURS**

  Introduction to semiconductors, momentum energy diagram for band gap explanation P and N Type semiconductors, direct and indirect band gap materials, Hall effect, P-N junction diode, forward and reverse biasing of P-N junction diode, Shockley equation, Avalanche breakdown, Zener breakdown, Zener diode, Photodiode, Photovoltaic effect, LED construction and materials.

- **UNIT IV: DIELECTRIC AND MAGNETIC MATERIALS- 9 LECTURE HOURS**

  Electric susceptibility, dielectric constant, electronic, ionic, orientational and space charge polarization, frequency and temperature dependence polarization, internal fields, Claussius and Mosotti relation (derivation), dielectric loss, dielectric breakdown, use of dielectric materials in capacitor and transformer, Ferroelectricity and applications.

  Origin of magnetic moments, Bohr magnetron, comparison of dia, para and ferro magnetism, domain theory, hysteresis, soft and hard magnetic magnetic materials, antiferromagnetic materials, ferrites and its applications.

## Text Books

1. Mehta N., (2009) Text Book of Engineering Physics Part-1. PHI Learning Pvt. Ltd. ISBN: 9788120333611.
2. Beiser A., Mahajn S., Chaudhury S. R., (2009) Concepts of Modern Physics, 6th ed. McGraw Hill Education Pvt. Ltd. ISBN: 9780070151550.
3. Vasudeva A.S., (2010) Modern Engineering Physics (Revised Edition), S. Chand & Company Ltd. ISBN: 9788121917575.
4. Jain A. K, Malik H. K., (2016) Engineering Physics, Tata McGraw-Hill Education Pvt. Ltd. ISBN: 9780070671539.

**Reference Books**

1 Griffith D.J. (2012) Introduction to Electromagnetics, PHI Learning, 4th edition, ISBN: 9780138053260
2. Pillai S.O., (2009) Solid State Physics, 6th ed. New Age International Pvt. Ltd. ISBN: 9781906574109.

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | CCT | Tutorial/Assignments | MSE | ESE |
|---|---|---|---|---|
| Weightage (%) | 15 | 15 | 20 | 50 |

**Relationship between the Program Outcomes (POs), Program Specific Outcomes and Course Outcomes (COs)**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO2 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO3 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO4 | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Average | 3 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

1. WEAK 2. MODERATE 3. STRONG

| MECH 1001 | Engineering Graphics | L | T | P | C |
|---|---|---|---|---|---|
| Version 3.0 | | 1 | 0 | 2 | 1 |
| Pre-requisites/Exposure | The knowledge of simple geometrical theorem and procedures is essential. | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. Increase ability to communicate with people.
  2. Enhance knowledge, imagination and drawing skill.
  3. Learn basics of design software Solid works skills.
  4. Draw the accurate and precise line drawing.
  5. Prepare the student for future Engineering positions.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to
  1. Understand the projection method and types of projection.
  2. Increase ability to communicate with people.
  3. Improve their visualization skills so that they can apply these skills in developing new products.
  4. Learn to take data and transform it into graphic drawings
  5. Hands on the basic commands of design software solid works.

- **CATALOG DESCRIPTION**

  Engineering graphics builds the foundation of analytical capabilities for solving a great variety of engineering problems involving diagrams. It also has numerous real time application in almost all branches of engineering. This subject helps the student to enhance their knowledge, imagination and drawing skill. The purpose of the study of of the engineering graphics is to develop the ability to visualize an object with physical and dimensional configurations. With its extensive coverage, the step-by-step approach and handy drawing tips. The subject support for students to draw the accurate and precise line drawing.

## Course Content

- **UNIT I: INTRODUCTION OF ENGINEERING DRAWING, LINES, LETTERING AND DIMENSIONING 1 LECTURE HOURS**

  Introduction, Drawing instruments, Drawing sheet, pencils, Sheet layout, Title Block, Configurations of lines, drafting of lines, Types of lines and their applications, Order of priority of coinciding lines, Lettering, Dimensioning, terminology and method of execution, placing and general rule of dimensioning.

- **UNIT II: ORTHOGRAPHIC PROJECTIONS. 1 LECTURE HOURS**

Projection, Pictorial view and Multi view, Orthographic Projection, Multi View Projection, Terminologies, First-Angle Projection, Third angle Projection, Second angle and Fourth angle Projection, Symbols of Orthographic Projection

- **UNIT III: PROJECTION OF POINT** **1 LECTURE HOURS**

  Introduction, Conventional Representation, A point situated in first quadrant (above HP and in front of VP), A point situated in second quadrant (above HP and behind VP), Point in the third quadrant (below HP and behind VP), Point in the Fourth quadrant (below HP and in front of VP). Problems

- **UNIT IV: PROJECTION OF LINES** **2 LECTURE HOURS**

  Orientations of straight lines, lines parallel to one or both the planes, line contained by one or both the planes, Line perpendicular to either of the RPs, line inclined to one RP and parallel to other, line inclined to both the RPs, Traces of a line, Methods of determining traces of line.

- **UNIT V: PROJECTION OF PLANES** **2 LECTURE HOURS**

  Introduction, Position of Planes, Terms used in projection of planes, Planes parallel to an RP, Plane inclined to one RP and perpendicular to the other RP, plane perpendicular to both the RPs, Plane inclined to both the RPs, Suspended planes, Traces of planes,

- **UNIT VI: PROJECTION OF SOLIDS** **2 LECTURE HOURS**

  Introduction, Basic solids, Frustums and Truncated Solids, position of the solids, solids with Axis perpendicular to an RP, Solid with Axis inclined to one RP and parallel to the other, solid with axis inclined to both the RPs, solid with axis parallel to both the RPs, Rules for deciding the Hidden Lines

- **UNIT VII: SECTION OF SOLIDS** **2 LECTURE HOURS**

  Section planes, Sections, True shape of a section, Section of prisms: section plane parallel to VP, Section plane parallel to the HP, Section plane perpendicular to HP and inclined to the VP, Section plane perpendicular to the VP and inclined to the HP. Sections of Pyramids, Sections of cylinders, sections of cones etc.

- **UNIT VIII: ISOMETRIC PROJECTION** **1 LECTURE HOUR**

  Introduction, Principle of Isometric Projection, Terminology, Isometric Scale, Isometric Projections and Isometric Views.

**Text Books**


1. Bhatt, N. D. (2014) *"Engineering Drawing"*, Charol Publication
2. Gill, P. S. (2009) *"Engineering Drawing"*, Kataria Publication
3. Dhawan, R. K. (2011) *"Engineering Drawing"*, S Chand


**Reference Books**


1. Morling, K. *"Geometric and Engineering Drawing"*, Third Edition, Elsevier 32 Jamestown Road London NW1 7BY 30 Corporate Drive, Suite 400, Burlington, MA 01803, USA


Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

| CO vs Poe | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO 11 | PO 12 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | | 3 | | 3 | | | | | | | | | |
| CO2 | 3 | | 3 | | 3 | | | | | | | | | |
| CO3 | 3 | 3 | 3 | | 3 | | | | | 2 | | | | |
| CO4 | 3 | 3 | 3 | | 3 | | | | | 2 | | | | |
| CO5 | 3 | | 3 | | 3 | | | | | 2 | | | | |
| Engineering Graphics | 3 | 3 | 3 | 2 | 3 | - | - | - | - | 2 | - | - | - | - |

1=Weakly mapped
2=Moderately mapped
3=Strongly mapped

| MATH 2001 | Mathematics III | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 1 | 0 | 4 |
| Pre-requisites/Exposure | Mathematics up to B.Tech 1st year | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. To help the students develop the concept of difference equations and their solution.
  2. To enable the students understand the series solution of second order differential equation.
  3. To make the students able to investigate the behaviour of complex variable functions.
  4. To enable the students to understand the use of analytic functions in evaluating complex and real integrals.
  5. To make the students able to solve PDEs and its applications.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Find the solution of linear difference equations.

  CO2. Solve linear second order differential equations using series solution method and comprehend the Legendre's polynomials, Bessel functions, its related properties

  CO3. Explain the concepts of analyticity, integration of a complex function and conformal mapping.

  CO4. Find the series representation of a complex function

  CO5. Evaluate real integrals using calculus of residues.

  CO6. Solve homogeneous partial differential equations with constant coefficients and its applications in one dimensional heat and wave equations.

- **CATALOG DESCRIPTION**

  This course covers the difference equations, ordinary differential equations, partial differential equations and complex analysis. The difference equations will be solved using operator method, generating function technique and matrix method. The solution of second order linear differential equations will be obtained using series solution method and the properties of special functions like Legendre's polynomials and Bessel's functions will be investigated. In addition, this course will introduce the calculus of complex functions of a complex variable. It turns out that complex differentiability is a very strong condition and differentiable functions behave very well. The central result of this spectacularly beautiful part of mathematics is Cauchy's Theorem guaranteeing that certain integrals along closed paths are zero. This striking result leads to useful techniques for evaluating real integrals based on the 'calculus of residues'. Charpit method ensures the solution of first order nonlinear partial differential equations and separation of variables method useful to solve the one dimensional wave and heat equations.

## Course Content

- **UNIT I: DIFFERENCE EQUATIONS AND ORDINARY DIFFERENTIAL EQUATION 12 LECTURE HOURS**

  Introduction, formulation, homogeneous and non-homogeneous difference equations, Solution by Operator method, Solution by Generating function technique, Solution by Matrix method, Introduction of series solution, Power series method, Frobenius method and its cases, Series solution of Legendre's and Bessel's Des, Legendre polynomials, Bessel functions and its Properties.

- **UNIT II: COMPLEX VARIABLES-I 9 LECTURE HOURS**

  Introduction to functions of a complex variable, Notion of limit, continuity and differentiability, Analytic function and CR equations, Necessary & sufficient conditions for analyticity, Harmonic function, harmonic conjugate and orthogonal families, construction of an analytic, function using Milne Thomson method, Line integral where curve defined in parametric, form, explicit function, Path independence for a contour integral, Cauchy's theorem, Cauchy-Goursat theorem for simply and multiply connected domain, Cauchy's integral formula for the derivatives of an analytic function.

- **UNIT III: COMPLEX VARIABLES-II 12 LECTURE HOURS**

  Taylor's and Laurent's series, Zeros and poles of a function, the residue at a singularity, Cauchy Residue Theorem, Contour integration and its applications to improper integrals, evaluation of a real integrals, improper integrals involving sines and cosines, definite integrals involving sines and cosines, Image under translation, rotation, magnification/contraction, inversion, Definition of Conformal mapping and Bilinear, transformation , Cross ratio.

- **UNIT IV: PARTIAL DIFFERENTIAL EQUATIONS 9 LECTURE HOURS**

  Formation of PDE by elimination of arbitrary constants and arbitrary functions and classification of PDEs, Lagrange's Multipliers and Charpit Method, Solution of linear PDE with constant coefficients, Solution of one dimensional heat and wave equation by method of separation of variables.

## Text Books


1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publications. ISBN: 9788184875607.
2. G. F. Simmons and Differential Equations with Applications and Historical Note, McGraw Hill. ISBN: 0070530718.
3. D. G. Zill and P. D. Shanahan , A first course in complex analysis with applications, Jones and Bartlett Publishers. ISBN: 9789380108193.
4. M. D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand Publishers. ISBN: 9789385676161.


## Reference Books


1. M. D. Greenberg, Advanced Engineering Mathematics, Pearson Education, India. ISBN: 9788177585469.
2. I. Sneddon, Elements of Partial Differential Equations, McGraw-Hill Book Company.
3. R. V. Churchill, Complex Variables and Applications, McGraw Hill. ISBN: 9780070108530.


## Modes of Evaluation: Class tests/Assignment/Tutorial Assessment/Written Examination

**Examination Scheme:**

| Components | Tutorial/Faculty Assessment | Class Tests | MSE | ESE |
|---|---|---|---|---|
| Weightage (%) | 15 | 15 | 20 | 50 |

**Relationship between the Program Outcomes (POs), Program Specific Outcomes and Course Outcomes (COs)**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO2 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO3 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO4 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO5 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CO6 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Average | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

1. WEAK 2. MODERATE 3. STRONG

# Model Question Paper

| | |
|---|---|
| **Name:**<br>**Enrolment No:** | UPES |

**Course: MATH 2001 – Mathematics III**
**Programme: B.Tech. (All SoE except Chemical and Mechanical department programmes)**

**Semester: III (ODD-2017-18)**
**Time: 03 hrs.** **Max. Marks: 100**

**Instructions:**
Attempt all questions from **Section A** (each carrying 4 marks); all questions from **Section B** (each carrying 10 marks)**;** all questions from **Section C** (each question carrying 20 marks)**.**

| | | | |
|---|---|---|---|
| | **SECTION A**<br>**(Attempt all questions)** | | |
| 1. | Find the nature and location of singularities of the function $f(z) = \frac{z-\sin z}{z^2}$. | **[4]** | **CO3** |
| 2. | Solve the difference equation: $y_{n+2} - 4y_{n+1} + 4y_k = 3$ | **[4]** | **CO1** |
| 3. | Evaluate the following integrals in terms of the Bessel's function.<br>a. $\int \frac{1}{x} J_2(x)dx$ b. $\int x^2 J_1(x)dx$ | **[4]** | **CO2** |
| 4. | Evaluate the integral of $f(z)$ counterclockwise around the unit circle, $\lvert z\rvert = 1$ by means of a residue: $f(z) = \frac{\sin z}{z^4}$ | **[4]** | **CO5** |
| 5. | Evaluate using Cauchy's Integral formula: $\oint_C \frac{z^2-4z+4}{z+i} dz$, where $C$ is the circle $\lvert z\rvert = 2$. | **[4]** | **CO3** |
| | **SECTION B**<br>**(Q6-Q8 are compulsory and Q9 has internal choice)** | | |
| 6. | Find the bilinear transformation which maps the points $z = 1,\ i, 2+i$ in the $z$ –plane onto the points $w = i,\ 1,\ \infty$, respectively, in the $w$ –plane. | **[10]** | **CO3** |
| 7. | Verify that $u = x^2 - y^2 - y$ is harmonic in the whole complex plane and find a harmonic conjugate function $v$ of $u$. | **[10]** | **CO3** |
| 8. | Solve the Partial differential equation:<br>$\frac{\partial^2 z}{\partial x^2} + \frac{\partial^2 z}{\partial x \partial y} - 6\frac{\partial^2 z}{\partial y^2} = \cos(2x + y$ | **[10]** | **CO6** |
| 9. | Expand $f(z) = \frac{1}{(z-1)^2(z-3)}$ in a Laurent series valid for<br>a. $0 < \lvert z-1\rvert < 2$<br>b. $0 < \lvert z-3\rvert < 2$ | **[10]** | **CO4** |
| | **SECTION C** | | |

| (Q10 is compulsory and Q11 has internal choice) | | | |
|---|---|---|---|
| 10.A | Find the power series solution about $x = 0$, of the differential equation: $\frac{d^2y}{dx^2} - 4y = 0$ | **[10]** | **CO2** |
| 10.B | Prove the following recurrence relations for the Legendre polynomials<br>i. $(n+1)P_{n+1}(x) = (2n+1)xP_n(x) - nP_{n-1}(x)$<br>ii. $nP_n(x) = xP_n'(x) - P_{n-1}'(x)$ | **[10]** | **CO2** |
| 11. | Find the solution of the wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ corresponding to the triangular initial deflection<br>$f(x) = \begin{cases} \frac{2k}{l}, & 0 < x \leq \frac{l}{2} \\ \frac{2k}{l}(l-x), & \frac{l}{2} < x < l \end{cases}$<br>and initial velocity zero. The boundary conditions for the wave equation are $u(0,t) = u(l,0) = 0$ for all $t \geq 0$.<br>**OR**<br>Solve the partial differential equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$ for the conduction of heat along a rod without radiation subjected to the following conditions:<br>(i) $\lvert u(x,t) \rvert < M$ for $t \to \infty$, where $M$ is a real number.<br>(ii) $\frac{\partial u}{\partial x} = 0$, for $x = 0$ and $x = l$.<br>(iii) $u(x,0) = lx - x^2$ for $0 < x < l$. | **[20]** | **CO6** |

| CHEG-236 | Chemical Engineering I (Thermodynamics & Measuring Analytical Instruments) | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | Basic knowledge of physics and mathematics (Trigonometry and Calculus) | | | | |
| Co-requisites | Basic Knowledge of Fluid Mechanics | | | | |

- **COURSE OBJECTIVES**
  1. To help the students understand the fundamentals and relevance of thermodynamics in the broader context of engineering sciences in general, and fire safety engineering in particular.
  2. Students should be able to apply laws of thermodynamics and use thermodynamics functions to solve engineering problems.
  3. Student should be learn the principle of various measurement instruments and their functioning
  4. The student will learn about various control equipment there their usage in process industry.
  5. The student will learn about various modern methods of chemical analysis and understand and explain the structures of metals, polymers and ceramics.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Define system and surrounding and apply laws of thermodynamics to solve practical engineering problems.

  CO2. Explain thermodynamics of chemical reactions and solve engineering problems.

  CO3. Design and explain the functioning of heat engines/pumps and refrigeration cycles.

  CO4. Understand and explain the basics of controllers.

  CO5. Explain modern methods of chemical analysis and describe the structure of metals, polymers and ceramics.

- **CATALOG DESCRIPTION**

  The present course aims to introduce the principles of Chemical Engineering I (Thermodynamics and Analytical Measuring Instruments) and illustrate their application to thermodynamics systems. The content comprises the fundamental laws of thermodynamics, the estimation of volumetric and key thermodynamic properties of real fluids and mixtures, phase and chemical reaction equilibria. In addition, select special applications of the principles of phase and reaction equilibria are also illustrated. The highly multidisciplinary nature of the subject can be gauged from the fact that it is taught across multiple disciplines ranging from Mechanical, Aerospace, Chemical to Environmental Engineering. Students will also learn about various analytical measuring instruments – level, pressure, flow, volume, and temperature. Students are also taught about various controllers and their application in process industries. Applications are emphasized through extensive problem work relating to practical cases. Further, being a

rigorous course on problem-solving, it will acquaint students with engineering problem-solving approaches and the effective use of commercial software packages to answer engineering questions.

## Course Content

- **UNIT I** **10 LECTURE HOURS**

  Introduction to Chemical Engineering, Chemical thermodynamics, first law, entropy and second law, Carnot cycle, thermodynamic functions, Maxwell relations, Joule - Thomsons's expansion.

- **UNIT II** **7 LECTURE HOURS**

  Thermodynamics of chemical reactions, enthalpy change, entropy change and free energy change, equilibrium constant. Le-Chatelier's principle elementary reaction kinetics, order of reactions, effect of temperature in reaction ratio, type of chemical reactors.

- **UNIT III** **9 LECTURE HOURS**

  Instrument technology, measurement of flow, primary or quantity methods, secondary or rate devices- measurement of pressure gravitational types, bellows, measurement of high pressure, measurement of low pressure- McLeod vacuum gauge-temperature - thermometers, bimetal thermometers, pyrometers, resistance thermometer, thermocouples. Measurement of level and volume.

- **UNIT IV** **4 LECTURE HOURS**

  Measurement of force, straingauge and load cells, Introduction to transducers, automatic control, controllers, proportional derivative, integral and combined modes, final control elements and computer control.

- **UNIT V** **6 LECTURE HOURS**

  Modern methods of chemical analysis, visible spectroscopy, UV spectroscopy, vibrartional spectroscopy, nuclear magnetic resonance, mass spectrometry,

  X-ray diffraction, structure of metal, polymer and ceramics.

## Text Books


1. Cengel, Y. A., & Boles, M. A. (2002). *Thermodynamics: an engineering approach (Vol. 5)*. M. Kanoğlu (Ed.). New York: McGraw-Hill.
2. Austin, E., & Fribance. (1985). *Industrial Instrumentation Fundamentals*. J Wiley and Sons..


## Reference Books


3. Abbott, M. M., Smith, J. M., & Van Ness, H. C. (2001). *Introduction to chemical engineering thermodynamics*. New York: McGraw-Hill.
4. Sonntag, R. E., Borgnakke, C., Van Wylen, G. J., & Van Wyk, S. (2003). *Fundamentals of thermodynamics* (Vol. 6). New York: Wiley.


**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal | MSE | ESE |
|---|---|---|---|

| | Assessment | | |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| **POs/COs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 3 | - | - | 2 | - | - | - | 2 | - | 3 | 2 | 1 |
| **CO2** | 2 | 2 | - | - | 2 | - | - | - | - | - | - | - | 2 | - | 2 |
| **CO3** | - | - | 3 | - | - | - | - | - | 3 | - | 2 | - | 3 | - | - |
| **CO4** | - | - | - | 2 | 3 | - | - | - | - | 2 | - | 2 | 2 | - | - |
| **CO5** | - | - | 2 | 3 | - | 2 | - | - | - | - | - | 2 | - | 2 | - |

1. WEAK 2. MODERATE 3. STRONG

| MECH 2016 | Fluid Mechanics and fluid flow machines | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 4 | 0 | 0 | 4 |
| Pre-requisites/Exposure | a. Basic Knowledge of law of physics.<br>b. Basic Knowledge of thermodynamics | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**

The course will enable the students to:

1. apply knowledge of mathematics, science, and engineering
2. identify, formulate, and solve engineering problems
3. design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
4. use techniques, skills, and modern engineering tools necessary for engineering

- **COURSE OUTCOMES:**

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

CO1. Classify and exploit fluids based on the physical properties of a fluid

CO2. Apply hydrostatic law on submerged surfaces and ascertain the stability of floating body.

CO3. Compute correctly the kinematics properties of a fluid element

CO4. Apply conservation laws to fluid flow problems in engineering applications.

CO5. Understand dynamic of fluid, and apply in hydraulic machines

- **CATALOG DESCRIPTION**

Fluid mechanics, the branch of science that deals with the study of fluids (liquids and gases) in a state of rest or motion is an important subject of Civil, Mechanical and Chemical Engineering. Its various branches are fluid statics, fluid kinematics and fluid dynamics.

A substance that flows is called as fluid. All liquid and gaseous substances are considered to be fluids. Water, oil, and others are very important in our day-to-day life as they are used for various applications. For instance, water is used for generation of electricity in hydroelectric.

power plants and thermal power plants, water is also used as the coolant in nuclear power plants, oil is used for the lubrication of automobiles etc.

Fluid Mechanics is the branch of science that studies the behavior of fluids when they are in state of motion or rest. Whether the fluid is at rest or motion, it is subjected to different forces and different climatic conditions and it behaves in these conditions as per its physical properties. Fluid mechanics deals with three aspects of the fluid: static, kinematics, and dynamics

## Course Content

- **UNIT 1: FLUIDS AND THEIR PROPERTIES: (LECTURE 3)**

Fluids, shear stress in a moving fluid, viscosity, Newtonian and non-Newtonian fluids, viscosity in liquids and gases.

- **UNIT 2: FLUID STATICS: (LECTURE 5)**

  pressure, variation of pressure in a static fluid, absolute and gauge pressure, measurement of gauge pressure, hydrostatic forces on plane and curved surfaces, center of pressure, buoyancy and stability of submerged and floating bodies, metacentric height.

- **UNIT 3: KINEMATICS OF FLUID FLOW: (LECTURE 6)**

  eulerian and Langrangian approaches, classification of fluid flow as steady and unsteady flow, uniform and non-uniform flow, laminar and turbulent flow, path line, stream line, streak line and stream tube, one, two, and three dimensional flow, velocity and accelerations in steady and unsteady flow.

- **UNIT 4: BASIC HYDRODYNAMICS: (LECTURE 6)**

  ideal fluids, Equations of continuity in the differential form, rotational and irrational flow, circulation and vorticity, stream function, velocity potential, one dimensional flow along a stream line, Bernoulli`s equation and its limitations, measurement of velocity, pitot tube and pitot -static tube, venturi meter, orifice meter, flow nozzles, notches and weirs.

- **UNIT 5: STEADY FLOW OF INCOMPRESSIBLE FLUIDS IN PIPES: (LECTURE 5)**

  laminar and turbulent flows, critical Reynolds number, hydraulic radius, general equation for friction, laminar flow in circular pipes, Darcy weisbach equation, friction factor, equivalent pipes, minor losses in pipes, development of boundary layer.

- **UNIT 6: DIMENSIONAL ANALYSIS & SIMILITUDE: (LECTURE 6)**

  rayleigh's method, Buckingham's Pi theorem, non-dimensional parameters in fluid mechanics and machinery-principles of similitude- geometric, kinematic and dynamic similarities- model studies. Physical meaning of important dimensional groups of fluid mechanics and the practical use.

- **UNIT 7: DYNAMIC ACTION OF FLUID: (LECTURE 3)**

  momentum equation applied to a control volume, impact of jets, flow of an incompressible fluid over fixed and moving vanes, work done and efficiency.

- **UNIT 8: HYDRAULIC TURBINES: (LECTURE 6)**

  velocity triangles, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine, their constructional features and performance characteristics-non dimensional parameters for comparative study of turbine performance, theory of draft tubes, speed regulation of turbines, selection of type and speed of turbines.

- **UNIT 9: PUMPING MACHINERY: (LECTURE 8)**

  general features of positive displacement and rotodynamic pumps, centrifugal pumps, classification, principle of working, velocity diagrams, losses in pumps, circulatory flow, efficiencies, non-dimensional parameters, specific speed, pump characteristics-selection of pumps, multistage pumps, propeller pumps, priming, cavitation and its significance. Acceleration head, effect of friction, use of air vessels, efficiencies, pump characteristics.

**Textbooks:**


4. Das, M. M. (2010). Fluid mechanics and turbomachines. New Delhi, India: PHIL earning. 621.406 DAS 006426
5. Davidson, P. A. (2004). Turbulence: an introduction for scientists and engineers. Oxford: Oxford University Press. 532.0527 DIT 015186
6. Davidson, P. A. (Ed.). (2011). Voyage through turbulence. Cambridge: Cambridge University Press. 532.0527 VOY 013311


**Modes of Evaluation: Quiz/Assignment/ Class Test/ Tutorial**

**Examination Scheme:**

| **Components** | **Internal Assessment** | **MSE** | **ESE** |
|---|---|---|---|
| **Weightage (%)** | **30** | **20** | **50** |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| PO/CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | - | - | - | - | - | - | - | - | | | | | 2 | |
| CO2 | 3 | - | 3 | - | 3 | - | - | 2 | - | | | | | 3 | |
| CO3 | 3 | - | - | - | 3 | - | - | - | - | | | | | | 3 |
| CO4 | 3 | - | - | - | 3 | - | - | - | - | | | | 3 | | |
| CO5 | 3 | - | - | - | 3 | - | - | - | - | | | | | 2 | 1 |

2. WEAK 2. MODERATE 3. STRONG

| FSEG 222 | First Aid & Emergency Procedures | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | Basic knowledge of physics and chemistry (Basic science), Basic knowledge of biology | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. To help the students understand the fundamentals and relevance of first aid and Deal with emergency situations
  2. To enable students to understand Know the limits of basic first aid and Legal perspective of First Aid, Safety at the workplace and highlights of accident prevention
  3. To empower students with the expertise of experimentation, in Know the limits of basic first aid.
  4. To expose students to a wide range of duties of the employer as a First Aider.
  5. To equip students with necessary engineering skills to Understand and demonstrate essential lifesaving skills

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Gaining knowledge of principles of first aid

  CO2. Gaining knowledge on human anatomy and safety tools during emergency

  CO3. Understanding the nervous systems and modern engineering tool's application

  CO4. Handling of emergency and engineering in life long process

  CO5. Identify a range of common illnesses and injuries.

  CO6. Assess appropriate action in a variety of adult, child and infant emergency situations.

  CO7. React to the emergency situations

- **CATALOG DESCRIPTION**

  This course is designed to provide opportunities to learn and practice the basic first aid skills necessary to become a citizen responder for many emergencies, including adult CPR with AED, choking, shock, neck-spinal injuries and others. Participants may earn Adult CPR with AED and First Aid Responding to Emergencies after successfully completing the course; which has their test included. The course begins with a description of different Identification of the most important action that a student as a first aider can take in a life-threatening emergency and major structures of the respiratory, circulatory, nervous, and musculoskeletal systems including the emergency action steps/principles in any emergency.

## Course Content

- **MODULE 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.

- **MODULE 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 casualtyproblems of unconsciousness. Fainting-recognition-management-aftercare. Diabetes - hypoglycaemia - hyperglycaemia- management. Seizures (epileptic fits, convulsions) features- management , stroke. Head injuries-fractures of the base-vault and sides of skull.

- **MODULE III**

  The respiratory system-respiratory failure - asphyxia-abdominal thrust in Heimlich manoeuvre. Chest injuries-types-fractured ribs -pneumothrox-haemothrox. The circulatory system-heat attack-chest compression- CPR

  Shock -causes - signs and symptoms - management of shock.

- **MODULE IV**

  Eye-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.

- **MODULE V**

  Fractures- classification of fractures-principles of immobilisation-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 ionising.Physical fitness. Lifting - casualty handling. Use of stretchers.

**Text Books**

1. American Red Cross First Aid-Responding to Emergencies, 4th Ed. (2007) The textbook is a very integral part of this course.Material in the text is frequently referred to and used in class, and students are responsible for all information within designated chapters for exams.

2. Internet Access: Access and usage instructions will come from; http://paris.mcgrawhill.com/sites/0077349695/student_view0

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO110 | PO111 | PO112 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | 3 | - | - | - | - | - | - | - | - | - | - |
| CO3 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CO4 | 3 | - | 3 | - | - | - | - | - | - | - | 3 | - |
| CO5 | 3 | - | - | - | 3 | - | - | - | 3 | - | 3 | - |
| CO6 | 2 | - | - | - | - | - | - | 2 | - | - | 3 | - |
| CO7 | 3 | - | - | - | - | - | - | - | - | - |  | - |

1=Weakly mapped
2= Moderately mapped
3=Strongly mapped

| MATH 2002 | APPLIED NUMERICAL METHODS | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 1 | 0 | 4 |
| Pre-requisites/Exposure | Mathematics up to B. Tech 3rd semester | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**

  1. To make the students realize the importance of numerical methods.
  2. To enable students to understand the mechanism of iterative techniques.
  3. To enable students derive appropriate numerical methods to solve a linear system of equations.
  4. To make the students able to solve ODEs and PDEs numerically.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  1. Implement iterative and non-iterative numerical methods for the solution of single variable algebraic and transcendental equations by understanding the concept of errors.
  2. Interpolate and extrapolate values of the dependent variable from equally and unequally spaced data.
  3. Perform numerical differentiation and integration from the available discrete data.
  4. Solve the system of linear algebraic equations both by direct and iterative methods.
  5. Apply single, multistep and finite difference techniques for the solution of initial and boundary value problems in ODEs.
  6. Apply finite difference technique for the solution of PDEs.

- **CATALOG DESCRIPTION**

  Numerical methods deal with the study of algorithms that use numerical approximation for the problems arising in science and engineering. The course is aimed to provide the knowledge of numerical methods for solving a variety of mathematical models. It deals with the basic definitions, properties of various finite difference operators and their applications to engineering problems associated with polynomial interpolation, differentiation and integration from the given tabular data. It discusses various algorithms associated with the technique of finding zeros of the algebraic and transcendental equations. This course also provides a detailed knowledge of various direct and iterative methods to solve system of linear algebraic equations. Several techniques will be discussed for solving initial value problems of ordinary differential equations. The students will also get insight into the solutions of boundary value problems in both ordinary and partial differential equations.

## Course Content

- **UNIT I: ERROR ANALYSIS, SOLUTION OF ALGEBRAIC & TRANSCENDENTAL EQUATIONS (08 LECTURE HOURS)**

Exact and approximate numbers, rounding off numbers, significant digits, correct digits, various types of errors encountered in computations, propagation of errors, Bisection and Fixed Point Iteration method with convergence criteria, Regula-Falsi and Secant methods with convergence criteria, Newton-Raphson method with convergence criteria

- **UNIT II: FINITE DIFFERENCE OPERATORS, INTERPOLATION, EXTRAPOLATION, NUMERICAL DIFFERENTIATION (13 LECTURE HOURS)**

  Introduction to finite difference operators and properties, Factorial notation and Missing term techniques, Newton's Forward and Backward Interpolation, Gauss's Forward and Backward Interpolation, Stirling's and Bessel's Interpolation, Interpolation of unevenly spaced data by Lagrange's and Newton's divided difference formula, Numerical Differentiation

- **UNIT III: NUMERICAL INTEGRATION, SOLUTIONS OF SIMULTANEOUS LINEAR EQUATIONS & ORDINARY DIFFERENTIAL EQUATIONS (13 LECTURE HOURS)**

  Numerical Integration: Trapezoidal, Simpson's 1/3 and 3/8 rules with error terms, Composite integral methods: Trapezoidal, Simpson's 1/3 and 3/8 rules, Gauss Legendre 2-points and 3-points formulae, LU Decomposition, Doolittle, Crouts and Cholesky methods, Gauss Jacobi & Gauss Seidel methods with convergence criteria, Taylor's series method, Euler's method, Modified Euler's method, 2nd and 4th order Runge-Kutta method, Milne Predictor Corrector method

- **UNIT IV: SOLUTIONS OF ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS BY FINITE DIFFERENCE METHODS (8 LECTURE HOURS)**

  Finite difference approximations, Solution of 2 point BVP, Five point finite difference approximations, Liebmann's Iteration process, Explicit and Implicit methods: Bendre - Schmidt Process, Crank-Nicholson method

## Text Books


1. M. K. Jain, S. R. K. Iyengar and R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, ISBN: 9788122420012.
2. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI Learning, India. ISBN: 9788120345928.
3. E. Bala Guru Swamy, Numerical Methods, Tata McGraw Hill, India. ISBN: 0074633112.


## Reference Books


1. F. C. Gerald and P.O. Wheatley, Applied Numerical Analysis, Pearson, India. ISBN: 9788131717400.
2. S. Pal, Numerical methods: Principles, analyses, and algorithms, Oxford University Press, New Delhi, ISBN: 9780195693751.


**Modes of Evaluation: Class tests/Assignment/Tutorial Assessment/Written Examination**
**Examination Scheme:**

| Components | Tutorial/Faculty Assessment | Class Tests | MSE | ESE |
|---|---|---|---|---|
| Weightage (%) | 15 | 15 | 20 | 50 |

**Relationship between the Program Outcomes (POs), Program Specific Outcomes and Course Outcomes (COs)**

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| CO2 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| CO3 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| CO4 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| CO5 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| CO6 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Average | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

1. WEAK 2. MODERATE 3. STRONG

## Model Question Paper

**Name:**

**Enrolment No:**

**Course: MATH 2002 – Applied Numerical Methods**

**Programme: B.Tech (SoE)** **Semester: IV (EVEN-2017-18)**

**Time: 03 hrs.** **Max. Marks: 100**

**Instructions:**
Attempt all questions from **Section A** (each carrying 4 marks); all questions from **Section B** (each carrying 8 marks) and all questions from **Section C** (carrying 20 marks)**.**

**SECTION A**
**(Attempt all questions)**

| | | | |
|---|---|---|---|
| 1. | Explain Absolute, Relative and Percentage errors with relevant examples. | **[4]** | **CO1** |
| 2. | From an experiment we get the following values of a function $f(x)$ for certain values of $x$:<br>$x$: 0, 1, 2, 5<br>$f(x)$: 2, 3, 12, 147<br>By using Lagrange's formula of interpolation for unequal intervals, represent the function $f(x)$ approximately by a polynomial of degree 3. | **[4]** | **CO2** |
| 3. | The value of the integral $\int_1^9 x^2 dx$ by Trapezoidal rule is $2\left[\frac{1}{2}(1+9^2)+\alpha^2+\beta^2+7^2\right]$ for $n-4$. Find the value of $\alpha$ and $\beta$. | **[4]** | **CO3** |
| 4. | Using Newton Raphson method, find an iterative scheme to compute the cube root of a positive number. | **[4]** | **CO1** |

| | | | |
|---|---|---|---|
| 5. | Perform two iterations of Picard's method to find an approximate solution of the initial value problem $\frac{dy}{dx} = x + y^2; \quad y(0) = 1$ | **[4]** | **CO5** |
| | **SECTION B**<br>**(Q6-Q9 are compulsory and Q10 has internal choice)** | | |
| 6. | Use Simpson's rule to find the value of the definite integral $\int_{-1}^{1} e^{-\lvert x \rvert}\, dx$ by dividing the range of integration $(-1,1)$ into four equal parts. Compare this result with the exact value of the integral and hence compute the approximate value of $e$. | **[8]** | **CO3** |
| 7. | Solve the following system of equations by Gauss Seidel iterative method:<br>$10x + 2y + z = 9$<br>$2x + 20y - 2z = -44$<br>$-2x + 3y + 10z = 22$<br>correct to two places of decimal. | **[8]** | **CO4** |
| 8. | Using finite difference method, solve for $y$ given the differential equation $\frac{d^2u}{dx^2} + 1 + y = 0$ and the boundary conditions $y(0) = y(1) = 0$ by taking $h = 0.25$. | **[8]** | **CO5** |
| 9. | Evaluate the values of $y(0.1)$ and $y(0.2)$ given $y' = x^2 + y^2, y(0) = 1$ by using Modified Euler's method. | **[8]** | **CO5** |
| 10. | (a) If $y_x$ is a function of $x$, $(x = 1 \text{ to } 7)$ whose fifth differences are constant and given that $y_1 + y_7 = -786, y_2 + y_6 = 686,$ and $y_3 + y_5 = 1088$, find $y_4$.<br>**OR**<br>(b) Find $f(32)$ by using central difference formula from the following table: | **[8]** | **CO2** |

| $x$ | 25 | 30 | 35 | 40 |
|---|---|---|---|---|
| $f(x)$ | 0.2707 | 0.3027 | 0.3386 | 0.3794 |

| | | | |
|---|---|---|---|
| | **SECTION C**<br>**(Q11 is compulsory, Q12 has internal choice)** | | |
| 11. A | Estimate $y(1)$ if $2yy' = x^2$ and $y(0) = 2$ using Runge-Kutta method of fourth order by taking $h = 0.5$. Also compare the result with the exact value. | **[10]** | **CO5** |
| 11. B | Using Crank Nicholson's scheme, solve<br>$\frac{\partial u}{\partial t} = \frac{1}{16}\frac{\partial^2 u}{\partial x^2}, \quad 0 < x < 1, \quad t > 0$<br>given that $u(x,0) = 0$, $u(0,t) = 0$, $u(1,t) = 100t$. Compute $u$ for two steps in t direction taking $h = \frac{1}{4}$. | **[10]** | **CO6** |

| | | | |
|---|---|---|---|
| 12. | Consider $u_{xx} + u_{yy} = 0$ in $0 \le x \le 4$, $0 \le y \le 4$ given $u(0,y) = 0, u(4,y) = 12 + y$ $u(x,0) = 3x$ and $u(x,4) = x^2$ with $h = k = 1$.Find the initial approximate solutions using standard or diagonal five point formulae and also obtain the solutions correct to two decimal points.<br>**OR**<br>Solve $u_{xx} + u_{yy} = -10(x^2 + y^2 + 10)$ over the square mesh with sides $x = 0, y = 0, x = 3, y = 3$ with $u = 0$ on the boundary and mesh length 1 unit. Use an appropriate numerical technique to solve the linear equations obtained. | **[20]** | **CO6** |

| CHEG 237 | Chemical Engineering II (Unit Operations) | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | a. Basic Knowledge of law of physics.<br>b. Basic Knowledge of mathematics and chemistry.<br>c. Knowledge of thermodynamics. | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. To give student the knowledge of principles of mass and energy balance which are crucial for setting up any chemical process plant
  2. To familiarize the student with various unit operations used in chemical process plant and enable him to do related calculations
  3. To give student the knowledge of processes units used in chemical process plants

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Understand and apply fundamental knowledge of the basic operations of chemical engineering.

  CO2. Identify, formulate and solve simple balances, separation operations and other unit operations.

  CO3. Apply knowledge that enable them to take measurements, calculations and similar work.

  CO4. Assess the impact of basic or unit operations of chemical engineering in sustainable development of the Company.

  CO5. Knowledge of material and energy balances, mass transfer, separation processes, and recovery and processing of raw materials and energy resources.

- **CATALOG DESCRIPTION**

  The aim of this course is to deepen the students' knowledge of the unit operations with a focus on distillation, absorption, adsorption, heat exchange, etc. This provides an understanding of various unit operations and the associated hazards.

  The student will learn about the steps involved in doing mass and energy balance. Understand the principles heat and mass transfer. Solve heat transfer problems in steady and transient heat transfer. Additionally, student will learn about Ceramics and polymers, kinetics of polymerisation reactions structure properties and applications - introduction to plastics and rubber processing - fibre reinforced plastics, adhesives and surface coatings.

## Course Content

- **UNIT I** **5 LECTURE HOURS**

  Introduction to unit operations of Chemical Engineering, material balances without and with chemical reactions, heat balances.

- **UNIT II** **6 LECTURE HOURS**

Principle s of steady state heat transfer, Fourier's law, heat transfer coefficient, plane walls in series and multilayer cylinders, overall heat transfer coefficient, heat exchangers, radiation heat transfer, principles of unsteady state heat transfer, thermal processing and sterilization - Evaporation - Evaporators

- **UNIT III** **10 LECTURE HOURS**

Principles of mass transfer, Fick's law of molecular diffusion, diffusion in gases, diffusion in liquids and solids, distillation, batch and continuous absorption, extraction leaching and crystallisation, packed columns and plate columns, packing materials, drying and dryers.

- **UNIT IV** **9 LECTURE HOURS**

Mechanical operations, filtration, different types of filters, setting and sedimentation, clarifiers and thickeners, centrifugal separation, cyclones, particle sizing, methods of size analysis, reduction equipment, storage and transportation of bulk solids- types of conveyors and selection.

- **UNIT V** **6 LECTURE HOURS**

Ceramics and polymers, kinetics of polymerisation reactions structure properties and applications - introduction to plastics and rubber processing - fibre reinforced plastics, adhesives and surface coatings.

## Text Books


1. McCabe, W. L., Smith, J. C., & Harriott, P. (1993). *Unit operations of chemical engineering (Vol. 5)*. New York: McGraw-Hill.
2. Peters, M. S., & Timmerhaus, K. D. (1991). *Plant design and economics for chemical engineers.* McGraw-Hill chemical engineering series.


## Reference Books


1. Sinnott, R. K. (2006) *Chemical Engineering Design*, Coulson & Richardson's Chemical Engineering, vol 6., fourth edition.
2. Seider, W. D., Seader, J. D., & Lewin, D. R. (2009). *Product & process design principles: synthesis, analysis and evaluation*. John Wiley & Sons.
3. D. W. Green y R. H. Perry (2008) *Chemical Engineers' Handbook*, 8ª ed., McGraw-Hill, New York.


**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| POs/COs | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | 3 | - | 3 | - | - | - | 2 | - | - | - | 2 | - | 2 |
| **CO2** | - | 3 | 2 | 3 | - | - | - | - | 2 | - | - | - | - | 3 | 2 |
| **CO3** | - | - | - | - | - | - | - | - | 2 | 3 | - | 2 | - | 2 | - |
| **CO4** | - | - | - | 2 | - | 3 | 2 | 2 | 3 | 2 | 3 | - | 2 | 2 | - |
| **CO5** | 3 | - | 2 | - | - | - | - | - | - | - | 2 | - | 2 | - | - |

1. WEAK 2. MODERATE 3. STRONG

| GNEG 227 | Strength of Materials | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | a. Basic Knowledge of law of physics.<br>b. Basic Knowledge of Mechanics | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**

  The course will enable the students to:

  1. Recalling previous knowledge required to the course Strength of Materials.
  2. Calculate and derive various equations required to assure strength of materials.
  3. Design and solve engineering problems.

- **COURSE OUTCOMES:**

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

  CO1. Analyze the statically determinate and indeterminate problems.

  CO2. Determine the stresses and strains in the members subjected to axial, bending and torsional loads

  CO3. Evaluate the slope and deflection of beams subjected to loads.

  CO4. Determine the principal stresses and strains in structural members

- **CATALOG DESCRIPTION**

  Strength of materials, also called mechanics of materials, is a subject which deals with the behavior of solid objects subject to stresses and strains. The complete theory began with the consideration of the behavior of one and two dimensional members of structures, whose states of stress can be approximated as two dimensional, and was then generalized to three dimensions to develop a more complete theory of the elastic and plastic behavior of materials. An important founding pioneer in mechanics of materials was Stephen Timoshenko.

  The study of strength of materials often refers to various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts. The methods employed to predict the response of a structure under loading and its susceptibility to various failure modes takes into account the properties of the materials such as its yield strength, ultimate strength, Young's modulus, and Poisson's ratio; in addition, the mechanical element's macroscopic properties (geometric properties), such as its length, width, thickness, boundary constraints and abrupt changes in geometry such as holes are considered.

## Course Content

- **UNIT 1: SHEAR FORCE AND BENDING MOMENT DIAGRAMS: (LECTURE 5)**

  Relation between shear force, bending moment and loading, Shear force and bending moment diagram in cantilever, simply supported and compound beam with concentrated, distributed load and couples, overhanging beams, points of contra-flexure.

- **UNIT 2: SIMPLE STRESSES AND STRAINS: (LECTURE 5)**

Normal stresses and strains; Various types of stresses and strains; Hook's Law; Elastic Constants; Generalized Hook's law; Axial load diagrams; Deformation in prismatic, stepped, linearly varying and composite members under axial load and self-weight; Stress and strain in Indeterminate member; Temperature stresses, working stress concept; Stress due to impact load using strain energy concept.

- **UNIT 3: STRESS IN BEAMS: (LECTURE 6)**

  Theory of bending, Flexural formula, Moment of resistance and section modulus, Skew Loading: Bending of symmetrical sections about axis other than axis of symmetry, Eccentric Loading: Combined bending and direct stress, Shear stresses in beams, Shear stress formula, and Shear stress determination in symmetrical sections.

- **UNIT 4: TORSION: (LECTURE 4)**

  Introduction, Theory of torsion, Shear stress in hollow and solid circular shafts due to torsion, Comparison of Hollow and Solid shafts, Composite shafts, Spring concept.

- **UNIT 5: AXIALLY LOADED COLUMNS AND COMBINED STRESSES: (LECTURE 5)**

  Introduction, Buckling Effect, Euler's theory and Rankine's formula for axially loaded columns with different end conditions, Concept of equivalent length, Stresses due to eccentric and lateral loads, Core of sections.

- **UNIT 6: COMPOUND STRESSES AND STRAINS: (LECTURE 5)**

  Stresses on inclined plane, Principle planes, Principle stresses and strains, Graphical method – Mohr's circle, Stresses due to combined bending and torque in shaft, Complex state of stress, Strain Energy, Impact loading, Theories of failures.

- **UNIT 7: DEFLECTION OF BEAM: (LECTURE 6)**

  Relation between beam curvature, Deflection and slope, Slope and deflection of determinate beams, Transverse deflection of beam under static load, Area moment method, Method of superposition and conjugate beam method, Use of energy theorem to determine deflection of beams – Castigliaon's theorem, Maxwell's reciprocal theorem for deflection.

**TEXT BOOK:**

Strength of Materials – U.C. Jindal

Strength of Materials – S S Rattan

Strength of Materials – Sadhu Singh

Mechanics of Materials – B C Punmia

**REFERRENCE BOOKS:**

Mechanics of Materials – Timoshenko

Mechanics of Materials - Russell C. Hibbler

Strength of Materials – Ryder

**Modes of Evaluation: Quiz/Assignment/ Class Test/ Tutorial**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| POs/COs | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 1 | - | - | 2 | 2 | - | 1 | 3 | 3 | - | 1 | 3 | - | - |
| CO2 | 1 | 3 | 3 | - | 2 | - | 1 | 3 | - | - | 3 | 2 | 2 | - | - |
| CO3 | - | 2 | - | 1 | 1 | 2 | 3 | - | 1 | 2 | - | 2 | - | 3 | - |
| CO4 | 3 | - | 3 | 1 | - | - | 3 | - | - | 3 | 3 | 1 | - | 3 | - |

3. WEAK 2. MODERATE 3. STRONG

| FSEG 201 | Fire Engineering-I | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 4 | 0 | 0 | 4 |
| Pre-requisites/Exposure | Basics of Thermo-Dynamics & Heat Transfer<br>Differential Calculus<br>Basics of Electrical Circuits | | | | |
| Co-requisites | Electrical Safety | | | | |

- **COURSE OBJECTIVES:**

  The objectives of this course are as follows:

  1. To provide in-depth view of fire/combustion science
  2. To introduce the concepts of fire protection/suppression engineering principles & systems currently followed in Oil & Gas industrial sector
  3. To brief the legislation requirements-national/international codes/ standards from fire & safety perspective

- **COURSE OUTCOMES:**

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

  CO1. Explain the causations and extinguishment of different kinds of fire

  CO2. Describe different stages of fire, harmful products-health effects & behavior

  CO3. Demonstrate the usage of various fire extinguishers

  CO4. Identify & explain different types of fire protection systems/ installations in oil and gas industry

  CO5. Elucidate various hazards & safety measures associated with flammable/combustible liquid storage tank

  CO6. Explicate types, cusses & consequences of explosions and associated safety measures

- **CATALOG DESCRIPTION**

  In the modern era of industrialization and globalization, human race not only is enjoying the benefits of development, but also experiencing huge loss of life due to exposure to different sets of hazards in day to day life. Among these hazards, fires became one of the commonest and severe ones. Hence, national/local governments formulating, enforcing and updating legislations for 'Being Fire Safe' everywhere. However, without understanding the fundamental concepts, achieving the same would be difficult. Thus, this subject aimed to imparting knowledge to and development of skills for students, by giving a strong base for industrial and building fire safety.

## Course Content

- **MODULE I : INTRODUCTION- 10 LECTURES**

  Fire, Classifications of fires, temperature, heat, specific heat, Fire Causation theories, Theory of Fire extinguishment, Governing equations for calculation of heat flux of a fire

Combustion Science of Solids, Liquids & Gases: flash point, fire point, ignition, combustion; Ignition- pilot ignition, spontaneous ignition, ignition sources; Types of combustion-rapid, spontaneous, explosion; Diffusion flames-zones of combustion, smoldering combustion, characteristics of diffusion flame; Premixed flames-burning velocity, limits of flammability, characteristics of premixed flame;

- **MODULE II: DEVELOPMENT OF FIRE- 6 LECTURES**

  incipient, smoldering, flame and heat stages; Products of combustion-flame, heat, smoke, fire gases; Smoke – constituents of smoke, quantity and rate of production of smoke, quality of smoke, smoke density, visibility in smoke; Toxicity of smoke- effect of harmful agents preventing escape and causing injury or death - CO, CO2, HCN, SO2, NH3, Nitrogen oxide. Effect of heat exposure to human body, body burns.

- **MODULE III: FIRE SUPPRESSION & PROTECTION-1- 19 LECTURES**

  Introduction, Definitions, Water as an extinguishing agent, Basic Components of a Fire Protection system, Fire water supply systems-Types, Design philosophy acc.to OISD, Foam, DCP & other gaseous extinguishing agents; Classification of fire protection systems-Active & Passive: Active FPS- Definitions, classifications- Water Based (Vs) Non water based & Fixed (Vs) Portable/Mobile, Types:- Fire Extinguishers, Fire hydrants, Sprinklers, standpipe systems, Fire detectors, water spray systems - definitions, types, operation, applications & limitations, selection, installation & maintenance as per relevant national and international standards(IS, OISD, NFPA etc)

- **MODULE IV: FIRE SUPPRESSION & PROTECTION-2: 6 LECTURES**

  Passive FPS- Fire Resistance: Basic Concepts(philosophy), Materials used & their Fire Resistance ratings, Fire Resistance tests; Fire Proofing: Introduction, materials used in coatings & paintings, concrete as a fire proofing material; Exit & Egress Arrangements: Basic definitions- Exit, Means of Egress system, Exit door, Refuge area, Safe area & other related as per NFPA codes & NBC

- **MODULE V: EXPLOSION SCIENCE: 7 LECTURES**

  Explosion and expansion ratios, deflagration and detonation, Explosion- physical explosion, chemical explosion; Special kinds of combustion- Flash fire, Pool fire, Deep seated fire, Spillover, Boil over, Dust explosion, BLEVE, UVCE; Classification of fire based on material .Hazards in Flammable liquid storage tanks: Types of storage tanks acc.to NFPA, API & other national/ international standards, Classification of liquids- based on flammability, toxicity & reactivity; Safety, Fire & Health hazards of materials being stored- Static Electricity, Reactivity with water/air, dependence of Flammability range on Temperature & Pressure, Relative vapor density, etc., Fire Safety in Flammable liquid storage tanks: Prevention of failure, fire prevention measures, Grounding & Bonding, Purging of storage tanks, Hydrants & other Fixed/portable fire protection measures

**Textbooks:**

1. ***Principles of Fire Safety Engineering and Management***-(Understanding Fire & Fire Protection)- by A.K. Das, First edition, 2014.
2. ***Handbook of Fire Technology***- by R.S. Gupta, 2005.
3. ***Industrial Fire Protection***- Second Edition, R. Craig Schroll – 2002.

**Modes of Evaluation: Quiz/Assignment/ Class Test/ Tutorial**
**Examination Scheme:**

| **Components** | **Internal Assessment** | **MSE** | **ESE** |
|---|---|---|---|
| **Weightage (%)** | **30** | **20** | **50** |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| **POs/COs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | -- | - | 1 | - | - | 1 | - | - | 1 | - | 1 | 3 | 1 | - |
| **CO2** | 1 | - | - | 1 | - | - | 1 | - | - | 1 | - | 2 | 1 | 2 | 1 |
| **CO3** | - | - | - | 1 | - | - | 2 | - | - | 2 | - | 2 | 2 | 3 | 2 |
| **CO4** | 1 | - | - | 1 | - | - | 3 | - | - | 2 | - | 1 | 3 | 3 | 2 |
| **CO5** | 2 | - | - | 2 | - | - | 1 | 2 | - | 2 | - | 2 | 3 | 1 | 2 |
| **CO6** | 2 | - | - | 2 | - | - | 1 | 1 | - | 1 | - | 3 | 3 | 2 | 1 |

4. WEAK 2. MODERATE 3. STRONG

| FSEG 212 | Electrical Technology & Safety in Electrical Systems | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | Basic Knowledge of Electrical Circuits<br>Basic Physics<br>Basic First-Aid | | | | |
| Co-requisites | Basics of Fire engineering | | | | |

- **COURSE OBJECTIVES:**

  The objectives of this course are as follows:

  1. To provide an overview of basic electrical engineering concepts
  2. To provide in-depth view of electrical safety at workplace as per national/international standards, codes and/or rules
  3. To brief the legislative requirements for electrical safety- national/international laws/codes of practices/ standards and/or regulations

- **COURSE OUTCOMES:**

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

  CO1. Explain the working principles and applications of various kinds of Electrical Machines and/or systems

  CO2. Understand & brief the hazards associated with electricity at work place

  CO3. Describe human safety aspects over electric and magnetic fields

  CO4. Identify various protective equipment and enumerate their working and application

  CO5. Identify hazardous areas/locations in a given industrial site for selection, installation, operation and maintenance of electrical equipment

- **CATALOG DESCRIPTION**

  In the modern era of industrialization and globalization, human race not only is enjoying the benefits of development, but also experiencing huge loss of life due to exposure to different sets of hazards in day to day life. Among these hazards, electricity became one of the commonest and severe ones. Hence, national/local governments formulating, enforcing and updating legislations for 'Being electricity Safe' everywhere. However, without understanding the fundamental concepts, achieving the same would be difficult. Thus, this subject aimed to imparting knowledge to and development of skills for students, by giving a strong base for industrial and building electrical safety.

## Course Content

- **MODULE I : ELEMENTARY IDEAS OF ELECTRICAL EQUIPMENTS – 10 LECTURES**

  Transformers, DC Machines, Alternators, Induction Machines- Characteristics, application

  Protection Relays: Requirements of relay- types of protection, Classification: Distance Relay, Differential Relay, Static Relay- Definitions and types

- **MODULE II: CIRCUIT BREAKERS – 11 LECTURES**

  Function switchgear, Arc Phenomenon- Initialization of an Arc, Arc interruption, Recovery voltage, and Restriking voltage classification and working, Working of MCB and ELCB

  **Faults in Power System:** Causes and types, Fuses: Definition, types of fuses, selection of fuses, advantages and disadvantages

  **Grounding:** Neutral grounding, Solid grounding, Resistance grounding, Arc suppression coil grounding, Equipment grounding for safety, Grounding sub-station, Grounding of line structure, Earthing

- **MODULE III: EFFECT OF ELECTRIC FIELD AND MAGNETIC FIELD – 8 LECTURES**

  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

- **MODULE IV: SAFETY DURING INSTALLATION OF PLANT AND EQUIPMENT 8 LECTURES**

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

- **MODULE V: HAZARDOUS ZONES: 6 LECTURES**

  Classification of hazardous zones. Intrinsically safe and explosion proof electrical apparatus, Selection of equipment in hazardous area

  **Electrical Fires:** Hazards of static electricity, Safety procedures in electrical maintenance, Statutory requirements from Electrical Inspectorate. Introduction to Indian Electricity Act and Rules

**Textbooks:**


1. "**Electrical Safety, Fire Safety and Safety Management**"-S. Rao, Khanna Publishers, Delhi
2. "**Electrical Safety Handbook**"- John Cadick, TMH publishers, 6th Edition
3. "**Basic Electrical Engineering**"- C.L.Wadhwa, New Age Publishers


**Modes of Evaluation: Quiz/Assignment/ Class Test/ Tutorial**

**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| POs/COs | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 1 | -- | - | - | - | 2 | - | - | - | - | - | - | - | - | - |
| **CO2** | 1 | 1 | - | 1 | - | - | - | - | - | - | - | - | 1 | 1 | 1 |
| **CO3** | 1 | 2 | - | 2 | - | - | - | - | - | - | 1 | - | 2 | 1 | 1 |
| **CO4** | 1 | 1 | 2 | 1 | - | - | - | - | - | - | - | 1 | 1 | 1 | 2 |
| **CO5** | 1 | - | - | 2 | - | - | - | - | - | - | 2 | 1 | 1 | 1 | 2 |

5. WEAK 2. MODERATE 3. STRONG

| CHEG-391 | Chemical Engineering III (Process Technology) | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | Basic knowledge of physics and mathematics, Knowledge of Thermodynamics (1st law), Knowledge of Unit Operations, Mass and Energy Balance | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. To familiarize the student with various aspects of a chemical process plant and enable him to do related calculations from conception to commissioning of plant
  2. To give student the knowledge of commonly used processes in chemical process plants and various codes implemented in the selection of material, equipment, etc
  3. To give student the knowledge and understanding of various sources of energy and there relative performance

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Design a chemical process plant from scratch – conception to commissioning.

  CO2. Outline an integrated bioprocess and various unit operations involved in bioprocesses.

  CO3. Classify various sources of energy and access their comparative economy.

  CO4. Describe the process for extraction of raw materials and manufacture of basic chemicals.

  CO5. Select engineering materials based on their chemical and physical properties.

- **CATALOG DESCRIPTION**

  This course equips a student with the knowledge of process technology. A student with the knowledge of process technology can be a key member of a team of people responsible for planning, analyzing, and controlling the production of products from the acquisition of raw materials through the production and distribution of products to customers in a variety of process industries. These industries include, but are not limited to, chemical, food and beverage, oil exploration and production, pharmaceuticals, power generation, pulp and paper, refining and waste water treatment. This program assists students in developing skills necessary for being an effective operator, such as working effectively in a team-based environment, strong oral and written communication, maintaining a safe work environment, controlling, monitoring and troubleshooting equipment, analyzing, evaluating and communicating about data, and training others.

## Course Content

- **UNIT I:** **8 LECTURE HOURS**

  Bench scale experiments, Pilot plant studies, Semi-commercial plant, Process flow chart, Material and energy balance, Process design, The P and I diagram, Detailed engineering including mechanical, structural, electrical, instrument and building designs, Equipment

specifications, Piping and layout, Pressure vessel design codes, Plant location and Site selection, Capital cost estimates, Fixed and working capital, Cost escalation.

- **UNIT II: 6 LECTURE HOURS**

  An overview of traditional and modern applications of biotechnological processes, Outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, General requirements of fermentation processes,

  Types of fermentors, Design of fermentors, Auxiliary instrumentation of bioreactors, Main parameters to be monitored and controlled in fermentation processes, An overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry.

- **UNIT III: 7 LECTURE HOURS**

  Classification and sources of energy, Fossil and processed fuels – solid, liquid and gaseous, Effective utilisation of solar energy, Energy from high velocity winds, Geothermal, Tida l and ocean thermal sources of energy, Fuel cells, MHD systems, Different types of furnaces and kilns used in industry, Refractories, Fuel economy, Thermal efficiency.

- **UNIT IV: 9 LECTURE HOURS**

  Processes for the manufacture of important basic chemicals like Sulphuric acid, soda ash, chlorine and caustic soda, Manufacture of ammonia, nitrogenous and phosphatic fertilisers, Extraction of copper, iron and aluminium, Manufacturing processes for pulp and paper, sugar, Oils and fats, Soaps and detergents, agrochemicals, Introduction to petrochemical industries.

- **UNIT V: 6 LECTURE HOURS**

  Selection of engineering materials – carbon and low alloy steels, high alloy steels, cast iron, nickel and alloys, copper and alloys, aluminium and alloys, lead and alloys, glass, cement, bricks and tiles, plastics and rubbers. Corrosion of metals – nature and mechanism of corrosion, theories of corrosion, factors that influence corrosion, corrosion in the atmosphere, corrosion under water, methods of prevention of corrosion. Choice of metals and alloys for chemical plant construction under ordinary temperatureand pressure and under high temperature and pressure conditions.

**Text Books**


1. McCabe, W. L., Smith, J. C., & Harriott, P. (1993). *Unit operations of chemical engineering (Vol. 5)*. New York: McGraw-Hill.
2. Peters, M. S., & Timmerhaus, K. D. (1991). *Plant design and economics for chemical engineers*. McGraw-Hill chemical engineering series


**Reference Books**


1. Sinnott, R. K. (2006) *Chemical Engineering Design*, Coulson & Richardson's ChemicalEngineering, vol 6., fourth edition.
2. Seider, W. D., Seader, J. D., & Lewin, D. R. (2009). *Product & process design principles: synthesis, analysis and evaluation*. John Wiley & Sons.


**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| **POs/COs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 2 | 3 | 2 | 2 | - | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | - |
| **CO2** | 2 | 1 | 2 | 2 | - | - | - | - | - | - | - | 3 | 2 | - | - |
| **CO3** | 1 | 2 | - | - | - | - | 3 | - | - | - | - | - | - | - | 2 |
| **CO4** | - | 2 | 3 | - | - | 2 | - | - | - | - | - | - | 3 | 2 | - |
| **CO5** | 2 | - | 3 | 2 | 1 | 3 | 2 | 2 | - | - | - | 2 | - | 3 | - |

6. WEAK 2. MODERATE 3. STRONG

| HSFS 3002 | Principle of Engineering Design | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 2 | 0 | 0 | 2 |
| Pre-requisites/Exposure | Basic Knowledge of Mechanics and Engineering Mathematics<br>Basic Knowledge of Engineering Drawing and Strength of Materials | | | | |
| Co-requisites | | | | | |

- **COURSE OBJECTIVES**

  The course will enable the students to:

  1. Recalling previous knowledge required to the course engineering design.
  2. Calculate and derive various equations required to design engineering components.
  3. Design and solve engineering design problems.

- **COURSE OUTCOMES:**

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

  CO1. Incorporate Basic understanding of "Engineering mechanics" and "Strength of materials" with "Principle of Engineering Design. (Bloom Taxonomy – Level 2 – Understand)

  CO2. Classify, Explain, Identify and Recognize Suitable/capable/safe engineering tools for Practical work. (Bloom Taxonomy – Level 2 – Understand)

  CO3. Solve and interpret problems associated with engineering design of mechanical components. (Bloom Taxonomy – Level 3 – Apply)

  CO4. Execute/implement engineering design related solutions for real life use of mechanical equipment. (Bloom Taxonomy – Level 3 – Apply)

  CO5. Relate and compare best engineering design solution for engineering elements (like, joints, springs, shafts, conveyors and power transmission system). (Bloom Taxonomy – Level 4 – Analyze)

  CO6. Design various engineering elements/components and Inspect/survey/Investigate Safety related issues in engineering product during design, installation, operation and maintenance. (Bloom Taxonomy – Level 6 – Create)

- **CATALOG DESCRIPTION**

  By engineering principles, we mean the ideas, rules, or concepts that need to be kept in mind when solving an engineering problem. However, there is no one specific list of engineering principles that can be written down or posted. That is because the concepts used to solve a problem will often be different depending on the type of problem encountered.

  The engineer must be aware of this and consider the most important features of a design before she begins. For example, one often-noted principle in engineering design is "keep it simple" or "KISS (keep it simple stupid)". This is something that engineers must remind themselves to do when they imagine very fancy complicated products that few people would really be able to use. On the other hand, simple designs can't always meet the needs of the customer. Another principle might be to "keep the target user in mind" when creating a product. If the user does

not want a simple solution, then an engineer will have to make a choice between those two principles.

Engineers designing a visual product will use principles of line, color, shape and form to make their design more visually pleasing, Others may not care what their product looks like, and will concentrate on principles like ease-of-use, or economy.

**Course Content**

- **MODULE 1: INTRODUCTION TO DESIGN- (6 LECTURES)**

  steps in design- design factors- practical considerations in design- theories of failure- stress concentration - consideration of creep and thermal stress in design.

  Detachable joints- design of screws- thread standards- thread stress- pre-loading of bolts- external load with pre-load -fatigue and shock loading- Types of keys- types of pins- design of cotter and pin joint.

- **MODULE 2: RIVETED JOINTS- (5 LECTURES)**

  stresses in riveted joints- design of riveted joints subjected to central & eccentric loads boiler and tank joints - structural joints.

  Welded joints-types of welded joints- design of welded joints subjected to axial, torsion and bending loads.

- **MODULE 3: SPRINGS- (7 LECTURES)**

  stresses in helical spring- deflection of helical compression and extension Spring- springs subjected to fatigue loading- concentric and helical torsion spring - critical frequency of springs- leaf springs- design of automotive leaf springs.

  Power Shafting- Design for static loads- combined stresses- design of shaft for strength and deflection- axial load on shaft.

- **MODULE 4 (5 LECTURES)**

  Design of cylindrical and spherical vessels for internal and external pressures- design of heads and enclosures- tall vessels- supports for vessels- nonstandard flanges- pipeline design. Design of storage tanks.

**Textbooks:**

1. Shigley, Mechanical engineering design
2. Avallone, Handbook of Mechanical Design
3. V B Bhandari, Design of Machine Elements

**Modes of Evaluation: Quiz/Assignment/ Class Test/ Tutorial**

**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| POs/COs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | -- | - | - | 2 | 2 | - | 1 | 3 | 3 | - | 1 | 3 | - | - |
| **CO2** | 1 | - | 3 | - | 2 | - | 1 | 3 | - | - | 3 | 2 | 2 | - | 3 |
| **CO3** | - | - | - | 1 | 1 | 2 | 3 | - | 1 | 2 | - | 2 | - | 3 | - |
| **CO4** | 3 | - | 3 | 1 | - | - | 3 | - | - | 3 | 3 | 1 | - | 3 | - |
| **CO5** | 2 | - | 3 | 3 | 1 | - | 1 | 2 | - | 3 | 1 | - | - | - | 2 |
| **CO6** | 3 | - | 2 | - | 3 | - | - | 1 | 3 | - | 1 | 3 | - | - | - |

7. WEAK 2. MODERATE 3. STRONG

| FSEG 301 | Fire Engineering-II | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 4 | 0 | 0 | 4 |
| Pre-requisites/Exposure | Basics of Fire Engineering<br>Fluid Mechanics<br>Hydraulic Machines | | | | |
| Co-requisites | Basics of Fire engineering | | | | |

- **COURSE OBJECTIVES:**
  1. To provide an in-depth in site of Fire Water Pumping Systems & different types of Fire Vehicles used in fire service
  2. To enumerate the accessories used in Fire Service:-Functions/Uses/Applications, Types, Maintenance & Safe Handling Procedures
  3. To provide a brief overview of Fire ground operations

- **COURSE OUTCOMES:**

  At the end of this course student should be able to:

  CO1. Explain operation uses/functions, Applications & limitations of different types of Pumps

  CO2. Describe the layout of different Fire Vehicles used in fire service

  CO3. Calculate pump discharge pressure and maximum flow capacity for a fire stream

  CO4. Identify & elaborate about different types of hoses, nozzles, tools & ladders used in fire service

  CO5. Demonstrate usage of different kinds of breathing apparatus and PPEs along with their functions and applications

  CO6. Formulate a rough plan of action to deal with fire emergency

- **CATALOG DESCRIPTION**

  To serve in fire service field, one must understand not only the dynamics of fire but also the science and engineering of various firefighting appliances, dealing with fire related emergencies to bring the situation under control for example, the type of pump to be used, its operational attributes to deliver certain quantity of water at a specific pressure, oriented and aimed to extinguish the fire. Fire engineer's role is to design/select/use appropriate firefighting equipment effectively and efficiently to bring situation under control. To do so, basic knowledge of the equipment, engineering (calculation of capacity, and how to use them, is required. Hence, this subject aims to inculcate knowledge and skills necessary for understanding, designing and utilizing various firefighting equipment such as fire pumps, vehicles, firefighter's tools, breathing aids and utilization of these in real-time firefighting operations to decide right course of action.

## Course Content

- **MODULE I: FIRE FIGHTING VEHICLES AND APPLIANCES:- NO. OF LECTURES: 9**

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

- **MODULE II: FIRE SERVICE EQUIPMENT: NO. OF LECTURES: 9**

  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.

- **MODULE III: ROPES AND LINES: NO. OF LECTURES: 10**

  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, turntable, Snorkel, safety devices, uses and maintenance. Small gear and miscellaneous equipment's- General-purpose tools and equipment, Lamps and lighting sets.

- **MODULE IV: BREATHING APPARATUS AND ASSOCIATED EQUIPMENT NO. OF LECTURES: 13**

  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.

- **MODULE V: FIRE GROUND OPERATIONS - NO. OF LECTURES: 7**

  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:**

4. "**Fundamentals of Firefighter skills-by IAFC**"- J&B learning, 2013 edition
5. " **Fire Service Pump Operator-by IAFC**"- J&B learning, 2013 edition
6. "**Fire Service Hydraulics & Pump Operation**"- Paul Spurgeon, Fire Engineering Series, Penwell Publications

**Modes of Evaluation: Quiz/Assignment/ Class Test/ Tutorial**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| POs/COs | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | 2 | - | 2 | 1 | - | 1 | - | - | - | - | 2 | 2 | - | 2 |
| CO2 | 1 | 1 | - | 1 | 2 | - | 2 | - | - | - | - | 2 | 2 | - | 1 |
| CO3 | 1 | 2 | - | 2 | 2 | - | 2 | - | - | - | - | 3 | 2 | - | 1 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO4** | 1 | 1 | - | 1 | 2 | - | - | - | - | - | - | 2 | 2 | - | 2 |
| **CO5** | 1 | 2 | - | 2 | 1 | - | - | - | - | - | - | 2 | 2 | 1 | 2 |
| **CO6** | 2 | 2 | 3 | 1 | 2 | - | - | - | - | - | - | 2 | 2 | 1 | 1 |

8. WEAK 2. MODERATE 3. STRONG

| HSFS 3005 | Safety in Construction | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 2 | 0 | 0 | 2 |
| Pre-requisites/ Exposure | Principles of safety management<br>Basic Knowledge of construction works.<br>Basic knowledge of equipment, tools, methods in Construction site. | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVE**

The objectives of this course are to:

1. To provide knowledge of various safety practices followed in Construction site
2. To provide in-depth knowledge of various work carried in Construction site
3. To familiarize the student applicable Statutory regulations, acts, Regulations

- **COURSE OUTCOMES**

On completion of this course, the students will be able to

CO1. List out Hazards from various Construction equipment and activities

CO2. Mention various Control measures adopted in each Construction activity to avoid Incidents

CO3. Demonstrate the safe use of various types of ladders, Handheld power tools, Hydraulic tools used in Construction industry

CO4. Describe various components of cranes, safety features and its function

CO5. Apply the minimum requirements of BOCW act to the Construction site when they work.

- **CATALOG DESCRIPTION**

Students will get an exposure on the leading safety hazards on construction sites include falls, being caught between objects, electrocutions, and being struck by objects and how these hazards have caused injuries and deaths on construction sites throughout the world. Construction work is basically a hazardous land-based job. Some construction site jobs include: building houses, roads, tree forts, workplaces and repair and maintain infrastructures.

Students will study work includes many hazardous task and conditions such as working with height, excavation, noise, dust, power tools and equipment. The most common fatalities are caused by the fatal four: falls, being struck by an object, electrocutions, and being caught in between two objects. Construction work has been increasing in developing and undeveloped countries over the past few years. With an increase in this type of work occupational fatalities have increased. Occupational fatalities are individuals who die while on the job or performing work related tasks. Within the field of construction it is important to have safe construction sites. Failures in hazard identification are often due to limited or improper training and supervision of workers. Areas where there is limited training include tasks in design for safety, safety inspection, and monitoring safety. Failure in any of these areas can result in an increased risk in exposing workers to harm in the construction environment

**Course Content**

- **INTRODUCTION TO CONSTRUCTION INDUSTRY (4 HOURS)**

  Safety aspects of construction planning- Human factors in construction safety management. Roles of various groups in ensuring safety in construction industry.

- **SAFETY IN VARIOUS CONSTRUCTION OPERATIONS (7 HOURS)**

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

- **SAFETY IN MATERIAL HANDLING AND EQUIPMENTS (7 HOURS)**

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

- **CONTRACT CONDITIONS ON SAFETY (4 HOURS)**

  Health, welfare, social security and insurance. Application of ergonomics for construction safety.

- **CONTRACT LABOUR ACT AND CENTRAL RULES (5 HOURS)**

  Buildings and other Construction Workers (RE & CS ) Act and Central Rules. (Provisions regarding Licensing, safety, health, welfare and social security aspects only.

**Reference Books**


1. K.N. Vaid (Ed.), *Construction Safety Management*, National Institute of Construction Management and Research, Bombay.
2. V.J. Davies & K. Tomasin, *Construction Safety Handbook,* Thomas Telford Publishing, London.
3. James B. Fullman, *Construction Safety, Security & Loss Prevention,* John Wiley & Sons
4. Linger L, *Modern Methods of Material Handling*
5. R.T. Ratay, *Handbook of Temporary Structures in Construction* , Mc Graw-Hill
6. National Building Code of India 2005, SP-7, Bureau of Indian Standards, New Delhi.
7. Contract Labour Act and Central Rules
8. Building & Other Construction Workers (RE &CS) Act, 1996 and Central Rules.


**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| PO/ CO | PO1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | P01 1 | P01 2 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO 1** | **2** | **2** | **-** | **-** | **-** | **3** | **2** | **-** | **-** | **-** | **-** | **1** | **2** | **1** | |
| **CO 2** | **3** | **3** | **-** | **-** | **-** | **-** | **1** | **-** | **-** | **-** | **-** | **3** | **2** | | |
| **CO 3** | **-** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **2** | | **3** |
| **CO 4** | **-** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** | | |
| **CO 5** | **-** | **-** | **-** | **-** | **2** | **-** | **-** | **-** | **-** | **-** | **-** | **-** | **1** | | |

| FSEG 332 | Legal Aspects of Safety Health & Environment | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 2 | 0 | 0 | 0 |
| Pre-requisites/Exposure | Basic knowledge of legal jurisdiction. | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. To create the awareness among students regarding the various legislations applicable to industries.
  2. To introduce the definitions, concepts, requirements of various safety, health environment and welfare related acts and rules

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1: Demonstrate knowledge and understanding of basic terms and definitions as per different acts and rules.

  CO2: Gain knowledge on laws relevant and concerning towards welfare, working hours and health and safety of workers engaged in industries.

  CO3. Understand and learn about the legal aspects granting of license for storage, transportation and usage of explosive and flammable substance as per various acts and rules.

  CO4. Learn concept, agencies and provisions are per various environmental laws.

  CO5: Evaluate the compliance legal and other requirements in a workplace.

- **CATALOG DESCRIPTION**

  This module teaches systematic approaches and all the aspects of Health, Safety and Environmental laws for various industries. This module tells the students about the role and responsibility of the employer towards the workers and his employees. In this way the students can understand, explain how risks will be controlled and tell you who is responsible for this. It also tells about working with workers and concerning about their health and also tells about the roles and responsibilities of safety representatives in protecting everyone from harm in the workplace.

## Course Content

- **UNIT I: FACTORIES ACT**

  DEFINITIONS, Preliminary, inspecting staff, Health, Safety, Provisions relating to hazardous processes, welfare, working hours of adults, Employment of young persons, Special provisions, Penalties, Supplemental.

- **UNIT II: DOCK WORKERS (SAFETY, HEALTH AND WELFARE) ACT, 1986: DEFINITIONS,**

  Powers of Inspectors, Power of Govt. to direct Inquiry, Obligation of Dock workers, General Provisions relating to rules and regulations. Dock workers (SHW) Rules- Definitions, Inspection Procedure, Inquiry into certain accidents, Advisory Committee, Inquiry in Public. Dock workers

(SHW) Regulations- Definitions, Power of Inspectors. Penalties, Responsibilities, Safety Officers, Reporting of accidents, Emergency Action Plan, Safety Committee, Occupational Health services for dock workers, various safety and health regulations in brief.

- **UNIT III: EXPLOSIVES ACT:**

  definitions, grant of license, notice of accidents, inquiry into ordinary and serious accidents, punishment for offences, extension of definition to other explosive substances. petroleum act - definitions, control over petroleum import, transport, storage, production, refining and blending, need for license, exemption. inspection and sampling for testing, notice of accidents and inquiries. petroleum rules - definitions, brief idea on the rules relating to safety aspects in transport, storage, refining and blending of petroleum, notice of accidents

- **UNIT IV: WORKMEN'S COMPENSATION ACT.**

  ESI Act & Rules. Public Liability Act & Rules- Substantive provisions in the above Acts and Rules.

- **UNIT V: WATER ACT:**

  Definitions, Powers and Functions of Central, State and Joint Boards, Provisions regarding prevention and control of water pollution, Penalties, Central & State Water Laboratories, Power to make rules, Power of supersession and overriding effect. Rules on Consent for Establishment. Air Act - Definitions, Power & Functions of Boards, Prevention & Control of Air Pollution, Penalties, Application for Consent as per Air Pollution Rules. Environment (Protection) Act- Definitions, general powers of central government, prevention, control and abatement of environmental pollution. EP Rules-Definitions, standards for emission, prohibition and restrictions on siting and operation of industries. MSIHC Rules- Definitions, Duties of Authorities, Notification of Major Accidents Safety Reports, On-site & Off-site Emergency Plan, Giving safety information to public. Chemical Accidents (Emergency Planning, Preparedness and Response) Rules- Definitions, Constitution, functions & powers of various Crisis groups.

## Text Books and Reference Books


1. **Health Safety and Environment (Safety Management) by Ganguly & Changerlya**
2. *Factories Act,1948 by Dr. J.P. Sharma*
3. The Petroleum Act, 1934 © Universal Law publishing
4. The Gas Cylinder Rules,2004, Professional Book publishers.


**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | - | 1 | 1 | 2 | | 1 | - | - | 3 | - | 2 | - | 2 |
| CO2 | | 2 | 1 | 2 | | 3 | | | | | 3 | | | | 2 |
| CO3 | | 2 | | 2 | | 3 | | | | | 3 | | | | 2 |
| CO4 | | 2 | | | | 2 | | | | | 2 | | | 1 | 2 |
| CO5 | 2 | 2 | 2 | 2 | 2 | 3 | | | | | 2 | | 2 | | 3 |

9. WEAK 2. MODERATE 3. STRONG

| FSEG-312 | Chemical Process Safety | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | Basic Knowledge of Physics, Chemistry and Maths<br>Knowledge of manufacturing processes (Sem II)<br>Principles of safety management (Sem III)<br>Fire engineering I, II and III (Sem IV, V and VI)<br>Process instrumentation and control engineering (Sem VI)<br>Occupational health and hygiene management (Sem VI) | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**

1. Understand and apply the principles and approach of inherently safer design to reduce and eliminate hazards and thereby lower the risk of new or currently operating chemical systems
2. To provide in-depth knowledge in safety in chemical process industry it's applications in various fields.
3. To provide in-depth knowledge of safety in the design and operation of chemical process plant
4. To provide in-depth knowledge of safety in the storage and handling of chemicals and gases
5. To familiarize the student with hazards arising from chemical reactions in chemical process industry

- **COURSE OUTCOMES**

On completion of this course, the students will be able to

CO1. Distinguish the typical sources of risk in a process plant by hazard identification and examination of case studies.

CO2. Assess the severity of the consequences of incidents.

CO3. Understand and suggest various methods for safe storage and handling of chemicals and gases.

CO4. Describe various testing and inspection methods for pressure and reaction vessels.

CO5. Demonstrate how the root cause of incidents can be investigated and analysed and the various human and technical aspects of such causes.

- **CATALOG DESCRIPTION**

The course will provide an overview of Process Safety in the Chemical Industry, focusing on the nature of chemical plant accidents, their causes, and steps to eliminate them, with emphasis on inherently safe designs. Chemical Plant accidents deal most often with Flammability and Toxicity issues and these are dealt with in great detail. The role of Human Error in accidents is also examined Actual case studies (including Bhopal, BP Texas City, Piper Alpha) will be examined to show the relevance in today's workplace. Student will be equipped with the tools to perform consequence assessment for accidents involving fire, explosion or toxic release. The

course requires active student participation via discussions of system designs, their weakness and improvements.

## Course Content

- **UNIT I: SAFETY IN THE DESIGN OF CHEMICAL PROCESS PLANTS :- 8 LECTURE HOURS**

  Design principles – reliability and safety in designing – inherent safety – engineered safety - piping and instrumentation – safety during startup and shutdown – safety checks in the design of the equipments – reactor safety – safety in erection and commissioning of chemical plants - non destructive testing methods – pressure and leak testing – emergency safety devices – scrubbers and flares – new concepts in safety design and operation- Pressure vessel testing standards - Gas cylinder rules, SMPV rules – Inspection techniques for boilers and reaction vessels.

- **UNIT II: SAFETY IN THE OPERATION OF CHEMICAL PROCESS PLANTS:- 7 LECTURE HOURS**

  Properties of chemicals – Material Safety Data Sheets – the various properties and formats used – methods available for property determination. Operational activities and hazards – standards operating procedures – safe operation of pumps, compressors, heaters, column, reactors, pressure vessels, storage vessels, piping systems – effects of pressure, temperature, flow rate and humidity on operations – corrosion and control measures- condition monitoring - control valves – safety valves – pressure reducing valves, drains, bypass valves, inert gases. Chemical splashes, eye irrigation and automatic showers.

- **UNIT III: SAFETY IN THE STORAGE AND HANDLING OF CHEMICALS AND GASES: 7 LECTURE HOURS**

  Types of storage-general considerations for storage layouts- atmospheric venting, pressure and temperature relief – relief valve sizing calculations - storage and handling of hazardous chemicals and industrial gases, safe disposal methods, reaction with other chemicals, hazards during transportation – pipe line transport – safety in chemical laboratories. Safety provisions like level and flow indicators – alarms, trips – protection of stills, columns and towers from lightening – colour coding for pipe lines and cylinders.

- **UNIT IV: CHEMICAL REACTION HAZARDS : 4 LECTURE HOURS**

  Hazardous inorganic and organic reactions and processes, Reactivity as a process hazard, Detonations, Deflagrations, and Runaways, Assessment and Testingstrategies, Self – heating hazards of solids, Explosive potential of chemicals, Structural groups and instability of chemicals, Thermochemical screening, Case studies. Stability and sensitivity tests, Classification of materials with explosive potential, Hazard prediction by thermodynamic calculations, Prevention and control of explosions and detonations – diluting a release, purging and inerting, venting, explosion relief, flame arrestors, explosion suppression, Classification of hazardous areas.

## Text Books

3. Crowl and Louvar (2002), *Chemical Process Safety: Fundamentals with applications*, New Jersey: Prentice Hall

**Reference Books**

1. Arendt and Lorenzo(2000), *Evaluating Process Safety in the Chemical Industry*, New York: CCPS
2. Lees F. P. (2005) *Lees Handbook of Loss Prevention in Chemical Process Industries: hazard identification, assessment and control*, Butterworths.
3. King et al. (1998) *King's safety in the process industries*, London: Wuerz Publishing Ltd.

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| **POs/COs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | - | - | - | - | - | 3 | - | 3 | - | - | 3 | 3 | - | - |
| **CO2** | 3 | 3 | - | - | 3 | - | - | - | - | - | 1 | 2 | - | 3 | - |
| **CO3** | 2 | - | - | - | 3 | 2 | - | - | - | 2 | - | - | - | - | 3 |
| **CO4** | 2 | - | - | 2 | 3 | - | - | - | - | 3 | - | - | 2 | 3 | - |
| **CO5** | 2 | 3 | 3 | 2 | 3 | - | - | 3 | 3 | - | 3 | - | 3 | 3 | 2 |

10. WEAK 2. MODERATE 3. STRONG

| GNEG 386 | Process Instrumentation and Control Engineering | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | Basic Knowledge of law of physics and mathematics.<br>Knowledge of partial differential equations<br>Knowledge of transfer functions | | | | |
| Co-requisites | Chemical Process Safety | | | | |

- **COURSE OBJECTIVES**
  1. Students should have understanding of various measuring and control instruments
  2. Student should be learn the principle of various measurement instruments and their functioning
  3. Student should learn about various controllers – functioning, strength and limitations

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Explain the basic principles & importance of process control in industrial process plants.

  CO2. Draw and explain the use of block diagrams & the mathematical basis for the design of control systems.

  CO3. Perform frequency response analysis, stability analysis.

  CO4. Explain functioning of various instruments for measurement of temperature, pressure, flow rate, and other flow parameters.

  CO5. Explain the importance and application of good instrumentation for the efficient design of process control loops for process engineering plants.

- **CATALOG DESCRIPTION**

  The purpose of this course is to introduce the key concepts in automatic control and instrumentation of process plants. Material and energy balances are extended to unsteady state (dynamic) systems and Laplace Transforms are introduced as a means of conveniently representing process control systems and solving ordinary differential equations. First order, second order, and integrating systems including dead time are treated with basic controller algorithms. Commonly used sensing, transmission and final control elements are described and depicted in piping and Instrumentation Diagrams (P&IDs). The course is delivered through a combination of lectures, tutorials and exposure to simulation programs currently used in industry. Once you have completed the course, you should be able to characterise and tune simple processes and appreciate the relevance of control systems to safety and profitability.

## Course Content

- **UNIT I: ELEMENTS OF MEASUREMENT – 10 LECTURE HOURS**

  Fundamental standards, Quality of measurement, Meaning of measurement, Errors in measuring instruments, Precision and accuracy, Calibration principle, Static and dynamic characteristics of measuring instruments.

Measurement of temperature – Bimetallic and pressure thermometers, Thermocouples, Resistance thermometers, Pyrometry, Calibration.

Pressure and vacuum measurement – Manometers, Measuring element, Absolute pressure measurement, Static accuracy of pressure gauges.

- **UNIT II: FLOW MEASUREMENT - 8 LECTURE HOURS**

Orifice installation, Pitot tube, Area flow meters, Open channel meters. Level measurement – Direct method, Measurement of level in open and pressure vessels. Measurement of pH and humidity. Recording Instruments, Indicating and signaling instruments, Signal transmission, and codes.

- **UNIT III: OPEN LOOP AND CLOSE LOOP SYSTEMS – 9 LECTURE HOURS**

Transfer function modeling – block diagram representation of mechanical, thermal and liquid level systems.

Transient response analysis – Time response of first and second order system for impulse and step inputs – Effect of damping factors on transient response – Characteristics of proportional, integral, derivative, PI, PD and PID controllers.

Frequency response method of analysis – polar plot – Bode Plot.

- **UNIT IV: INTRODUCTION TO STABILITY – 9 LECTURE HOURS**

Definition via impulse response function – Routh-Hurwitz stability criterion – Nyquist stability criterion.

Control system components – error detectors – modulators and demodulators – Hydraulic controllers – Pneumatic controllers – PLC. Introduction to computer control in chemical process industry. Comparison between discrete data, digital and analogue control systems. Introduction to digital signal processing.

## Text Books


4. Ogata, K. (2010). *Modern Control Engineering*, Prentice Hall.


## Reference Books


1. Johnson C. D. (2013), *Process control instrumentation technology*. Pearson Education Limited.
2. Douglas O de Sa (2001) *Instrumentation fundamentals for process control*. CRC Press.
3. Dunn (2005), *Fundamentals of industrial instrumentation and process control*. Tata McGraw-Hill Education
4. Kallen H. P. (Ed) (1961) *Handbook of instrumentation and control*. New York: McGraw-Hill Book Company

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| **POs/COs** | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PO 7** | **PO 8** | **PO 9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | | 2 | | | | 3 | | | | 2 | | | | | 2 |
| **CO2** | 1 | 2 | 3 | | 2 | | | | 3 | | | | 2 | 3 | 2 |
| **CO3** | 2 | 3 | 2 | 3 | 3 | | | | 2 | | | | 3 | | |
| **CO4** | | 2 | | | | 2 | 3 | | | 2 | | | | | 2 |
| **CO5** | 3 | 3 | | | | 2 | 2 | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 3 |

11. WEAK 2. MODERATE 3. STRONG

| FSEG 302 | Fire Engineering III | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 4 | 0 | 0 | 4 |
| Pre-requisites/Exposure | Basic Knowledge of Physics, Chemistry and Maths.<br>Knowledge of basics of civil engineering<br>Principles of safety management (Sem III)<br>Fire engineering I, &II (Sem IV& V) | | | | |
| Co-requisites | National Building code<br>IS Codes,<br>NFPA | | | | |

- **COURSE OBJECTIVES**

The course will enable the students to:

1. To know the importance and need of fire & safety aspects in a building and adverse effect during rise of temperature due to fire.
2. To know the characteristics of building material and their relevance in fire protection design.
3. Study about fire resistant rating of material used and knowing materialistic behaviour with respect to time & temperature. In addition, to learn various type of fire resistant boards used in a building based on their rating.
4. Learn various fire test methods applicable for knowing their characteristics when exposed to fire.
5. To know damage assessment of building, reparability techniques and fire insurance requirements for a building.

- **COURSE OUTCOMES:**

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

CO1. Design of passive fire protection based on occupancy and material used and advice to suitable building material based on their rise in temperature.

CO2. Determine building material fire resistant level and can advise to use minimizing fire spread, fire severity or for minimum loses.

CO3. Know mean and methods for fire stops, compartmentation increasing fire duration in case of fire.

CO4. Recommend suitable fire resistant boards based on their fire grading, fire load, number of extinguishing system, their application rate minimum fire propagation or extinguishment.

CO5. Use their learning in building reinstatement, and may work actively during fire investigations or during damage assessment.

- **CATALOG DESCRIPTION**

Fire safety is an essential requirement for any building or industrial premises today. It has many challenges during construction with respect to complying legal requirements and for the safe execution. Globally, fire risk is a catastrophe, based on its level suitable techniques is being recommended which requires to be taught, and people should aware minimizing loses due to

fire. While thinking on minimization of loses due to fire, material used in building plays important by which fire spread rate or fire intensity influence. This course broadly covered effects of temperature on building material and their other properties. Effects of fire on building material with respect to time are most important phenomenon, which is to be known to students. Further, they will apply its application at work place being an engineering team at work place or consultant. Student's will be using quantitative approach to identify and analyze building materials e.g. steel, concrete, wood, plastics, glasses & bricks to their fire resistance rating. Students will able to work as fire consultant, fire safety engineer/ officers, advisors etc.

## Course Content

- **UNIT I: EFFECT OF TEMPERATURE ON THE PROPERTIES OF MATERIALS: 18 LECTURE HOURS**
  concrete, steel, masonry and wood. Combustibility of building materials and structures - Fire resistance of structural members - Fire resistance of buildings.
- **UNIT II: EXPERIMENTAL DETERMINATION OF FIRE RESISTANCE, 9 LECTURE HOURS**
  approximate method for calculating the fire resistance of structures. Fire resistance limits of structures, coefficient of fire resistance, fire duration.
- **UNIT III: DESIGN OF FIRE RESISTANT WALLS - 9 LECTURE HOURS**
  ceilings-screens -local barriers- Roof separations and partitioned fire areas - Fire stopped areas in connecting constructions. Fire protection of building structures: Wooden structures, Steel structures, Reinforced concrete structures, Plastic structures.
- **UNIT IV: BUILDING FIRE AREAS - 6 LECTURE HOURS**
  calculation of fire areas, subdivision of fire areas, Industrial, Residential and Public buildings, Fire transmission between buildings, and propagation of fire. Protection of openings: Openings for conveyors - opening for doors – low combustible doors – Non-combustible doors - Spark proof doors - suspension of doors - Air-tight sealing of doors - Windows.
- **UNIT V: REPARABILITY OF FIRE DAMAGED STRUCTURES: 6 LECTURE HOURS**
  Assessment of fire severity - assessment of damage-concrete, steel, masonry, timber - feasibility of repair -Repair techniques: Columns, beams, floors, etc. - a case study on building reinstatement.

## Text Books


1 BIS, NBC Part IV – Fire and Life Safety", Bureau of Indian Standards, New Delhi, 2016.
2 Royetman M Ya – Principles of fire safety standards for building construction
3 Jain V K – Fire Safety in Building
4 Dr. Thank Singh Sharma- Fundamental of fire safety in building
5 Butcher and Parnell; Designing of Fire Safety;
6 BS 5588 : British Standard – Fire precautions in the design, construction and use of buildings
7 T. Z Harmathy - Fire Safety Science and engineering

**Reference Books**


1. Fire Insurance Policies of Public Sector insurance companies
2. AIFT (TAC) Regulations
3. BIS, "IS 2189:2008 –Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System – Code of practice" Bureau of Indian Standards, New Delhi, 2008.


**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written**

**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

| PO/ CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 2 | - | - | 1 | - | - | - | - | - | 2 | 2 | 2 | 2 | - | 1 |
| CO2 | 2 | 3 | 2 | 3 | 1 | 1 | 2 | - | - | 1 | 3 | 2 | 2 | 3 | 2 |
| CO3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | - | 2 | 1 | 2 |
| CO5 | 2 | 1 | 2 | 2 | 2 | 2 | 1 | - | 1 | 3 | 3 | 2 | 2 | 2 | 2 |

12. WEAK 2. MODERATE 3. STRONG

| HSFS 4001 | ENVIRONMENTAL ENGINEERING & MANAGEMENT | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | Basic knowledge of physics and chemistry (Basic science), Basic knowledge of Environmental Science | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. To help the students understand the fundamentals and relevance of Environmental standards and laws for water, air and land quality by Pollution Control board.
  2. To enable students to understand water Quality Parameters and learn various water treatment processes.
  3. To empower students with the expertise of experimentation, in water, air, soil and noise and the fundamental concepts that are required to translate a novel engineering idea to reality for sustainable development.
  4. To expose students to a wide variety of research areas of Air pollutants and different models to study them.
  5. To equip students with necessary engineering skills such as solving engineering problems in pollution control methodologies in process.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Gain knowledge on Various Environmental standards and laws for water, air and land quality by Pollution Control boards

  CO2. Gain knowledge on steady state conservative systems and types of reactors.

  CO3. Learn various water Quality Parameters.

  CO4: Understand and learn various water treatment processes

  CO5. Gain Knowledge on various kinds of Air pollutants and different models to study them.

  CO6. Understand and learn pollution control methodologies in process industries

  CO7. Learn concept of Sustainable Development and its Role in Building of Environment

- **CATALOG DESCRIPTION**

  Environmental engineering and management is important in many scientific and technological problems including natural resource conservation, Pollution control and different equipment's to control it, atmospheric and oceanic circulation, renewable energy generation, energy production by chemical or green technology, optimum energy utilization in vehicles, buildings and industrial processes, and biological processes for sustainable development. The highly multidisciplinary nature of the subject can be gauged from the fact that it is taught across multiple disciplines ranging from Mechanical, Aerospace, Civil, Chemical to Biotechnology. The current course covers the fundamental background in the environmental resource conservation, with a special emphasis on water air and noise, as relevant to sustainable development in general and

environmental engineering in particular. The course begins with a description of different fundamentals and relevance of Environmental standards and laws for water, air and land quality by Pollution Control board. The students will learn the fundamental laws of environmental conservation and then apply it to two distinct type of process commonly found in real life. The students will thus get an adequate exposure to water, air, soil and noise and the fundamental concepts that are required to translate a novel engineering idea to reality for sustainable development.

## Course Content

- **UNIT 1: INTRODUCTION TO ENVIRONMENTAL ENGINEERING 4 HR**

  Introduction to Environment, its impact, Present scenario, Various Environmental standards and laws for water, air and land quality by Pollution Control boards and their working Modules.

  Mass and energy transfer within the environmental system: Law of conservation of energy and Law of conservation of mass. Material Balance in an environmental system, Steady state conservative Systems-Steady state systems with non-conservative pollutants, -Type of reactors, Reaction rate and order of a reaction (Zero order, First order and Second order reactions).

- **UNIT 2: WATER POLLUTION AND WATER QUALITY CONTROL 9 HR**

  Water Resources- Hydrologic Cycle, Water Quality Parameters: Physical characteristics like Color, Odour, Temperature, Turbidity and Total Solids; Chemical Characteristics like pH, Hardness, Alkalinity, Acidity, Oxygen Demanding (COD, BOD, Nitrates, Sulfates and phosphates; Microbiological characteristics). Effect of Oxygen Demanding Wastes on Rivers.

  BOD and DO Profile: Deoxygenation and Reaeration of the polluted water, Exertion of BOD with ultimate BOD loading. -Streeter Phelps Model and Oxygen Sag Curve, -Self Purification Phenomenon.

  Ground Water- Aquifers, Flow Rate and Hydraulic Gradient by Darcy's Law, Cone of Depression, Treatment of Water, Water Quality: Drinking water quality standards, Treatment Systems: Screening, Coagulation and Flocculation, Sedimentation, Filtration, Disinfection and Softening, Wastewater Treatment, Typical Range of Composition of Domestic Sewage and Regulatory Standards, Primary Treatment: Screening, Grit Chamber, Equalization Basins, Primary Settling, Sedimentation with Coagulation and Flocculation. Secondary Treatment Systems; Activated Sludge Process, Trickling Filter, RBC, Oxidation Ponds. Advanced Treatment- Nitrogen and Phosphorous Removal.

- **UNIT 3: AIR POLLUTION 8 HR**

  Introduction- Definition, Overview of Emissions, Type of Pollutants, Chemical Composition. • Sources and Effects of Major Air Pollutants- CO, SOx, NOx, Hydrocarbons, Ozone, Photochemical Oxidants, Lead, Particulate Matter.

  Air Pollution and Metrology- Environmental Lapse Rate and Adiabatic Lapse Rate, Atmospheric Stability, Inversion, Type of Plumes., Gaussian Atmospheric Dispersion Model for Point Sources, Emission Controls., Control Devices for Particulate Pollutants- Gravity Settling Chambers,

Centrifugal Separators, Wet Scrubber, Electrostatic precipitator, Control devices for Gaseous Pollutants- Adsorption, Absorption, Condensation and Combustion.

- **UNIT 4: POLLUTION CONTROL IN PROCESS INDUSTRIES POLLUTION CONTROL METHODOLOGIES 5 HR**

  Pollution Control in Process Industries like Cement, Paper, Petroleum -Petroleum Products-Textile-Tanneries-Thermal Plants-Eco-Friendly Energy and Environment, Hazardous Waste Treatment Technologies, Physical Treatment- Sedimentation, Adsorption, Aeration. Ion Exchange, Electro Dialysis. Chemical Treatment- Precipitation, Biological Remediation Techniques, Incineration and Land Disposal. Environmental Impact Assessment and Environmental Management.

- **UNIT 5: INTRODUCTION TO EIA, NEED AND SCOPE OF EIA 6 HR**

  Objectives and Purpose of EIA Studies, Indian Policies requiring EIA- Enactment of EIA as a Law, EIA Notifications, Siting Criteria. Components and Types of EIA, Roles in the EIA Process, Objectives and purpose of EIA studies., Indian policies requiring EIA- Enactment of EIA as a law, EIA notifications, Siting criteria, EIA cycle and procedure- Initial screening till Environmental Management plan.

  Components and Types of EIA, Roles in the EIA process, Environmental Audit- Need, Purpose, Criteria., Case studies.

- **UNIT 6: SUSTAINABLE DEVELOPMENT 4 HR**

  Concept of Sustainable Development and its Role in Building of Environment, Background, Life Cycle Assessment, Source Reduction, Collection and Transfer Operations, Recycling and Composting, Discarded Materials, Waste to Energy Combustion, Landfills, Problems, Hazardous Waste Management

**Text Books**


7. MASTERS, G. M. & ELA, W. 2008. Introduction to environmental engineering and science, Prentice Hall Englewood Cliffs, NJ.
8. METCALF & EDDY 1979. Wastewater Engineering: Treatmentm Disposal, Reuse, McGraw-Hill.
9. PUNMIA, B., JAIN, A. K. & JAIN, A. K. 1998. Waste water engineering, Firewall Media.
10. TCHOBANOGLOUS, G. & BURTON, F. L. 1991. Wastewater engineering. Management, 7, 1-4.


**Reference Books**


11. Air Pollution Control Engineering, N. de Nevers. McGraw Hill, Singapore, 2011.
12. Environmental Noise Pollution, P. E. Cunniff, McGraw Hill, New York, 1987.
13. Fundamentals of Air pollution, R. W. Boubel, D. L. Fox, and A. C. Stern, Academic
14. press, NY, 2011.

15. Wastewater Engineering – Treatment and Reuse, Metcalf & Eddy, Inc., Revised by G. Tchobanoglous, F. L. Burton, and H. D. Stensel. Tata McGraw-Hill Publishing Company Limited, New Delhi, 2011.
16. Unit Operations and Processes in Environmental Engineering, T. D. Reynolds, P. Richards. PWS Series in Engineering, Boston, 2010.
17. Environmental Pollution and its Control, S. A. Abbasi, DPH, New Delhi 2010.
18. Manual on Water Supply and Treatment. CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1999.
19. Environmental Impact Assessment, L. W. Canter, Mc Graw Hill, New York, 2010.
20. Handbook of Environmental Impact Assessment Vol I and II, J. Petts, Blackwell Science, London, 2010.
21. The Theory and the Practice of Environmental Impact Assessment, S. A. Abbasi and N. Ramesh, DPH, New Delhi, 2003.
22. *Complete Guide to ISO 14000,* R. B. Clements. Simon & Schuster, 2011

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | 1 | - | - | - | - | 1 |
| CO2 | 3 | 3 | - | - | - | - | 2 | - | - |
| CO3 | 3 | - | - | - | - | - | - | - | - |
| CO4 | 3 | - | 3 | - | - | 1 | - | - | - |
| CO5 | 3 | - | - | - | 3 | - | - | - | 3 |
| CO6 | 2 | 2 | - | 2 | - | - | 1 | 2 | - |
| CO7 | 3 | - | - | - | 1 | - | - | - | - |

1=Weakly mapped
2= Moderately mapped
3=Strongly mapped

| FSEG 4003 | Safety in rail and Road Transport | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 3 |
| Pre-requisites/Exposure | • Brief Idea of Transportation Engineering and Rail Engineering<br>• Fundamental knowledge of Mathematics and Physics | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. To familiarize the student with cause of train accidents, Road classification, Control of traffic, Geometric Design
  2. To provide in-depth knowledge in safety in rail and road transport engineering industry
  3. To provide in-depth knowledge of various components of railway and road sections,

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Understand functions of rail, sleepers, Ballast and Fittings

  CO2. Understand the control of train movement by various system

  CO3. Design the geometric design, Super elevation of a Railway section

  CO4. Describe safe method of operation of railways and road.

  CO5. Understand types of tracks in Indian Railways and its features

  CO6. Describe Classification of Highways, Consideration for safe designs

  CO7. Design basic cross sections and its minimum requirements as per standards

- **CATALOG DESCRIPTION**

  This subject deals with all aspects of railway and road engineering in fundamental concepts with special focus on Indian Railways and Highways. It also presents the theories and field practices as well as the modern techniques in detail. It is very important for engineering students and new entrants into the field of railways to be aware of not only the fundamentals of railway engineering but also latest developments with regard to railway tracks, locomotives and rolling stock, signaling and interlocking, etc.

## Course Content

- **RAILWAY ENGINEERING (7 HOURS)**

  Permanent way- components. Rails- Functions, requirements, defects, rail joints and fastenings, check and guard rails, coning of wheels, creep of rails. Sleepers- functions, requirements, types, density. Ballast- functions, requirements types.

- **GEOMETRIC DESIGN (6 HOURS)**

  Horizontal curves, Super- elevation, Negative super elevation in branches, Length of transition curves- Grade compensation on curves, Widening of Gauge on curves.

- **RAILWAY OPERATION CONTROL (6 HOURS)**

Points and crossings- Design features of a turn out –Types of Railway track- Points- Details of Station Yards and Marshalling Yards- Signaling and interlocking- Principles of track circuiting- Control of train movement by absolute block system- Automatic block system- Centralized traffic control Systems.

- **CLASSIFICATION OF HIGHWAYS (9 HOURS)**

  Historical development of road construction- Typical cross section of roads - Definition of various cross- sectional elements- Requirements & factors controlling alignment of roads - Basic Geometric design.

- **TRAFFIC ENGINEERING (8 HOURS)**

  Traffic characteristics- various traffic studies and their applications – Traffic Regulations and Controls- Traffic Control devices- Traffic signals- Classification of signals- carriage- way markings- Traffic islands- Highway intersections- Principles of highway lighting.

**Text books**


1. S.C. Rangwala, *Railway Engineering,* Charotar Book Distributors, 2012.
2. S. Chandra and M.M. Agarwal, Railway Engineering, Oxford University Press
3. S.K. Khanna and C.E.G. Justo, *Highway Engineering,* Nem Chand & Brothers
4. L.R. Kadiyali, *Traffic Engineering and Transport Planning*, Khanna Publishers, New Delhi, 2004.
5. Mike Slinn, Peter Guest and Paul Mathews, Traffic *Engineering Design: Principles and Practice*, Butterworth-Heinemann Elsevier.
6. R. Agor, *Railway Track Engineering*, Khanna Publishers.
7. R. Srinivasan, *Harbour, Dock and Tunnel Engineering*, Charotar Publishing House Pvt. Ltd.


**Reference Books**


1. Railway Engineering by B.L Gupta, Amit Gupta
2. Highway Engineering by L.R. Kadyali, N,B.Lal


**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| PO/ CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PS O1 | PS O2 | PS O3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | | | | | | | | | | | 1 | | 1 | | |
| CO2 | | | | 1 | | | | | | | 1 | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO3 | | 1 | 3 | | | | | | | | | | 1 | | |
| CO4 | | | | 1 | | | | | | | 1 | | | | 1 |
| CO5 | | | | | | 1 | 1 | | | | | | | 1 | |
| CO6 | | 1 | 1 | | | | | | | | | | | 1 | |
| CO7 | | 1 | 3 | | | | | | | | | | | | |

13. WEAK 2. MODERATE 3. STRONG

| HSFS 4004 | Safety In Engineering Industries | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 0 |
| Pre-requisites/Exposure | FSEG 232, FSEG 201, GNEG 227, FSEG 332, ENVO 303 | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. To provide in-depth knowledge in safety in engineering industry it's applications in various fields.
  2. To provide in-depth knowledge of various processes involved in engineering industry and the associated hazards.
  3. To familiarize the student with occupational hazards associated with various industrial processes.
  4. To expose the students to the risk control process of identified hazards

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1: Understand the various processes in engineering industries.

  CO2: Identify the various hazards associated with different operations.

  CO3: Formulate the methods of safe operations by effectively controlling the occupational health and safety hazards.

  CO4: Understand and apply safety requirements for safe material handling

- **CATALOG DESCRIPTION**

  Over the years industrial accidents in the engineering industries have affected many workers and their family members, who have suffered due to injuries or loss of life of their dear ones. This course introduces different operations in engineering industry, hazards associated with it and adopting effective control measures to eliminate or mitigate the hazards. The legal requirements, code of practice and recognized best practices and methods for effective safety management will be discussed to future safety practitioners.

## Course Content

- **UNIT I: INTRODUCTION- 7 LECTURE HOURS**

  Definitions- classification of industry- different process in engineering industry.

- **FOUNDRY OPERATIONS-**

  Furnace - health hazard - safe methods of operation. Forging operations - heat radiation - maintenance of machines - final checking of tools, guards, lubrication, shop equipment and hand tools - safe work practice. Operations in hot and cold rolling mills.

- **UNIT II: SAFETY IN THE USE OF POWER PRESSES- 7 LECTURE HOURS**

  Shearing -bending - rolling - drawing - turning - boring - milling - planing - grinding. Selection and care of tools - health hazards and prevention

- **UNIT III: SAFETY IN WELDING, CUTTING, FINISHING, CLEANING, POLISHING, BUFFING SAFETY IN HEAT TREATMENTS - 7 LECTURE HOURS**

  safety in handling and storage. disposal of effluents - health precautions, elimination and prevention of long time exposure to the hazardous fumes, source of fumes, ventilation and fume protection.

- **UNIT V: CARE AND MAINTENANCE OF COMMON ELEMENTS USED IN MATERIAL 7 LECTURE HOURS**

  Equipment like rope chains slings, hooks, clamps general safety consideration in material handling - manual and mechanical handling. Handling assessments - handling techniques – lifting, carrying, pulling, pushing, palletizing and stocking. Occupational diseases due to physical and chemical agents

**Text Books**

1. Safety and Health for Engineers by Roger L. Brauer John Wiley & Sons, Inc.
2. Ronald P. Blake, Industrial Safety: Prentice Hall, New Delhi,

**Reference Books**

5. Accident Prevention Manual for Industrial Operations: National Safety Council, Chicago
6. Willie Hammer, Occupational Safety Management and Engineering, Prentice Hall

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | POS1 | PSO2 | POS3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | - | 1 | - | - | - | 1 | - | - | - | - | 2 | - | - | - | - |
| CO2 | 1 | 3 | 2 | - | - | 3 | 2 | - | - | - | 2 | 1 | 2 | | 3 |
| CO3 | 2 | 2 | 3 | - | 2 | 3 | 2 | - | - | 2 | 2 | 1 | 1 | | 3 |
| CO4 | 2 | 2 | 3 | - | 2 | 3 | 2 | - | - | 2 | 2 | - | 1 | | 2 |

14. WEAK 2. MODERATE 3. STRONG

| FSEG 401 | Fire Engineering IV | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 4 | 0 | 0 | 4 |
| Pre-requisites/Exposure | Basic Knowledge of Mechanics and Engineering Mathematics, Engineering Drawing and Strength of Materials, Maths etc.<br>Fundamental of civil engineering<br>Fire engineering I, II and III (Sem IV, V and VI) | | | | |
| Co-requisites | a. National Building code<br>b. IS Codes,<br>c. NFPA | | | | |

- **COURSE OBJECTIVES**

The course will enable the students to:

1. Learn various type of building and their general requirements.
2. Understand the various aspects considered during evacuation in lined with codes of practices.
3. Acknowledge planning and design consideration while constructing various categories of building with respect to fire & safety.
4. Lean means of access, routes and exit used during any emergency evacuation.
5. In-depth learning of inspection, auditing process, fire investigation & fire risk assessment.

- **COURSE OUTCOMES:**

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

CO1. Know general requirements of various types of building their means of access, and different parameters as outlined in NBC.

CO2. Learn, analyze, design and installation of fire protection systems in building based on code of practices.

CO3. Capable of design and evaluation of suitable mean of access and emergency response plan layout in a building

CO4. Carry out fire safety audit, incident investigation being a fire safety auditor, advisor, investigator, and recommend suitable control measures.

CO5. Justify the need of required fire safety appliances/ equipment at work place and would able to innovate for further improvements.

- **CATALOG DESCRIPTION**

Fire safety is an essential requirement for any building or industrial premises today. It has many challenges during construction with respect to complying legal requirements and for the safe execution. Globally, fire risk is a major catastrophe and based on its level suitable techniques are available which is to be taught, and students should aware about it minimizing loses due to fire. On building fire safety, national building code has given guidelines, which covers various classification of building and their general requirements. This course is based on practical

aspect of firefighting and the hurdles coming in during building evacuation at the time of fire emergency. Mainly the focus of NBC part IV is to covers various aspect of fire safety parameters, which can be helpful in planning and designing of building and evacuation routes/ exit. To ensure the fire safety requirements and complying legal requirements or recommendation stated in NBC, learning of audit and inspections are important. Students will learn about various types of building and apply their learning to cope up from fire and other emergencies by suitable control measures.

## Course Content

- **UNIT I:** **8 LECTURE HOURS**

  Classification of building based on occupancy. Residential - Educational - Institutional - Assembly - business - Mercantile - Industrial - storage - hazardous. General Requirements.

- **UNIT II:** **10 LECTURE HOURS**

  Process of emergency evacuation - special features of personnel movement. Parameter characteristics of the movement of people-practical methods of designing evacuation passages and exists. Evacuations exist and routes - stages of evacuation.

- **UNIT III:** **13 LECTURE HOURS**

  Planning of evacuation routes and exits - Seating arrangement - Passages and corridors - Stairs - Smoke proof stairs - External fire escape ladders.

- **UNIT IV:** **7 LECTURE HOURS**

  Technical economical evacuation of fire safety - special fire protection features for modern buildings - Ensuring fire safety and capital investment - Evaluation of cost effectiveness - Case study.

- **UNIT V:** **10 LECTURE HOURS**

  Training and education, Arson, Fire safety audits, Risk Assessment, Fire Insurance. Investigation of fire -evidence and court procedure - law of evidence - cross-examination - giving evidence.

## Text Books


1 BIS, NBC Part IV – Fire and Life Safety", Bureau of Indian Standards, New Delhi, 2016.
2 Royetman M Ya – Principles of fire safety standards for building construction
3 Jain V K – Fire Safety in Building
4 Butcher and Parnell; Designing of Fire Safety;
5 BS 5588 : British Standard – Fire precautions in the design, construction and use of buildings
6 T. Z Harmathy- Fire Safety Science and Engineering


## Reference Books


1. Fire Insurance Policies of Public Sector insurance companies
2. AIFT (TAC) Regulations

3. BIS, “IS 2189:2008 –Selection, Installation and Maintenance of Automatic Fire Detection and Alarm System – Code of practice” Bureau of Indian Standards, New Delhi, 2008.

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written**

**Examination Scheme:**

| **Components** | **Internal Assessment** | **MSE** | **ESE** |
|---|---|---|---|
| **Weightage (%)** | **30** | **20** | **50** |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

| **PO/ CO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PO8** | **PO9** | **PO 10** | **PO 11** | **PO 12** | **PSO 1** | **PSO 2** | **PSO 3** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 2 | 2 | - | 1 | - | 2 | 2 | 1 | 3 | - | 2 | - | - | 2 | 3 |
| **CO2** | 2 | 1 | - | - | 2 | 2 | - | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 2 |
| **CO3** | 2 | - | 1 | - | 2 | - | 2 | 2 | 2 | - | 1 | 2 | 2 | 2 | 2 |
| **CO4** | 1 | 2 | 2 | 2 | 2 | 2 | - | 2 | 2 | 3 | 2 | 2 | 1 | 2 | 1 |
| **CO5** | 2 | 2 | 3 | 3 | - | 1 | 2 | 2 | - | 2 | 2 | 1 | 1 | 2 | 2 |

15. WEAK 2. MODERATE 3. STRONG

| HSFS 4105 | Environmental management in power Industry | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 2 | 0 | 0 | 2 |
| Pre-requisites/Exposure | Basic knowledge of Chemistry<br>Basic Knowledge of Environmental Science | | | | |
| Co-requisites | | | | | |

- **COURSE OBJECTIVES**

  The course will enable the students to:

  CO1. To explain fundamentals of Environmental Management, national and international environmental issues and to identify tools used for Environment Management.

  CO2. To make the student understand the areas where the management of environment is required at each stage of power industry.

  CO3. To explain the detail EIA process, methodologies and component of EIA for Power Industry.

  CO4. To explain basic requirement to get the environmental management certification (i.e. ISO 14001)

  CO5. To enable the student to understand and implement environmental management helps to develop sustainability

- **COURSE OUTCOMES:**

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

  CO1. Student would able to explain fundamentals of EM, national and international environmental issues and to identify tools used for Environment Management. (Bloom Taxonomy – Level 2 – Understand)

  CO2. Students should be able to understand the environmental management scheme for power industry and various factor of environmental management. (Bloom Taxonomy – Level 2 – Understand)

  CO3. Student would be able to understand and implement the basic requirement to get the environmental management certification (i.e. ISO 14001) (Bloom Taxonomy – Level 3 – Apply)

  CO4. To apply and to conduct EIA process for Power Industry for taking environmental clearance from MoEF and Climate Change. (Bloom Taxonomy – Level 3 – Apply)

  CO5. Students would be able to understand and implement environmental management helps to develop sustainability. (Bloom Taxonomy – Level 4 – Analyze)

- **CATALOG DESCRIPTION**

  Environment Management in power industry provide the knowledge about the environmental issues, environmental pollution control methods and environmental management system pertaining to power sector . It will provide detailed understanding of the methods and techniques for environmental management(management based tools, process based tool and product based tools), sustainable development and EIA process in power industry. This course

will also highlight types of environmental pollution and environmental management techniques in nuclear power plant, thermal power plant, hydel power plant and in renewable sectors. Student will be able to identify the impact of environmental pollution on ecosystem generated by power industry. Further, the present programme will provide a new dimension to R&D activities together with Engineering problem-solving approaches in the area of environmental pollution and control, EIA process and sustainable development and environmental management in Power Industry

- **THE COURSE HAS BEEN DESIGNED TO:**
  - To explain fundamentals of Environmental Management, national and international environmental issues and to identify tools used for Environment Management.
  - To make the student understand the areas where the management of environment is required at each stage of power industry.
  - To explain the detail EIA process, methodologies and component of EIA for Power Industry.
  - To explain basic requirement to get the environmental management certification (i.e. ISO 14001)
  - To enable the student to understand and implement environmental management helps to develop sustainability

## Course Content

- **MODULE 1** **(8 LECTURES)**
- **UNIT 1. INTRODUCTION TO ENVIRONMENT MANAGEMENT**

Declaration of United National Conference, (Stockholm Conference) , Kyoto Protocol, Earth Summit, UNFCC Climate Change, UNEP, Approach of Environment Management, concept of Environment Management, Environmental Impact on Industry and Business Institute of Environment, Ecological Foot print, Environmentalist at Global Level, International and national Environmental Movement , Environmental Auditing Need for an Environment Audit, Procedure for Environment Audit

- **MODULE 2** **(5 LECTURES)**

Introduction to Environmental Legislation and Sustainable development, Regulatory agencies and compliances, Environmental Protection Act 1986, Air Pollution Control Act 1981, Water Prevention and Control Act 1974, Indian Electricity Rule, Indian Boiler Act , Atomic Energy Act, Petroleum Act, Sustainable development, Sustainable development, Origin, concept, principle and characteristics of SD, Social Economic and Environmental Dimension of SD

- **MODULE 3** **(5 LECTURES)**

Renewable and non renewable energy resources, Generation of electricity with geothermal power plant, tidal power plant, wind energy, wind turbo generator, Hydel power plant, OTEC, Coal Based thermal power plant, Nuclear Power plant, Biomass energy, Environmental pollution

generated from thermal power plant, Air emission, waste water effluent, air pollution control equipment, Waste water quality and treatment of waste water, thermal pollution and control methods

- **MODULE 4** **(6 LECTURES)**

  **Concepts of Environmental Management Plan and EIA in Thermal Power Plant**

  Objective of EIA, EIA in Indian Scenario, Evolution of EIA, EIA Process, Screening, Scoping, Operational Aspect of EIA , EIA notification 1994, amendment public hearing 1997, Environmental citing rule for Industrial project, Rule 1999, Types of EIA , Rapid EIA and Comprehensive EIA, regional EIA, Strategic EIA, sectorial EIA, Methodology for EIA : Adhoc methods, overlays, checklist, GIS, Expert system, matrices, Component of EIA – Air, Water, noise, land, biological, risk assessment, Environmental Management Plan , EIA process for Category A and Category B project

- **MODULE 5** **(3 LECTURES)**

  Concepts of Environmental Management Plan and EIA in Nuclear Power Plant Environmental pollution generated from nuclear power plant, Air, Water Pollution Control, Nuclear Pollution Control, Environment Management Plan for Nuclear Power Plant

- **MODULE 6** **(3 LECTURES)**

  Concepts of Environmental Management and EIA in Hydroelectric Power Plant

- **MODULE 7** **(2 LECTURES)**

  Environmental Management in Solar Power Plant

- **MODULE 8** **(3 LECTURES)**

  Environmental Management Standards EMS ISO 140001, ISO – 14000 Standards of EMS Environmental Policy, EMS EMS Auditing, Objective , Planning, Implementation and Operation, Operation Checking, , Corrective Prevention Action, Non Conformance, Management Review, EMS Auditing, Objectivity , Independences

**TEXT BOOK:**

1. **Environmental Engg. P. Venugopala Rao**
2. Environmental Engineering , Gilbert Master

**REFERRENCE BOOKS:**


1. Environmental Engg. P. Venugopala Rao, PHI Learning Pvt Ltd 2002, ISBN, PP 280.
2. Environment Management, Prin. H.V. Jadhav, Dr. S.H. Purohit, Himalaya Publishing House
3. Environmental Engineering , Gilbert Master, Prentice Hall, 1997 - Technology & Engineering - 651 pages
4. Environmental Impact Assessment Methodologies, Y. Anjsneyulu Valli Manickam, BS Publication
5. Environmental Pollution Control Engineering, CS Rao, New Age International Publishers
6. Chemical Process Safety Fundamental with Application , Daniel A. Crowl.

7. Industrial Safety, Health Environmental Management System: R.K. Jain, Sunil S. Rao
8. Safety & Environmental Management , Daniel E. Della – Giustina , International Thomson Publishing
9. Industrial Safety, Health Environmental Management System: R.K. Jain Sunil S. Rao, Khana Publishers
10. Chemical Process Safety Fundamental with Application, Daniel A. Crowl, Prentice Hall PTR

**Modes of Evaluation: Quiz/Assignment/ Class Test/ Tutorial**
**Examination Scheme:**

| **Components** | **Internal Assessment** | **MSE** | **ESE** |
|---|---|---|---|
| **Weightage (%)** | **30** | **20** | **50** |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| PO-PSO/CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PO 13 | PSO1 | PSO2 | PSO 3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | | - | - | 2 | 3 | - | - | - | | | | 3 | - | - |
| CO 2 | 1 | 2 | | - | - | | 3 | - | - | - | | | | 3 | - | - |
| CO 3 | 1 | | | | - | 3 | 3 | - | - | - | | | | 3 | - | - |
| CO 4 | 1 | | | - | - | | 3 | - | - | - | | | | 3 | - | - |
| CO 5 | 1 | | | | | | 2 | | | | | | | 2 | | |

16. WEAK 2. MODERATE 3. STRONG

| FSEG 232 | Principles of Safety Management | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 2 | 0 | 0 | 0 |
| Pre-requisites/Exposure | Understanding of Physics, Chemistry, Mathematics and Environmental studies. | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. To create the awareness among students regarding importance of safety in industries.
  2. To introduce the definitions, concepts, methodologies used in management of occupational safety in industries.
  3. Students will be able to recognize and evaluate occupational safety and health hazards in the workplace, and to determine appropriate hazard controls following the hierarchy of controls.
  4. To give students a foundation on theories of accident causation and prevention methods and carryout systematic accident investigation to identify the root causes.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1: Demonstrate the knowledge and understanding of basic terms in safety management.

  CO2: Understand safety organizational requirements for effective safety management.

  CO3: Evaluate the workplace hazards and apply controls measures using hierarchy of control.

  CO4: Evaluate the safety performance of an organization.

  CO5: Understand accident investigation methodologies and apply systematic procedure to identify~~unearth~~ the root cause of the incident~~accident~~.

- **CATALOG DESCRIPTION**

  This course examines occupational safety and health principles and practices needed to address occupational safety and health issues in the workplace. Students will utilize national and international standards as a guide to apply policies, procedures, standards and occupational safety and health principles. Industry requirements, recognized best practices and methods for effective safety management will be introduced to future safety practitioners.

## Course Content

- **UNIT I: INTRODUCTION- 7 LECTURE HOURS**

  Safety -Goals of safety engineering. Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. History of safety movement. Theories of accident causation

- **SAFETY ORGANIZATION-**

  objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages

- **UNIT II: ACCIDENT PREVENTION METHODS-** **7 LECTURE HOURS**

  Engineering, Education and Enforcement.
- **SAFETY EDUCATION & TRAINING –**

  Importance, Various training methods, Effectiveness of training,
- **BEHAVIOR ORIENTED TRAINING.**

  **Communication-** purpose, barrier to communication. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping.

  **Work permit system-** objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.
- **UNIT III: MONITORING SAFETY PERFORMANCE:** **7 LECTURE HOURS**

  Frequency rate, severity rate, incidence rate, activity rate. Cost of accidents-Computation of Costs- Utility of Cost data. Plant safety inspection types, inspection procedure. Safety sampling techniques. Job safety analysis(JSA), Safety surveys, Safety audits. Safety Inventory Technique
- **UNIT V: ACCIDENT INVESTIGATION –** **7 LECTURE HOURS**

  Why? When? Where? Who? & How? Basics- Man- Environment & Systems. Process of Investigation –Tools-Data Collection-Handling witnesses- Case study. Accident analysis – Analytical Techniques-System Safety-Change Analysis-MORT-Multi Events Sequencing-TOR.

**Text Books**


1. Safety and Health for Engineers by Roger L. Brauer John Wiley & Sons, Inc.
2. N.V. Krishnan, Safety Management in Industry, Jaico Publishing House, 1997
3. Ronald P. Blake, Industrial Safety: Prentice Hall, New Delhi, 1973
4. David L. Goetsch, Occupational Safety and health, Prentice Hall


**Reference Books**


7. Accident Prevention Manual for Industrial Operations: National Safety Council, Chicago
8. Willie Hammer, Occupational Safety Management and Engineering, Prentice Hall
9. Ted S. Ferry, Modern Accident Investigation and Analysis, John Wiley & Sons
10. John V. Grimaldi and Rollin H. Simonds,Safety Management, All India Traveller Book Seller, Delhi.
11. Alan Waring, Safety Management System, Chapman & Hall


**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | 2 | - | 1 | 1 | 2 | 2 | 1 | - | - | 3 | - | 2 | - | 2 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO2 | - | 1 | 2 | - | 1 | 1 | - | 1 | 2 | - | 2 | - | - | - | 1 |
| CO3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | - | 2 | 2 | - | 2 | 1 | 3 |
| CO4 | 1 | 2 | 2 | 2 | 2 | 2 | - | - | - | 1 | 2 | - | 1 | - | - |
| CO5 | 3 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | - | 2 | - | 2 |

17. WEAK 2. MODERATE 3. STRONG

| FSEG 232 | Human Factors Engineering | L | T | P | C |
|---|---|---|---|---|---|
| **Version 1.0** | | 3 | 0 | 0 | 0 |
| **Pre-requisites/Exposure** | Safety Management<br>Basic Management Sciences | | | | |
| **Co-requisites** | -- | | | | |

- **COURSE OBJECTIVES**
  1. To provide clear understanding of role & importance of Human factors in industrial work environments, and
  2. To explain both Physiological & Psychological aspects & negative effects of work and the ways to prevent them.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Understand and apply the human factors engineering design concepts and principles to enhance workplace safety.

  CO2. Understand the concept of man- machine system, human error and control,

  CO3. Understand the fundamentals of human body functioning its limits and performance assessments

  CO4. Understand and control disorders that are the results of poor design and working practices

  CO5. Provide an insight of how working conditions affect human performance and comfort

**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Table: Correlation of POs v/s COs**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | | - | - | 2 | - | 2 | 2 | |
| CO2 | | 1 | 1 | | 1 | | | | | | 2 | | 2 | 2 | |
| CO3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | | | | 2 | | 2 | | 3 |
| CO4 | 2 | 2 | 2 | 2 | | 2 | | | 2 | | 2 | | 2 | | 2 |
| CO5 | 2 | 2 | | | 2 | 2 | | | | | 2 | | 3 | | 3 |

18. WEAK 2. MODERATE 3. STRONG

| MDMT 716 | Global Disaster Scenario and Types of Natural Diasters | L | T | P | C |
|---|---|---|---|---|---|
| Version 1.0 | | 3 | 0 | 0 | 0 |
| Pre-requisites/Exposure | Fundamentals of safety, health and environment management. Exposure to hazard identification, risk assessment and control. | | | | |
| Co-requisites | -- | | | | |

- **COURSE OBJECTIVES**
  1. Provide a conceptual and methodological framework for the study of natural and manmade disasters and preparedness.
  2. To educate students about the underlying natural process that give rise to natural hazards such as earthquakes, volcanic eruptions, tsunamis, floods, and more
  3. Expose students to the technological innovations that are allowing an increasing large human population to monitor, predict, and warn society about natural/industrial hazards and impending disasters.
  4. To give students a foundation for critically evaluating future approaches to managing hazards, from a technical, personal, and societal point of view.

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1: To understand and apprehend basic concepts of disaster management cycle.

  CO2: Understand and appreciate the institutional framework in India for disaster preparedness and mitigation.

  CO3: To characterize and analyzes natural and manmade hazards, to identify their causes, mechanisms and evaluate their risks for the human population

  CO4: Explore the scientific principles behind the occurrence of natural disasters.

  CO5: Create strategies and implementation plan for Prevention, Responsive mitigation and recovery during industrial or natural disaster.

  CO6: To critically examine and evaluate the best practices and gaps from case studies on natural and manmade disasters.

- **CATALOG DESCRIPTION**

  Many countries in the world and India in particular are vulnerable in varying degrees to a large number of natural as well as man-made disasters. And these disasters seriously threaten country's economy and its sustainable development. The main aim of this course is to provide aspiring disaster management students or those who may have future disaster or emergency management responsibilities, training in a holistic approach towards disaster management to enable them to manage all kinds of disasters by implementing proactive disaster management strategies in terms of relevant legislation, policies and directives, and effectively co-ordinate relief and recovery programs. Students will have an understanding of the principles and practices of disaster management. Critical understanding about the underlying natural process or mechanisms that give rise to natural hazards such as earthquakes, volcanic eruptions,

tsunamis, floods, and more. The course will discuss case studies on infamous natural and manmade disasters to critically examine and evaluate the best practices and gaps on disasters preparedness and response.

## Course Content

- **UNIT I: INTRODUCTION - 10 LECTURE HOURS**

  Disaster Management Cycle, Public administration/policy and emergency management – incident command center – training need analysis and human resource development plan – corporate/public agency coordination and the human element in preparedness planning. Institutional framework in India for disaster preparedness and mitigation

- **UNIT II: EARTHQUAKE: 8 LECTURE HOURS**

  Introduction – general characteristics – mechanism – causes and effects – prediction - seismic zones and waves – vulnerability – damage potential – magnitude and intensity – geological and geographical analysis – epicenter – characteristics of general motion and attenuation. Landslide and land degradation: Causes – tectonic conditions – erosion – avalanches – rock fall – damage assessment. Fire Urban area fire – building construction and structural fire protection – electric hazard, shock and protection – aircraft fire – actions required for rescue and fire fighting in air crafts and airports forest fires – explosives, fire hazard and protection in special risk areas – coal fire. Biodiversity extinction and deforestation. Biodiversity species at risk – biodiversity loss – management of species diversity – deforestation – causes and adverse effects Epidemics: Health risks – chemicals- diseases – future diseases – medical aid – vulnerability analysis – rehabilitation

- **UNIT III: FLOODS: 6 LECTURE HOURS**

  General characteristics – causes – geomorphology and floods – flood forecasting – river and coastal flood – flash flood – lake outburst – risks, environmental planning – flood control and management. Cyclone and Tsunami: Structure and nature of cyclones and Tsunamis – characteristics hazard donation – factors-hazard potential – impact assessment. Coastal and marine environment pollution and control – marine environment degradation – land use changes in coastal zones – wave – tidal storms – erosion habitat pollution – sediment discharge and control. Droughts Causes – vulnerability – tides – famines – desert and desertification.

- **UNIT IV: MANMADE HAZARDS: 6 LECTURE HOURS**

  Toxic chemicals – noise pollution – environment ground water pollution and management – solid waste management. Terrorist disaster/War: Hazardous wastes – reactivity – toxicity – nuclear war – biological weapons – armed conflicts – land mines etc.

- **UNIT V: NATIONAL & WORLD WIDE SCENARIO: 6 LECTURE HOURS**

  History of disasters - various disasters in various countries - Disasters in India Relief and rehabilitation in disasters at local, national and global levels, Gaps in disaster management identified on analysis, Worldwide Aid and Agencies, Study of different case studies on natural disaster & man-made disaster

**Text Books**


23. Donald Hyndman, "Natural Hazards and Disasters" Third Edition
24. Coppola P Damon, 2007. Introduction to International Disaster Management, Carter, Nick 1991.


**Reference Books**


12. Disaster Management: A Disaster Manager's Handbook. Asian Development Bank, Manila
13. Government of India, Ministry of Home Affairs, National Disaster Management Division, 2004, Disaster Management in India – A Status Report
14. National Policy on Disaster Management 2009, NDMA, Government of India.


**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | ESE |
|---|---|---|
| Weightage (%) | 50 | 50 |

**Table: Correlation of POs v/s COs ( M Tech HSE)**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | 2 | - | - | - | - | - | - | 1 |
| CO2 | 3 | 2 | 2 | 2 | - | - | - | - | - | | |
| CO3 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | | 2 |
| CO4 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | | 2 |
| CO5 | 2 | 2 | 3 | 2 | - | - | - | | - | | 2 |
| CO6 | 2 | 3 | 2 | 2 | - | | - | | 1 | | 2 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

**Correlation of POs v/s COs ( M Tech HSE- DM)**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PSO1 | PSO2 | PSO3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | - | 2 | - | - | - | - | - | - | 1 | - |
| CO2 | 3 | 2 | 2 | 2 | - | - | - | - | - | | | 2 |
| CO3 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | | 2 | 2 |
| CO4 | 3 | 3 | 2 | 2 | - | - | - | - | 1 | | 2 | 1 |
| CO5 | 2 | 2 | 3 | 2 | - | - | - | | - | | 2 | 3 |
| CO6 | 2 | 3 | 2 | 2 | - | | - | | 1 | | 2 | 2 |

| MEEG745 | Fundamentals of sustainable development | L | T | P | C |
|---|---|---|---|---|---|
| | | 2 | 0 | 0 | 2 |
| **Pre-requisites/Exposure** | Basic knowledge of physics and chemistry (Basic science), Basic knowledge of Environment | | | | |
| **Co-requisites** | -- | | | | |

- **COURSE OBJECTIVES**
  1. To help the students understand the fundamental key concepts on Sustainable Development (SD), such as intra- and inter-generational equity, economic, social and environmental, sustainability; strong and weak sustainability, natural capitalism, steady state and green economy;
  2. To enable students to understand to identify and discuss in detail the key empirical issues on sustainable development, such as renewable energy transitions, urban agriculture, and green architecture;
  3. To empower students with the expertise to distinguish between "green economy" and "sustainability", and various efforts at multiple levels of governance: from individual to governments;
  4. To expose students to a wide variety of research areas to apply and therefore appropriate theoretical knowledge on public policy and international relations to the issue area of sustainable development, in such aspects as international aid, global climate change negotiations, the importance of international regimes as opposed to voluntary private governance;
  5. To empower Students to make their own lives more sustainable and join social movements to bring about more of sustainable development;

- **COURSE OUTCOMES**

  On completion of this course, the students will be able to

  CO1. Gain knowledge of sustainability

  CO2. Gain knowledge on biodiversity

  CO3. Study about greenhouse gases

  CO4: Learn dynamics of sustainability

  CO5. Gain Knowledge on socio-economic systems

  CO6. Study about the conventions on sustainable development

  CO7. Learn concept of Sustainable Development and its Role in Building of Environment

- **CATALOG DESCRIPTION**

  Sustainable Development is the key policy concept of the contemporary world, both in academic and policy circles. The world has entered the new geological era of Anthropocene, that is, we, as human beings, change the structure of Earth and its climate to an extent that it warrants a new geological era. This comes with the depletion of resources, growing climate instabilities, demographic changes of unprecedented scale and the social inequality. The world is currently

discussing the Sustainable Development Goals to take humanity to 2030 in place of the expired Millennium Development Goals. This course will give the students the key concepts to discuss sustainable development and its three pillars: the social, the environmental, and the economic. The course will consist of three parts: in the first part, we will deal with the global trends and the changing conditions of our lives and habitats. This would cover the population explosion, urbanization, the situation with energy, water, food and agriculture and globalization more generally. In part 2 of the course we will talk about various actors involved in efforts towards sustainable development, such as the governments, non-state actors, sustainable communities and the private sector. We are interested in what these various actors can do (and have done) to shift humanity on the course towards sustainability. Finally, in the third part of the course, we will discuss the global policy framework towards sustainability, such as policy indicators, national strategies, global summits and legal and policy frameworks for sustainability. Here, we will also talk about what we can do, as individuals and communities, to encourage a more sustainable future.

## Course Content

- **CONCEPT OF SUSTAINABLE DEVELOPMENT**

  Definition of sustainability - History and emergence of the concept of sustainable development – Our Common Future - Objectives of Sustainable Development - Millennium Development Goals - Environment and Development linkages – Globalization and environment - Population, Poverty and Pollution – Global, Regional and Local environmental issues – Resource Degradation – Greenhouse gases and climate Change – Desertification – Industrialization – Social insecurity.

- **SUSTAINABILITY AND THE TRIPLE BOTTOM LINE**

  Components of sustainability – Complexity of growth and equity - Social, economic and environmental dimensions of sustainable development – Environment – Biodiversity – Natural Resources – Ecosystem integrity – Clean air and water – Carrying capacity –Equity, Quality of Life, Prevention, Precaution , Preservation and Public participation.- Structural and functional linking of developmental dimensions – Sustainability in national and regional context

- **SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE**

  Role of developed countries in the development of developing countries – International summits – Stockholm to Johanesburg – Rio Principles – Agenda 21 - Conventions –Agreements – Tokyo Declaration-Doubling statement-Transboundary issues –Integrated approach for resource protection and management

- **SUSTAINABLE DEVELOPMENT OF SOCIO-ECONOMIC SYSTEMS**

  Demographic dynamics of sustainability – Policies for socio-economic development – Strategies for implementing eco-development programmes – Sustainable development through trade – Economic growth – Action plan for implementing sustainable development – Urbanization and Sustainable Cities – Sustainable Energy and Agriculture – Sustainable Livelihoods – Ecotourism

- **FRAMEWORK FOR ACHIEVING SUSTAINABILITY**

Sustainability indicators - Hurdles to Sustainability - Operational guidelines –Interconnected prerequisites for sustainable development – Empowerment of Women, Children, Youth, Indigenous People, Non-Governmental Organizations, Local Authorities, Business and Industry - Science and Technology for sustainable development –Performance indicators of sustainability and Assessment mechanism – Constraints and barriers for sustainable development.

**Text Books**


25. Austin, James and Tomas Kohn. 1990. Strategic Management in Developing Countries.The Free Press.

26. Berger. 1994. "The Environment and the Economy." In Smelser and Swedberg (eds.)

27. The Handbook of Economic Sociology. Russel Sage Foundation. D'Arcy, David. Transcript of broadcast, Dec. 5, 2002, "In Houston, a Treasure of Exiled Afghan Art," National Public Radio,


**Reference Books**


28. Elkington, John. Cannibals with Forks: The Triple Bottom Line for 21st Century Business Oxford: Capstone Publishing, October 1997.

**29.** Guillen, Mauro and Sandra L. Suarez. 2002. "The Institutional Context of Multinational Activity." In Organization Theory and the Multinational Corporation. 2nd edition. New York: St. Martin's Press

30. http://discover.npr.org/features/feature.jhtml?wfld=867875 Egan, Mary Lou and Marc Bendick, Jr. "Workforce Diversity Initiatives of US MNCs in Europe." Thunderbird International Business Review, Forthcoming December 2003.


**Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination**
**Examination Scheme:**

| Components | Internal Assessment | MSE | ESE |
|---|---|---|---|
| Weightage (%) | 30 | 20 | 50 |

**Relationship between the Course Outcomes (COs) and Program Outcomes (POs)**

| PO/CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 |
|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | - | - | - | - | - | - | - | - |
| CO2 | 3 | 3 | - | - | - | - | - | - | - |
| CO3 | 3 | - | - | - | - | - | - | - | - |
| CO4 | 3 | - | 3 | - | - | - | - | - | - |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CO5 | 3 | - | - | - | 3 | - | - | - | 3 |
| CO6 | 2 | - | - | - | - | - | - | 2 | - |
| CO7 | 3 | - | - | - | - | - | - | - | - |

1=Weakly mapped
2= Moderately mapped
3=Strongly mapped