VISION
To impart high quality education and technical expertise to the students and inculcate in them humanistic attitude, scientific temper, sense of commitment to the profession and spirit of participation in nation building.

MISSION

M1 Provide quality education and knowledge base to the students in structural engineering.
M2 Prepare the students as nationally competitive and trend setters for the future generation in the realm of technical education.
M3 Assimilate the available theories, explore new frontiers, to propound new theories which will result in improving the quality of the life of the student community.
M4 Develop personality of the students in a healthy way and to provide opportunity to acquire knowledge in state-of-the-art research.
M5 Provide service to the university, engineering profession, and the public through consultancy services.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

<table>
<thead>
<tr>
<th>PEO</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PEO1</td>
<td>To develop the technical and engineering skills of the students and to train them in applying fundamental principles in the domain, feeding the needs of global expectations with professional competence.</td>
</tr>
<tr>
<td>PEO2</td>
<td>To explore the students in the field of Civil and Structural Engineering areas both in theory and practice and tuning the academic programmes periodically to make the students fit for professional jobs, research assignment or self-employment.</td>
</tr>
<tr>
<td>PEO3</td>
<td>To demonstrate their ability to deal effectively with ethical and professional issues, taking into account the broader societal implications.</td>
</tr>
<tr>
<td>PEO4</td>
<td>To impart communication, analytical and soft skills for the students towards either placing them in a comfort zone in their profession or a path to pursue higher studies.</td>
</tr>
</tbody>
</table>
ENGINEERING GRADUATES will be able to:

<table>
<thead>
<tr>
<th>PO1</th>
<th><strong>Engineering Knowledge</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PO2</th>
<th><strong>Problem Analysis</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PO3</th>
<th><strong>Design/Development of Solutions</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PO4</th>
<th><strong>Conduct Investigations of Complex Problems</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PO5</th>
<th><strong>Modern Tool Usage</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PO6</th>
<th><strong>The Engineer and Society</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PO7</th>
<th><strong>Environment and Sustainability</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PO8</th>
<th><strong>Ethics</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PO9</th>
<th><strong>Individual and Team Work</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PO10</th>
<th><strong>Communication</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>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.</td>
</tr>
</tbody>
</table>
### Project Management and Finance
Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

## PROGRAMME SPECIFIC OUTCOMES (PSOs)

<table>
<thead>
<tr>
<th>PSO</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSO1</td>
<td>Apply the knowledge of mathematics, science and fundamentals of engineering in the engineering problems to provide suitable, viable and economic solutions.</td>
</tr>
<tr>
<td>PSO2</td>
<td>Students can identify the problem, analyse and design according to the needs of the society and to come up with the environmental friendly sustainable solutions even for the complex problems.</td>
</tr>
<tr>
<td>PSO3</td>
<td>Apply modern tools and management techniques for the complex engineering problems, design of new experiments based on the researches, interpretation and analysis of data to make valid conclusions.</td>
</tr>
<tr>
<td>PSO4</td>
<td>Apply the principle of ethics in approaching different projects and problems, communicate with the concerns effectively, proper reports and documentations.</td>
</tr>
</tbody>
</table>

### Mapping PO with PEO

<table>
<thead>
<tr>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
<th>PO8</th>
<th>PO9</th>
<th>PO10</th>
<th>PO11</th>
<th>PO12</th>
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<tr>
<td>PEO1</td>
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<td>PEO2</td>
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<td>PEO3</td>
<td>*</td>
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<td>PEO4</td>
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### SEMESTER I

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Category</th>
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<th>Credits</th>
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<td></td>
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<td>Engineering</td>
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<tr>
<td>ETSP106</td>
<td>ESP-II</td>
<td>Engineering Workshop/ Manufacturing Practices</td>
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<td>4</td>
<td>40</td>
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**Total Credits:** 17.5

Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming III Semester.

### SEMESTER II

<table>
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<tr>
<th>Course Code</th>
<th>Category</th>
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<th>Credits</th>
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<tbody>
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<td>HS-I</td>
<td>English</td>
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<tr>
<td>ETBS202</td>
<td>BS-III</td>
<td>Chemistry</td>
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<td>Programming for Problem Solving</td>
<td>3</td>
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<td>BS-IV</td>
<td>Mathematics – II</td>
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<td>HSP-I</td>
<td>Communication Skills and Language Laboratory</td>
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<td>BSP-II</td>
<td>Chemistry Laboratory</td>
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<td>ESP-III</td>
<td>Computer Programming Lab</td>
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<tr>
<td>ETSP208</td>
<td>ESP-IV</td>
<td>Engineering Graphics &amp; Drafting</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>40</td>
<td>60</td>
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</table>

**Total Credits:** 20.5
### COURSES OF STUDY AND SCHEME OF EXAMINATIONS (REGULATION -2019)

#### SEMESTER III

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Category</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETBS301</td>
<td>BS-V</td>
<td>Engineering Mathematics - III</td>
<td>3</td>
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<tr>
<td>ETES302</td>
<td>ES-III</td>
<td>Environmental Studies</td>
<td>3</td>
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<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>ETES303</td>
<td>ES-IV</td>
<td>Engineering Mechanics</td>
<td>3</td>
<td>1</td>
<td></td>
<td>25</td>
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<td>100</td>
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<tr>
<td>CEES304</td>
<td>ES-V</td>
<td>Construction Engineering</td>
<td>2</td>
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<tr>
<td>CEPC305</td>
<td>PC-I</td>
<td>Introduction to Fluid Mechanics</td>
<td>3</td>
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<tr>
<td>CZPC306</td>
<td>PC-II</td>
<td>Concrete Technology</td>
<td>3</td>
<td>1</td>
<td></td>
<td>25</td>
<td>75</td>
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<tr>
<td>CZSP307</td>
<td>ESP-V</td>
<td>Computer Practical-I (Building Drawings)</td>
<td>-</td>
<td>-</td>
<td></td>
<td>3</td>
<td>40</td>
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<tr>
<td>CECP308</td>
<td>PCP-I</td>
<td>Fluid Mechanics Laboratory</td>
<td>-</td>
<td>-</td>
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<tr>
<td>CZCP309</td>
<td>PCP-II</td>
<td>Concrete and Construction Laboratory</td>
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<td>-</td>
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<td>3</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>ETIT310</td>
<td>IT-I</td>
<td>Internship Inter/ Intra Institutional Activities*</td>
<td></td>
<td></td>
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<td>100</td>
</tr>
</tbody>
</table>

*For the Lateral entry students total credit for III Semester is 23.5 as they are exempted from internship during summer vacation of II semester.

#### Total Credits 27.5

#### SEMESTER IV

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Category</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CZBS401</td>
<td>BS-VI</td>
<td>Probability Random Process and Numerical Methods</td>
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<td>100</td>
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<tr>
<td>CZES402</td>
<td>ES-VI</td>
<td>Introduction to Solid Mechanics</td>
<td>2</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>CZPC403</td>
<td>PC-III</td>
<td>Engineering Economics, Estimation and Costing</td>
<td>3</td>
<td></td>
<td></td>
<td>25</td>
<td>75</td>
<td>100</td>
</tr>
<tr>
<td>CEPC404</td>
<td>PC-IV</td>
<td>Applied Hydraulics Engineering</td>
<td>3</td>
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<tr>
<td>CZPC405</td>
<td>PC-V</td>
<td>Structural Concrete Design-I</td>
<td>3</td>
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<tr>
<td>CZPC406</td>
<td>PC-VI</td>
<td>Surveying and Geomatics</td>
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<tr>
<td>CZCP407</td>
<td>PCP-III</td>
<td>Structural Materials Testing Laboratory</td>
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<td>3</td>
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</table>

*Four weeks during the summer vacation at the end of II Semester*
Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming V Semester.

### SEMESTER V

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Category</th>
<th>Course</th>
<th>L</th>
<th>T</th>
<th>P</th>
<th>CA</th>
<th>FE</th>
<th>Total</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CZPC501</td>
<td>PC-VII</td>
<td>Structural Mechanics-I</td>
<td>3</td>
<td>-</td>
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<tr>
<td>CZPC502</td>
<td>PC-VIII</td>
<td>Structural Steel Design-I</td>
<td>3</td>
<td>-</td>
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<tr>
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<td>Soil Mechanics</td>
<td>3</td>
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<tr>
<td>CZPE505</td>
<td>PE-I</td>
<td>Hydrology and Water Resource Engineering</td>
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<tr>
<td>CZPE506</td>
<td>PE-II</td>
<td>Engineering Geology</td>
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<tr>
<td>CZCP509</td>
<td>PCP-VIII</td>
<td>Structural Reinforcement Detailing Laboratory</td>
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<td>3</td>
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<tr>
<td>ETIT510</td>
<td>IT-II</td>
<td>Industrial Training / Rural Internship/Innovation / Entrepreneurship</td>
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<td>Four weeks during the summer vacation at the end of IV Semester</td>
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**Total Credits 26.5**

### SEMESTER VI

<table>
<thead>
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<th>Category</th>
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<th>L</th>
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<tbody>
<tr>
<td>CZPC601</td>
<td>PC-XI</td>
<td>Structural Mechanics-II</td>
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<tr>
<td>CZPC602</td>
<td>PC-XII</td>
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Students must undergo Internship for 4 weeks during summer vacation which will be assessed in the forthcoming VII Semester.

### SEMESTER VII

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Total Credits 19.5

### SEMESTER VIII

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**SEMESTER III**

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**COURSE OBJECTIVES**
- To learn Partial Differential equations, Fourier Series and Boundary Value Problems.
- To learn the transforms such as Sine, Cosine, Fourier Transform and Z Transforms.
- To gain the knowledge of the method to find the solutions of different method.

**UNIT I Partial Differential Equations**

**UNIT II Fourier Series**
Dirichle’s conditions - General Fourier series - Odd and Even functions - Half range sine series - Half range cosine series - Complex form of Fourier series – Parseval’s identity.
UNIT III    Boundary Value Problems
Solutions of one dimensional wave equation – One dimensional heat equation (without derivation) – Fourier series solutions in Cartesian co-ordinates.

UNIT IV    Fourier Transform

UNIT V    Z Transform and Difference Equations

TEXT BOOKS

REFERENCES

COURSE OUTCOMES
At the end of the course the students will be able to acquire knowledge on
1. Be capable of mathematically formulating certain practical problems in terms of partial differential equation. Solve them and physically interpret the results.
2. Have gained a well founded knowledge of Fourier series, their different possible forms and the frequently needed practical Fourier analysis that an engineer may have to make from discrete data.
3. Have obtained capacity to formulate and identify certain boundary value problems encountered in engineering practices, decide on applicability of the Fourier series method of solution, solve and interpret the results.
4. Have grasped the concept of expression of a function under certain conditions as a double integral leading to identification of transform pair, and specialization of Fourier transform pair, their properties, and the possible special cases with attention to their applications.
5. Have learnt the basics of z transform in its applicability to discretely varying functions, gained the skill to formulate certain problems in terms of difference equations and solve them using the z transform techniques bringing out the elegance of the procedure involved.
ETES302 ENVIRONMENTAL STUDIES

<table>
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<tr>
<th>COURSE OBJECTIVES</th>
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<td>To realize the importance of environment for engineering students.</td>
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<td>To understand the basis of ecosystems</td>
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<td>To make aware the students about global environmental problems and natural disasters.</td>
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<tr>
<td>To give the ideas about advance technologies of engineering that will useful to protect environment.</td>
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UNIT I Introduction

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

UNIT II Ecosystem

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


UNIT IV    Pollution


UNIT V    Social Welfare


FIELD WORK

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

TEXT BOOKS


REFERENCES

2. Clark R.S., Marine Pollution, Clanderson Press Oxford
5. Down to Earth, Centre for Science and Environment
7. Hawkins R.E., *Encyclopaedia of Indian Natural History*, Bombay Natural History Society, Bombay

**COURSE OUTCOMES**
At the end Students can able to
1. Understand the importance of environment.
2. Analyse the importance of environment in engineering.
3. Apply their own ideas and demonstrate advanced technologies that will be useful to protect environment.
4. Employ awareness among the society about environmental problems and natural disasters.
5. Practice according to the present and future environmental issues.

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<th>Mapping of COs with POs</th>
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ETES303  ENGINEERING MECHANICS  L  T  P  C
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COURSE OBJECTIVES
- To provide an introductory treatment of Engineering Mechanics with a view to prepare a good foundation for taking up advanced courses.
- To provide knowledge of statics with emphasis on force equilibrium, equilibrium equations, and free body diagrams.
- To understand the basics of kinds of stress, moments and deformation in rigid bodies under different loading conditions and inertia problems.
- To determine the behaviour of wide range of simple, practical structural problems, and an understanding of the mechanical behavior of materials under various load conditions.

UNIT I  Introduction to Engineering Mechanics
Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.
Friction - Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.

UNIT II  Basic Structural Analysis
Equilibrium in three dimensions-Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines.
Centroid and Centre of Gravity - Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

UNIT III  Virtual Work and Energy Method
Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

UNIT IV  Review of Particle Dynamics
Rectilinear motion - Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton’s 2nd law (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).
Introduction to Kinetics of Rigid Bodies - Basic terms, general principles In dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D’Alembert’s principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.
UNIT V Mechanical Vibrations

Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.

Tutorials

To find the various forces and angles including resultants in various parts of wall crane, roof truss, pipes, etc.; To verify the line of polygon on various forces; To find coefficient of friction between various materials on inclined plan; Free body diagrams various systems including block-pulley; To verify the principle of moment in the disc apparatus; Helical block; To draw a load efficiency curve for a screw jack.

TEXT BOOKS


REFERENCES


COURSE OUTCOMES

On successful completion of the course the learner will be able to

1. Use scalar and vector analytical techniques for analysing forces in structures.
2. Apply basic knowledge of maths and physics to solve real world problem.
3. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems
4. Determine resultants and apply conditions of static equilibrium to plane force systems.
5. Calculate the motion characteristics of a body subjected to a force system and mechanical vibrations.
COURSE OBJECTIVES

- To expose the students to construction practice through an understanding of different types of construction materials and their properties.
- To understand the techniques of construction, different finishing works and remedial practices for distressed structures.
- To impart knowledge of modern construction materials and equipments.

UNIT I Properties of Construction Materials


UNIT II Substructure


UNIT III Superstructure


UNIT IV Finishing of Superstructure

Types of Floor finishes - Mud Flooring, Cement flooring, Ceramic Tile Flooring, Marble and Granite Flooring, Wooden Flooring, Flooring with Puffed Panels – Plastering (Interior
and Exterior) – Pointing for Walls and Floors using Grouts – White Washing, Colour Washing with different Colour Shades available in the Markets – Painting – Types of Painting for Interior and Exterior application. Form Work (Shuttering or Scaffolding) - Types of Form Work – Use of Shoring and Underpinning.

UNIT V Special materials and Repairs


TEXT BOOKS

REFERENCES

STANDARDS

COURSE OUTCOMES
At the completion of the course students will be able to
1. Compare the properties of most common and advanced building materials.
2. Understand the typical and potential applications of these materials.
3. Acquire knowledge of testing of construction materials and their strength requirements.
4. Recognize the functions of different building components.
5. Understand the usage of modern building materials and construction equipments and apply techniques to repair buildings.

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COURSE OBJECTIVES

- To introduce the concepts of fluids mechanics thorough understanding of the properties of the fluids, behavior of fluids under static conditions.
- To learn dynamics of fluids through control volume approach this gives an integrated understanding of the transport of mass, momentum and energy.
- To expose to boundary layer theory and a training to analyze engineering problems involving fluid.
- To understand the applications of the conservation laws to (a) flow measurements and (b) flow through pipes (both laminar and turbulent).

UNIT I  Properties of Fluids
Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

UNIT II  Fluid Pressure

UNIT III  Fluid Flow
Fluid Kinematics-Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates.

UNIT IV  Fluid Dynamics
Fluid Dynamics- Surface and body forces; Equations of motion – Euler’s equation; Bernoulli’s equation-derivation; Energy Principle; Practical applications of Bernoulli’s equation : venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced.

UNIT VDimensional Analysis
Dimensional Analysis and Dynamic Similitude – Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham’s π-Theorem.

TEXT BOOKS
REFERENCES

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Understand the broad principles of fluid statics, kinematics and dynamics
2. Understand definitions of the basic terms used in fluid mechanics
3. Understand classifications of fluid flow
4. Apply the continuity, momentum and energy principles
5. Apply dimensional analysis

Mapping of COs with POs

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COURSE OBJECTIVES
- To develop systematic knowledge about the nature and basic properties of the ingredients of concrete.
- To familiarises the testing procedures for properties of fresh and hardened concrete.
- To introduce fundamentals and principles of mix design.

UNIT I Cement

UNIT II Aggregates
Aggregates– Natural and Mineral aggregates – Characteristics of aggregates and their significance–Testing of aggregates properties as per IS:2386 (I to VIII)- 1963–comparison of

UNIT III Concrete

UNIT IV Properties of Concrete

UNIT V Mix Design
Objectives of mix design –Concept of concrete mix proportioning- Methods of mix proportioning as per IS: 10262-2009 and ACI Committee 211.1.91 method – Fly ash based concrete mix design – Effect of replacement materials for binder and filler in mix design-sustainable concrete.

TEXT BOOKS

REFERENCES

STANDARDS
3. IS516: 1959,Method of Test for Strength of Concrete (with Amendment No.2), Bureau of Indian Standards, New Delhi.
10. ACI Committee 211.1-91 Standard Practice for Selecting Proportions for Normal, Heavy weight and Mass Concrete, American Concrete Institute, Farmington Hill, Michigan, USA, 2002

**COURSE OUTCOMES**

At the completion of the course, students will be able to
1. Compare the properties of most common and advanced building materials.
2. Test the construction materials to determine their properties and strength requirements.
3. Understand the typical and potential applications of these materials.
4. Analyse the properties of concrete and recommend it to the suitable purpose.
5. Calculate the mix ratio of concrete according to the requirements.

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**CZSP307 COMPUTER PRACTICAL I**

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**COURSE OBJECTIVES**

- To train the students in developing skills in drawings and detailing of the Building components using AUTOCAD and also develop the skills of using MS office Excel for estimating and costing the Buildings.

**LIST OF EXERCISES**

- Plate 1. Symbols used in Civil Engineering drawings.
- Plate 2. Doors, Windows and Ventilators (wooden, glazed and aluminium)
- Plate 3. Comprehensive Planning and Drawings of Residential building Layout, plan, elevation & sectional elevation based on the NBC standards
  a. Single Room RCC roof building
  b. Double Room RCC roof building
  c. Bungalow/duplex building with sloped tiled Roof
  d. 2BHK types Residential building
  e. Two storied Residential building
Plate 4. Preparation of Layout plan of different types of commercial building Projects.
   a. School building,
   b. Office building (Bank, Government office, IT park)
   c. Hospital building, and
   d. Shopping Mall

Plate 5. Draw the Residential building Layout, plan, elevation & sectional view with all specification and standards of municipal guidelines (Local Bylaws).

**MS office – EXCEL**


Exercise 2. Preparation of building Estimation of the practiced drawing

**REFERENCES**

5. MSOffice Manual.

**COURSE OUTCOMES**

At the completion of the course students will be able

1. To identify the drawings of detailing and building plans.
2. Draw the building plans and sections using AUTOCAD.
3. To prepare the doors and windows details and other requirements.
4. To draw approval plans with complete requirements of the authorities.
5. To prepare the estimation of buildings in spreadsheets.

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COURSE OBJECTIVES
- To understand the concepts of flow of fluids under static and dynamic conditions
- To understand the discharge capacities through various notches and channels
- To have a knowledge on dimensional analysis of flow

LIST OF EXPERIMENTS
a. Measurement of viscosity
b. Study of Pressure Measuring Devices
c. Stability of Floating Body
d. Hydrostatics Force on Flat Surfaces/Curved Surfaces
e. Verification of Bernoulli’s Theorem
f. Venturimeter
g. Orifice meter
h. Impacts of jets
i. Flow Visualisation -Ideal Flow
j. Length of establishment of flow
k. Velocity distribution in pipes
l. Laminar Flow
   1) Determination of Co-efficient of discharge of Mouthpiece
   2) Determination of Co-efficient of discharge of Venturimeter
   3) Determination of Co-efficient of Head loss due to Sudden Change in Section
   4) Determination of Co-efficient of Head loss due to Friction in Pipes
   5) Determination of Co-efficient of discharge of Rectangular Notch
   6) Determination of Co-efficient of Impact of Jet on Vanes
   7) Determination of Metacentric Height of a floating vessel

REFERENCES

COURSE OUTCOMES
At the end of the course, the student will be able to
1. Understand the broad principles of fluid statics, kinematics and dynamics
2. Understand definitions of the basic terms used in fluid mechanics
3. Understand classifications of fluid flow
4. Be able to apply the continuity, momentum and energy principles
5. Be able to apply dimensional analysis
Mapping of COs with POs

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CZCP309 CONCRETE & CONSTRUCTION LABORATORY

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COURSE OBJECTIVES

- To train the students in standard testing procedures for different compositions of building materials and provides them an opportunity to design a concrete mix.

LIST OF EXPERIMENTS

1. Standard Tests on Cement as per IS Standards
2. Standard test on fine and coarse aggregates as per IS Standards
3. Workability tests on Fresh Concrete
4. Tests on Hardened Concrete, Bricks and Tiles as per IS Standards
5. Concrete Mix design as per IS 10262: 2009
6. Study on Reinforcement Detailing for different Structural Components as per SP34: 1987.

REFERENCES


STANDARDS

1. IS 269: 1989 Specification for Ordinary Portland cement, 33 grade (fourth revision), Bureau of Indian Standards, New Delhi
3. IS 516: 1959, Method of Test for Strength of Concrete (with Amendment No.2), Bureau of Indian Standards, New Delhi.
4. IS 2386 (Part I to VIII) :1963, Method of Test for Aggregate for Concrete, Bureau of Indian Standards, New Delhi
10. SP 34: 1987, Handbook on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi

COURSE OUTCOMES

At the completion of the course students will be able
1. Identify the tests for determining concrete properties
2. To test the workability of a concrete for specific purpose depends on requirements.
3. To determine the strength of hardened concrete, bricks, tiles, coarse aggregates, etc.
4. Calculate the mix proportion for concrete
5. Identify the detailing of the structural reinforcements

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COURSE OBJECTIVES

- Be exposed to probability, random processes, and statistical methods designed to contribute to the process of making scientific judgements in the face of uncertainty and variation.
- To develop the skills of the students in numerical mathematics – using method of finite difference interpolation, finding numerical solution of algebraic and transcendental equations, and finding numerical solution of ordinary and partial differential equations.

UNIT I Probability and Random Variables


UNIT II Random Processes


UNIT III Test of Significance

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

UNIT IV Interpolation, Numerical Differentiation and Integration

Interpolation: Gregory Newton forward and backward interpolation formula; Stirling’s central difference formula; Lagrange’s interpolation formula for unequal interval.

Numerical differentiation: Using Newton’s forward and backward interpolation formula.

Numerical integration: Trapezoidal rule, Simpson’s one-third and three-eight rule.

UNIT V Solution of Algebraic and Transcendental and Ordinary Differential Equations

Solution of algebraic and transcendental equations: Bolzano’s bisection method, Regula-falsi method, Newton-Raphson method.

Solution of simultaneous algebraic equation: Gauss elimination method, Crout’s method, Gauss-Seidel iteration method.


TEXT BOOKS

REFERENCES

COURSE OUTCOMES
The students should be able to
1. Collect data on a problem and describe the data using graphical and descriptive measures; develop a probabilistic model for the problem; perform probability operations and evaluations;
2. Acquire skills in handling situations involving random variables and random processes
   Perform statistical analyses of the data and hypotheses testing
3. Perform correlation and regression analyses for fitting a curve or model to data and formulate algorithms to solve problems
4. To solve problems for engineers in using numerical methods.

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<td>To understand the concept of stresses and strains and associated deformations of solid bodies due to various loading conditions with the application to bars, beams, columns, etc.</td>
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<td>To understand the concept of shear force, bending moments, slope and deflection of different beams under various loadings.</td>
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<td>To understand the concept of determinate structures and their equilibrium conditions.</td>
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<td>To understand the behaviour of torsion, thin and thick cylinders, and springs.</td>
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UNIT I Simple Stresses and Strains
Concept of stress and strain, St. Venant’s principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke’s law – stress – strain diagram for mild

UNIT II Shear Force and Bending Moment

Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams. BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

UNIT III Flexural and Shear Stresses


Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

UNIT IV Slope and Deflection, Torsion and Springs

Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay’s method. Use of these methods to calculate slope and deflection for determinant beams.

Torsion - Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.

Analysis of close-coiled-helical springs.

UNIT V Thin and Thick Cylinders

Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

TEXT BOOKS


REFERENCES

COURSE OUTCOMES
On completion of the course, the student will be able to:
1. Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke’s law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components;
2. Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures
3. Analyze solid mechanics problems using classical methods and energy methods
4. Analyse various situations involving structural members subjected to combined stresses by application of Mohr’s circle of stress; locate the shear center of thin wall beams
5. Calculate the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under unsymmetrical loading; apply various failure criteria for general stress states at points; solve torsion problems in bars and thin walled members.

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COURSE OBJECTIVES
- To equip the students with current practices in government policies and applications.
- To understand the basic principles, economics, cost and material estimates.
- To identify the methods adopted for different structural components.
- To impart knowledge on valuation practices necessary to make the student a complete civil engineer.
- To learn the bidding, contract and tender procedures.

UNIT I

UNIT II


UNIT III

Estimation / Measurements for various items- Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying.

UNIT IV

Specifications-Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures. Rate analysis-Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/productivity.

UNIT V

Tender- Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management - Introduction to Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.

Term Work Assignments:
1. Deriving an approximate estimate for a multi-storeyed building by approximate methods.
2. Detailed estimate for the following with the required material survey for the same.
a. Ground plus three storied RCC Framed structure building with block work walls
b. bridge with minimum 2 spans
c. factory building
d. road work
e. cross drainage work
f. Ground plus three storied building with load-bearing walls
g. Cost of finishes, MEP works for (f) above

4. Assignments on rate analysis, specifications and simple estimates.
5. Detailed estimate of minor structure.
6. Preparation of Bar bending schedule.

TEXT BOOKS

REFERENCES
5. B.S. Patil, “Building & Engineering Contracts”.
8. FIDIC Contract Conditions.
10. Typical PWD Rate Analysis documents.

COURSE OUTCOMES
On completion of the course, the students will
1. Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses
2. Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
3. Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
4. Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
5. Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure and how competitive bidding works and how to submit a competitive bid proposal.
### Mapping of COs with POs

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### COURSE OBJECTIVES

- To introduce the students to various hydraulic engineering problems like open channel flows and their computations.
- To understand the methods of dimensional analysis.
- To impart knowledge on characteristics and working principles of hydraulic machines.

### UNIT I

Types of flow in open channels – geometrical properties of channel sections – velocity distribution in a channel section – Chezy’s formula – Manning’s formula – Most economical sections of a channel – rectangular, trapezoidal, triangular and circular sections – uniform flow computations – specific energy and critical depth – critical flow and its computation.

### UNIT II


### UNIT III

UNIT IV


UNIT V

Pumps – classification of pumps – working principle of single acting and double acting pumps – slip and coefficient of discharge – rate of delivery – velocity and acceleration of water – speed indicator diagrams – effect of bent delivery pipe on separation – air vessels – suction in pumps with air vessels – pressure in cylinder on delivery stroke with air vessels – maximum speed of pump with air vessel – power required to drive the pump fitted with air vessels.


TEXT BOOKS

REFERENCES

COURSE OUTCOMES
At the end of the course students will be able to
1. Relate the theory and practice of problems in hydraulic engineering.
2. Apply knowledge of fluid mechanics in addressing open channel flow problems.
3. Solve problems in uniform, gradually varied and rapidly varied flows in steady state conditions.
4. Understand the working principle of pumps.
5. Understand the working principle of turbines.
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### COURSE OBJECTIVES

- To introduce the different types of Philosophies related to design of basic RCC structural elements such as slab, beam and column which forms the part of any structural system with reference to Indian Standard Code of Practice.

**UNIT I**


**UNIT II**


**UNIT III**

Shear: Shear stresses distribution in rectangular beams-Shear stresses distribution in flanged beams -Shear stresses distribution in rectangular beams due to torsion - Design shear strength of concrete- Flexural shear-Codal provisions for rectangular and flanged

UNIT IV
Design of Short and Slender Columns as per IS456:2000 standards – Design of Columns subjected to axial compression and uni-axial bending – Columns subjected to axial compression and biaxial bending – Axial load verses moment Interaction charts as per SP-16-1978- Reinforcement detailing as per SP 34: 1987 and IS 13920: 1993.

UNIT V

TEXT BOOKS

References

STANDARDS

COURSE OUTCOMES
At the end of the course students will be able
1. To understand the behaviour of steel and concrete structures.
2. To develop and strengthen the knowledge on physical, mechanical and inherent properties of concrete and reinforcing materials and to design practical reinforced concrete structural components.
3. To understand the fundamental application of structural loads, stresses and to design the structural elements using various design philosophies.
4. To acquire the knowledge about the state of the art principles, procedures and current Indian Code requirements for the design of reinforced concrete structural elements.
5. To understand the concept of detailing of reinforced concrete structural elements as per the Indian Codes.

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UNIT I Introduction to Surveying

Principles, Linear, angular and graphical methods, Survey stations, Survey lines-ranging, Bearing of survey lines, Levelling: Plane table surveying, Principles of levelling-book and reducing levels; differential, reciprocal levelling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes.


UNIT II Simple and Compound Curves

Elements of simple and compound curves – Method of setting out–Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve -Vertical curves
UNIT III  Modern Field Survey Systems
   Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories – Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.

UNIT IV  Photogrammetry Surveying
   Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereoplotting instruments, mosaics, map substitutes.

UNIT V  Remote Sensing
   Introduction – Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.

TEXT BOOKS

REFERENCES

COURSE OUTCOMES
The course will enable the students to
1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities.
2. Translate the knowledge gained for the implementation of Civil infrastructure facilities
3. Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.
4. Be familiar with the principals of recording accurate, orderly, complete, and logical field notes from surveying operations, whether recorded manually or with automatic data collection methods.
5. Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments
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COURSE OBJECTIVES
- To provide practical training on the testing and studying the stress–deformation response under axial and transverse loading conditions of conventional engineering materials like steel and wood.

LIST OF EXPERIMENTS
1. Tension test on Steel rods
2. Double Shear test on Steel rods
3. Deflection test on Steel and Wooden beams
4. Compression test on wooden specimen
5. Impact tests
6. Hardness tests on different metals
7. Test on Helical springs
8. Torsion Test.

REFERENCES

COURSE OUTCOMES
At the end of the course students will be able
1. To find out the material properties.
2. To find out the stress, strain, young’s modulus, Poisson’s ratio, etc. for different materials.
3. To understand the materials behaviour by their properties.
4. To determine the hardness of materials
5. To determine the stiffness of the springs.
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### COURSE OBJECTIVES

- To apply their knowledge of fluid mechanics in addressing problems in open channels, will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions.

### LIST OF EXPERIMENTS

1. Flow Visualization
2. Studies in Wind Tunnel
3. Boundary Layer
4. Flow around an Aerofoil / circular cylinder
5. Uniform Flow
6. Velocity Distribution in Open channel flow
7. Venturi Flume
8. Standing Wave Flume
9. Gradually Varied Flow
10. Hydraulic Jump
11. Flow under Sluice Gate
12. Flow through pipes
13. Turbulent flow through pipes
14. Flow visualization
15. Laminar flow through pipes
16. Major losses / Minor losses in pipe

### REFERENCES

### COURSE OUTCOMES
1. The students will be able to apply their knowledge of fluid mechanics in addressing problems in open channels.
2. They will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
3. They will have knowledge in hydraulic machineries (pumps and turbines).
4. They will be able to identify the flow properties under various conditions.
5. They will be able to calculate the losses in flow.

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### COURSE OBJECTIVES
- To conduct experiments on Surveying and Levelling.
- To understand the principles of Surveying.
- To know about compass surveying and plane table surveying.
- To understand the concepts of levelling and its applications.
- To understand the concepts of Theodolite surveying.

### LIST OF EXERCISES

#### I Chain Surveying
1. Study of Chains and its accessories
2. Ranging a line and taking offsets
3. Cross-Staff Survey (Area of a traversing by Chain triangulation)

#### II Compass Surveying
1. Study of prismatic compass and its accessories
2. Determination of area of an extent by radiation methods
3. Determination of distance of two inaccessible points
III Levelling
1. Study of Dumpy level and telescopic staff
2. Simple Levelling – Determination of Reduced levels
3. Differential Levelling - Determination of Reduced levels

IV Theodolite and Trigonometric Surveying
1. Study of transit theodolite, fundamental of various axes
2. Measurement of horizontal angle by repetition method
3. Measurement of horizontal angle by reiteration method
4. Heights and distances

V Tachometric Surveying
1. Determination of tachometric constants
2. Distance and elevation by stadia method
3. Distance and elevation by tangential method
4. Determination of Gradient of a line

Demonstration
1. Study of GPS
2. Study of Total Station.
The syllabus includes a Survey Camp for about one week

REFERENCES

GEOMATICS LAB (FROM NET)
- Pacing and taping
- Differential levelling
- Familiarization with TS
- Closed traverse
- Construction lab
- Horizontal curve
- GPS
- GIS and auto-cadd
- Plant and profile

COURSE OUTCOMES
At the completion of the course students will be able to
1. Do chain surveying, compass surveying, plane table surveying, and Levelling
2. Carry out Theodolite survey and Tachometric survey.
3. Handle the Survey Instruments, their care and adjustments and the, principles of Chain Surveying.
4. Understand the concept of total station.
5. Carry out the contouring.
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### COURSE OBJECTIVES
- To understand the complex analysis of structures with different end conditions.
- To learn the concepts of analysis in arches and cables.
- To have knowledge in the various classical methods of analysis of structures.

### UNIT I Indeterminate Structures
Linear elastic Analysis - Degree of Redundancy - Degree of Freedom - Static and Kinematic Indeterminacies – Maxwell's Theorem-Betti's law- Method of consistent deformation- sign convention- Clapeyron's theorem of three moments equation method – Problems with concentrated loads, partial or and full UDL, concentrated moments - Propped Cantilever Beams, Fixed Beams and Continuous Beams (restricted to two spans) - Additional problems with flexural hinges, elastic supports and support settlements. All problems shall end with elastic curve, Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD).

### UNIT II Indeterminate Structures
Degree of Redundancy - Static and Kinematic Indeterminacies - Plane frames – Virtual work method (Unit Load Method) – Castigliano’s Theorems – Simple frames (restricted to three members with two redundancies) - Simple trusses (restricted to five members with two redundancies)- Additional problems with flexural hinges, elastic supports and support settlements. All problems shall end with elastic curve, Shear Force Diagrams (SFD) and Bending Moment Diagrams (BMD).

### UNIT III Influence Lines
Analysis for moving loads - Influence Line Diagram (ILD) – Muller Breslau Principle for Influence Lines- ILD for simply supported beams - ILD for overhanging beams - ILD for Propped cantilever beams with flexural hinges- simply supported beams with floor girders –
Problems with single concentrated loads, two loads, train of loads, UDL longer than span and shorter than span – Maximum SFD and BMDs – Absolute maximum bending moment-ILD for Simple Plane truss. ILD for continuous beams and rigid frames (no problems) - Indirect model analysis for indeterminate structures.

**UNIT IV  Arches**

Arch action – Types of Arches - Analysis of Three-hinged and Two-hinged arches with effect of temperature change, rib shortening - Yielding of supports - Influence lines - Parabolic and Circular arches – Settlement effects.

**UNIT V  Cables and Suspension Bridges**

Cables and Suspension bridges – Cable Theorem – Cable under uniformly distributed loads (Cable Equation) - Horizontal thrust on the cable - Tension in the cable - Length of the cable - Effect of temperature on the cable - Stiffening girders in suspension bridges - Analysis of three-hinged and two-hinged stiffening girders with different support levels. ILD for moving loads over suspension bridges. Analysis of Beams Curved in Plan – Analysis of Space trusses using tension coefficient method.

**TEXT BOOKS**


**REFERENCES**


**COURSE OUTCOMES**

At the completion of the course students will be able
1. To analyze the indeterminate structures like beams and frames with different end conditions.
2. To analyze the indeterminate structures like beams and frames with different loading conditions.
3. To analyse the arch structures and suspension cable bridges.
4. To solve the structural problems with influence line methods of analysis.
5. To analyse the problems in the various classical methods of analysis of structures
COURSE OBJECTIVES

- To understand the fundamentals of the design of steel Structures.
- To design simple steel elements and the corresponding fastening systems.

UNIT I


UNIT II

Tension members – Types – Design strength due to yielding of cross section – Rupture of critical section – Plates – Threaded rod single Angles – Other sections – Block shear – Bolted and welded connection of Tension members – Design of Tension members as per IS 800 – 2007 provisions.

UNIT III

UNIT IV


UNIT V


TEXT BOOKS


REFERENCES


STANDARDS

2. IS 813: 1986, Scheme of symbols for welding, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able
1. To understand the different types of Steel sections available in the market.
2. To design the connections and different types of members subjected to various loading conditions.
3. To understand the Codal provisions for designing the members.
4. To design the compression and tension members as per the requirements
5. To design the plate girders inclusive of the design of flanges and web and their connections.

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COURSE OBJECTIVES

- To understand the nature, properties and behavioral response of soils is essential for a safe and stable design of foundations.
- To understand the principles involved in the understanding of the behavior of soils as a supporting medium for structures.

UNIT I


UNIT II

Flow through soil: Darcy's Law, Coefficient of permeability, laboratory and field determination of coefficient of permeability, Permeability for Stratified Deposits, Laplace’s Equations, Flow nets, Flow Through Earthen Dam, Estimation of Seepage, Uplift due to seepage. Effective Stress Principles: Effective Stress, Effective pressure due to different conditions, Seepage force, Critical hydraulic gradient, Quick sand condition, Design of filters, Capillarity in soil.

UNIT-III

Stress Distribution In Soil: Normal and shear stresses, Stress due to point loads, Stress beneath Line, strip & uniformly loaded circular area & rectangular area, pressure bulbs, Newmark’s charts- Use for determination of stress due to arbitrarily loaded areas.

UNIT-IV


UNIT-V

Shear Strength of Soil: Basic concepts, Mohr- Columb’s Theory, Laboratory Determination of soil shear parameter- Direct Shear, Tri-axial Test, Unconfined Compression, Vane Shear Test, Sensitivity & thixotropy of clay as per SP 36 – 1 (1987).Slope failure mechanisms - total stress analysis for saturated clays - friction circle method, tension cracks - use of stability number.

TEXT BOOKS

REFERENCES

STANDARDS

COURSE OUTCOMES
At the end of the course students will be able
1. To understand the soil characters such as shear strength and stress distribution.
2. To determine the soil properties.
3. To demonstrate the experiments on different soils.
4. To understand the stress distribution under the soils.
5. To understand the shear strength and uplift due to seepage.

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COURSE OBJECTIVES
- To understand the concepts of advanced structural design of building frames, raft foundations, pile foundations and water tanks.
- To enhance the structural design skill to develop confidence in structural design.
UNIT I
Analysis and design of concrete Building frames: load combinations for gravity and lateral loads (wind or seismic)- Substitute frame method for gravity loads - Portal and Cantilever methods for lateral loads - Analysis and design of two storied two bay concrete Plane frames under gravity and lateral loads- Reinforcement detailing as per SP 34 : 1987 and IS 13920: 1993.

UNIT II

UNIT III

UNIT IV
Design of square, rectangular and circular shape water tanks resting on ground - Design of square, rectangular and circular shape water tanks resting underground(IS 3370 (Part IV) : 1967) - Reinforcement detailing as per SP 34 : 1987. Design of Concrete Domes - Reinforcement Detailing as Per SP:34 -1987. Introduction to bridge engineering, Investigation for bridges, IRC loadings, Design of slab culvert; Design of Masonry walls and columns.

UNIT V
Design of cantilever type retaining walls without surcharge - Design of cantilever type retaining walls with surcharge and traffic loads - Design of counter-fort type retaining walls without surcharge - Design of counter-fort type retaining walls with surcharge and traffic loads - Reinforcement detailing as per SP 34: 1987.

TEXT BOOKS

REFERENCES

STANDARDS

COURSE OUTCOMES
1. The students will have the knowledge of analysis and design of multi-storeyed frames with lateral loads
2. The students will have the knowledge of analysis and design of the pile foundation.
3. The students will have the knowledge of analysis and design of the strap footings and raft foundation.
4. The students will have the knowledge of analysis and design of the water tanks of different sizes for various staging conditions.
5. The students will have the knowledge of analysis and design of the retaining walls of different types.

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COURSE OBJECTIVES
- To train the students in the use of latest software’s available to solve structural engineering problems and documentations procedures.

LIST OF EXERCISES
Plate 1. Draw cross section, longitudinal sections of Concrete Beams with reinforcement details as per SP 34: 1987, IS 13920: 1993.
- Singly and Doubly Reinforced Concrete Beams
- Flanged beam: T and L shaped Reinforced Concrete Beams
- Rectangular Continuous Beams
d. Lintel Beams with sunshade
  e. Plinth Beams
  f. One way and two way slabs.
  g. Continuous slabs
Plate 2. Draw cross section, longitudinal sections of Concrete staircase with reinforcement details as per SP 34: 1987, IS 13920: 1993.
  a. Dog legged staircase
Plate 3. Draw cross section, longitudinal sections of Column with Footings and reinforcement details as per SP 34: 1987, IS 13920: 1993.
  a. Rectangular Column with Isolated Footings
  b. Circular Column with Circular Isolated Footings
Plate 4&5. Draw cross section, longitudinal sections and reinforcement details for the followings
  a. Strap footing
  a. Pile with Pile cap ( Two pile group)
  b. Pile with Pile cap ( Three pile group)
  c. Pile with Pile cap ( Four pile group)
Plate 9 & 10. Draw cross section, longitudinal sections and reinforcement details as per SP 34: 1987.
  a. Cantilever Type Retaining Wall
  b. Counter fort Type Retaining Wall

REFERENCES
  1. ACAD Manuals.

STANDARDS
  1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi
  2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code of Practice, Bureau of Indian Standards, New Delhi
  7. IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundation (Under-reamed piles), Bureau of Indian Standards, New Delhi,

COURSE OUTCOMES
At the completion of the course students will be
  1. Having the knowledge of how to represent the detailing in the form of drawings for practical applications.
2. Draw the detailed drawings showing reinforcement details.
3. Able to gain experience/ practice on Modern Software in Civil Engineering field.
4. Able to give the reinforcement detailing for the structures like foundations, water tanks, retaining walls, etc.
5. Able to understand the codal provisions for detailing of reinforcements and how to implement in the drawings.

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**COURSE OBJECTIVES**
- To train the students in various aspects of soil investigation.
- To determine the basic soil properties, strength, deformation and permeability characteristics of soils through which the students can try to be successful geotechnical engineers.

**LIST OF EXERCISES**
1. Field Density using Core Cutter method.
2. Field Density using Sand replacement method.
3. Natural moisture content using Oven Drying method.
5. Specific gravity of Soils.
7. Grain size distribution by Hydrometer Analysis.
8. Consistency limits by Liquid limit
9. Consistency limits by Plastic limit
15. Relative density.
17. Triaxial Test (UU)
18. Vane shear test
19. Direct Shear Test
20. Unconfined Compression Strength Test.

REFERENCES

COURSE OUTCOMES
At the completion of the course students will be able
1. To understand the soil properties.
2. To gain knowledge about the soil characteristics.
3. To conduct the different experiments according to the soil types for finding their properties.
4. To classify the soils by its size and type.
5. To know the consistency limits of soils and consolidation process for the usefulness of practical applications.

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COURSE OBJECTIVES
- To train the students to know an appropriate detailing of every structural elements involved in field of structural engineering problems and documentations procedures.
LIST OF EXERCISES

1. Draw cross section, longitudinal sections of Concrete Beams with reinforcement details as per SP 34: 1987, IS 13920: 1993.
   i. Singly and Doubly Reinforced Concrete Beams
   ii. Flanged beam: T and L shaped Reinforced Concrete Beams
   iii. Rectangular Continuous Beams
   iv. Lintel Beams with sunshade
   v. Plinth Beams
   vi. One way and two way slabs.
   vii. Continuous slabs

2. Draw cross section, longitudinal sections of Concrete staircase with reinforcement details as per SP 34: 1987, IS 13920: 1993.
   i. Dog legged staircase

   i. Rectangular Column with Isolated Footings
   ii. Circular Column with Circular Isolated Footings

4 & 5. Draw cross section, longitudinal sections and reinforcement details for the followings
   i. Strap footing

   i. Pile with Pile cap ( Two pile group)
   ii. Pile with Pile cap ( Three pile group)
   iii. Pile with Pile cap ( Four pile group)

9 &10. Draw cross section, longitudinal sections and reinforcement details as per SP 34: 1987.
   i. Cantilever Type Retaining Wall
   ii. Counter fort Type Retaining Wall

REFERENCES

1. ACAD Manuals.

STANDARDS

1. IS 456: 2000, Code of Practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi
2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code of Practice, Bureau of Indian Standards, New Delhi
7. IS 2911 (Part III): 1980, Code of Practice for Design and Construction of Pile Foundation (Under-reamed piles),Bureau of Indian Standards, New Delhi,
8. IS 3370 (Part IV): 1967, Code Of Practice For Concrete Structures for the Storage of
Liquids, Bureau of Indian Standards, New Delhi.

**COURSE OUTCOMES**

At the completion of the course students will be

1. Having the knowledge of how to represent the detailing in the form of drawings for practical applications.
2. Draw the detailed drawings showing reinforcement details.
3. Able to gain experience/practice on Modern Software in Civil Engineering field.
4. Able to give the reinforcement detailing for the structures like beams, columns, footings, foundations, water tanks, retaining walls, etc.
5. Able to understand the codal provisions for detailing of reinforcements and how to implement in the drawings.

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**SEMESTER VI**

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**COURSE OBJECTIVES**

- To understand the complex analysis of indeterminate structures with different end conditions. Through various classical methods of analysis of indeterminate structures.
- To provide advanced and modern methods of structural analysis of simple and complicated structures and structural systems.
- To learn the concept of force method and displacement method of analysis using matrix approach.
- To have the knowledge of plastic analysis of concrete structures.

**UNIT I** Slope Deflection Method

Slope deflection equations- sign convention - Continuous beams (two spans only) – Simple Plane frames with and without sway (three members only) - Problems with flexural hinges, elastic supports support settlements and non prismatic fixed beams- Problems using Symmetry and Anti-symmetry concepts.
UNIT II  Moment Distribution Method


UNIT III  Flexibility Method

Flexibility or Force equation - Member flexibility – Flexibility coefficients – Equivalent Joint Loads- Choice of Redundant force restricted to two - Analysis of continuous beams, frames (two redundant forces), Analysis of simple plane truss, Problems with temperature changes, pre-strains and support settlements.

UNIT IV  Stiffness Method

Stiffness or Displacement equation - Member stiffness – Stiffness coefficients – Element and Global stiffness matrices - Transformations of stiffness matrices, load vectors and displacements vectors- Choice of displacements restricted to two - Analysis of continuous beams, frames, Analysis of simple plane truss, Problems with temperature changes, pre-strains and support settlements.

UNIT V  Approximate Method


TEXT BOOKS

REFERENCES

COURSE OUTCOMES

At the completion of the course students will be able

1. To analyze the indeterminate structures like beams and frames with different end conditions through various advanced and modern methods.
2. To solve the structural problems with matrix approach.
3. To do the plastic analysis for concrete structures.
4. To analyse the problems with approximate methods and compare the results.
5. To have a sound knowledge on the application of these methods in to practical problems.

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**COURSE OBJECTIVES**

The objectives of the course are
- To understand basic concepts in Disaster Management.
- To Understand Definitions and Terminologies used in Disaster Management.
- To Understand Types and Categories of Disasters.
- To Understand the Challenges posed by Disasters.
- To understand Impacts of Disasters Key Skills.

**UNIT I**

Introduction-Concepts and definitions: disaster, hazard, vulnerability, risks- severity, frequency and details, capacity, impact, prevention, mitigation.

**UNIT II**

Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); man-made disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

**UNIT III**

Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.
UNIT IV

Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT V

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.

TEXT BOOKS

REFERENCES

COURSE OUTCOMES
The student will develop competencies in
1. The application of disaster concepts to management
3. Ability to understand categories of disasters and
4. Realization of the responsibilities to society
5. Mitigate the people and make awareness during disasters.

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COURSE OBJECTIVES

- To demonstrate the model analysis to understand the structural elements behaviour.
- To determine the material properties of different cross sections, steel reinforcements, concrete, etc.
- To understand the behaviour of HPC, HSC and SCC.

LIST OF EXPERIMENTS

1. Model analysis
   a. Continuous beam
   b. Portal frame
2. Flexure test on beams of various cross sections.
3. Flexure test on Continuous beam.
4. Sand heap analogy
5. Modulus of Elasticity of concrete
6. Modulus of Elasticity of Steel by Ewing’s Extensometer
7. Modulus of Elasticity of Steel by Whitemore’s Strain Gauge
8. Modulus of Elasticity of Steel by Electrical Strain Gauge
9. Unsymmetrical bending
10. Concrete durability tests
11. Preparation of HPC using chemicals and test on HPC
12. Preparation of HSC using chemicals and test on HSC
13. Preparation of SCC using chemicals and test on SCC

REFERENCES


COURSE OUTCOMES

At the completion of the course students will be able
1. To understand the behaviour of steel elements for practical application.
2. To get experience in Modal analysis.
3. To understand the development of concrete for durability studies.
4. To determine the material property concrete and steel.
5. To check the property of special concrete like HSC, HPC, SCC, etc.
### COURSE OBJECTIVES

- This course enables the students in studying and understanding structural drawings by training them in doing the structural drawings themselves for various structural elements and systems.

### LIST OF EXERCISES

**Plate 1.** Draw cross section and longitudinal sections of a steel roof truss with Connection details as per SP:38–1987.

**Plate 2.** Draw cross section and longitudinal section of a welded plate girder as per SP: 6 (2) - 1962.

**Plate 3.** Draw cross section, longitudinal section and reinforcement details of bunkers as per IS 4995 (Part I&II): 1974.

**Plate 4.** Draw cross section, longitudinal section and reinforcement details of silos as per IS 5503 (Part I):1969.

**Plate 5 & 6.** Draw cross section, longitudinal sections and reinforcement of water tanks resting on ground details as per IS 3370 (Part IV): 1967 and SP:34-1987.

- a. Square or Rectangular
- b. Circular

**Plate 7 & 8.** Draw cross section, longitudinal sections of Underground water tanks and reinforcement details as per IS 3370 (Part IV): 1967 and SP:34- 1987.

- a. Square or Rectangular
- b. Circular

**Plate 9 &10.** Draw cross section, longitudinal section and reinforcement details of Elevated Rectangular and Circular water tanks as per IS 3370 (Part IV): 1967 and SP: 34- 1987.

**Plate 11.** Draw cross section, longitudinal section and reinforcement detailing of a RC grid floor as per IS 456: 2000.
TEXT BOOKS

REFERENCES

STANDARDS

COURSE OUTCOMES
At the completion of the course students will be
1. Having the knowledge of how to represent the detailing in the form of drawings for practical applications.
2. Draw the detailed drawings showing the truss structure and its connection details.
3. Able to gain experience/practice on Modern Software in Civil Engineering field.
4. Able to give detailing for the steel structures like truss, columns, water tanks, elevated water tanks, bracings, plate girders, bunkers and silos.
5. Able to understand the codal provisions for detailing and how to implement in the drawings.
Mapping of COs with POs

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SEMESTER VII

ETHS701 | PROFESSIONAL PRACTICE, LAW & ETHICS | L | T | P | C
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COURSE OBJECTIVES

- To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession

UNIT I Professional Practice and Ethics

Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/ Service agencies (role governed by contracts and regulatory Acts and Standards).

Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistle blowing, protected disclosures.
UNIT II  General Principles of Contracts Management

General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and subcontracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /“Red Flag” conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public-Private Partnerships; International Commercial Terms.

UNIT III  Arbitration, Conciliation and ADR

Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law –Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats.

UNIT IV  Engagement of Labour and Labour & other Construction related Laws

Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen’s Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017.

UNIT V  Law relating to Intellectual Property


TEXT BOOKS
2. The National Building Code, BIS, 2017

REFERENCES
1. RERA Act, 2017
16. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and
17. Application
19. Engineering Ethics, National Institute for Engineering Ethics, USA
20. www.ieindia.org
21. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
23. Internet and Business Handbook, Chap 4, CONTRACTS LAW,
25. Contract & Agreements
31. IV. TYPES OF CONTRACTS AND IMPORTANT PROVISIONS,
33. Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02),

COURSE OUTCOMES
1. To familiarise the students to what constitutes professional practice, introduction of various stakeholders and their respective roles; understanding the fundamental ethics governing the profession
2. To give a good insight into contracts and contracts management in civil engineering, dispute, resolution mechanisms; laws governing engagement of labour
3. To give an understanding of Intellectual Property Rights, Patents.
4. To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession
5. To develop good ideas of the legal and practical aspects of their profession
The objective of this Course is

- To understand instrumentation, sensor theory and technology, data acquisition, digital signal processing, damage detection algorithm, life time analysis and decision making.
- To understand the theoretical and practical principles of design of sensor systems.
- To provide principle knowledge, practical training and measurement best practice for a range of temperature, pressure, electrical, velocity, acceleration and vibration systems.

UNIT I  Fundamentals of Measurement, Sensing and Instrumentation
Definition of measurement and instrumentation, physical variables, common types of sensors; - LVDT - Describe the function of these sensors; Use appropriate terminology to discuss sensor applications; and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations.

UNIT II  Strain Gauges and Rosettes

UNIT III  Sensor Installation and Operation
i) Predict the response of sensors to various inputs; ii) Construct a conceptual instrumentation and monitoring program; iii) Describe the order and methodology for sensor installation; and iv) Differentiate between types of sensors and their modes of operation and measurement and v) Approach to Planning Monitoring Programs, Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Advanced topic, Sensor design, Measurement uncertainty
UNIT IV  Data Analysis and Interpretation
a) Fundamental statistical concepts, b) Data reduction and interpretation, c) Piezometer, Inclinometer, Strain gauge, etc. d) Time domain signal processing, e) Discrete signals, Signals and noise and f) a few examples of statistical information to calculate are: Average value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range)

UNIT V  Frequency Domain Signal Processing and Analysis
Explain the need for frequency domain analysis and its principles; Draw conclusions about physical processes based on analysis of sensor data; Combine signals in a meaningful way to gain deeper insight into physical phenomena, Basic concepts in frequency domain signal processing and analysis, Fourier Transform, FFT (Fast Fourier Transform), Example problems: Noise reduction with filters, Leakage, Frequency resolution

TUTORIALS
Demonstrating clearly the understanding and use for the sensors and instruments used for the problems posed and inferences drawn from the measurement and observations made along with evaluation report.

TEXT BOOKS
1. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann
2. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press

REFERENCES
2. Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer

COURSE OUTCOMES
1. To analyze the errors during measurements, specify the requirements in the calibration of sensors and instruments and to describe the noise added during measurements and transmission
2. To describe the measurement of electrical variables
3. To describe the requirements during the transmission of measured signals
4. To construct Instrumentation/Computer Networks
5. To suggest proper sensor technologies for specific applications and to design and set up measurement systems and do the studies

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COURSE OBJECTIVES

- This course aims at providing practical training in understanding the behaviour of the building elements subjected to earthquake.

A) INSTRUMENTATION AND SENSOR TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS

LIST OF EXPERIMENTS

- Instrumentation of typical civil engineering members/structures/structural elements
- Use of different sensors, strain gauges, inclinometers,
- Performance characteristics
- Errors during the measurement process
- Calibration of measuring sensors and instruments
- Measurement, noise and signal processing
- Analog Signal processing
- Digital Signal Processing
- Demonstration & use of sensor technologies

B) COURSE OBJECTIVES: (EARTHQUAKE ENGINEERING)

LIST OF EXPERIMENTS

1. Application of accelerometers and their use in structural models
2. Application of digital oscilloscope and their use in structural models
3. Application of signal converter and their use in structural models
4. Free vibration analysis of wooden, Steel and aluminium cantilever beam models.
5. Determination of viscous damping co-efficient for wooden, Steel and aluminium cantilever beam models.

REFERENCES


COURSE OUTCOMES

1. To analyze the errors during measurements, specify the requirements in the calibration of sensors and instruments and to describe the noise added during measurements and transmission
2. To construct Instrumentation/Computer Networks
3. To understand the dynamic properties.
4. To gain knowledge about the earthquake occurrence and resistance.
5. To analyse the structure under free and forced vibrations.

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COURSE OBJECTIVES
1. To encourage the students to study advanced engineering developments.
2. To Prepare and present technical reports.
3. To encourage the students to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

METHOD OF EVALUATIONS
1. During the seminar session each student is expected to prepare and present the topic on the relevant engineering project topics for duration of about 8 to 10 minutes.
2. In a session of 3 periods per week, 15 students are expected to present the seminar.
3. Each student is expected to present at least twice during the semester and the student is evaluated based on that.
4. At the end of the semester, he/she can submit a report on his/her topic of seminar and marks are given based on the reports.
5. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
6. Evaluation is 100% Internal.

COURSE OUTCOMES
1. The students know the advanced engineering developments.
2. Able to Prepare and present technical reports.
3. Able to use various teaching aids such as over head projectors, power point presentation and demonstrative models.
4. Able to present infront of the experts about a topic or technical matters.
5. Able to adapt themselves in the situation needed.
### COURSE OBJECTIVES
- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

### COURSE OUTCOMES
- On completion of the project work students will be in a position
  1. To take up any challenging practical problems and find solution by formulating proper methodology
  2. To carry out any experimental works on concrete and steel or any other construction material to know the behavior and properties
  3. Understand the modelling, analysis and design concepts by taking up a structure.
  4. Carry out a different projects like stadium, theatre, multiplex malls, etc for the analysis and design.
  5. Carry out water retaining structures, dams and bridges for the analysis and design.

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### Mapping of COs with POs

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### SEMESTER VIII

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COURSE OBJECTIVES

- To understand the interaction among various processes in the hydrologic cycle; application of fluid mechanics and use of computers in solving problems in hydraulic engineering
- To study types and classes of hydrologic simulation models and design procedures for safe and effective passage of flood flows for design of hydraulic structures
- To understand the basic aquifer parameters and estimate groundwater resources for different hydro-geological boundary conditions
- To understand application of systems concept, advanced optimization techniques to cover the socio-technical aspects in the field of water resources
- To apply the principles and applications of remote sensing, GPS and GIS in the context to hydrological extreme flood and drought events in water resources engineering.

UNIT I

Introduction - hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data. Precipitation - forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth-area duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India. Abstractions from precipitation - evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapo-transpiration, measurement of evapo-transpiration, evapo-transpiration equations, potential evapo-transpiration over India, actual evapo-transpiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.

UNIT II

Runoff - runoff volume, SCS-CN method of estimating runoff volume, flow duration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph surface water resources of India, environmental flows. Ground water and well hydrology - forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

UNIT III

Water withdrawals and uses – water for energy production, water for agriculture, water or hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.
UNIT IV

UNIT V
Dams and spillways - embankment dams: Classification, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams. Spillways: components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site.

TEXT BOOKS

REFERENCES

COURSE OUTCOMES
At the end of the course, students must be in a position to:
1. Understand the interaction among various processes in the hydrologic cycle; Apply the application of fluid mechanics and use of computers in solving a host of problems in hydraulic engineering
2. Study types and classes of hydrologic simulation models and design procedures for safe and effective passage of flood flows for design of hydraulic structures
3. Understand the basic aquifer parameters and estimate groundwater resources for different hydro-geological boundary conditions
4. Understand application of systems concept, advanced optimization techniques to cover the socio-technical aspects in the field of water resources
5. Apply the principles and applications of remote sensing, GPS and GIS in the context to hydrological extreme flood and drought events in water resources engineering.

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COURSE OBJECTIVES

- To understand the site characterization and geologic hazard identification and mitigation.
- To know the engineering properties of rock and unconsolidated materials in the characterization of geologic sites for civil work projects.
- To learn the quantification of processes such as rock slides, soil-slope stability, settlement, and liquefaction.
- To know the collection, analysis, and interpretation of geological data and information required for the safe development of civil works.

UNIT I

Introduction-Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, NIRM. Mineralogy- Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy, SEM, XRD., Rock forming minerals, megascopic identification of common primary & secondary minerals.

UNIT II


UNIT III

Outcrop and width of outcrop. Inliers and Outliers. Main types of discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures.

UNIT IV


UNIT V

Rock masses as construction material: Definition of Rock masses. Main features constituting rock mass. Main features that affects the quality of rock engineering and design. Basic element and structures of rock those are relevant in civil engineering areas. Main types of works connected to rocks and rock masses. Important variables influencing rock properties and behaviour such as Fresh rock Influence from some minerals. Effect of alteration and weathering. Measurement of velocity of sound in rock. Classification of Rock material strength. Core logging .Rock Quality Designation. Rock mass description. Geology of dam and reservoir site- Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures. Rock Mechanics- Sub surface 9investigations in rocks and engineering characteristics or rocks masses; Structural geology of rocks. Classification of rocks, Field & laboratory tests on rocks, Stress deformation of rocks, Failure theories and sheer strength of rocks, Bearing capacity of rocks.

TEXT BOOKS

REFERENCES

COURSE OUTCOMES
At the completion of the course students will understand
1. Site characterization and how to collect, analyze, and report geologic data using standards in engineering practice
2. The fundamentals of the engineering properties of Earth materials and fluids.
3. Rock mass characterization and the mechanics of planar rock slides and topples.
4. Soil characterization and the Unified Soil Classification System.
5. The mechanics of soils and fluids and their influence on settlement, liquefaction, and soil slope stability.

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COURSE OBJECTIVES
- To make the students conversant with the design procedures and practices of complex steel structures like industrial structures and Gantry girders as per IS 800 – 2007 procedures.

UNIT I

UNIT II
UNIT III
Design of gantry girder – Gantry supporting columns – Columns with battened plate –
column with cap plate details — Stepped columns – Moment Resistant Connections - Beam
and column connections – Beam to Beam connections – Braced industrial buildings – Un-
braced industrial frames– Base plate with anchor bolt details - Detailing as per IS 800 : 2007.

UNIT IV
Plastic analysis and design – Advantages and disadvantages – Plastic neutral axis –
Plastic modulus – Plastic moment of resistance – Shape factor – Load factor – Plastic hinge
– Collapse mechanisms – Theorems of plastic analysis – Analysis and Design of beams and
simple frames – Limitations – Plastic design Versus Elastic design. Design of castellated
beam for bending and shear.

UNIT V
Cold Form light gauge sections - Type of cross section, stiffened, multiple stiffened and
un-stiffened element, Design of light gauge compression, tension and flexural members as
per IS 802(Part 1 to 3):1995.

TEXT BOOKS

REFERENCES
New Delhi, 2012.

STANDARDS
1. IS800:2007, General Construction in Steel – Code of Practice, Bureau of Indian
Standards, New Delhi.
2. IS 875 (Part3): Wind Loads on Buildings and Structures, Bureau of Indian Standards,
New Delhi.
3. Teaching resource materials by INSDAG, Kolkata.
structural members in general building construction, Bureau of Indian Standards,
New Delhi.
5. IS 806:1968 Code of practice for use of steel tubes in general building construction,
Bureau of Indian Standards, New Delhi.
6. IS 4014 (Part I and II): 1967 Code of practice for steel tubular scaffolding, Bureau of
Indian Standards, New Delhi.
7. SP: 6 (2) – 1962, Hand book for structural Engineers, Steel beams and plate girders,
Bureau of Indian Standards, New Delhi.
steel, Bureau of Indian Standards, New Delhi.
9. IS codes for Aluminium Structures, IS:3908, 3909, 3921, 5384, 6445, 6476, 6475,
6449, 8147, Bureau of Indian Standards, New Delhi.
Design Loads (other than Earthquake), Bureau of Indian Standards, New Delhi.
COURSE OUTCOMES
At the completion of the course students will be able
1. To identify the different types of Steel sections available in the market.
2. To design of Connections and Different types of members which are subjected to various loads.
3. To do the plastic analysis and estimate its effects.
4. To design the PEB and Gantry girders.
5. To understand the cold form gauge sections and its applications.

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COURSE OBJECTIVES
- To make the students to expose with the design practices of elevated water tanks, deep beams, grid floors, flat slabs, concrete walls.
- To understand the force flow at the joints and design of joints.

UNIT I Water Tanks
Design of Elevated square, rectangular and circular shape water tanks with staging – Design includes cover slab; side wall, base slab, columns with staging as per IS 11992: 1995, Reinforcement detailing as per SP 34: 1987.

UNIT II Corbels and Deep Beams

UNIT III Grid Floors
Design of Ribbed (Voided Slabs), Design of Grid floors - Reinforcement detailing as per SP 34: 1987.

UNIT IV Flat Slabs
Design of Flat Slabs using Direct Design Method - Equivalent Frame Method - Reinforcement detailing as per SP 34: 1987.
UNIT V Shear Wall and B-C Joints

Design of Concrete Shear Walls - Design of concrete joints - Interior and exterior column beam joints - Reinforcement detailing as per SP 34: 1987.

TEXT BOOKS

REFERENCES

STANDARDS

COURSE OUTCOMES
At the completion of the course students will be able
1. To design the special structural elements as per relevant IS standards.
2. To design the grid floor and flat slabs as per codal recommendations.
3. To design the corbels and deep beams.
4. To understand the concept of force flow at the joints and design of joints.
5. To design the shear walls and its benefits.

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COURSE OBJECTIVES

- To impart knowledge on the layout, operations and design of Highways, Railways, Waterways and Airways transportation systems

UNIT I

Highway development and planning-Classification of roads, road development in India, Current road projects in India; highway alignment and project preparation.

UNIT II

Geometric design of highways- Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems

UNIT III

Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems

UNIT IV

Pavement materials- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems

UNIT V

Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems

TEXT BOOKS


REFERENCES

1. Partha Chakraborty, “Principles Of Transportation Engineering”, PHI Learning,

COURSE OUTCOMES

On completion of the course, the students will be able to:
1. Carry out surveys involved in planning and highway alignment
2. Design the geometric elements of highways and expressways
3. Carry out traffic studies and implement traffic regulation and control measures and intersection design
4. Characterize pavement materials and
5. Design flexible and rigid pavements as per IRC
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COURSE OBJECTIVES

- To inculcate the basics of pre-stressing techniques to understand the design concepts used for design of bridge structures.

UNIT I


UNIT II

Flexural strength – Simplified procedures as per codes – Strain compatibility method – Basic concepts in selection of cross section for bending - Design of sections as per code for pre-tensioned and post-tensioned rectangular beams – Check for strength limit based on IS:1343-2012 – Design for shear based on IS:1343-2012. Design of anchorage zone reinforcement (end block)

UNIT III

Composite Sections – Types – Advantages - Analysis of stresses for composite sections – Analysis and Design – Flexural and shear strength of composite members – Shear key.

UNIT IV

Factors influencing deflections – Effect of tendon profile on deflections –Calculation of deflections –Short term deflections of un-cracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit state of deflection and crack width.
Continuous beams - Method of achieving continuity - Analysis - Concordant cable and linear transformation

UNIT V


TEXT BOOKS


REFERENCES


COURSE OUTCOMES

At the completion of the course students will be able to
1. Gain knowledge on methods of pre-stressing.
2. Design various Pre-stressed concrete structural elements.
3. Understand the deflection criteria and its Codal recommendations.
4. Understand the concepts of composite section and its analysis.
5. Design the cables and tendons profile for prestressing and also to design the concrete pipes, circular tanks, railway sleepers, etc.

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COURSE OBJECTIVES

- To make the students conversant with basic principles of water supply engineering.
- To know quantification of water, analysis, sources, conveyance, treatment and distribution of water.

UNIT I Water

Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design. Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes

UNIT II Sewage

Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes.

UNIT III Air

Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution automobile pollution, Chemistry of combustion, Automobile engines, quality of fuel, operating conditions and interrelationship. Air quality standards, Control measures for Air pollution, construction and limitations. Noise- Basic concept, measurement and various control methods.

UNIT IV Solid Waste Management

Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes, Effects of solid waste on environment: effects on air, soil, water surface and ground health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle. Disposal methods- Integrated solid waste management. Hazardous waste: Types and nature of hazardous waste as per the HW Schedules of regulating authorities.

UNIT V Building Plumbing

Introduction to various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used. Government authorities and their roles in water supply, sewerage disposal. Solid waste management and monitoring/control of environmental pollution.
TEXT BOOKS

REFERENCES

COURSE OUTCOMES
After successfully studying this course, students will:
1. Understand the impact of humans on environment and environment on humans
2. Be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
3. Be able to plan strategies to control, reduce and monitor pollution.
4. Be able to select the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air.
5. Be conversant with basic environmental legislation.

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COURSE OBJECTIVES
- To understand the concepts of designing bridges deck slab, concrete Pipes, bunkers and silos and chimneys with relevant codal standards.
UNIT I

UNIT II
Machine Foundations - Types - General Requirements - Design Parameters - Design Criteria and Codal Provisions for Reciprocating and Rotary Type Machines as per IS 2974 (Part I to IV ).

UNIT III
Design of prestressed bridges for Buried Concrete Pipes to Carry Water and Gas as per relevant codes – Design of Post tensioned Concrete slabs - Design of Post tensioned Concrete T section Girders as per IS 1343:2012.

UNIT IV

UNIT V
Design of concrete Chimneys as per IS 4998(Part I):1992 - Stresses in chimneys - Reinforcement detailing as per relevant codes.

TEXT BOOKS

REFERENCES

STANDARDS
2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code of Practice, Bureau of Indian Standards, New Delhi
3. SP 34: 1987, Handbook on Concrete Reinforcement And Detailing, Bureau of Indian Standards, New Delhi
4. IRC: 6-2014, Standard Specifications and Code of Practice for Road Bridges Section: II ( Loads And Stresses), Indian Roads Congress , New Delhi
5. IRC 21: 2000, Standard Specifications and Code of Practice for Road Bridges Section: III [Cement Concrete (Plain And Reinforced)], Indian Roads Congress , New Delhi
10. IS 2974 ( Part IV) :1979, Code of Practice for Design and Construction of Machine Foundations (Foundations for Rotary Type Machines of Low Frequency), Bureau of Indian Standards, New Delhi
12. IS 4995 ( Part II ) :1974, Criteria for Design of Reinforced Concrete Bins for Storage of Granular and Powdery Materials (Design Criteria), Bureau of Indian Standards, New Delhi
13. IS 9178 ( Part II ) :1979, Criteria for Design of Steel Bins for Storage of Bulk Materials (Design Criteria), Bureau of Indian Standards, New Delhi
14. IS 5503 (Part I) :1969, General Requirements for Silos for grain storage (Construction requirements), Bureau of Indian Standards, New Delhi

COURSE OUTCOMES
At the end of the course students will be able
1. To design the bridges deck slab as per Indian Standards.
2. To design concrete Pipes as per the codal provisions.
3. To design bunkers, silos and chimneys with relevant IS standards.
4. To provide the detailing of reinforcements as per Codal recommendations.
5. To design the machine foundation and its detailing.

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COURSE OBJECTIVES
- To develop furtherance of knowledge about advances in concrete technology.
- To introduce concept of mix design for special concretes.
- To develop the principles of special concreting techniques and non destructive testing procedures for concrete structures.
UNIT I

UNIT II

UNIT III

UNIT IV

UNIT V
Scanning Electron Microscopy (SEM) and X-ray microanalysis to examine cement, mortar concrete - Techniques of SEM and X-ray microanalysis- Simple imaging of fracture surfaces -Advanced techniques using X-ray microanalysis and digital image analysis on polished sections. X-ray spectra of cement clinker minerals and cement hydration products. Identify deleterious process in concrete, including alkali-silica reaction and sulphate attack- Interpretation of example images and X-ray spectra of the principal causes of damage to concrete.

TEXT BOOKS

REFERENCES

COURSE OUTCOMES
At the completion of the course students will be able
1. To understand about various types of special concretes and testing techniques.
2. To understand the principles of special concreting techniques and non destructive testing procedures for concrete structures.
3. To prepare and recommending special concrete using admixtures.
4. To understand the behaviour of microstructure of concrete.
5. To understand the concepts of SEM analysis and X-ray micro analysis.
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COURSE OBJECTIVES

- Masonry structures need not always be less strong in comparison to structures constructed with other materials.
- If proper principles of analysis and design are scientifically adopted and innovative approach is followed, masonry structures can be as strong and functional as other structures.
- This course deals with the scientific approach to be followed in the design of masonry structures.

UNIT I

Historical development – Classification of masonry construction – Codes and standards – Types of masonry walls – Bricks, Mortar, Grout and Steel reinforcement – Characteristics and Requirements – Loads types and intensities – Basic design data.

UNIT II


UNIT III


UNIT IV


UNIT V

High-rise masonry – Design factors – Reinforcing details – Floor systems – Construction techniques.
TEXT BOOKS

REFERENCES

COURSE OUTCOMES
At the end of the course students will be able
1. To understand the scientific approach to be followed in the design of masonry structures.
2. To analyse the application masonry materials and design related to civil engineering problems.
3. To know the testing of masonry structures.
4. To know where and how to construct the expansion joints in brick masonry structures.
5. To design the prestressed brick masonry structures.

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COURSE OBJECTIVES
- To study and understand the overall and detailed planning of formwork, plant and site equipment.
- To understand the Design and erection of forms for various elements such as slabs, beams, columns, walls, shells and tunnels.
- To know the latest methods of form construction.

UNIT I
Definition – Economy of formwork and scaffolding – Care of formwork material – Type of form work materials - Allowable stresses in formwork materials – Factors affecting selection of scaffolding and formwork systems – Equipments -.General objectives of formwork building - Planning for safety - Planning for maximum reuse- Scaffold frames.
UNIT II
Qualities of formwork and scaffolding – Types of formwork – Types of scaffolding: Putlog and independent scaffold -Single pole scaffolds - Truss suspended - Gantry and system scaffolds - Stages in formwork and scaffold – Formwork and Scaffold details for different structural members - Maintenance and Cost of formwork, scaffolding– Advantages of formwork and scaffold – Loads on formwork and scaffolds - Forms for foundations, columns, beams walls etc - Formwork hours- Formwork accessories - Formwork elements.

UNIT III
Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Slenderness ratio - Allowable load vs. length behaviour in forms - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Allowable withdrawal load and lateral load -. Various causes of failures - ACI – Design and deficiencies.

UNIT IV
Pressure of concrete on formwork and scaffolding – Lateral pressure of concrete on formwork and scaffolding – Failures of formwork and scaffolding in different structural members- Pressures on formwork - Examples - Vertical loads for design of slab forms - Laterals loads on slabs and walls.

UNIT V
Hemispherical, Parabolic, Translational shells - Forms for Thin Shell roof slabs design considerations - Building the forms - Placing concrete - Form removed -Strength requirements -Tunnel forming components - Curb forms invert forms - Arch forms - Concrete placement methods - Cut and cover construction - Bulk head method - Pressures on tunnels - Continuous Advancing Slope method - Form construction – Shafts - Slip Forms - Principles -Types - advantages - Functions of various components - Planning -Desirable characteristics of concrete - Common problems faced - Safety in slip forms special structures built with slip form Technique.

TEXT BOOKS
2. Safety requirements for scaffolding, American National standards Institute; Broadway; New York.

REFERENCES
1. Awad S. Hanna ; Concrete formwork systems ; Prentice Hall Inc., New Jersey USA 2003.

COURSE OUTCOMES
At the end of the course students will be able
1. To know the detailed planning of framework, design of forms and erection of form work.
2. To select the timbers and wooden planks with quality.
3. To have an idea of scaffolding fabrication for different works.
4. To check the formworks and scaffolding works and to check the stability before concreting.
5. To design the formwork and scaffolding works for different shapes to make paraboloid, shell and cylindrical structures.
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COURSE OBJECTIVES

- To understand the concept of different structural systems used for tall structures.
- To understand the types and principles of analysis and design of tall structures.

UNIT I


Structural and non-structural systems – Structural system idealisations - Floor slab systems (wall supported slab system, Beam supported slab system, Ribbed slab system, Flat slab system). Vertical framing system (Columns, concrete walls, transfer girders, Suspenders) – Composite floor systems Modelling for gravity and lateral loads – Assumptions – Modelling for approximate analyses – Modelling for accurate analysis.

UNIT II

Lateral load resisting systems – Behaviour of Rigid frames, Behaviour of Braced Rigid frames, Behaviour of shear wall with Rigid frames, Behaviour of framed-tubes, Behaviour of tube in tube, Behaviour of bundled tubes – Behaviour of In-filled frame structures

UNIT III

Analysis and design concepts of Rigid frames, Rigid frames with bracings, Rigid frames with shear walls, framed-tubes, tube in tube and bundled tubes.

UNIT IV

UNIT V


TEXT BOOKS


REFERENCES


STANDARDS

3. SP:64 (S&T)-2001 Design Loads (other than earthquake) for Buildings and Structures, Bureau of Indian Standards, New Delhi.

COURSE OUTCOMES

At the completion of the course students will be able to

1. Gain the knowledge about the behaviour of tall buildings subjected to lateral loads and their stability.
2. Design the tall buildings as per the existing codes.
3. Check the stability of the structures under the present and expected loading conditions.
4. Do the dynamic analysis of a structure to withstand the present and expected loadings.
5. Estimate the natural frequencies and damping of a structure.
Mapping of COs with POs

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COURSE OBJECTIVES

- To impart basic knowledge on design of foundations and its behaviours under different soil conditions to carry out proper foundation design.

UNIT I


UNIT II


Settlement of foundations – Immediate, consolidation and secondary(creep) Settlements – Elastic Settlement of footings – Correction for depth and width of foundation - Determination of total Settlement of foundations on cohesion-less and cohesive soils as per relevant IS standards – Total and differential settlements – Allowable settlements as per relevant IS standards – Methods of minimizing total and differential settlements.
UNIT III

Contact pressure distribution on base of footings under rigid and flexible footings - Modulus of sub-grade reaction on rigid and flexible footings – Problems on contact pressure distributions beneath the isolated, combined, strap and mat foundations for axial and eccentric column loads. Draw shear force and bending moment diagrams using appropriate contact pressures beneath the foundations.

UNIT IV

Types of piles and their function – Factors influencing the selection of pile – Ground heave and pile heave effects- Effective length – Point of inflection – Load carrying capacity of single pile in cohesion-less or granular and cohesive soils as per relevant IS standards – Static formula – Dynamic formulae (Engineering news and Hiley’s) – Capacity from in-situ tests (SPT and SCPT) – Negative skin friction – Uplift capacity - Group capacity by different methods – Settlement of pile groups – Interpretation of pile load test (routine test only) – Under reamed piles – Capacity under compression and uplift.

UNIT V

Plastic equilibrium in soils – Active and passive states – Rankine’s theory – Cohesionless and cohesive soil – Coulomb’s wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations with and without surcharge and traffic loads – Culmann Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls.

TEXT BOOKS


REFERENCES


STANDARDS


COURSE OUTCOMES
At the completion of the course students will be able
1. To select type of foundation required for the soil at a place and able to design shallow, foundation, deep foundation and retaining structures.
2. To calculate the safe bearing capacity of soils.
3. To advise the type of foundation suitable for the particular soil type.
4. To know the tests required to conduct for the soil type and how to carry out those tests.
5. Calculate the properties of soils and to estimate the optimum levels for recommending the foundation sizes.

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COURSE OBJECTIVES
• To learn the analysis of structures with a versatile technique finite element methods which can accommodate variations in material and engineering properties and can tackle multilayered systems and non linearity with ease.

UNIT I

UNIT II
Finite Element types – Displacement Function - Natural Coordinates – Shape Functions – Shape functions for truss elements in local and global coordinates - Shape function for beam and frame elements, Triangular elements (CST and LST elements), Rectilinear Isoparametric elements, Solid elements.
UNIT III
Element stiffness formulation for truss elements in local and global coordinates, beams, CST elements, Load vectors for gravity, surface and body forces.

UNIT IV
Numerical Integration for evaluation of element stiffness – Load vectors- Computation of stresses. Use of Static Condensation Techniques, Axi-symmetric elements, Sub-structuring, Plate bending and shell elements.

UNIT V
Pre and Post Processing – Modelling techniques – Complete algorithms with flow chart for solving FEM problems - Solution Techniques – Linear analysis-Non-linear analysis both material and geometric non-linearity Use of Finite element software packages such as ANSYS, SAP 2000N, STAAD Pro, ETABS, ABAQUS, MSC/NASTRAN, etc.

TEXT BOOKS

REFERENCES

COURSE OUTCOMES
At the completion of the course students attains
1. The knowledge of solving physical problems using finite element softwares.
2. To develop computer coding for any structural problem and creating software packages.
3. The knowledge in solving practical problems by global stiffness matrix approaches for truss, beam, etc.
4. The knowledge of modelling techniques of the problems.
5. The knowledge of using FEM softwares for the practical problems and to find the solution.
### Mapping of COs with POs

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### COURSE OBJECTIVES

- To make the students to understand Earthquake and Wind excitations are two major dynamic loadings to be considered for many modern civil engineering structures.
- To understand the seismic loadings to ensure the safety and serviceability of structures.

**UNIT I**

Elements of Earth, core, mantle and crust- Engineering Seismology, Plate tectonic theory, originations of earthquake- Volcanic and tectonic origins, Faults, Dips, slips in crust, seismic zoning map of India & its use.

Earthquake Effects: Land and rock slides, Liquefaction, Fires, Tsunamis, Floods, Release of poisonous gases and Radiation.

Earthquake Phenomenon: - Focus epicentre, Seismic waves, Magnitude, intensity, Richter scale, MM scale, Earthquake recording instruments, and Seismic resistant design guidelines

**UNIT II**


**UNIT III**

Forced Vibration Analysis (Harmonic loading) of Single Degree of freedom systems with and without damping under harmonic excitations, Forced vibration response to harmonic base excitation. Formulation of Response Spectrum, Design Response spectrum as per IS:1893, simple problems using the above response spectrums. Forced vibration analysis of
multi Degrees of freedom systems (restricted to two degrees of freedom only) using modal
superposition technique.

**UNIT IV**

Analysis of building frames, Equivalent static method as per IS: 1893- Dynamic
analysis using mode superposition concept- Push over analysis. Modelling of Building
Frames with Brick and Concrete Walls- Centre of Mass locations- Centre of Stiffness
locations- Orientation of Shear walls.

**UNIT V**

Philosophy and Principles of Earthquake Resistance design- Strength and Stiffness,
Ductility Design and Detailing (IS 13920: 1993), Concept of Energy Absorbing Devices,
Concepts of Seismic Base isolation technique and Seismic Active control methods. Lessons
learnt from the Past Earthquakes - Case studies of important Indian Earthquakes, Major
world Earthquakes.

**TEXTBOOKS**

1. Dowrick, D.J., “Earthquake Resistant Design, John Wiley & Sons”, Winchester, U.K.,
   1977.

**REFERENCES**

   Delhi, 1998.
3. Kiyoshi Muto, “Earthquake Resistant Design of Tall Buildings in Japan”, University of
   Handbook Advances in Earthquake Engineering”, Computational Mechanics Inc, Billerica
   1997.
5. Hiroshi Akiyama, “Earthquake Resistant Limit State Design for Buildings”,University of

**STANDARDS**

1. IS 1893:2002 Criteria for Earthquake Design of Structures, Bureau of Indian Standards,
   New Delhi.
2. IS 4236:1976 Code of Practice for Earthquake Resistant Design and Construction of
   Buildings, Bureau of Indian Standards, New Delhi.
3. IS 13920: 1993 Ductile Detailing of Reinforced Concrete Structures Subjected to
   Seismic Forces Code of Practice, Bureau of Indian Standards, New Delhi.
4. SP: 22- 1982 Explanatory Handbook on Codes for Earthquake Engineering, Bureau of
   Indian Standards, New Delhi.
5. IS 1382: 1993 Guidelines for Improving Earthquake Resistance of Earthen Buildings
   Bureau of Indian Standards, New Delhi.
   Buildings, Bureau of Indian Standards, New Delhi.
7. IS 13935: 1993 Guidelines for Repair and Seismic Strengthening of BuildingsBureau of
   Indian Standards, New Delhi.
8. SP:24 (S&T) - 1983 Explanatory Handbook on Indian Standard Code of Practice for Plain
   and Reinforced Concrete (IS 456:2000), Bureau of Indian Standards, New Delhi.
COURSE OUTCOMES
At the completion of the course students will be able
1. To design the earthquake resistance structures.
2. To understand the behaviour of structure during earthquake.
3. To recommend the materials used for construction in the earthquake prone areas.
4. To analyze the building frames for dynamic loadings.
5. To provide the detailings of reinforcement for seismic analysis.

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Mapping of COs with POs

CZOE802 REPAIR AND REHABILITATION OF STRUCTURES

UNIT I

UNIT II

UNIT III
UNIT IV


UNIT V


TEXT BOOKS


REFERENCES


COURSE OUTCOMES

At the completion of the course students will be able
1. To understand about the mechanics of deterioration of concrete.
2. To estimate and analyze the degree of damage by testing methods.
3. To identify the repairs and suitable repair methods and materials.
4. To gain the knowledge about rehabilitation and retrofitting of structural members.
5. To understand the repair and strengthening of RC structures with reasonable cost.

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COURSE OBJECTIVES

- The objective of this course is to provide basic knowledge relating to the behaviour of concrete under flexure, shear and torsion in isolation and in combination.
- The serviceability issues are also included in the course.

UNIT I


UNIT II


UNIT III


UNIT IV


UNIT V

Detailing of reinforcements – Beams – Columns – beam- column connections –corbels – deep beams. Concrete cover-Fire Rating as per IS specification.

TEXT BOOKS

1. Robert Park & Thomas Paulay, Reinforced Concrete Structures, John Wiley & Sons, 1975

REFERENCES


<table>
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<tr>
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<tr>
<td>- As modern structures are becoming more slender and light, they are also becoming more susceptible to dynamic loadings.</td>
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<td>- Examples of real-life dynamic problems that frequently confront civil engineers include: aerodynamic stability of long-span bridges, earthquake response of multi-storey buildings, impact of moving vehicles on highway structures, etc.</td>
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<td>- The traditional engineering solutions to these problems, based on “static force” and “static response”, are no longer valid in most cases.</td>
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<td>- Many of these problems have to be tackled by applying knowledge of structural dynamics.</td>
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<td>- Thus, a basic understanding of the dynamic behaviour of structures as well as the underlying principles is essential for structural engineers</td>
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| UNIT I | Dynamics Systems |
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| UNIT II | Discrete Systems |
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| UNIT III | Discrete Systems |
|-------------------|
UNIT IV  Force vibrations


UNIT V  Continuous Systems


TEXT BOOKS

REFERENCES

COURSE OBJECTIVES

- Bridge engineering is a specialized area in structural engineering practice. In this course, the students are taught the IRC loading standards and analysis and design of different types of bridges.

UNIT I


UNIT II

Pipe culverts - General features - Classification - Analysis and design of Pipe Culvert. Box culverts – General features - Analysis and design of Box culverts as per IRC: 6-2014 and IRC 21: 2000.
UNIT III


UNIT IV


UNIT V

Segmental bridges - Segmental bridge design, design for flexure Guidelines as per IRC 18-2000 and detailing as per SP-65:2005. Bridge bearings - Plate, Roller and Rocker bearings - Elastomeric bearings as per IRC: 83(Part I)-1999 and IRC 83(Part II)-1987).

TEXT BOOKS


REFERENCES


STANDARDS

2. IS 13920: 1993, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces -Code of Practice
3. SP 34: 1987, Handbook on Concrete Reinforcement And Detailing.
5. IRC 21: 2000, Standard Specifications and Code of Practice for Road Bridges Section: III[Cement Concrete (Plain And Reinforced)].

COURSE OBJECTIVES

- To develop an understanding of the behavior and design study of Steel concrete composite elements and structures.
UNIT I
Introduction to composite construction – Basic concepts – Types of composite materials - Application of composite construction in Civil Infrastructure – Durability – Physical and Mechanical properties of composite structures – Influence of moisture at consistent level in composite structure – Construction of composite structures.

UNIT II

UNIT III
Introduction – Combustion of Polymer Composites – Fire reaction properties of Polymer Composites – Fire resistant Polymer Composites – Structural properties of Polymer Composites in Fire – Fire protection coatings – Predictive Modelling of Fatigue – Descriptive Modelling of Fatigue.

UNIT IV

UNIT V

TEXT BOOKS

REFERENCES
4. Lawrance C. Bank, Composite Construction, John Weiley sons & inc, USA, 2006
COURSE OBJECTIVES

- This course provides a brief introduction to the analysis of folded plates and knowledge about the formation and classification of shell structures. Preliminary design is also included.

UNIT I

Introduction to plate structures - Thin and thick plates - Structural action of plates – Assumptions involved in plate theories - Differential equation for cylindrical bending of plates – Cylindrical bending of uniformly loaded rectangular plates with simply supported and built-in edges – Small deflection theory of laterally loaded rectangular plates - Kirchoffs boundary conditions - Corner effects

UNIT II

Simply supported rectangular plates under Sinu-soidal load - Navier solution - Levys method - Symmetrical bending of laterally loaded circular plates - Circular plates with simply supported and built-in edges - Bending of annular plates.

UNIT III

Introduction to shell structures - Classification of shells - Membrane action - Stressed shell element and stress resultants - Load transfer mechanism - Characteristics of shell surfaces - structural behaviour of shells - Membrane theory of cylindrical shells

UNIT IV

Bending theory of circular cylindrical shells - Comparison of various bending theories - Introduction to other types of shells.

UNIT V

Necessary design inputs - Detailed design - Prismatic folded plates - Circular cylindrical barrel shell roofs - Spherical dome - Conical dome - HYPAR shell - Helicoids.

TEXT BOOKS


REFERENCES

4. 64 Bairagi N.K, Shell Analysis, Khanna Publishers, Delhi, 1986.
COURSE OBJECTIVES

- This course aims in understanding the concept of designing structures to withstand disaster.

UNIT I


UNIT II

Types – Design of Shear walls as per IS: 13920 – Detailing of reinforcements.

UNIT III


UNIT IV


UNIT V


TEXT BOOKS

1. Jaikrishna & Chandrasekar, Elements of Earthquake Engineering.

REFERENCES


**MINOR ENGINEERING ELECTIVES**

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**COURSE OBJECTIVES**

- To know the fundamentals of the construction of structures from the beginning to the end.
- To understand the construction projects planning and methods of execution, contracts and tendering, management methods and assessing the probability of completion.
- To know the various construction techniques involved in the execution of construction.
- To know the availability of various equipments used for the construction and their related problems.
- To manage the various activities of construction, project monitoring and control over the contracts.

**UNIT I Basics of Construction**

Unique features of construction, construction projects- types and features, phases of a project, agencies involved and their methods of execution; Construction project planning- Stages of project planning: pre-tender planning, preconstruction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.
UNIT II Construction Methods

Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.

UNIT III Construction Equipments

Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities. Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffimg, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction.

UNIT IV Project Monitoring & Control

Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost over runs and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

UNIT V Contracts Management

Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price). Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination, Changes & variations, Dispute Resolution methods - Construction Costs: Make-up of construction costs; Classification of costs, time-cost trade-off in construction projects, compression and decompression.

TEXT BOOKS


REFERENCES

COURSE OBJECTIVES

- High rise buildings are a pleasure to watch, but they are made a pleasure to live in only when the functional requirements are adequately provided through proper ventilation, sanitation and water supply in addition to safety measures during calamities like fire.
- This course covers the principles and practices to be followed in the provision of good service systems.

UNIT I
Planning of building services - Important considerations - Floor loadings - Building cost – Material requirements.

UNIT II
Water supply services - Collection and examination of water samples - Standards - Internal storage and distribution - Bulk water supply - Water treatment - Selection of pumps - Pump rooms and sump.

UNIT III
Sanitation services - Sewerage collection and disposal - Storm water drains - Sewage disposal - Septic tanks - Solid waste disposal - Refuse disposal systems.

UNIT IV
Lift and Escalators - Types - Selection - Codes and Rules - Structural provisions – Strength considerations - Pits and overheads - Safety precautions.

UNIT V

TEXT BOOKS

REFERENCES
COURSE OBJECTIVES

- To know the different products of smart materials
- To know the purpose of Piezoelectric Ceramics, Piezo-polymers, Magnetostrictive Materials, Electro active Polymers, Shape Memory Alloys, Electro and Magneto Rheological Fluids, Modelling of smart materials.
- To study about the composite smart materials, Mechanics of smart composite materials, Smart sensors based on high bandwidth low strain smart materials, Low-bandwidth high strain smart actuators, Micro-electro mechanical Smart Systems and Intelligent devices based on smart materials
- To know the applications of Smart Actuators, Active and Hybrid Vibration Control, Active Shape Control, Distributed Sensing and Control of Smart Beams.

UNIT I


UNIT II

Piezoelectric Strain Sensors, In-plane and Out-of Plane Sensing, Shear Sensing, Accelerometers, Effect of Electrode Pattern, Active Fibre Sensing, Magnetostrictive Sensing, Villari Effect, Matteuci Effect and Nagoka-Honda Effect, Magnetic Delay Line Sensing, Application of Smart Sensors for Structural Health Monitoring (SHM), System Identification using Smart Sensors.

UNIT III


UNIT IV

Review of Composite Materials, Micro and Macro-mechanics, Modelling Laminated Composites based on Classical Laminated Plate Theory, Effect of Shear Deformation, Dynamics of Smart Composite Beam, Governing Equation of Motion, and Finite Element Modelling of Smart Composite Beams.

UNIT V


TEXT BOOKS


REFERENCES

COURSE OBJECTIVES

• This course teaches the advancement in the subsoil stabilization in a modern approach
• The real problem, methods of improvement over such problems and the methodology are dealt.

UNIT I

Introduction - Methods of ground improvement - Geotechnical problems in alluvial, lateritic and Black Cotton soils - Selection of suitable ground improvement methods based on soil conditions.

UNIT II

Drainage and dewatering - Drainage techniques - Vacuum and electro - Osmotic methods – Seepage analysis for 2D flow fully and partially penetrating slots in homogeneous deposits.

UNIT III


UNIT IV

Earth reinforcement - concept - Types of reinforcing materials - Application of reinforced earth – Geo-textiles in filtration drainage - Separation and road works.

UNIT V


TEXT BOOKS


REFERENCES

COURSE OBJECTIVES

- This course helps the students to understand the elastic and plastic behaviours of engineering materials and to evaluate stresses and strains developed in materials more exactly.

UNIT I

Basic equations - Stress and strain at a point - Generalized Hooke's law - Plane stress and plane strain - Equilibrium conditions - Compatibility conditions. Two-dimensional problems in Cartesian Co-ordinates - Airys stress function.

UNIT II


UNIT III


UNIT IV


UNIT V


TEXT BOOKS


REFERENCE BOOKS

COURSE OBJECTIVES

- To enable students to develop knowledge on Urban and rural planning.
- To introduce the regulations and laws related to urban planning.
- To educate the importance of zoning in planning.
- To get to know the principles involved in planning public buildings.

UNIT I


UNIT II

Types of surveys–Collection of Data–Importance of zoning–Classification of Zoning–Use of zoning–Height zoning–Density zoning–Housing–Planning of neighbourhood units–Types of Layouts–Classification of housing–Housing problems in India.

UNIT III


UNIT IV


UNIT V


TEXT BOOKS


REFERENCES

Vision
To impart high quality education and technical expertise to the students and inculcate in them humanistic attitude, scientific temper, sense of commitment to the profession and spirit of participation in nation building.

Mission
M1 The ultimate goal of the Department of Civil and Structural Engineering is to provide quality education towards preparing nationally competitive students and trend-setters for the future generation in the realm of technical education.
M2 The student should be able to assimilate the available theories, explore new frontiers to propound new theories which will result in improving the quality of life of people.
M3 To develop their personality in a healthy way and to provide opportunities for acquiring knowledge in state-of-the-art research; and to provide service to the university, engineering profession, and the public through consultancy services.
M4 To provide students with hands-on training in latest technologies with supporting softwares.
M5 To facilitate effective interactions among faculty and students and foster networking with alumni, industries and other reputed institutions.

Programme Educational Objectives (PEOs)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>PROGRAMME EDUCATIONAL OBJECTIVES</th>
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<tbody>
<tr>
<td>PEO1</td>
<td>To develop the technical and engineering skills of the students and to train them in applying fundamental principles in the field of Structural Engineering domain feeding the needs of global expectations with professional competence.</td>
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<tr>
<td>PEO2</td>
<td>To enable the graduates to apply sustained learning, their engineering skills and adopting to multidisciplinary situations through graduate work.</td>
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<tr>
<td>PEO3</td>
<td>To expose the students to the latest innovations and trends in the field of Structural Engineering in theory, professional development and self-study in Structural Engineering and Practice and tuning the academic programmes periodically to make the students fit for a professional job, a research assignment or self-employment.</td>
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<tr>
<td><strong>PO1</strong></td>
<td><strong>Engineering knowledge:</strong> Apply the knowledge of Civil and Structural Engineering fundamentals to identify, formulate and present solutions to technical problems in their field of expertise.</td>
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<tr>
<td><strong>PO2</strong></td>
<td><strong>Problem analysis:</strong> Identify, formulate, review research literature and analyse complex engineering problems reaching substantiated conclusions using the concepts of that required advanced knowledge within the field.</td>
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<td><strong>PO3</strong></td>
<td><strong>Design / Development of solutions:</strong> Design solutions for Structural engineering related engineering problems and design system components or processes that meet the desired specifications.</td>
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<td><strong>PO4</strong></td>
<td><strong>Conduct investigations:</strong> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid concussions.</td>
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<td><strong>PO5</strong></td>
<td><strong>Modern tool usage:</strong> Create, select and apply appropriate techniques, resources and modern engineering tools including prediction ad modelling to Structural analysis activities with an understanding of the limitations.</td>
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<td><strong>The engineer and society:</strong> Apply reasoning informed by the contextual knowledge and impact of Structural systems and engineering solutions to the society and the consequent responsibilities relevant to the professional engineering practice.</td>
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<td><strong>PO7</strong></td>
<td><strong>Environment and sustainability:</strong> Understand the sustainability of design commutation systems with respect to environmental and social issues by their knowledge of contemporary issues in their expertise.</td>
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<td><strong>PO8</strong></td>
<td><strong>Ethics:</strong> Apply ethical principles and commit to professional ethics and responsibilities and norms of the structural engineering practice.</td>
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**Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.

**Communication:** Communicate professionally and technically on complex engineering activities with their peer engineering community and society in an effective way, such as, being able to comprehend effective reports and design documents, make effective presentations and make and execute clear instructions.

**Project management and finance:** Demonstrate the knowledge and understanding of the engineering principles by applying the gained knowledge, to manage projects and in multidisciplinary environments.

**Life-long learning:** Recognize the need, adopt themselves for the preparation and ability to engage in independent life-long learning wholly to the demands of the communication and technical changes.

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**M.E. (STRUCTURAL ENGINEERING) FULL TIME**

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M.E. (STRUCTURAL ENGINEERING) PART TIME

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### SEMESTER IV

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### ADVANCED STRUCTURAL ANALYSIS

**CZSEPC11**

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### COURSE OBJECTIVES

- To make the students obtain influence coefficients for hyperstatic structures.
- To enable the students apply stiffness method to discrete structures.
- To train the students for solving planar structures by member and structure approaches.
- To familiarise the students with solving simple boundary value problems.
- To provide a basic understanding of the finite element method.

### Influence Coefficients

- Physical Significance - Effects of Settlements - Temperature Change and Lack of Fit - Member Approach and Structure Approach.

### Stiffness Method applied to Large Frames

- Local Coordinates and Global Coordinates - Stiffness Matrix Assembly of Structures: Stiffness Matrix in Global Coordinates - Boundary Conditions - Solution of Stiffness Matrix Equations - Calculation of Reactions and Member Forces.

### Applications to Simple Problems

- Beams - Plane Trusses - Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.

### Boundary Value Problems (BVP)

- Approximate Solution of Boundary Value Problems - Modified Galerkin Method for One-Dimensional BVP - Matrix Formulation of the Modified Galerkin Method.

### Linear Element

- Shape Functions - Solution for Poisson’s Equation - General One Dimensional Equilibrium Problem.
REFERENCES

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Obtain influence coefficients for hyperstatic structures
2. Apply stiffness method to discrete structures
3. Analyze planar structures by member and structure approaches
4. Solve simple boundary value problems
5. Understand the basics of finite element method.

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CZSEPC12 ADVANCED SOLID MECHANICS

COURSE OBJECTIVES
- To introduce the fundamentals of elasticity.
- To familiarise the students with the equations of elasticity.
- To train the students for solving 2D problems of elasticity.
- To enable the students solve torsion problems in bars and thin tubes.
- To provide a basic understanding of plasticity.

Introduction to Elasticity
Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity. Strain and Stress Field: Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.

Equations of Elasticity
Equations of Equilibrium, Stress-Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.
Two-Dimensional Problems of Elasticity


Torsion of Prismatic Bars

Saint Venant’s Method, Prandtl’s Membrane Analogy, Torsion of Rectangular Bar and Torsion of Thin Tubes.

Plastic Deformation


REFERENCES


COURSE OUTCOMES

At the end of the course, the student will be able to:
1. Understand the fundamentals of elasticity.
2. Apply the equations of elasticity.
3. Solve 2D problems of elasticity.
4. Solve torsion problems in bars and thin tubes.
5. Understand the basics of plasticity.

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COURSE OBJECTIVES

1. To train the students towards identifying research problems.
2. To familiarise the students with technical paper and research proposal writing.
3. To familiarise the students with patenting.
4. To make the students understand the patent rights.
5. To familiarise the students with new developments in IPR.

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.


New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Identify good research problems.
2. Write sound technical papers and research proposals.
3. Understand the concepts of patenting.
4. Understand the patent rights.
5. Utilise the new developments in IPR.

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Mapping Course Outcomes(Cos) with Programme Outcomes (Pos)
COURSE OBJECTIVES

- To introduce the fundamentals of structural analysis, design and detailing.
- To familiarise the students with the analysis of symmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software.
- To familiarise the students with the analysis of unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software.
- To familiarise the students with the analysis of symmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software.
- To familiarise the students with the analysis of unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software.

LIST OF EXPERIMENTS

1. Analysis of Symmetrical Building Frames (Gravity load only) using STADD PRO Software.
2. Analysis of Symmetrical Building Frames (Wind load only) using STADD PRO Software.
3. Analysis of Symmetrical Building Frames (Earthquake load only) using STADD PRO Software.
4. Analysis of Un-Symmetrical Building Frames (Gravity load only) using STADD PRO Software.
5. Analysis of Un-Symmetrical Building Frames (Wind load only) using STADD PRO Software.
6. Analysis of Un-Symmetrical Building Frames (Earthquake load only) using STADD PRO Software.
7. Analysis of Symmetrical Building Frames (Gravity load only) using Etabs Software.
8. Analysis of Symmetrical Building Frames (Wind load only) using Etabs Software.
9. Analysis of Symmetrical Building Frames (Earthquake load only) using Etabs Software.
10. Analysis of Un-Symmetrical Building Frames (Gravity load only) using Etabs Software.
11. Analysis of Un-Symmetrical Building Frames (Wind load only) using Etabs Software.
12. Analysis of Un-Symmetrical Building Frames (Earthquake load only) using Etabs Software.

COURSE OUTCOMES

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

1. Understand the codal provisions relating to structural design and detailing.
2. Analyse symmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software.
3. Analyse unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software.
4. Analyse symmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software.
5. Analyse unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software.

Mapping Course Outcomes (Cos) with Programme Outcomes (Pos)

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CZSECP 17 ADVANCED CONCRETE LAB

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**COURSE OBJECTIVES**

1. To introduce the fundamentals of concrete mix design.
2. To familiarise the students with Stress - Strain Curves for concrete and Reinforcing Steel.
3. To make the students understand the flexural behaviour of RC Beams.
4. To make the students understand the shear behaviour of RC beams.
5. To familiarise the students with non-destructive testing on concrete elements.

**LIST OF EXPERIMENTS**

1. Concrete Mix Design - IS and ACI Methods
2. Study of Stress - Strain Curve for concrete
3. Study of Stress - Strain Curve for Reinforcing Steel
4. Flexure Test on RC Beam
5. Shear Test on RC Beam
6. Study on Rolled Steel Joist
7. Bending Test on Steel Flat
8. Non-destructive Testing

**REFERENCES**

3. IS 10262:2019, Recommended Guidelines for Concrete Mix Design, BIS, New Delhi
4. IS 13920:1993, Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces, BIS, New Delhi
5. SP 34:1987, Handbook on Concrete Reinforcement and Detailing, BIS, New Delhi.
COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Understand the fundamentals of concrete mix design.
2. Design concrete mixes using national and international codes of practice.
3. Understand the flexural behaviour of RC beams.
4. Understand the shear behaviour of RC beams.
5. Conduct non-destructive testing on concrete elements.

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COURSE OBJECTIVES
- To introduce the fundamentals of concrete mix design.
- To familiarise the students with Stress - Strain Curves for concrete and Reinforcing Steel.
- To make the students understand the flexural behaviour of RC Beams.
- To make the students understand the shear behaviour of RC beams.
- To familiarise the students with non-destructive testing on concrete elements.

To familiarise the students with non-destructive testing on concrete elements

Introduction

Beam Elements
- Flexure Element, Element Stiffness Matrix, Element Load Vector.

Method of Weighted Residuals
Application to Solid Mechanics
Plane Stress, CST Element, Plane Strain Rectangular Element, Iso-parametric Formulation of the Plane Quadrilateral Element, Axi- Symmetric Stress Analysis, Strain and Stress Computations.

Computer Implementation of FEM procedure, Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software.

REFERENCE BOOKS

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Understand the fundamentals of numerical methods.
2. Solve Eigen Value problems.
4. Understand the finite difference schemes.
5. Solve numerically different structural problems.

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COURSE OBJECTIVES
- To provide an information about Vibration Analysis and Mathematical Modeling.
- To know about numerical solution and its methods.
- To study about dynamics response of SDOF system using fundamental theory and equation of motion.
- To study about dynamics response of MDOF system using fundamental theory and equation of motion.
- To learn about the available software for dynamic analysis.
Introduction


Numerical Solution


Multiple Degree of Freedom System (Lumped parameter)

Two Degree of Freedom System, Multiple Degree of Freedom System, Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equation of Motion.

Multiple Degree of Freedom System (Distributed Mass and Load)


Special Topics in Structural Dynamics (Concepts only)


REFERENCES

6. Hart and Wong, Dynamics of Structures.

COURSE OUTCOMES

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

1. Understand the dynamic properties.
2. Analyze and study dynamics response of single degree freedom system using fundamental theory and equation of motion.
3. Analyze and study dynamics response of Multi degree freedom system using fundamental theory and equation of motion.
4. Use the available software for dynamic analysis.
5. Understand the basic concept of special topics in structural dynamics.
### Mapping Course Outcomes (Cos) with Programme Outcomes (Pos)

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#### CZSECP26 | MODEL TESTING LAB

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### COURSE OBJECTIVES
- To test structural models under static condition.
- To test structural models under dynamic condition.

### LIST OF EXPERIMENTS
1. Model Analysis – Continuous beam.
3. Model Analysis – Plate.
4. Free vibration analysis of wooden cantilever beam model.
5. Free vibration analysis of steel cantilever beam model.
6. Free vibration analysis of aluminum cantilever beam model.
7. Free vibration analysis of glass cantilever beam model.
8. Determination of viscous damping co-efficient for wooden beam model.
9. Determination of viscous damping co-efficient for steel beam model.
10. Determination of viscous damping co-efficient for aluminum beam model.
11. Determination of viscous damping co-efficient for glass beam model.
12. Free vibration Analysis of Simply Supported Steel Beam model.
13. Forced vibration Analysis of Simply Supported Steel Beam model.

### COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Understand the response of structures.
2. Prepare the models.
3. Conduct model testing for static loading.
4. Conduct model testing for free and forced vibrations.
5. Evaluation of dynamic modulus.
### Mapping Course Outcomes (Cos) with Programme Outcomes (Pos)

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### COURSE OBJECTIVES

- To determine structural engineering problems reviewing available literature.
- To study about different techniques used to analyze complex structural systems.
- To compare the solutions given and present solution by using his/her technique applying engineering principles.
- To Understand of contemporary / emerging technology.

The students will individually undertake a training program in reputed concerns in the field of structural engineering field during vacation period for a minimum stipulated period of four weeks. At the end of the commencement of the third semester for Full Time / fifth semester for Part Time. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals’ contribution.

Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

### COURSE OUTCOMES

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

1. Identify structural engineering problems reviewing available literature.
2. Study different techniques used to analyze complex structural systems.
3. Work on the solutions given and present solution by using his/her technique applying engineering principles.
4. Understand of contemporary / emerging technology.
5. Share knowledge effectively in oral and written form and formulate documents.
COURSE OBJECTIVES

1. To prepare the final report of project work in standard format.
2. To use knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
3. To learn about different methodologies, methods and forms of analysis to produce a suitable research design and justify their design.
4. To manipulate the findings of their technical solution in a written report.
5. To present the work in International/National conference or reputed journals.

The students will individually undertake a research problems in the field of Structural Engineering in the third semester for Full Time / Fifth semester for Part Time. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of the third semester for Full Time / fifth semester for Part Time. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

COURSE OUTCOMES

At the end of the course, the student will be able to

1. Prepare the final report of project work in standard format for satisfactory completion of the work.
2. Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
3. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design and justify their design.
4. Ability to present the findings of their technical solution in a written report.
5. Presenting the work in International/National conference or reputed journals.
COURSE OBJECTIVES

1. To prepare the final report of project work in standard format.
2. To learn about different methodologies, methods and forms of analysis to produce a suitable research design and justify their design.
3. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design and justify their design.
4. To manipulate the findings of their technical solution in a written report.
5. To present the work in International/National conference or reputed journals.

The students will individually undertake research problems in the field of Structural Engineering in the fourth semester for Full Time / sixth semester for Part Time. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of the fourth semester for Full Time / sixth semester for Part Time. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

COURSE OUTCOMES

At the end of the course, the student will be able to:
1. Prepare the final report of project work in standard format for satisfactory completion of the work.
2. Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
3. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design and justify their design.
4. Ability to present the findings of their technical solution in a written report.
5. Presenting the work in International/National conference or reputed journals.

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PROGRAM ELECTIVES

COURSE OBJECTIVES
1. To introduce the fundamentals of thin plates and shells.
2. To train the students for analysing thin rectangular plates.
3. To train the students for solving problems in circular plates.
4. To provide a basic understanding of membrane theory of shells.
5. To enable the students analyse shells of revolution.


Static Analysis of Plates: Governing Equation for a Rectangular Plate, Navier Solution for simply Supported Rectangular Plate under Various Loadings, Levy solution for Rectangular Plate with other Boundary Conditions.


Static Analysis of Shells: Membrane Theory of Shells - Cylindrical, Conical and Spherical Shells,

Shells of Revolution: with Bending Resistance- Cylindrical and Conical Shells, Application to Pipes and Pressure Vessels - Thermal Stresses in Plate/Shell

REFERENCES
2. Ugural Ansel C., Stresses in Plates and Shells, McGraw Hill.

COURSE OUTCOMES
At the end of the course, students will be able to
1. Understand the fundamentals of thin plates and shells.
2. Analyse thin rectangular plates.
5. Analyse shells of revolution.

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COURSE OBJECTIVES

1. To introduce the fundamentals of composite materials.
2. To familiarise the students with the mechanical behaviour of composite materials.
3. To familiarise the students with new fibre reinforced cement composites.
4. To make the students understand the mechanical properties of cement composites.
5. To familiarise the students with the applications of cement composites.


REFERENCES


COURSE OUTCOMES

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

1. Formulate constitutive behaviour of composite materials – Ferro-cement, SIFCON and Fibre Reinforced Concrete - by understanding their strain-stress behaviour.
2. Classify the materials as per orthotropic and anisotropic behaviour.
3. Estimate strain constants using theories applicable to composite materials.
4. Analyse and design structural elements made of cement composites.
5. Gain the knowledge about composite materials.

### Mapping Course Outcomes (Cos) with Programme Outcomes (Pos)

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### COURSE OBJECTIVES
1. To introduce the fundamentals of structural stability.
2. To familiarise the students with column buckling.
3. To familiarise the students with the stability of frames.
4. To make the students understand the buckling of beams.
5. To make the students understand the concepts of inelastic stability.

**Criteria for Design of Structures:** Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behaviour.

**Stability of Columns:** Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.

**Stability of Frames:** Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.

**Stability of Beams:** lateral torsion buckling.

**Stability of Plates:** axial flexural buckling, shear flexural buckling, buckling under combined loads - Introduction to Inelastic Buckling and Dynamic Stability.

### REFERENCES

### COURSE OUTCOMES
At the end of the course, students will be able to
1. Understand the criteria for design of structures.
2. Determine stability of columns.
3. Determine stability of frames.
5. Use stability criteria and concepts for analysing discrete and continuous systems.

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### Mapping Course Outcomes (Cos) with Programme Outcomes (Pos)

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### COURSE OBJECTIVES

1. To introduce the fundamentals of numerical methods.
2. To familiarise the students with Eigen value problems.
3. To train the students for solving ordinary and partial differential equations.
4. To provide the students with a background of finite difference scheme.
5. To enable the students write computer programs for solving mathematical problems.

**Fundamentals of Numerical Methods:** Error Analysis, Polynomial Approximations and Interpolations, **Curve Fitting;** Interpolation and extrapolation.

**Solution of Nonlinear Algebraic and Transcendental Equations** - Elements of Matrix Algebra: Solution of Systems of Linear Equations, Eigen Value Problems.

**Numerical Differentiation & Integration:** Solution of Ordinary and Partial Differential Equations.

**Finite Difference scheme:** Implicit & Explicit scheme.

**Computer Algorithms:** Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.

### REFERENCES

COURSE OUTCOMES:
At the end of the course, students will be able to
1. Solve ordinary and partial differential equations in structural mechanics using numerical methods.
2. Gain the knowledge about the solution of nonlinear equations.
3. Understand the solution of differential equations.
4. Solve the problems using finite difference scheme.
5. Write a program to solve a mathematical problem using software.

Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)

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COURSE OBJECTIVES
1. To introduce the basic concepts of structural health monitoring.
2. To familiarise the students with structural audit.
3. To train the students in static field testing.
4. To train the students in dynamic field testing.
5. To provide the students with information on smart materials.


Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

REFERENCES

COURSE OUTCOMES
At the end of the course, students will be able to
1. Diagnosis the distress in the structure understanding the causes and factors.
2. Assess the health of structure using static field methods.
3. Assess the health of structure using dynamic field tests.
4. Suggest repairs and rehabilitation measures of the structure
5. Understand the structures monitoring based on strength using different types of methods.

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CZSEPEXX STRUCTURAL OPTIMIZATION

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COURSE OBJECTIVES
1. To introduce the fundamentals of structural optimization procedures.
2. To familiarise the students with variational principles.
3. To train the students in applying dynamic programming procedures.
4. To train the students in applying stochastic programming procedures.
5. To enable the students apply optimization procedures for steel and concrete members.

Calculus of Variation: Variational Principles with Constraints,
Linear Programming, Integer Programming, Nonlinear Programming, Dynamic Programming,
Geometric Programming and Stochastic Programming.

Applications: Structural Steel and Concrete Members, Trusses and Frames - Design: Frequency Constraint, Design of Layouts.

REFERENCES
2. Cherkaev Andrej, Variational methods for Structural optimization, Springer

COURSE OUTCOMES
At the end of the course, students will be able to
1. Solve the classical external problems
2. Use Variational principle for optimization
3. Develop the linear programming
4. Apply optimization techniques to structural steel and concrete members.
5. Design using frequency constraint.

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COURSE OBJECTIVES
1. To familiarise basic concepts about properties of steel.
2. To learn about design of steel structures/components by different design processes.
3. To evaluate the beams and columns for stability and strength, and drift.
4. To know about the design of beams.
5. To learn about design of welded and bolted connections.

Properties of Steel: Mechanical Properties, Hysteresis, Ductility- Hot Rolled Sections: compactness and non-compactness, slenderness, residual stresses.
**Design of Steel Structures**: Inelastic Bending Curvature, Plastic Moments, Design Criteria Stability, Strength, Drift.

**Stability of Beams**: Local Buckling of Compression Flange & Web, Lateral Torsional Buckling - Stability of Columns: Slenderness Ratio, Local Buckling of Flanges and Web, Bracing of Column about Weak Axis.


**Connections**: Welded, Bolted, Location Beam Column, Column Foundation, Splices.

**REFERENCES**
2. Arya A. S., Ajmani J. L., Design of Steel Structures - Nemchand and Bros., Roorkee.
6. SP – 6 - Handbook of Structural Steel Detailing, BIS,1987

**COURSE OUTCOMES**
At the end of the course, students will be able to
1. Understand the knowledge about properties of steel
2. Design steel structures/ components by different design processes.
3. Analyze the beams and columns for stability and strength, and drift.
4. Understand the design of beams.
5. Design welded and bolted connections.

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COURSE OBJECTIVES

1. To provide an information about proper formwork, accessories and material.
2. To learn about the form work design for Beams, Slabs, columns, Walls and Foundations.
3. To study about the form work design for Special Structures.
4. To Understand the working of flying formwork.
5. To determine the formwork failures through case studies.


Formwork Design for Special Structures: Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges.

Flying Formwork: Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre- and Post-Award.

Formwork Failures: Causes and Case studies in Formwork Failure, Formwork Issues in Multi-Story Building Construction.

REFERENCES

3. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.

COURSE OUTCOMES

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

1. Select proper formwork, accessories and material.
2. Design the form work for Beams, Slabs, columns, Walls and Foundations.
3. Design the form work for Special Structures.
4. Understand the working of flying formwork.
5. Judge the formwork failures through case studies.

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COURSE OBJECTIVES
1. To study about Transmission/ TV tower, Mast and Trestles with different loading conditions.
2. To design and detail the RC and Steel Chimney.
3. To evaluate the tall buildings subjected to different loading conditions using relevant codes.
4. To analyse the tall buildings subjected to firefighting provision using relevant codes.
5. To design the tall buildings using relevant software.

Design of transmission/ TV tower, Mast and trestles: Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.

Analysis and Design of RC and Steel Chimney, Foundation design for varied soil strata.

Tall Buildings: Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions.

Firefighting design provisions.

Application of software in analysis and design.

REFERENCES
5. Smith Byran S. and Coull Alex, Tall Building Structures, Wiley India. 1991.

COURSE OUTCOMES
At the end of the course, students will be able to
1. Analyse, design and detail Transmission/ TV tower, Mast and Trestles with different loading conditions.
2. Analyse, design and detail the RC and Steel Chimney.
3. Analyse, design and detail the tall buildings subjected to different loading conditions using relevant codes.
4. Design and detail the tall buildings subjected to firefighting provision using relevant codes.
5. Analyse and design the tall buildings using relevant software.
Introduction: Historical Perspective, Masonry Materials, Masonry Design Approaches, Overview of Load Conditions, Compression Behaviour of Masonry, Masonry Wall Configurations, Distribution of Lateral Forces.


Shear Strength and Ductility of Reinforced Masonry Members.

Prestressed Masonry - Stability of Walls, Coupling of Masonry Walls, Openings, Columns, Beams.


REFERENCES

COURSE OUTCOMES

At the end of the course, students will be able to
1. Understand the masonry design approaches.
2. Analyse Reinforced Masonry Members.
3. Determine interactions between members.
4. Determine shear strength and ductility of Reinforced Masonry members.
5. Check the stability of walls and Perform elastic and inelastic analysis of walls.

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COURSE OBJECTIVES

1. To evaluate the deflection and crack width of flexural members using code provisions.
2. To know about the redistribution moments in R. C. Beams.
3. To study about the deep beams designs as per relevant codes
4. To learn about the shear wall designs.
5. To design machine foundations as per relevant codes.

Deflection and crack width – estimation based on IS 456, BS 8110, EC and ACI method.
Redistribution of moments in RC beams – Condition for moment redistribution – moment redistribution in fixed beam and two span continuous beam – Advantages
Design of deep beams, spandrel beams – Analysis of grid floors.
Analysis, design and detailing of shear walls.

REFERENCES


COURSE OUTCOMES
At the end of the course, students will be able to:
1. Determine the deflection and crack width of flexural members using code provisions.
2. Understand the redistribution moments in R. C. Beams.
3. Design the deep beams as per relevant codes.
4. Analyse the special structures by understanding their behaviour.
5. Design and prepare detail structural drawings for execution citing relevant IS codes.

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COURSE OBJECTIVES
1. To provide an information about planning of soil exploration.
2. To study about the shallow foundations design for construction engineering structures.
3. To learn about the pile foundations design for construction engineering structure.
4. To determine the well foundations for construction engineering structures.
5. To study about open cuts in different soils.

Planning of Soil Exploration for Different Projects, Methods of Subsurface Exploration, Methods of Borings along with Various Penetration Tests.


Open Cuts, Sheet and Bracing Systems in Shallow and Deep Open Cuts in Different Soil Types - Cofferdams, Various Types, Analysis and Design, Foundations under uplifting loads, Soil-structure interaction

REFERENCES

COURSE OUTCOMES
At the end of the course, students will be able to:
1. Understand the knowledge about planning of soil exploration.
2. Design the shallow foundations for construction engineering structures.
3. Design the pile foundations for construction engineering structures.
4. Design the well foundations for construction engineering structures.
5. Understand the knowledge about open cuts in different soils.

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COURSE OBJECTIVES:
1. To learn about soil structure interaction concept and complexities involved.
2. To study about the soil structure interaction for different types of structure under various conditions of loading and subsoil characteristics.
3. To know about the comprehensive design oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.
4. To examine different types of frame structure founded on stratified natural deposits with linear and non-linear stress-strain characteristics.
5. To learn about action of group of piles considering stress-strain characteristics of real soils.

Preparation of Comprehensive Design Oriented Computer Programs for Specific Problems, Interaction Problems based on Theory of Sub Grade Reaction Such as Beams, Footings, Rafts Etc.
Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics.
Determination of Pile Capacities and Negative Skin Friction, Action of Group of Piles Considering Stress-Strain Characteristics of Real Soils, Anchor Piles and Determination of Pull-out Resistance.

REFERENCES

COURSE OUTCOMES
At the end of the course, students will be able to
1. Understand soil structure interaction concept and complexities involved.
2. Evaluate soil structure interaction for different types of structure under various conditions of loading and subsoil characteristics.
3. Prepare comprehensive design oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.
4. Analyze different types of frame structure founded on stratified natural deposits with linear and non-linear stress-strain characteristics.
5. Evaluate action of group of piles considering stress-strain characteristics of real soils.
Mapping Course Outcomes (Cos) with Programme Outcomes (Pos)

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COURSE OBJECTIVES

1. To learn about types of Gantry Girders and its design procedure.
2. To study about design of Square bunker.
3. To know about chimneys.
4. To study about Water Tanks.
5. To learn about prestressed steel water tank.

Steel Gantry Girders – Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure - Portal Frames – Design of portal frame with hinge base, design of portal frame with fixed base - Gable Structures – Lightweight Structures


Chimneys – Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of base plate, design of foundation bolts, design of foundation.


REFERENCES

3. Subramanian, Design of Steel Structures.
COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Design Steel Gantry Girders.
2. Evaluate the design of Square bunker.
3. Evaluate the design of chimneys.
4. Design Water Tanks.
5. Design prestressed steel water tank.

Mapping Course Outcomes (Cos) with Programme Outcomes (Pos)

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CZSEPEXX DESIGN OF PRESTRESSED CONCRETE STRUCTURES

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COURSE OBJECTIVES
1. To introduce the basic concepts of prestressed concrete.
2. To design the prestressed concrete beams.
3. To analyze prestressed concrete pipes and columns.
4. To analyze the statically indeterminate structures.
5. To learn about the design of composite prestressed concrete members.

Introduction to prestressed concrete: types of prestressing, systems and devices, materials, losses in prestress. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, code provisions.

Statically determinate PSC beams: design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion, code provisions.

Transmission of prestress in pretensioned members; Anchorage zone stresses for post-tensioned members - Analysis and design of prestressed concrete pipes, columns with moments.

Statically indeterminate structures - Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordancy.

Composite construction with precast PSC beams and cast in-situ RC slab - Analysis and design, creep and shrinkage effects. Partial prestressing - principles, analysis and design concepts, crack width calculations.
REFERENCES
4. IS: 1343- Code of Practice for Prestressed Concrete.
5. IRC: 112

COURSE OUTCOMES
At the end of the course, students will be able to
1. Understand the basic concepts of prestressed concrete.
2. Design prestressed concrete beams.
3. Design prestressed concrete pipes and columns.
4. Evaluate the statically indeterminate structures.
5. Develop skills on the design of composite prestressed concrete members.

COURSE OBJECTIVES
1. To determine the rectangular composite plates using the analytical methods.
2. To determine the analytical solutions for bending of laminated plates using FSTP.
3. To learn about the composite plates using advanced finite element method.
4. To study about the laminated composite plates.
5. To study about the computer programs for the analysis of composite plates.

Introduction: Displacement Field Approximations for Classical Laminated Plate Theory (CLPT) and First Order Shear Deformation Theory (FSDT), Analytical Solutions for Bending Of Rectangular Laminated Plates using CLPT.
Governing Equations
Navier Solutions of Cross-Ply and Angle-Ply Laminated Simply-Supported Plates, Determination of Stresses. Levy Solutions for Plates with Other Boundary Conditions, Analytical Solutions for Bending of Rectangular Laminated Plates Using FSDT.


Finite Element Solutions for Bending of Rectangular Laminated Plates using FSDT.

Finite Element Model, C0Element Formulation, Post Computation of Stresses - Analysis of Rectangular Composite Plates using Analytical Methods.

REFERENCES

COURSE OUTCOMES
At the end of the course, students will be able to
1. Analyze the rectangular composite plates using the analytical methods.
2. Evaluate the analytical solutions for bending of laminated plates using FSTP.
3. Apply the advanced finite element method using composite plates.
4. Gain knowledge about the laminated composite plates.
5. Develop the computer programs for the analysis of composite plates.

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CZSEPEXX FRACTURE MECHANICS OF CONCRETE STRUCTURES

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COURSE OBJECTIVES
1. To learn about the basics of fracture mechanics.
2. To study about the stress at crack tip.
3. To study about the fracture mechanics models to high strength concrete and FRC structures.
4. To evaluate the J-integral for various sections understanding the concepts of LEFM.
5. To know about the fracture mechanics of concrete structures.
**Introduction:** Basic Fracture Mechanics, Crack in a Structure, Mechanisms of Fracture and Crack Growth, Cleavage Fracture, Ductile Fracture, Fatigue Cracking, Environment assisted Cracking, Service Failure Analysis.

**Stress at Crack Tip:** Stress at Crack Tip, Linear Elastic Fracture Mechanics, Griffith’s Criteria, Stress Intensity Factors, Crack Tip Plastic Zone, Erwin’s Plastic Zone Correction, R curves, Compliance, J Integral, Concept of CTOD and CMD.

**Material Models:** General Concepts, Crack Models, Band Models, Models based on Continuum Damage Mechanics, Applications to High Strength Concrete.

**Fibre Reinforced Concrete,** Crack Concepts and Numerical Modeling.

**REFERENCES**


**COURSE OUTCOMES**

At the end of the course, students will be able to
1. Identify and classify cracking of concrete structures based on fracture mechanics.
2. Implement stress intensity factor for notched members
3. Apply fracture mechanics models to high strength concrete and FRC structures.
4. Compute J-integral for various sections understanding the concepts of LEFM.
5. Gain the knowledge about the fracture mechanics of concrete structures.

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COURSE OBJECTIVES
1. To analyze the folded plate systems.
2. To evaluate differential equation for bending of plates.
3. To determine the approximate solutions for folded plates.
4. To evaluate differential equation for bending of shells.
5. To Analyze and design cylindrical plates.

Prismatic folded Plate Systems – Types - Assumptions – Boundary condition- Kirchoffs boundary condition.


Differential equation for bending of shells- Cylindrical bending of UDL of circular shell-simply supported – built –in-edges – small deflection theory of laterally loaded.

REFERENCES

COURSE OUTCOMES
At the end of the course, students will be able to
1. Analyse and design the folded plate systems.
2. Develop the shell equation for folded plates
3. Develop the approximate solutions for folded plates.
4. Analyse and design the cylindrical shells.
5. Analyse and design the double cylindrical shells.

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Mapping Course Outcomes(Cos) with Programme Outcomes (Pos)
COURSE OBJECTIVES

1. To provide an information about business analytics and its scope.
2. To know about decision making based on data and business analytics.
3. To learn about team management and data mining methodologies.
4. To learn about qualitative, statistical and judgmental forecasting.
5. To study about decision analysis.


Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making.

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.
REFERENCES
2. James Evans, Business Analytics, persons Education.

COURSE OUTCOMES
At the end of the course, students will be able to
1. Understand about business analytics and its scope.
2. Think critically in making decisions based on data and business analytics.
3. Use technical skills in team management and data mining methodologies.
4. Understand qualitative, statistical and judgmental forecasting.
5. Formulate decision problems and strategies.

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COURSE OBJECTIVES
1. To learn about industrial safety.
2. To introduce fundamentals of maintenance engineering.
3. To know about the concepts of wear and corrosion and their prevention.
4. To know about the concept and importance of fault tracing.
5. To understand the concept and importance of periodic and preventive maintenance.

**Industrial safety:** Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

**Fundamentals of maintenance engineering:** Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

**Fault tracing:** Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment’s like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler,vi. Electrical motors, Types of faults in machine tools and their general causes.

**Periodic and preventive maintenance:** Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

**REFERENCES**

**COURSE OUTCOMES**
At the end of the course, the student will be able to:
1. Apply safety practices.
2. Inspect maintenance operations.
3. Trace faults in equipments.
4. Do event tree and fault tree analyse
5. Understand the concept and importance of repair recycle.

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COURSE OBJECTIVES

1. To evaluate optimization techniques.
2. To evaluate dual simplex method and sensitivity analysis.
3. To learn about the concept of non-linear programming.
4. To learn about the concept and importance of scheduling and sequencing.
5. To evaluate Competitive Models.

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.
Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

REFERENCES


COURSE OUTCOMES

At the end of the course, the student will be able to:
1. Have an idea about optimization techniques.
2. Carry out dual simplex method and sensitivity analysis.
3. Apply the concept of non-linear programming.
4. Understand the importance of scheduling and sequencing.
5. Solve Competitive Models.

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Mapping Course Outcomes(Cos)with Programme Outcomes (Pos)
COURSE OBJECTIVES
1. To introduce the strategic cost management processes.
2. To learn about project execution.
3. To know the importance and role of project team.
4. To study about the various quantitative techniques for cost managements.
5. To evaluate flexible budgets.

Introduction and Overview of the Strategic Cost Management Process

Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non technical activities. Detailed Engineering activities. Pre project execution main clearances and documents

Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process


Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.


REFERENCES
2. Charles T. Horngren and George Foster, Advanced Management Accounting.
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Understand the strategic cost management processes.
2. Plan project execution.
3. Plan project cost control.
4. Apply various quantitative techniques for cost managements.
5. Use flexible budgets.

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**COURSE OBJECTIVES**

1. To introduce composite materials and its advantages.
2. To understand the Mechanical Behavior of composites.
3. To learn about the manufacturing of metal matrix composites.
4. To learn about the manufacturing of polymer matrix composites.
5. To determine stresses and strains relation in composite materials.

**INTRODUCTION:** Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

**REINFORCEMENTS:** Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.


**Manufacturing of Polymer Matrix Composites:** Preparation of Moulding compounds and prepress – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

**Strength:** Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygro thermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

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COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Gain knowledge about composite materials and its advantages.
2. Understand the mechanical behavior of composites.
3. Know about the manufacturing of metal matrix composites.
4. Know about the manufacturing of polymer matrix composites.
5. Determine stresses and strains relation in composite materials.

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COURSE OBJECTIVES
1. To understand the recycling and reuse of waste.
2. To study about the design, construction and operation of biomass gasifiers.
3. To study about bio diesel, its production and applications.
4. To learn about Biomass Combustion.
5. To learn about Biogas.

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors


**Biomass Combustion**: Biomass stoves – Improved chullahs, types, some exotic designs, fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

**Biogas**: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - Biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

**REFERENCES**

**COURSE OUTCOMES**
At the end of the course, the student will be able to:
1. Understand the concept of harnessing energy from waste.
2. Know the design, construction and operation of biomass gasifiers.
3. Come know about bio diesel, its production and applications.
5. Gain knowledge about Biogas.
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AUDIT COURSES

COURSE OBJECTIVES

1. To study about how to improve your writing skills and level of readability.
2. To learn about what to write in each section.
3. To know about the skills needed when writing a Title.
4. To study about the skills when writing the discussion.
5. To provide a good quality of paper at very first-time submission.

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.


Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,

skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions.

useful phrases, how to ensure paper is as good as it could possibly be the first-time submission.

REFERENCES:


COURSE OUTCOMES

Students will be able to

1. Understand that how to improve your writing skills and level of readability.
2. Learn about what to write in each section.
3. Understand the skills needed when writing a Title.
4. Understand the skills when writing the discussion.
5. Ensure the good quality of paper at very first-time submission.
COURSE OBJECTIVES

1. To know about humanitarian response.
2. To examine disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. To study about standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. To learn about the strengths of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.
5. To understand the weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Repercussions Of Disasters And Hazards:
Introduction: Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.
Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem.
Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.
Disaster Prone Areas In India: Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics.
Disaster Preparedness And Management: Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.
Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

REFERENCES
2. Sahni, Pardeep Et.Al. (Eds.), “Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.

COURSE OUTCOMES
Students will be able to
1. Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Understand the standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Understand the strengths of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.
5. Understand the weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

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COURSE OBJECTIVES
1. To understand basic Sanskrit language
2. To learn about ancient Sanskrit literature.
3. To know about roots.
4. To provide a information about technical information about Sanskrit Literature.
5. To understand the Technical concepts of other language.
Alphabets in Sanskrit - Past/Present/Future Tense - Simple Sentences
Order - Introduction of roots - Technical information about Sanskrit Literature
Technical concepts of Engineering-Electrical, Mechanical - Architecture, Mathematics

REFERENCES
1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi

COURSE OUTCOMES
Students will be able to
1. Understand basic Sanskrit language.
2. Access ancient Sanskrit literature about science & technology can be understood.
3. Help to develop logic in students.
4. Understand the technical information about Sanskrit Literature.
5. Understand the Technical concepts of other language.

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COURSE OBJECTIVES
Students will be able to
1. To get an Knowledge of self-development.
2. To know about the importance of Human values.
3. To learn about the personality and behavior development.
4. To know about the self-destructive habits.
5. To learn about the self-management and good health.

Values and self-development – Social values and individual attitudes - Work ethics, Indian vision of humanism - Moral and non-moral valuation - Standards and principles - Value judgments.
Importance of cultivation of values - Sense of duty. Devotion- Self-reliance - Confidence, Concentration – Truthfulness – Cleanliness Honesty, Humanity - Power of faith, National Unity – Patriotism - Love for nature - Discipline


REFERENCES:

COURSE OUTCOMES:
Students will be able to
2. Learn the importance of Human values.
3. Developing the overall personality.
4. Understand the self-destructive habits.
5. Know about the self-management and good health.

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PO1 = Understand the self-destructive habits.
PO2 = Know about the self-management and good health.
PO3 = Develop the overall personality.
PO4 = Learn the importance of Human values.
PO5 = Knowledge of self-development.
COURSE OBJECTIVES
1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.
5. Understand the role of election commission.

History of Making of the Indian Constitution: History - Drafting Committee,(Composition& Working) - Philosophy of the Indian Constitution: Preamble - Salient Features


Local Administration: District’s Administration head: Role and Importance - Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation - Pachayati raj: Introduction, PRI: ZilaPachayat - Elected officials and their roles, CEO ZilaPachayat: Position and role - Block level: Organizational Hierarchy (Different departments) - Village level: Role of Elected and Appointed officials - Importance of grass root democracy

Election Commission: Election Commission: Role and Functioning - Chief Election Commissioner and Election Commissioners - State Election Commission: Role and Functioning - Institute and Bodies for the welfare of SC/ST/OBC and women

REFERENCES
1. The Constitution of India, 1950 (Bare Act), Government Publication.
COURSE OUTCOMES
Students will be able to:
1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
5. Understand the role of election commission.

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Mapping Course Outcomes (Cos) with Programme Outcomes (Pos)

COURSE OBJECTIVES
Students will be able to:
1. To study about the pedagogical practices being used by teachers in formal and informal classrooms in developing countries.
2. To know about the effectiveness of pedagogical practices.
3. To learn about the teacher education (curriculum and practicum) and the school curriculum and guidance materials.
4. To understand the barriers to learning.
5. To examine research gaps and future directions.

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.
Evidence on the effectiveness of pedagogical practices - Methodology for the in depth stage: quality assessment of included studies- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?- Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers’ attitudes and beliefs and Pedagogic strategies.

Professional development: alignment with classroom practices and follow-up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

Research gaps and future directions - Research design - Contexts - Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

REFERENCES

COURSE OUTCOMES
Students will be able to understand:
1. Pedagogical practices being used by teachers in formal and informal classrooms in developing countries.
2. Evidence on the effectiveness of these pedagogical practices.
3. Teacher education (curriculum and practicum) and the school curriculum and guidance materials that best support effective pedagogy.
4. The barriers to learning.
5. The research gaps and future directions.

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<td>CO3</td>
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COURSE OBJECTIVES
1. To develop healthy mind in a healthy body.
2. To improve efficiency.
3. To understand the various Yoga poses.
4. To know about the regulation of breathings.
5. To know about the types of pranayama and to overcome stress.

Definitions of Eight parts of yog. (Ashtanga)
- Yam and Niyam.
- Do’s and Don’ts in life.
- Ahinsa, satya, astheya, bramhacharya and aparigraha
- Shaucha, santosh, tapa, swadhyay, ishwarpadhan
- Asan and Pranayam

Various yoga poses and their benefits for mind & body
Regularization of breathing techniques and its effects - Types of pranayama

REFERENCES
1. ‘Yogic Asanas for Group Tarining-Part-I” : Janardan Swami YogabhysaMandal, Nagpur.
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata.

COURSE OUTCOMES
Students will be able to:
1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency
3. Understand the various Yoga poses.
4. Know about the regulation of breathings.
5. Know about the types of pranayama.

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COURSE OBJECTIVES

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To Study of Shrimad-Bhagwad-Geeta for developing his personality and achieve the highest goal in life.
4. To study about peace and prosperity.
5. To Study of Neetishatakam for developing personality.

Neetisatakam-Holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) - Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont’s) - Verses- 71,73,75,78 (do’s)

Approach to day to day work and duties –ShrimadBhagwadGeeta: Chapter 2-Verses 41, 47,48, - Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35 - Chapter 18-Verses 45, 46, 48.

Statements of basic knowledge –ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68 - Chapter 12 -Verses 13, 14, 15, 16,17, 18 - Personality of Role model. ShrimadBhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, - Chapter 4-Verses 18, 38,39 - Chapter18 – Verses 37,38,63

REFERENCES

1. “Srimad Bhagavad Gita” by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata.
2. Bhartrihari’s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

COURSE OUTCOMES

Students will be able to

1. Achieve the highest goal happily.
2. Become a person with stable mind.
3. Develop his personality and achieve the highest goal in life. By Study of Shrimad-Bhagwad-Geeta.
4. Know about peace and prosperity.
5. Develop versatile personality of students by Study of Neetishatakam.
Vision

To impart high quality education and technical expertise to the students and inculcate in them humanistic attitude, scientific temper, sense of commitment to the profession and spirit of participation in nation building.

Mission

M1: To provide quality education and knowledge base to the students in structural engineering.
M2: To prepare the students as nationally competitive and trend setters for the future generation in the realm of technical education.
M3: To assimilate the available theories, explore new frontiers, to propound new theories which will result in improving the quality of the life of the student community.
M4: To develop personality of the students in a healthy way and to provide opportunity to acquire knowledge in state-of-the-art research.
M5: To provide service to the university, engineering profession, and the public through consultancy services.

Programme Educational Objectives (PEOs)

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<th>PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)</th>
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<tr>
<td>PEO1</td>
<td>To develop the technical and engineering skills of the students and to train them in applying fundamental principles in the domain, feeding the needs of global expectations with professional competence.</td>
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<tr>
<td>PEO2</td>
<td>To explore the students in the field of Civil and Structural Engineering areas both in theory and practice and tuning the academic programmes periodically to make the students fit for professional jobs, research assignment or self-employment.</td>
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<tr>
<td>PEO3</td>
<td>To demonstrate their ability to deal effectively with ethical and professional issues, taking into account the broader societal implications.</td>
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To impart communication, analytical and soft skills for the students towards either placing them in a comfort zone in their profession or a path to pursue higher studies.

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<td>PO1</td>
<td><strong>Engineering knowledge:</strong> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.</td>
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<tr>
<td>PO2</td>
<td><strong>Problem analysis:</strong> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.</td>
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<tr>
<td>PO3</td>
<td><strong>Design/development of solutions:</strong> Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.</td>
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<tr>
<td>PO4</td>
<td><strong>Conduct investigations of complex problems:</strong> Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.</td>
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<tr>
<td>PO5</td>
<td><strong>Modern tool usage:</strong> 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.</td>
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<tr>
<td>PO6</td>
<td><strong>The engineer and society:</strong> Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.</td>
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<td>PO7</td>
<td><strong>Environment and sustainability:</strong> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.</td>
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<td>PO8</td>
<td><strong>Ethics:</strong> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.</td>
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<tr>
<td>PO9</td>
<td><strong>Individual and teamwork:</strong> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.</td>
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<tr>
<td>PO10</td>
<td><strong>Communication:</strong> Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to</td>
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comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

**PO11** Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

**PO12** Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
## SEMESTER II

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### M.E. CONSTRUCTION ENGINEERING & MANAGEMENT (PART TIME)

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**SEMESTER -III**

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**LIST OF AUDIT COURSE (AC)**

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COURSE OBJECTIVES

- To understand the concept of Project management planning on construction projects.
- To manage the project team, defining roles and responsibilities and fixing scope of the project.
- To know the time management of a construction project by proper scheduling using PERT, CPM, RPM, etc. Apply excel, MSP, PRIMAVERA, Construction manager and other softwares to solve construction problems.
- To learn about project controlling.
- To study the site mobilization, material and labor management.

Basics of Management

Introduction to construction industries, concepts and need of management in construction. Modern scientific management, Management Functions, Management Styles.

Construction Project Planning

- Project life cycle, identification, preparation, appraisal, detailed planning, implementation, Project delivery system, Leadership and motivation for the project team - effect of project risk on organization role and responsibilities of project Manager, Role of Project Management Consultants, Web based project management, monitoring and control.

Project Scheduling

- Construction Scheduling, Work break down structure, activity cost and time estimation in CPM, PERT, RPM (Repetitive Project Modelling) techniques. LOB technique, Mass haul diagrams. Precedence Network Analysis, software in Construction scheduling (MSP, primavera, Construction manager).

Project Controlling

- Monitoring and Control, Crashing, Resource Levelling, Updating. Construction Management

Site Mobilization: Demobilization aspects, various Resources management based on funds availability. Co-coordinating, communicating & reporting techniques. Application of MIS to construction. Training of Construction Managers. Material Management: Scope, importance, objectives, functions of material management classification and codification of
material, inventory control: need, function, economic order quantity. Labour Management: Labour laws for construction projects, welfare measures for labours. Equipment Management: Types of equipment and factors affecting selection, Functions of equipment management, owning and operating costs, Time-value of money concept, Economic life, safety, maintenance and repair of equipment.

REFERENCES

COURSE OUTCOMES
At the completion of the course students will be able to
1. Have an idea about the concept of Project management planning on construction projects
2. Understand the roles and responsibilities in project planning.
3. Find project duration and optimize the time and minimize the cost implement resource allocation and.
4. Understand the control techniques plan and implement
5. Know about site mobilization, material and labour management.

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<th>Mapping with Programme Outcomes</th>
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COURSEOBJECTIVES
- To Know the quality plan and performance factors influencing construction quality
- To provide a basic information about quality Management Guidelines
- To Know the quality planning and taguchi’s concept-codes
- To examine the quality assurance, appraisals and quality control by reliability testing.
- To find out how the quality techniques can be improved.

Introduction
Definition-Concept of quality-meaning of quality-design-conformance-performance-dimensions-factors influencing construction quality.
Quality Management
Fundamentals of quality management—function-inspection, control and enforcement-quality management system and method-quality circle-total quality management-quality management guidelines-responsibilities and authority

Quality Planning
Quality policy, objectives and methods- consumers’ satisfaction-time completion-documents- process and products- quality cost- Taguchi’s concept-codes and standards

Quality Control and Assurance
Objectives of quality control-appraisals- needs and techniques of quality control-critical, major failure aspects-failure mode and effect analysis-statistical process control-quality systems-quality audit- responsibilities and authorities in quality control and assurance

Quality Improvement Techniques
Selection of new materials-influencing drawings, detailing, specification, standardization-bid preparation- construction activity, environmental safety, social and environmental factors-natural causes and speed of construction-life cycle costing- value engineering and value analysis.

REFERENCES
3. Frank M Gryna, Quality Planning and Analysis, McGraw-Hill 2001

COURSE OUTCOMES
At the completion of the course students will be able to
1. Understand the concept of quality plan
2. Learn about quality Management Guidelines
3. Use taguchi’s concept-codes and standards
4. Know quality assurance, appraisals and quality control by reliability testing
5. Implement the quality improvement techniques.

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COURSE OBJECTIVES

1. To study the research problem and formulation.
2. To Analyze the Plagiarism and Research ethics.
3. To Know about Preparation of research proposal.
4. To understand about Patenting.
5. To learn about IPR.

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Effective literature studies approaches, analysis Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.


New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES

2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

COURSE OUTCOMES

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

1. Understand research problem formulation.
2. Analyze the Plagiarism and Research ethics.
3. Explain about Preparation of research proposal.
4. Learn about Patenting.
5. Understand IPR.
Course objectives | Mapping with Programme outcomes
---|---
CO1 | PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12
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CO3 | ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔
CO4 | ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔
CO5 | ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔ ✔

CZCMCP16 | DESIGN LABORATORY | L T P C
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**COURSE OBJECTIVES**
- To introduce the fundamentals of structural analysis, design and detailing.
- To familiarise the students with the analysis of symmetrical and unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software.
- To familiarise the students with the analysis of symmetrical and unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software.
- To familiarise the students with the scheduling of construction projects using MS Project and Primavera.
- To know the preparation of delivery of bid or proposal and quantity take off in engineering construction projects.

**LIST OF EXPERIMENTS**
1. Analysis of Symmetrical Building Frames (Gravity load only) uses STADD PRO Software.
2. Analysis of Symmetrical Building Frames (Wind load only) uses STADD PRO Software.
3. Analysis of Un-Symmetrical Building Frames (Gravity load only) using STADD PRO Software.
4. Analysis of Un-Symmetrical Building Frames (Wind load only) using STADD PRO Software.
5. Analysis of Symmetrical Building Frames (Gravity load only) using Etabs Software.
6. Analysis of Un-Symmetrical Building Frames (Wind load only) using STADD PRO Software.
7. Analysis of Un-Symmetrical Building Frames (Gravity load only) using Etabs Software.
8. Analysis of Un-Symmetrical Building Frames (Wind load only) using Etabs Software.
9. Quantity take off, Preparation and delivery of the bid or proposal of an Engineering construction project.
10. Design of a simple equipment information system for a construction project.
11. Scheduling of a small construction project using Primavera scheduling systems including reports and tracking.
12. Scheduling of a small construction project using tools like MS project scheduling systems including reports and tracking.
13. Simulation models for project risk analysis.
COURSE OUTCOMES
At the completion of the course students will be able to
1. Understand the codal provisions relating to structural design and detailing
2. Analyse symmetrical and unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using STADD PRO software
3. Analyse symmetrical and unsymmetrical building frames subjected to gravity loading, wind loading and seismic loading using ETABS software
4. Understand the computer application of estimation of quantity, planning and scheduling.
5. Prepare the delivery of bid or proposal and quantity take off in engineering construction projects and also simulation techniques.

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COURSE OBJECTIVES
- To Design high grade concrete and study the parameters affecting its performance.
- To study Non Destructive Tests on existing concrete structures.
- To understand engineering principles and behaviour of structural/ elements.
- To learn about the cyclic load testing.
- To learn about the durability tests on concrete.

LIST OF EXPERIMENTS
1. Concrete mix design based on IS and ACI codes of practice.
2. Determination of Elasticity modulus for concrete.
3. Determination of Elasticity modulus for steel using bonded strain gauges.
4. Study on Flexure in RC beams.
5. Study on Shear in RC beams.
6. Study on Torsion in RC beams.
7. Sand Heap Analogy and Unsymmetrical Bending.
8. Deflection Test on RSJ.
9. Deflection Test on Steel Flat.
10. Concrete Durability Test.

COURSE OUTCOMES
At the completion of the course students will be able to
1. Design high grade concrete and study the parameters affecting its performance
2. Conduct Non Destructive Tests on existing concrete structures.
3. Apply engineering principles to understand behavior of structural/elements.
4. Know about the cyclic load testing.
5. Know about the durability tests on concrete.

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**COURSE OBJECTIVES**

- To Know about Accidents and their Causes and Legal Implications.
- To provide an information about duties and responsibilities of construction management.
- To study about the safety in constructions and their applications.
- To Understand the Various Safety Equipment And Gear Used On Site.
- To learn about the safety policies.

**Construction Accidents**

Accidents and their Causes – Human Factors in Construction Safety - Costs of Construction Injuries – Occupational and Safety Hazard Assessment – Legal Implications

**Construction Safety Management**

Role of various parties, duties and responsibilities of top management, site managers, supervisors etc. role of safety officers, responsibilities of general employees, safety committee, safety training, incentives and monitoring. Writing safety manuals, preparing safety checklists and inspection reports.

**Safety in Construction Operations**

Safety of accidents on various construction sites such as buildings, dams, tunnels, bridges, roads, etc. safety at various stages of construction. Prevention of accidents. Safety measures. Safety in use of construction equipment e.g. vehicles, cranes, hoists and lifts etc. safety of scaffolding and working platforms. Safety while using electrical appliances. Explosives used.

**Various Safety Equipment And Gear Used On Site**

First aid on site, Safety awareness program. Labour laws, legal requirement and cost aspects of accidents on site, Incentive for safety practices.

**Study of Safety Policies**

Methods, equipment, training provided on any ISO approved construction Company, safety in office, working on sites of high rise construction, deep excavation.
REFERENCES
   NICMAR, Mumbai.

COURSE OUTCOMES
At the completion of the course students will be able to
1. Know about Accidents and their Causes and Legal Implications.
2. Know about duties and responsibilities of construction management.
3. Know about the safety in and their applications.
4. Understand the Various Safety Equipment And Gear Used On Site.
5. Know about the safety policies.

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CZCMPC22

**CONSTRUCTION EQUIPMENT AND MANAGEMENT**

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COURSEOBJECTIVES
- To know about the equipment in construction projects and its cost.
- To learn about construction equipment management.
- To provide an information about soil identification, earth moving technique and equipment’s.
- To understand the working principles of construction Equipment’s.
- To study about the method of scheduling.

Construction Equipment Cost
America (AGC) Method – Peurifoy/Schexnayder Method - Comparison of Costs Calculated by Different Methods.

**Construction Equipment Management**


**Equipment for Earthwork**


**Equipment for Other Works**

Production of Aggregate, Concrete, and Asphalt Mixes - Production of Aggregate - Crushers – Feeders - Screening Equipment - Handling Equipment. Production of Concrete - Batching and Mixing Equipment - Hauling, Pouring and Pumping Equipment - Production of Asphalt Mixes – Problems. Paving and Surface Treatments - Concrete Paving – Asphalt Paving and Surface Treatments - Pavement Repair and Rehabilitation - Problems. Compressed Air and Water Systems - Introduction – Compressed Air Systems - Water Supply Systems – Problems. Drilling, Blasting And Tunnelling Equipment- Definition of terms, bits, Jackhammers, Drifters, wagon drills, che drills, piston drills, blast hole drills, shot drills, diamond drills, tunnelling equipment, selecting the drilling method equipment; selecting drilling pattern; Rates for drilling rock, compressors. Pile driving equipment: Pile hammers, selecting a pile hammer, loss of energy due to impact, Energy losses due to causes other than impact.

**Equipment Scheduling**


REFERENCES

COURSE OUTCOMES
At the completion of the course students will be able to
1. Know about the equipment in construction projects and its cost.
2. Know about construction equipment management.
3. Knowledge on soil identification and earth moving techniques and equipment.
4. Understand the Equipments.
5. Know about the method of scheduling.

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CZCMCP26 MODEL TESTING LABORATORY

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COURSE OBJECTIVES
- To study the response of structures.
- To understand the models.
- To know about model testing for static loading
- To know about model testing for free and forced vibrations
- To learn about evaluation of dynamic modulus

LIST OF EXPERIMENTS
1. Model Analysis – Continuous beam.
3. Model Analysis – Plate.
4. Free vibration analysis of wooden cantilever beam model.
5. Free vibration analysis of steel cantilever beam model.
6. Free vibration analysis of aluminium cantilever beam model.
7. Free vibration analysis of glass cantilever beam model.
8. Determination of viscous damping co-efficient for wooden beam model.
9. Determination of viscous damping co-efficient for steel beam model.
10. Determination of viscous damping co-efficient for aluminium beam model.
11. Determination of viscous damping co-efficient for glass beam model.
12. Free vibration Analysis of Simply Supported Steel Beam model.
13. Forced vibration Analysis of Simply Supported Steel Beam model.

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Understand the response of structures.
2. Prepare the models.
3. Conduct model testing for static loading
4. Conduct model testing for free and forced vibrations
5. Evaluation of dynamic modulus.

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COURSE OBJECTIVES
- To study structural engineering problems reviewing available literature.
- To study different techniques used to analyze complex structural systems.
- To evaluate given and present solution by using his/her technique applying engineering principles.
- To learn about contemporary / emerging technology.
- To manage effectively in oral and written form and formulate documents.

The students individually undergo a training program in reputed concerns in the field of Construction Engineering and Management during the summer vacation (at the end of second semester for full – time / fourth semester for part – time) for a minimum stipulated period of four weeks. At the end of the training, the student has to submit a detailed report on the training he had, within ten days from the commencement of the third semester for Full-time / fifth semester for part-time. The students will be evaluated by a team of staff members nominated by head of the department through a viva-voce examination.
COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Identify Construction engineering problems reviewing available literature.
2. Study different techniques used to analyze complex systems.
3. Work on the solutions given and present solution by using his/her technique applying engineering principles.
4. Understand of contemporary / emerging technology.
5. Share knowledge effectively in oral and written form and formulate documents.

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COURSE OBJECTIVES
- To learn about the final report of project work in standard format
- To study about knowledge and skills in-depth and execution of new technical problem.
- To analyze suitable research design from different methodologies.
- To present the findings of their technical solution in a written report.
- To provide an information about presenting the work in International/National conference or reputed journals.

The student individually works on a specific topic approved by the Head of the Department under the guidance of a faculty member who is familiar in this area of interest. The student can select any topic which is relevant to the area of construction engineering and management. The topic may be theoretical or case studies. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work. The students will be evaluated through a viva-voce examination by a panel of examiners including one external examiner.

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Prepare the final report of project work in standard format for satisfactory completion of the work.
2. Synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
3. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design and justify their design.
4. Find technical solution in a written report.
5. Present the work in International/National conference or reputed journals.
COURSE OBJECTIVES
1. To learn about the final report of project work in standard format
2. To study about knowledge and skills in-depth and execution of new technical problem.
3. To analyze suitable research design from different methodologies.
4. To present the findings of their technical solution in a written report.
5. To provide an information about presenting the work in International/National conference or reputed journals.

The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners including one external examiner.

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Prepare the final report of project work in standard format for satisfactory completion of the work.
2. Synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
3. Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design and justify their design.
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### Mapping with Programme Outcomes

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COURSE OBJECTIVES

- To know about Durability criteria of concrete structures.
- To find out the methods of investigation and Diagnosis of concrete structures.
- To examine about the repair materials.
- To provide an information about the strategies for repair and retrofitting of structures.
- To evaluate protection techniques of structures.

Durability and Deterioration of Concrete


Investigation and Diagnosis


Repair Materials


Refurbishment Techniques

Routing and Sealing - Stitching - External Stressing - Resin Injection - Grouting - Blanketing - Overlays - Sprayed Concrete - Prepacked Concrete - Dry packing - Jacketing - Plate Bonding

Protection Techniques

Protective Coatings - Autogenous Healing - Vacuum Impregnation - Chloride Extraction - Realkalization of Concrete - Cathodic Protection.

REFERENCES


**COURSE OUTCOMES**

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

1. Understand the concepts of durability criteria.
2. Investigate the methods and Diagnosis of concrete structures.
3. Know about the repair materials.
5. Know the protection techniques of structures.

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**COURSE OBJECTIVES**

- To introduce the basics of structural integration and systems.
- To learn about the environmental factors and its relevant structural integration.
- To know the services regarding plumbing and electricity.
- To study the maintenance techniques and the materials involved.
- To understand the safety and preventive systems.

**Structural Integration**


**Environmental Factors**


**Services**

Plumbing – Electricity – Vertical circulation and their interaction – HVAC.

**Maintenance**

Component longevity in terms of operation performance and resistance to deleterious forces - Planning systems for least maintenance materials and construction – access for maintenance – Feasibility for replacement of damaged components – equal life elemental design – maintenance free exposed and finished surfaces.
Safety
Ability of systems to protect fire – Preventive systems – fire escape system design – Planning for pollution free construction environmental – Hazard free Construction execution.

REFERENCES

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Have an idea about the system integration.
2. Understand the influence of environmental factors.
3. Learn about the Plumbing and Electricity services in construction Engineering.
4. Know about the maintenance in construction Engineering.
5. Attain knowledge about the safety systems in construction Engineering.

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CZCMPEXX PROJECT FORMULATION AND APPRAISAL

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<td>To study about the costing of construction projects, appraisal, finance and private sector participation in construction Industry.</td>
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<td>To examine different project appraisal methods.</td>
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<td>To know about project finance.</td>
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<td>To find about Technology Transfer.</td>
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Project Formulation

Project Costing
Project Appraisal

Project Financing

Private Sector Participation
Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer.

REFERENCES
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Formulate and generate the project and prepare reports for executing the work.
2. Understand the costing and cash flows of a project.
3. Assess various methods of project appraisal.
4. Understand the project financing and special schemes.
5. Know about private sector participation in Infrastructure Development Projects.

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COURSE OBJECTIVES
1. To introduce types of contract- Indian contract and International contract.
3. To find out the Powers and Duties of Arbitrator.
4. To understand about the legal requirements for contracts and construction activities.
Construction Contracts


Tenders


Arbitration


Legal Requirements


Labour Regulations


REFERENCES

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India,

COURSE OUTCOMES

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

1. Identify and understand the types of contract
2. Implement the various processes involved in tenders.
3. Achieve awareness on powers and duty of an arbitrator.
4. Assess the legal requirements and the corresponding government laws.
## COURSE OBJECTIVES

- To introduce about the Construction Economics.
- To study about the Finance management.
- To find about the financial control and the need of financial management.
- To evaluate the Accounting for tax reporting purposes and financial reporting purposes.
- To learn about subcontracting and purchasing.

### Economics

Interests and time value consideration-depreciation, tax, inflation-lifecycle cost analysis-approached to asset valuation-resource allocation decision for asset management-cost of construction resources-cost of construction, land and administration-contingencies provisions and management

### Financing

Need for financial management-types of financing-short term borrowing-long term borrowing-leasing-equity financing-internal generation of funds-external commercial borrowing-assistance from government budgeting support and international finance corporation.

### Analysis of Finance


### Accounting Method

Basics of accounting method - budget and budgeting - site accounts-joint venture, project financial packaging, fund mobilization - accounting for tax reporting purposes and financial reporting purpose.

### Lending to Contractors

Loans to contractors-work package breakdown-subcontracting and purchasing.

### REFERENCES


COURSE OUTCOMES
At the end of the course, the student will be able to:

1. Have an idea about the Construction Economics.
2. Understand Finance management.
3. Analyze the financial control and the need of financial management.
4. Prepare accounting for tax reporting and financial reporting purposes.
5. Know about subcontracting and purchasing.

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CZCMPEXX RESOURCE MANAGEMENT AND CONTROL IN CONSTRUCTION

COURSE OBJECTIVES
- To introduce the concept of resource planning.
- To know about the resource allocation and leveling techniques in single and multi-projects.
- To study the various Systems approach in resource management.
- To evaluate the resources - material, equipment, labour and time.
- To know about the Skill in management of Time.

Resource Planning

Resource Allocation and Levelling
Time-cost trade off, Computer application in resource leveling examples, resource list, resource allocation graph, Resource loading, Cumulative cost ETC – Value Management.

Resources Management

Materials and Equipment
Time of purchase- Quantity of material- sources- Transportation- Delivery and Distribution. Planning and selecting by optimistic choice with respect to cost- Time- Source and handling.
Time
Personnel time- Management and planning - Managing time on the project - forecasting the future - Critical path measuring the changes and their effects.
Cost control: Cash flow and cost control - objectives of cost - Time and Quality.

REFERENCES

COURSE OUTCOMES
At the end of the course, the student will be able to:
1. Understand the Resource Planning, Procurement and Identification.
2. Use the resource allocation and leveling techniques in single and multi-projects.
3. Implement various Systems approach in resource management.
4. Assess the resources - material, equipment, labour and time.
5. Know about the Skill in management of Time for successful completion of project.

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CZCMPEXX CONSTRUCTION PLANNING, SCHEDULING AND CONTROL

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COURSE OBJECTIVES
- To provide an information about the basic concepts in development of construction planning.
- To evaluate the elements of scheduling.
- To apply appropriate tools and techniques.
- To study about the monitoring and accounting of projects through cost control.
- To know about the concept of organizing and Use of Project Information.

Construction Planning
Scheduling Procedures


Scheduling Techniques


Cost Control, Monitoring and Accounting


Organization and Use of Project Information


REFERENCES


COURSE OUTCOMES

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

1. Understand the basic concepts in development of construction planning.
2. Understand the Construction scheduling procedure and controls.
3. Apply appropriate tools and techniques for scheduling.
4. Gain knowledge about the monitoring and accounting of projects through cost control.
5. Apply the concept of organization and Use of Project Information

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COURSE OBJECTIVES

- To examine the effects of acoustics in buildings.
- To analyze the concepts of day lighting and components of daylight factor
- To study about the concept of ventilation and calculation of natural ventilation

Acoustics


Lighting


Ventilation

Ventilation due to wind – Ventilation due to stack effect – Ventilation due to combined effect – Infiltration – Ventilation of industrial building – Calculation of Natural Ventilation.

Mechanical Ventilation – Examples – Building regulation – Air Conditioning – Summary.

REFERENCES


COURSE OUTCOMES

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

1. Know about Sound, Noise and its effects.
2. Know about effects acoustics in buildings.
3. Understand the Effect of lighting.
4. Understand the Effect of ventilation in construction industries.
5. Know about the Building regulation and Air Conditioning.
Course objectives

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CZCMPEXX INFORMATION TECHNOLOGY FOR CONSTRUCTION MANAGERS

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**COURSE OBJECTIVES**

- To introduce about computer networking and use of network.
- To learn about the Database application in construction industry.
- To study about the role and types of information systems.
- To analyze the development and planning of information systems.
- Know about Computer aided design and issues in information systems.

**Networking and Internet**


**Database Application**


**Information Systems for Strategic Management**


**Planning for Information Systems**


**Emerging Concepts and Issues in Information Systems**

Enterprise Resource Planning, electronic business, Supply Chain Management, Customer Relationship Management, GIS Applications in Real Estate, Introduction to Data

REFERENCES
5. Prasanna Chandra. A management guide to PERT/CPM Project planning , analysis and selection.2011

COURSE OUTCOMES
At the end of the course, students will be able to
1. Have an idea about computer networking and use of network.
2. Use database application in construction industry.
3. Implement the role and types of information systems.
4. Identify the development and planning of information systems.
5. Formulate and generate computer aided design and issues in information systems.

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COURSE OBJECTIVES
- To study about the Industrial Health and Psychological problems of Employees.
- To Know about Occupational Stresses.
- To learn about the individual stress factors and career planning.
- To study about the factors influencing personality and emotions.
- To know about formation of Group in organizations and decision making techniques.

Industrial Health, Safety
Stress in the Workplace


Common Stress Factors Time and Career Planning


Individual Behaviour


Group Behaviour

Organization structure – Formation – Groups in organizations – Influence – Group dynamics –Emergence of informal leaders and working norms – Group decision making techniques – Teambuilding - Interpersonal relations – Communication – Control.

REFERENCES

1. ArunMonappa, RanjeetNambudiri, PatturajaSelvaraj. Industrial relations and Labour Laws. Tata
4. Mamoria C.B. and SathishMamoria, Dynamics of Industrial Relations, Himalaya Publishing

COURSE OUTCOMES:

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

1. Assess Industrial Health and Psychological problems of Employees.
2. Understand occupational Stresses.
3. Manage individual stress factors and career planning.
4. Solve the factors influencing personality and emotions.
5. Achieve awareness about formation of Group in organizations and decision making techniques.

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COURSE OBJECTIVES

- To learn about the cementitious material and its properties.
- To study mix design for different types of concrete.
- To understand the properties of fresh and hardened concrete.
- To know the special types of concrete.
- To study the various concreting methods.


REFERENCES


**COURSE OUTCOMES**

At the end of the course, students will be able to
1. Know about the Concrete materials.
2. Carry out mix design for different types of concrete.
3. Assess the properties of fresh and hardened concrete.
4. Gain knowledge about Special concrete.
5. Adopt special concreting methods.

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**CZCMPEXX**

**ANALYTICAL AND NUMERICAL METHODS FOR CONSTRUCTION ENGINEERING**

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**COURSE OBJECTIVES**

- To familiarise the students with numerical methods applicable to construction Engineering problems.
- To learn about the the Interpolation and extrapolation.
- To study about the Elements of Matrix Algebra.
- To understand ordinary and partial differential equations in structural mechanics.
- To train them for writing computer programs for solving a mathematical problem.

**Fundamentals of Numerical Methods**: Error Analysis, Polynomial Approximations and Interpolations,

**Curve Fitting**: Interpolation and extrapolation. Solution of Nonlinear Algebraic and Transcendental Equations

**Elements of Matrix Algebra**: Solution of Systems of Linear Equations, Eigen Value Problems.

**Numerical Differentiation & Integration**: Solution of Ordinary and Partial Differential Equations.

**Finite Difference scheme**: Implicit & Explicit scheme.

**Computer Algorithms**: Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.
REFERENCES
3. Introductory Methods of Numerical Analysis, Sastry S. S, Prentice Hall of India

COURSE OUTCOMES
At the end of the course, students will be able to
2. Understand the Interpolation and extrapolation.
4. Solve ordinary and partial differential equations in structural mechanics using numerical methods.
5. Write a program to solve a mathematical problem.

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COURSE OBJECTIVES
- To evaluate Computer aided Cost Estimation.
- To know about the techniques of linear, dynamic and integer programming.
- To learn about Inventory models.
- To study about advanced planning and scheduling concepts.
- To learn about Sequencing problems.

Introduction
Overview of IT Applications in Construction – Construction process – Computerization in Construction – Computer aided Cost Estimation – Developing application with database software.

Optimization Techniques
Linear, Dynamic and Integer Programming - Branch and Bound Techniques – Application to Production Scheduling, Equipment Replacement, Material Transportation and Work Assignment Problems – Software applications.

Inventory Models
Deterministic and Probabilistic Inventory Models - Software applications.
Scheduling Application

- PERT and CPM - Advanced planning and scheduling concepts – Computer applications – Case study.

Other Problems

- Sequencing problems – Simulation – Enterprises – Introduction to ERP systems.

REFERENCES


COURSE OUTCOMES

At the completion of the course students will be able to

- Know about Computerization in Construction.
- Know about the Optimization Techniques.
- Know about the Inventory Models.
- PERT and CPM using computer applications.
- Know about the different Problems in construction project.

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COURSE OBJECTIVES

- To study about the special structures and their applications.
- To learn about the construction methods of Bridge structures.
- To know about the construction methods of tunnelling and underground structures.
- To analyze the construction methods of marine structures.
- To study about Construction methods and techniques for high-rise buildings and power plant structures.

Introduction

Types of Special Structures: According to - location/environment, design, strength, radiation shielding, shape, aesthetic appearance, type of construction methods and techniques
Bridge Structures
Bridges, steel bridges, arch bridges, cantilever bridges, box girders. Construction of special type of bridges - cable stayed bridge, suspension and pre-stressed bridge. Segmental construction, cantilever construction, incremental construction, successive launching and pushing of box decks.

Underground Structures

Marine Structures
Off shore structures - beacons, oil drilling platforms, jetties and break water structures. Dredging equipments and techniques for construction of channels and islands. Laying operations for built up off-shore system. Underwater concreting using tremie method, underwater construction- problems encountered, caisson well sinking methods – conventional and jack down methods.

High Rise Structures and Power Plant Structures

REFERENCES

COURSE OUTCOMES
At the completion of the course students will be able to
1. Know about the advanced construction methods with special structures and their applications.
2. Learning construction methods of Bridge structures.
3. Know about the construction methods of tunnelling and underground structures.
4. Know about construction methods of marine structures.
5. Know about Construction methods and techniques for high-rise buildings and power plant structures.

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OPEN ELECTIVES

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COURSE OBJECTIVES

- To provide an information about the application of GIS software in construction projects.
- To Know about Geo reference data and data access.
- To Know about Data structure and Database Management system.
- To learn about Data Quality and its output.

Introduction to GIS


Types of Data


Data Structure

Raster and Vector Data Structure – Raster data storage – Methods of data compression-Run length, Chain and Block Coding – Vector Data Storage – Topology – Topological Models – Arc Node Structure – Surface Data – DEM – Grid DEM and TIN structure Applications of DEM- Database Management system

Data Quality and Output


Fields of application-construction management Parcel based, AM/FM applications examples – Case study
REFERENCES

COURSE OUTCOMES
At the completion of the course students will be able to
1. Understand the application of GIS software in construction projects.
2. Analyze Geo reference data and data access.
3. Gain knowledge about data structure and database management system.
5. Understand the Fields of application.

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CZCMOEXX SHORING, SCAFFOLDING AND FORMWORK

COURSE OBJECTIVES
- To study the detailed planning of formwork and materials associated with formwork.
- To learn about the design aspects of formwork under various requirements.
- To know the design of forms and shores.
- To evaluate the planning and erection aspects of form work for buildings.
- To know the latest methods of form construction.

Planning, Site Equipment and Plant for Form Work
Introduction - Forms for foundations, columns, beams walls etc., General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples. Overall Planning - Detailed planning - Standard units - Corner units - Pass units - Calculation of labour constants - Formwork hours - Labour Requirement - Overall programme - Detailed programme - Costing - Planning crane arrangements - Site layout plan - Transporting plant - Formwork beams - Scaffold frames - Framed panel formwork - Formwork accessories.
Materials Accessories Proprietary Products and Pressures


Design of Forms and Shores

Basic simplification - Beam formulae - Allowable stresses - Deflection, Bending - Lateral stability - Shear, Bearing - Design of Wall forms - Slab forms - Beam forms - Column forms - Examples in each. Simple wood stresses - Slenderness ratio - Allowable load vs length behaviour of wood shores - Form lining Design Tables for Wall formwork - Slab Formwork - Column Formwork - Slab props - Stacking Towers - Free standing and restrained - Rosett Shoring - Shoring Tower - Heavy Duty props.

Building and Erecting the Form Work

Carpentry Shop and job mill - Forms for Footings - Wall footings - Column footings - Sloped footing forms - Strap footing - Stepped footing - Slab form systems - Sky deck and Multiflex - Customized slab table - Standard Table module forms - Swivel head and uniportal head - Assembly sequence - Cycling with lifting fork - Moving with table trolley and table prop. Various causes of failures - ACI - Design deficiencies - Permitted and gradual irregularities.

Forms for Domes and Tunnels, Slip Forms and Scaffolds

Hemispherical, Parabolic, Translational shells - Typical barrel vaults Folded plate roof details - Forms for Thin Shell roof slabs design considerations - Building the forms - Placing concrete - Form removed -Strength requirements -Tunnel forming components - Curb forms invert forms - Arch forms - Concrete placement methods - Cut and cover construction - Bulk head method - Pressures on tunnels - Continuous Advancing Slope method - Form construction - Shafts. Slip Forms - Principles -Types - advantages - Functions of various components - Planning -Desirable characteristics of concrete - Common problems faced - Safety in slip forms special structures built with slip form Technique - Types of scaffolds - Putlog and independent scaffold -Single pole scaffolds - Truss suspended - Gantry and system scaffolds.

REFERENCES

2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996

COURSE OUTCOMES

At the completion of the course students will be able to

1. know the Planning, Site Equipment design.
2. Know about Materials Accessories Proprietary Products and Pressures.
3. Understand the Design of Forms and Shores.
4. Understand the erection of forms for various elements such as slabs, beams and columns.
5. Understand the erection of forms for elements such as shells and tunnels.

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**COURSE OBJECTIVES**
- To provide a basic information about value engineering.
- To learn about the various value analysis.
- To examine different methods of performing value engineering.
- To study about the types, purpose and factors affecting valuation.
- To learn about valuation report

**Value**
Value - Meaning of value, basic and secondary functions, factor contributing to value such as aesthetic, ergonomic, technical, economic: identifying reasons or unnecessary costs.

**Value Analysis**
10 Commandments of value analysis; value analysis team; principles of value analysis, elements of a job plan viz. orientation, Information, presentation. Implementation, follow up action, benefits of value analysis, various applications; assessing effectiveness of value analysis.

**Life Cycle Costing**
Life cycle costing – Forecasting of Capital as well as operating & maintenance costs, time value, present worth analysis, DCF methods, ROR analysis, sensitivity analysis. Different methods of performing value engineering.

**Valuation**
Types of value, purposes of valuation factors affecting value. Different methods of valuation for different types of assets such as land and building, horticulture, historical places.

**Valuation Report**
Valuation Report, contents, standard formats, Case study of any one Report.

**REFERENCES**
1. Del Younke, Value Engineering: Analysis And Methodology
6. G.S. Birdie, Estimating and Costing
7. Charotar Rangwala, Estimating and Costing Published by Publishing House,

COURSE OUTCOMES
At the completion of the course students will be able to
1. Know the application of value Engineering and valuation in construction projects.
2. Understand the value Analysis.
3. Know about Life cycle costing.
5. Understand of valuation report.

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COURSE OBJECTIVES
- To evaluate energy production systems and energy economic analysis.
- To understand the environmental aspect and resource conservation.
- To introduce smart buildings and energy efficient design strategies.
- To study about the energy efficient and environment friendly building.
- To learn about the concepts of energy management of electrical equipment.

Introduction

Environmental
Design

Natural building design consideration - Energy efficient design strategies – Contextual factors - Longevity and process Assessment –Renewable energy sources and design-Advanced building Technologies - Smart buildings - Economies and cost analysis.

Services


Energy Management


REFERENCES


COURSE OUTCOMES

At the completion of the course students will be able to
1. Have an idea about energy production systems and energy economic analysis.
2. Know the environmental aspect and resource conservation.
3. Share knowledge about smart buildings and energy efficient design strategies.
4. Get an exposure on the energy efficient and environment friendly building.
5. Understand the concepts of energy management of electrical equipment.

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COURSE OBJECTIVES

- To introduce the concept of composite structures and sandwich construction.
- To know about the design of composite members.
- To study about the types and design of connections.
To know about the design of box girder bridges.
To find out the seismic behaviour of composite structures.

Introduction
Introduction to steel - concrete composite construction - theory of composite structures
- Introduction to steel - concrete - steel sandwich construction.

Design of Composite Members
Behaviour of composite beams, columns, design of composite beams, steel composite
columns - design of composite trusses.

Design of Connections
Types of connections, Design of connections in the composite structures – shear
connections- Design of connections in composite trusses.

Composite Box Girder Bridges
Introduction - behaviour of box girder bridges - design concepts.

Case Studies
Case studies on steel-concrete composite construction in buildings – Seismic
behaviour of composite structures.

REFERENCES
1. R. P. Johnson, Composite Structures of Steel and Concrete: Beams, Slabs,
2. Graham W Owens, P R Knowles, P J Dowling, Steel Designers' Manual, Steel

COURSE OUTCOMES
At the completion of the course students will be able to
1. Assess the concept of composite structures and sandwich construction.
2. Formulate the design of composite members.
3. Identify the types and design of connections.
4. Formulate know about the design of box girder bridges.
5. Understand seismic behaviour of composite structures.

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COURSE OBJECTIVES
• To know about design of underwater construction.
• To study about the construction techniques of high rise and large span structures.
To study about the construction techniques of special structures like Silo, chimney, etc.
To learn about seismic retrofitting and strengthening techniques.
To know about demolition and dismantling techniques.

**Sub Structure Construction**

Box jacking - Pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - Piling techniques - Driving well and caisson - sinking cofferdam - cable anchoring and grouting - Driving diaphragm walls, Sheet piles - Laying operations for built up offshore system - Shoring for deep cutting - Large reservoir construction - well points - Dewatering for underground open excavation.

**Super Structure Construction for Buildings**

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures – launching techniques for heavy decks – in-situ prestressing in high rise structures, Post tensioning of slab- aerial transporting – Handling and erecting lightweight components on tall structures.

**Construction of Special Structures and Demolition**

Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and break water structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.

**Rehabilitation and Strengthening Techniques**


**Demolition**

Demolition Techniques: Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

**REFERENCES**

COURSE OUTCOMES
At the completion of the course students will be able to
1. Formulate the design of underwater construction.
2. Use the construction techniques of high rise and large span structures.
3. Use the construction techniques of special structures like Silo, chimney, etc.,
4. Achieve awareness about seismic retrofitting and strengthening techniques.
5. Learn about demolition and dismantling techniques.

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COURSE OBJECTIVES
- To know about planning and layout of prefabrication plant and IS Code specifications.
- To learn about prefabricated structures and its connections.
- To analyze the design of roof slab, Stair case, floor slab.
- To study about various types of wall.
- To study about industrial buildings and shell roofs

Design Principles
General Civil Engineering requirements, specific requirements for planning and layout of prefabrication plant. IS Code specifications. Modular co-ordination, standardization, Disuniting of Prefabricates, production, transportation, erection, stages of loading and code provisions, safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls.

Reinforced Concrete
Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, Framed buildings with partial and curtain walls, -Connections – Beam to column and column to column.

Floors, Stairs and Roofs
Types of floor slabs, analysis and design example of cored and panel types and two-way systems, staircase slab design, types of roof slabs and insulation requirements, Description of joints, their behaviour and reinforcement requirements, Deflection control for short term and long term loads, Ultimate strength calculations in shear and flexure.
Walls
Types of wall panels, Blocks and large panels, Curtain, Partition and load bearing walls, load transfer from floor to wall panels, vertical loads, Eccentricity and stability of wall panels, Design Curves, types of wall joints, their behaviour and design, Leak prevention, joint sealants, sandwich wall panels, approximate design of shear walls.

Industrial Buildings and Shell Roofs
Components of single-storey industrial sheds with crane gantry systems, R.C. Roof Trusses, Roof Panels, corbels and columns, wind bracing design. Cylindrical, Folded plate and hyper-prefabricated shells, Erection and jointing, joint design, hand book based design.

REFERENCES

COURSE OUTCOMES
At the completion of the course students will be able to
1. Have an idea about the planning and layout of prefabrication plant and IS Code specifications.
2. Identify prefabricated structures and its connections.
3. Generate the design of roof slab, Stair case, floor slab.
4. Know about various types of wall.
5. Gain knowledge about industrial buildings and shell roofs.

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COURSE OBJECTIVES

- To know about water treatment and waste treatment systems.
- To evaluate structural designs – construction below ground level.
- To learn about the functional design of overhead water tanks.
- To learn about the functional aspects of ground level water retaining structures.
- To study about the design of conduits and appurtenances.

Introduction

Review of the principle of design in respect of water treatment and waste treatment systems – criteria considered important structurally in the case of each component – consideration of soil bearing capacity under different combinations of soil types.

Factors Relevant to Structural Design

Ultimate load theory – plastic analysis – consideration on impact due to live and dead loads – considerations of corrosion effects on structural aspects – structural designs – construction below ground level.

Design of Overhead Water Tanks

Functional design – structural design – architectural design – cost aspects.

Design of Ground Level Water Retaining Structures

Functional aspects – maintenance factors.

Miscellaneous Structural Works


REFERENCES

1. Gray. C, Reservoirs and Tanks
2. Reynolds, R.C. Designers Hand Book.
3. Abeles and Turner, Prestressed Concrete Designers Hand Book.

COURSE OUTCOMES

On completion of this course the students will be able to

1. Get an exposure on water treatment and waste treatment systems.
2. Understand structural designs – construction below ground level.
3. Assess the design of overhead water tanks.
4. Understand the functional aspects of ground level water retaining structures.
5. Assess the design of conduits and appurtenances.
COURSE OBJECTIVES

- To know about the leadership power, leadership styles, leadership in administration.
- To provide a basic information about the stress and its causes, performance appraisal and time management.
- To learn about HRM.
- To study the relations and compensation management
- To understand the labors training and development.

Leadership, Interpersonal and Communication


Stress, Conflict, Performance, Time and Motivation


Time as a Resource - Identify Important Time Management Wasters - Individual Time Management Styles - Techniques for better Time Management- Introduction to Motivation, Relevance and types of Motivation - Motivating the subordinates - Analysis of Motivation.

Manpower Management

Recruitment-Sources of Recruitment-Selection Process-Placement and Induction-Retention of Employees.

**Relations and Compensation Management**


**Training and Development**


**REFERENCES**


**COURSE OUTCOMES**

At the completion of the course students will be able to

1. Gain knowledge about leadership power, leadership styles, and leadership in administration.
2. Have an idea about the stress and its causes, performance appraisal and time management.
3. Understand the HRM.
4. Know about relations and compensation management.
5. Learn about labours training and development.

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**COURSE OBJECTIVES**

1. To provide an information about the importance and scope of industrial and organizational psychology.
2. To understand the types of psychology and its effect on the efficiency and productivity.
3. To study Organizational Psychology
4. To evaluate Individual and Group Behavior of workers
5. To learn about Occupational Stress.

**Conceptual Awareness of Industrial Organizational Psychology**

Introduction of the terms ‘Industry’ ‘Organization’ and ‘Psychology.’ Definition & Nature – Industrial Organizational Psychology - Importance & Scope of its application - How I/O Psychology is different - Psychological factors responsible for behavior of an individual at workplace Industrial-Organizational Psychology on the job and in Everyday Life.

**Characteristics Psychology**

Types and characteristics of psychology Impacting factors and their effects on the behavior - Human psychology - Differentiating male & female psychology - Determining factors impacting work efficiency and productivity.

**Organizational Psychology**

Monitoring Industrial Organizational Psychology - Different tools for testing psychology - Problems with Using Psychological Tests - Measuring effectiveness of these tests - Usage of tests for improving the employee psychology, - Challenges for I-O Psychology

**Workers Behavior**

Individual and Group Behavior - Interaction as Individuals and as Groups - Determining factors for improving their psychology Group Dynamics - Characteristics of Group Dynamics - Necessary steps in Group Dynamics to enhance efficiency & productivity.

**Occupational Stress**


**REFERENCES**


**COURSE OUTCOMES**

At the completion of the course students will be able to

1. Understand the importance and scope of industrial and organizational psychology
2. Know about the types of psychology and its effect on the efficiency and productivity.
3. Have an idea about organizational psychology
4. Manage Individual and group behavior of workers
5. Learn about occupational stress.

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