UNIVERSITY OF PETROLEUM & ENERGY STUDIES

(ISO 9001:2008 Certified)

B.TECH CIVIL ENGINEERING WITH SPECIALIZATION IN INFRASTRUCTURE DEVELOPMENT

(Versions 7.0)

w.e.f. 2019

UPES Campus
“Energy Acres”
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2019-23 Batch
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Program Outcomes (POs)

PO1. Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

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

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1. The student should be able to apply engineering/sciences concepts, analytical and experimental skills to civil engineering systems.

PSO2. The student should be able to plan, analyze and design civil engineering infrastructure projects for sustainable and economic development.
## B. Tech. Civil Engineering with specialization in Infrastructure Development 2019

### SEMESTER I

<table>
<thead>
<tr>
<th>Subject Code</th>
<th>Subject</th>
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**TOTAL Credits for B. Tech. Civil Engineering with specialization in Infrastructure Development 2019:** 75

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*Note: The above table represents the course structure for the B. Tech. Civil Engineering with specialization in Infrastructure Development 2019 batch, indicating the distribution of courses and credits across different semesters.*
<table>
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**SEMESTER VII**

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<td>CIVL 4062</td>
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**Professional Elective Basket I and V (Structural Engineering)**

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<td>CIVL 4033</td>
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### Professional Elective Basket III (Geo Technical Engineering)
- CIVL 3005: Foundation Engineering
- CIVL 3038: Geotechnical Design
- PEGS 3024: Rock Mechanics

### Professional Elective Basket IV (Transportation Engineering)
- CIVL 3040: Pavement Design
- CIVL 3042: Traffic Engineering and Management
- CIVL 3043: Urban Transportation Planning
- CIVL 3045: Airport Planning and Design
- CIVL 3046: Railway Engineering

### Professional Elective Basket VI & VIII (Hydraulics, Water Resources Engineering and Offshore Structures)
- CIVL 4050: Groundwater
- CIVL 4051: Surface Hydrology
- CIVL 4043: Design of hydraulic structures/Irrigation Engineering
- CIVL 4045: River Engineering
- CIVL 4011: Design of Offshore Structures
- CIVL 4009: Construction of Offshore Structures

### Professional Elective Basket VII (Construction Engineering and Management)
- CIVL 4061: Advanced Construction Techniques
- CIVL 4055: Construction Project Planning & Systems
- CIVL 4054: Building Construction Practice

**Total Credits of B. Tech. Civil Engineering with specialization in Infrastructure Development 2018**

16

7
SEMESTER I
Course Objectives

- To enable the students to understand the basic concepts of differential and integral calculus.
- To help the students develop the skills related to multivariate calculus.
- To enable students to understand the matrix theory.
- To make the students able to understand the basic knowledge of sequences and series.

Course Outcomes

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

CO1. Find solution of a system of linear equations.
CO2. Apply the techniques to handle the functions of several variables for calculus.
CO3. Demonstrate the basic concepts of vector calculus with relevant applications.
CO4. Find the infinite series approximation of a periodic and non-periodic function of one variable.

Catalog Description

Mathematics is a natural complementary discipline for learning, understanding and appreciating many fundamental science and engineering concepts. It helps us to develop logical thinking and also to find the right way to solve problems. The purpose of this course is to provide participants with the skills, knowledge required to perform fundamental mathematical procedures and processes for solution of engineering problems, particularly the use of matrices, multivariable calculus, vector calculus. The approximation techniques for periodic and non-periodic functions using infinite series are important for engineering disciplines while matrices are foundations for computer science.

Course Content

Unit 1: Matrices (08 Lecture Hours)
Elementary transformation, Inverse of matrix, linearly independent vectors, rank of a matrix, solution of system of linear equations, Eigenvalues and Eigenvectors, characteristic equation, Cayley-Hamilton Theorem, Diagonalization of matrices, Orthogonal transformation and quadratic to canonical forms.

Unit 2: Multivariable Calculus (12 Lecture Hours)
Partial derivatives, Euler’s Theorem and its Applications, total derivative, Jacobians, extrema of functions of two variables, Method of Lagrange multipliers.
Beta and gamma function, Multiple Integration: double and triple integrals, change of order of integration, change of variables, Applications: areas, volumes, center of mass and Gravity (constant and variable densities).

Unit 3: Vector Calculus II (Integral) (08 Lecture Hours)
Vector and scalar functions and fields, Gradient of a scalar field, Directional derivative; Divergence and curl of a vector field. Line Integrals, Path Independence of Line Integrals; Surface Integral; Volume Integral, Applications of Green’s theorem, Gauss’ divergence theorem & Stoke’s theorem.

Unit 4: Fourier series and Transform (08 Lecture Hours)
Taylor’s and Maclaurin’s series, Periodic Functions, Fourier Series expansion of functions of period 2\(l\), Half Range Sine and Cosine series, Fourier transform.

Text Books

Reference Books

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

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

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

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

Course Outcomes

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

CO1. Choose and develop the appropriate fuel for commercial and domestic application with respect to socio-economic and environment concern
CO2. Apply the concepts of reaction dynamics for the improvement of chemical reactions involved in general chemical processes
CO3. Explain the mechanism, theories and preventive measurements, of corrosion, with the help of electrochemical concepts
CO4. Analysis and enhance the water quality
CO5. Explain preparation method, properties and application of polymeric and nanomaterials

Catalogue Description

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

Unit 1: Fuels & Thermochemistry (10 Lecture Hours)
Enthalpy of formation, Enthalpy of neutralization and Enthalpy of combustion, Hess’s law of constant heat summation and its application, bond energy. Fuels - Introduction, Classification, Important properties of a good fuels, Calorific value, Determination of calorific value by Bomb calorimeter, Analysis of coal- proximate, Ultimate analysis, Combustion and its calculations, Distillation of crude oil, composition of petroleum, Important reactions for petroleum industries (isomerization, dimerization, aromatization, cracking), Octane number, cetane number, renewable energy sources: biodiesel, biogas, bioethanol. Hydrocarbons chemistry: Basic concepts for preparation strategy, chemical properties and reactivity of aliphatic (alkanes, alkenes, alkynes, cycloalkanes) and aromatic hydrocarbons.

Unit 2: Reaction Dynamics (09 Lecture Hours)
Rate of reaction and rate constant, factors affecting rate of a reaction, order and molecularity of a reaction, Rate expression for zero and first order. Pseudo first order reaction, Second (2A & A+B) and third (3A) order reaction, Methods of determining order of a reaction: Hit and trial method, half-life period method, graphical method, Von’t Hoff method (ratio variation method), differential method and Ostwald isolation method. Concept of energy barrier and activation energy, Collision theory, Kinetics of complex reactions- reversible, parallel, consecutive and chain reaction, Steady state approximation, Lindemann theory. Equilibrium and equilibrium constant, Kp, Kc, Kx. Homogeneous and heterogeneous equilibrium, Le Chatelier principle.

Unit 3: Electrochemistry and Corrosion (06 Lecture Hours)

Unit 4: Water Chemistry (06 Lecture Hours)
Introduction, hardness of water, measurement of hardness, alkalinity, water softening- lime-soda process, zeolite process, ion exchange process.

Unit 5: Polymers (06 Lecture Hours)
Classification, Types of polymerization techniques: Bulk, solution, suspension and emulsion, mechanism of polymerization (cationic, anionic and free radical), vulcanization, average molecular weight of polymers, conducting polymers, plastic used in daily life applications viz. making of tyres, ropes, electrical fittings, contact lenses, credit cards, air tight containers, cookwares, cold drink bottles.

Unit 6: Nanomaterials (03 Lecture Hours)
Text Books


Reference Books


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

Examination Scheme:

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

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

- To enable students to acquire knowledge, imagination and be more assertive on opinions on problems in society.
- To enable students to learn basics of research, data collection, analysis, brainstorming to find solutions to issues.
- To make them understand Design Thinking methodologies to problems in field of study and other areas as well.
- To help students to understand future Engineering positions with scope of understanding dynamics of working between inter departments of a typical OEM.

Course Outcomes

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

CO1. Examine design thinking concepts and principles
CO2. Practice the methods, processes, and tools of design thinking
CO3. Apply the Design Thinking approach and model to real world scenarios
CO4. Analyze the role of primary and secondary research in the discovery stage of design thinking

Catalog Description

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

Unit 1: What Is Design Thinking (06 Lecture Hours)
Designers seek to transform problems into opportunities. Through collaboration, teamwork, and creativity, they investigate user needs and desires on the way to developing human-centered products and/or services. This approach is at the very heart of design thinking.

Unit 2: The Design Thinking Model (06 Lecture Hours)
A tool that helps guide you along a design thinking path. The model does this by providing a series of activities that will help you effectively design a product, service or solution to a user’s need. The model presents the approach as a process, allowing us to look at each step – or phase – along the journey to the development of a final design.

Unit 3: Phase 1: Discover (08 Lecture Hours)
Begin the design thinking process with the Discover phase, where you will identify the specific problem your design is intended to solve, as well as important usability aspects from those who will use your design. Discovery can be performed through a variety of different research methods which you will learn in this module.

Unit 4: Phase 2: Define (08 Lecture Hours)
In the Define phase, you come to understand the problem. We often refer to this as framing the problem. You can do this by using a variety of tools, including storytelling, storyboarding, customer journey maps, personas, scenarios, and more.

Unit 5: Phase 3: Develop (06 Lecture Hours)
Turn your attention to solving the problem. In this phase you brainstorm custom creative solutions to the problems previously identified and framed. To do this, you conceptualize in any way that helps, putting ideas on paper, on a computer, or anywhere whereby they can be considered and discussed.

Unit 6: Phase 4: Deliver (06 Lecture Hours)
This phase is all about testing and building concepts. Here you take all of the ideas that have been discussed to this point and bring them a little closer to reality by building a concept; something that makes it easier for a user to experience a design. This concept is referred to as a prototype.

Unit 7: Phase 5: Iterate (08 Lecture Hours)
You will test the prototype of your design solution, collecting and acting on feedback received. These actions may mean minor or major revisions to your design, and are repeated as often as necessary until a solution is reached. Tools such as focus groups and questionnaires are used to help you collect feedback that can help with your final design.

Unit 8: Beyond Design Thinking (06 Lecture Hours)
The Design Thinking Model is a tool that helps guide you along a design thinking path. The model does this by providing a series of activities that will help you effectively design a product, service or solution to a user’s need. The model presents the approach as a process, allowing us to look at each step – or phase – along the journey to the development of a final design.
Text Books

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

Reference Books


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

Examination Scheme:

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

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

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

- Study the fundamental laws of Electrical Engineering
- Apply laws to solve the DC & AC Circuits and 3-Phase Circuit
- Study the Constructional features, operation and characteristics of Electrical Machines
- Study and develop the Industrial Electrical System.

Course Outcomes

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

CO1. Understand the fundamental laws of Electrical Engineering
CO2. Solve DC & AC Circuits and understand 3-Phase Circuit
CO3. Understand the Constructional features, operation and characteristics of Electrical Machines
CO4. Understand the Industrial Electrical System.

Catalog Description

Electrical Engineering is an essential requirement part of human being and engineering. As a part of engineering studies, students must learn the basics of Electrical Engineering. This course describes about the various fundamental laws of Electrical Engineering, Various AC & DC Circuits and solution of simple electrical circuits. The course also describes about the various Electrical Machines their construction, Working principles, characteristics and applications. The course also deals with Industrial Electrical System layouts, earthings, protections and safety precautions associated with electrical engineering.

Course Content

Unit 1: Introduction (04 Lecture Hours)
Resistance, inductance and capacitance, open circuit and short circuit, electrical power and energy; Voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with DC excitation. Superposition, the Venin and Maximum Power Transfer theorem

Unit 2: AC Circuits (06 Lecture Hours)
Representation of sinusoidal waveforms, peak and RMS values, phasor representation. Elementary analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations. Real power, reactive power, apparent power, power factor. Resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.
Unit 3: Transformers (04 Lecture Hours)
Construction, Working Principle and Classification; Ideal and practical transformer, losses in transformers & efficiency; Introduction to 3-phase transformer;

Unit 4: Electrical Machines (06 Lecture Hours)
Classification of motors (AC & DC), characteristics & applications of DC Motors; Construction and working of Three Phase Induction motor, RMF, Torque-slip characteristics, Introduction of starting and speed control of Electric dc motors;

Unit 5: Electrical Installations (04 Lecture Hours)
Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB; Types of Wires and Cables, Earthing; Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, and battery backup.

Text Books:
1. Ashfaq Hussain and V.K. Mehta, Basic Electrical Engineering.

Reference Books:
2. U. A. Bakshi, and V. U. Bakshi, Basic Electrical Engineering, Technical Publications Pune
3. Rajput, A Text Book of Electrical Machines, L P Publications

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

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1 = weakly mapped, 2 = moderately mapped, 3 = strongly mapped
Course Objectives

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

Course Outcomes

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

CO1. Remember the conventions of engineering graphics such as types of lines, dimensioning, method of projection etc.
CO2. Demonstrate understanding of fundamental concepts of engineering graphics
CO3. Apply knowledge of orthographic and isometric projections to solve problems related to points, lines, planes and solids
CO4. Develop and model basic mechanical components

Catalogue Description

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

Course Content

Unit 1: Fundamental of Engineering Graphics and Projections (2L + 2P Hours)
Introduction to drawing instruments, sheet layout and sketching, Lines, Lettering and Dimensions.

Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Unit 2: Projection of Point (1L + 1P Hours)
Introduction to orthographic Projection, Projection of points situated in 1st, 2nd, 3rd and 4th quadrant
Unit 3: Projection of Lines
(1L + 1P Hours)
Line parallel to one or both the planes, line perpendicular to one plane and parallel to other, line inclined to one of the planes.

Unit 4: Projection of Planes
(1L + 1P Hours)
Types of plane, Projection of planes parallel to one of the references. Projections of planes inclined to one of the reference plane and perpendicular to the other.

Unit 5: Projection of Solids
(1L + 1P Hours)
Introduction and types of solid, Projections of solids in simple positions, inclined to one plane. Projections of spheres and problem solving.

Unit 6: Section of Solids
(1L + 1P Hours)
Introduction and Section of prisms, Pyramids, Cylinder, Spheres, Cones.

Unit 7: Isometric Projection
(2L + 2P Hours)
Introduction of isometric axes, lines and planes, Isometric drawing of different objects.

Unit 8: Surface Development and Perspective Projection
(1L + 1P Hours)
Methods of development, Developments of lateral surfaces; Principle of perspective projections, Definition of perspective elements.

Unit 9: Computer Graphics
(2L + 2P Hours)
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM).

Text Books:

Reference Books:

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

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

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

Course Outcomes

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

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

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

CO3. To provide fundamental knowledge of various aspects of pollution and to motivate to adopt ecofriendly technologies to facilitate conservation and regeneration of natural resource.

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

Catalog Description

Environmental Science, it is important for the students to have a knowledge about what is happening to the earth and its resources. "The interdisciplinary course will be helpful in imparting knowledge to undergraduates from all educational backgrounds". It will not only give them a better understanding of environmental issues at the local, regional and global levels but also help them develop lateral thinking in this area.
The subject gives a direct contact with nature and the knowledge of it: The subject environmental science gives students an ample scope for ‘application’. They will get some real-time knowledge and skill, which required when they are actually dealing with environmental problems and the possible solutions. They can actually see the knowledge of physics and chemistry and for that matter even biology helps them to protect environment. This could give the student community a sense of ‘empowerment’.

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

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

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

Course Content

**Unit 1: Multidisciplinary Nature of Environment Studies** (04 Lecture Hours)
Multidisciplinary nature of Environmental Studies, scope, importance of environment & need of public awareness. Institutions in Environment, People in Environment

**Unit 2: Ecosystem** (05 Lecture Hours)
Concept of Ecosystem, Structure of ecosystem (Biotic and Abiotic) Biotic (Producer, Consumer and Decomposer), Abiotic (Physical factors & Chemical Factors) Functions of ecosystem Food Chain, Food Web, Trophic Level, Ecological Pyramid (Pyramid of energy, biomass, number) Energy flow in an Ecosystem, Biogeochemical cycle (cycling of nutrients), Carbon Cycle, Nitrogen cycle, Water Cycle, Oxygen Cycle, Carbon Cycle, Phosphorus cycle, Ecological Succession – Definition, Types of Succession, (Hydrosere and Xerosere) and Process of Succession.

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

**Unit 3: Natural Resources and Management** (05 Lecture Hours)
Current and Future Global Challenges, Water (Surface water and ground water), Mineral resources

**Unit 4: Biodiversity & Its Conservation**  
(05 Lecture Hours)  
Introduction of biodiversity, types of biodiversity (Genetic, Species and Ecosystem Biodiversity), Biogeographic Classification of India, Four Level Biogeographical Classification, (a) The Biogeographic Zone (b) The Biotic Province, (c) The Land Region (d) The Biome, India-A Mega-diversity nation, Ecregion, Terrestrial Biome, Hot-Spots Biodiversity, Threats to Biodiversity, conservation of biodiversity (In - situ & Ex-situ), Case Study Project Tiger

**Unit 5: Environmental Pollution and Its Control Methods**  
(05 Lecture Hours)  
Environmental Pollution, Types of Pollution, Causes, Effects and Control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Radioactive pollution, Solid waste management- Causes, Effects and Control measures, Disaster Management (Flood, Earth Quake, Cyclone & Landslide)

**Unit 6: Social Issues and Environment**  
(06 Lecture Hours)  
Concept of sustainable development, (Concept, Principle and measures to Promote Sustainable Development), Climate changes, Global warming, Acid rain, ozone layer depletion, Carbon Foot Print, Ecological Foot Print, Environmental Impact Assessment, Environmental Protection Act, Air Prevention Act, The Water Prevention Act, The Wild Life Protection Act, Forest Conservation Act

**Unit 7: Human Population & Environment**  
(06 Lecture Hours)  

**Project Work (Field Work)**

**Text Books:**
1. Erach Bharucha, *Text Book of Environmental Studies*, UGC, New Delhi

**Reference Books**
3. Saigo & Cunningham, *Environmental Concerns*  

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

**Examination Scheme:**

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

- To understand various Electrical components and identify the importance of DC-theorem while solving any complex circuit
- To understand the concepts of Electrical Devices and their application.
- To understand working principle and behavior of Electrical Machines.
- To develop the application based circuits like switch, Rectifier by using Diode and transistor and also by logic gates.

Course Outcomes

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

CO1. Realize electrical circuits and measure various electrical quantities by applying fundamental theorems/laws
CO2. Analyze Electrical Power in AC circuits
CO3. Develop the logic and fabricate staircase wiring
CO4. Understand fundamentals of various electrical machines and their working

List of Experiments

Experiment - 1 To verify Thevenin’s Theorem on network theorem kit

Experiment - 2 To verify Super Position Theorem on network theorem kit

Experiment - 3 To verify Maximum Power Transfer Theorem on network theorem kit.

Experiment - 4 To verify Norton’s Theorem on network theorem kit.

Experiment - 5 Determine the active and reactive power in RLC series circuit.

Experiment - 6 Determine the active and reactive power in RLC parallel circuit.

Experiment - 7 To develop the logic for staircase wiring.

Experiment - 8 Open circuit and Short circuit test of single-phase transformer.

Experiment - 9 Demonstration of cut sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor) and single-phase induction machine.
Experiment – 10 Speed control of DC shunt motor.

Text Book

Reference Book
1. Basic Electrical Engineering by C. L. Wadhwa
2. Basic Electrical Engineering by Ashfaq Husain and Haroon Ashfaq

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

Examination Scheme:
Continuous Lab Evaluation is there to assess the student’s performance in the lab.

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

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1=weakly mapped  2= Moderately mapped  3=Strongly mapped
Course Code: CHEM 1111  
CHEMISTRY I LAB  

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Pre-requisites/Exposure: Fundamentals of 12th level Chemistry  
Co-requisites: --  

Course Objectives  
- To help the students familiar with the fundamental concepts of practical chemistry  
- To make the students able to prepare standard solutions and few commercial materials  
- To make the students able to determine the strength of the solutions using basic instrumental and classical methods.  

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

CO1. Demonstrate the kinetics of chemical reaction and the synthesis of polymeric material like resins.  
CO2. Analyze efficiency/quality of different fuels/water samples for commercial and domestic application.  
CO3. Apply different types of titrations for various quantitative analysis.  
CO4. Apply simulation method for the volumetric analysis of various neutralization reactions.  

Catalog Description  
Chemistry is present everywhere around us. It is existing in everything we see, feel or imagine. It is one of the very fundamental basics behind every structure, building, bridge, refinery and industry. In this lab course, focus will be on firming the basic knowledge of students about chemistry. Students will learn how to use the concepts correctly through prescribed syllabus and will perform related experiments in the Chemistry lab. They will be taught to find the more effective fuel using proximate analysis and sulfur present in fuel through gravimetric analysis. Different processes used to improve the quality of fuels in refineries will be discussed. Water chemistry will make the students understand various parameters of water quality and the treatments to improve it. Kinetics experiments help them to find order of reaction in lab. They learn to prepare polymers also at lab scale. Lab activities include lab instructions, hands on experience, maintaining lab record and viva-voce.
List of Experiments

1. To determine the strength of given solution of NaOH by titrating it against standard oxalic acid solution using phenolphthalein.
2. To determine the percentage of moisture, volatile matter, ash content and fixed carbon in a given coal sample by proximate analysis.
3. To estimate sulfur content in a given sulfate solution of Sodium Sulphate gravimetrically.
4. To determine the rate constant and order of the reaction of the hydrolysis of an ester (ethyl acetate) at 25°C in the presence of 0.5N hydrochloric acid.
5. To determine the strength of given solution conductometrically.
6. To determine the strength of the given solution pH-metrically
7. To determine the total hardness of the given hard water sample by EDTA method.
8. To determine the alkalinity of a given water sample.
9. To prepare Urea-Formaldehyde (UF) resin.
10. To determine the strength of given solution of NaOH by titrating it against standard oxalic acid solution using phenolphthalein using virtual lab.

Link: http://vlab.amrita.edu/?sub=2&brch=193&sims=352&cnt=4

Text Books / Reference Books
3. Practical Physical Chemistry by B. Viswanathan, Publisher: Viva Books, ISBML 9788130920696

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

Examination Scheme:

Continuous Evaluation

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1=weakly mapped    2= Moderately mapped    3=Strongly mapped
SEMESTER II
Course Objectives

- To help the students to solve the differential equations.
- To help the students understand the basic theory of function of a complex variable.
- To make the students apply the theory of contour integration using residue calculus.
- To enable the students solve specific classes of partial differential equations.

Course Outcomes

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

CO1. Apply techniques to solve linear ordinary differential equations.
CO2. Explain the concept of analyticity and integration of a complex function
CO3. Find the series representation of a complex function and to evaluate special integrals using calculus of residues.

Catalog Description

This course covers the ordinary differential equations, partial differential equations and complex analysis. In differential equations student equips with the fundamental tools to solve ordinary differential equations, glimpse of nonlinear ordinary differential equations of special forms and partial differential equations. Lagrange’s method ensures the solution of first order nonlinear partial differential equations and separation of variables method useful to solve the one dimensional wave and heat equations. In addition, this course introduces the calculus of complex functions of a complex variable. It turns out that complex differentiability is a very strong condition and differentiable functions behave very well. Integration is along paths in the complex plane. The central result of this spectacularly beautiful part of mathematics is Cauchy's Theorem guaranteeing that certain integrals along closed paths are zero. This striking result leads to useful techniques for evaluating real integrals based on the 'calculus of residues'.

Course Content

Unit 1: Ordinary Differential Equations (09 Lecture Hours)

Exact differential equation and equations reducible to exact, Linear Differential Equations with Constant Coefficients, Cauchy-Euler Differential Equations, Solution of Second Order Differential Equations (when a part of complementary function is known, by reduction to Normal Form, by changing the Independent Variable and by Variation of Parameters).
Unit 2: Complex variables-I  
Functions of a complex variable, Notion of limit, continuity and differentiability, Analytic function, Necessary & sufficient conditions for analyticity (Cauchy-Riemann equations), Harmonic function, harmonic conjugate and orthogonal families, construction of an analytic function, Milne Thomson method, Line integral and independence of path, Cauchy’s theorem, Cauchy-Goursat theorem for simply and multiply connected domain, Cauchy’s integral formula and its applications.

Unit 3: Complex variables-II  
Power series, Taylor’s and Laurent’s series, Zeros and singularities of a function, residues, Cauchy Residue Theorem, Evaluation of definite integral \( \int_{0}^{2\pi} F(\cos \theta, \sin \theta) \, d\theta \), Evaluation of improper integrals \( \int_{-\infty}^{\infty} \frac{p(x)}{q(x)} \, dx \) and \( \int_{-\infty}^{\infty} \frac{p(x)}{q(x)} e^{i \alpha x} \, dx \); evaluation of \( \int_{-\infty}^{\infty} \frac{p(x)}{q(x)} \, dx \) and \( \int_{-\infty}^{\infty} \frac{p(x)}{q(x)} e^{i \alpha x} \, dx \) with poles on real axis (semicircular contour), Conformal mapping, Linear mapping, inversion, Bilinear transformation.

Unit 4: Partial Differential Equations  
Formation of partial differential equation (PDE) and classification of PDEs, Lagrange’s Method, Solution of homogeneous linear PDE with constant coefficients, method of separation of variables, solution of one dimensional heat and wave equation.

Text Books:

Reference Books:
2019-23 Batch

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

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

- Explore Fiber optics and Lasers’ fundamentals and their applications to modern communication systems.
- Comprehend the effect of electric and magnetic field in materials and apply Maxwell’s equations to understand EM wave propagation
- Familiarize with the basics of solar photovoltaics and their applications in solar industries.
- Construct a quantum mechanical model to explain the behavior of a system at the microscopic level.
- Understand the fundamentals of crystal structure and X-rays diffraction.

Course Outcomes

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

CO1. Learn the principles of physical optics, lasers and fiber optics and their applications in various devices
CO2. Comprehend the properties of dielectric and magnetic materials under the influence of electric and magnetic fields.
CO3. Employ photovoltaics fundamentals in understanding the functioning of various devices used in electronics and solar photovoltaics industries.
CO4. Understand the behavior of microscopic objects using fundamentals of Quantum Mechanics.
CO5. Explore different types of crystals structures and use X-ray diffraction technique to understand their details.

Catalog Description

Almost all disciplines of engineering and technology have origins in the basic principles of Physics. In this course, we will systematically build the foundation of the students by teaching them introductory quantum mechanics, solid-state physics, electromagnetics, and optics. These topics will help the students in understanding their respective engineering content better. The theoretical development of wave mechanics, its limitations and contributions in revolutionizing the modern world will be covered in the first unit. In the second unit, the focus will be on different types of crystal structures and how X-ray diffraction may be utilized in understanding various attributes of a crystal structure. The third unit deals with very important class of engineering materials namely di-electric and magnetic materials along with their wide range of applications; understanding EM waves propagation with the help of Maxwell’s equations will also be covered in this unit. In the remaining units, the students will be apprised of physical
optics and its applications in various optical devices and measurements; lasers and optical fibres will be introduced thereafter with an objective to teach sufficient details to the students so that they should be able to understand modern day communications systems. A short unit on solar photovoltaics at the end has been provided to provide enough details so that the students could make themselves familiar with the PV technology applied nowadays for clean energy generation.

Course Content

Unit 1:  (09 Lecture Hours)
Introduction to interference and examples; concept of diffraction, Fraunhoffer and Fresnel diffraction, diffraction grating and its characteristics.
Polarization: Introduction, polarization by reflection, polarization by double refraction, circular and elliptical polarization, optical activity.
Fibre Optics: Introduction, total internal reflection, numerical aperture and various optical fibre parameters, step and graded index fibres, applications of optical fibres.
Lasers: Introduction to interaction of radiation with matter, principles and working of laser: population inversion, pumping; types and applications of lasers, He-Ne laser.

Unit 2:  (08 Lecture Hours)
Electric Polarization, permeability and dielectric constant, internal fields, Clausius-Mossotti equation, applications of dielectrics.
Magnetization, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

Unit 3:  (03 Lecture Hours)
Photovoltaic effect, irradiance, solar radiation and spectrum of sun, solar cells, basic structure and characteristics, solar cell arrays, PV modules.

Unit 4:  (09 Lecture Hours)
Introduction to Quantum Mechanics, photoelectric effect, Compton Effect, Pair production & Annihilation, De-Broglie waves, Waves of probability, phase and group velocities, Uncertainty principle and its applications, Wave function and its interpretation, Normalization, Schrodinger time independent & dependent wave equations, Linearity and superposition, expectation values, operators, Eigen values & Eigen functions, Particle in a 1-D box

Unit 5:  (07 Lecture Hours)
Introduction to Solid State Physics, single crystals and polycrystalline forms, Lattice, Basis and crystal structure, Translational symmetry and basis Vectors, Unit Cell (primitive and non-primitive), Bravais lattices, Miller indices, sc, bcc, and sodium chloride structures, closed packed structures(fcc and hcp), Reciprocal lattice, X-ray diffraction, Bragg's law.
2019-23 Batch

Text Books:

Reference Books:

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

Examination Scheme:

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

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

Course Outcomes

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

CO1. Identify the process, principles, barriers and types of Communication
CO2. Analyze & develop grammatically correct and situationally appropriate language for communicating effectively
CO3. Classify & apply the principles/techniques of mind mapping, precis writing and paragraph development.
CO4. Apply formal writing techniques to draft letters and emails for various organizational situations.
CO5. Professionally organize the content & deliver the presentation.

Catalog Description

The blended course on English focuses on the development of students’ language & communication skills. The course will make the students appreciate, learn and apply the nuances of Communication skills & the concepts. This course will also focus on the use of Applicative English Grammar for improved Writing Skills with precision and clarity and shall also help the students learn to design & deliver presentations.
2019-23 Batch

Course Content

Unit 1: Introduction to Communication (3(F2f) + 2(Online))
Definition, Process, Principles and Model, Barriers, Noise, Types and Forms, Grapevine

Unit 2: Identifying common errors (2(F2f) + 2(Online))
Common errors, learning through examples, Identifying common errors, Contemporary usage.

Unit 3: Nature & Style of Sensible Writing (3(F2f) + 2(Online))
Mind Map, Paragraph writing, (Principles, Methods of paragraph development, Precise Writing

Unit 4: Letter Writing (4(F2f) + 2(Online))
Letter writing (Format and content of complaint, request, application), Email (good news, bad news, netiquettes)

Unit 5: Formal Presentations (3(F2f) + 1(Online))
Nuances of Delivery, Group Presentations

Text Books


Reference Books

5. Essential English Grammar by Raymond Murphy, CUP, 2011

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

**Examination Scheme:**

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

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

- This course aims at imparting knowledge and skill components in the field of basic workshop technology.
- To enable student familiar with different hand and machine tools required for manufacturing simple metal components and articles.
- To impart the knowledge regarding the various basic manufacturing processes required in day to day life.
- To familiarize the students with the properties and selection of different engineering material.

Course Outcomes

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

CO1. Understand the basics of manufacturing processes used in engineering workshop
CO2. Identify basic workshop hand & machine tools
CO3. Fabricate simple models by using different Manufacturing processes
CO4. Compare conventional and advance manufacturing processes

Catalog Description

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

**Unit 1: Manufacturing Methods**  
(04 Lecture Hours)  

Machining - Types of machine tools - Lathe – working principle, operations, specification, accessories and attachments, joining processes – riveting and screws,

Advanced manufacturing processes- introduction to non-conventional machining processes and its needs, –difference between conventional and non-conventional processes, classification of NCM processes, its principle and methods, working principle of abrasive jet machining process.

**Unit 2: Fitting operations & power tools**  
(02 Lecture Hours)  
Various hand tools used in fitting shop and their functions, introduction to limits, fits and tolerance. Types of power tools-electric, pneumatic and hydraulic operated tools, limits, fits and tolerance.

**Unit 3: Metal casting**  
(02 Lecture Hours)  
Introduction, terminology of casting, patterns-types, allowances, molding sand-its properties, types of molds and cores, melting equipment, defects in casting and its inspection methods.

**Unit 4: Welding (arc welding & gas welding), brazing**  
(02 Lecture Hours)  
Introduction, classification of welding processes, types of welding joints, electric arc welding- AC, DC, types of electrodes, types of arc welding-MIG and TIG  
Gas welding –welding equipment, types of flames, welding defects and inspection, brazing-its types, Brazing – working and application.

**Unit 5: Carpentry**  
(01 Lecture Hours)  
Types of woods-soft and hard, defects of wood, seasoning of wood, types of carpentry tools

**Unit 6: Additive manufacturing**  
(01 Lecture Hours)  
Additive v/s subtractive manufacturing, need, advantages and applications of additive manufacturing, introduction to 3 D printing.

**Text Books**

**Reference Books**
2019-23 Batch

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

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

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1=weakly mapped  2= Moderately mapped  3=Strongly mapped
ECEG 1002 | BASIC ELECTRONICS ENGINEERING | L | T | P | C
--- | --- | --- | --- | ---
Version 1.0 | 2 | 0 | 0 | 2
Pre-requisites/Exposure | Basic Knowledge of fundamentals of electronic components
Co-requisites | --

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

**Course Outcomes**
On completion of this course, the students will be able to;

CO1. Employ electronic components and devices to solve the Engineering problems.
CO2. Analyse and make simple Circuits and Systems of Electronics Engineering, Interpret the logics used in the Digital Circuits and Systems.
CO3. Design the electronics system with discrete component, and understand the specifications of industrial equipment.

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

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

**Course Content**

**Unit 1: Diode & Applications** *(08 Lecture Hours)*
Introduction to Electronics and Motivation; Introduction to diode; Intrinsic and Extrinsic Semiconductor, Formation of P-N junction, Fundamental Characteristics of Diode and its various parameters like diode resistance, capacitance, zener and avalanche breakdown. half-wave and full-wave rectifier circuits; dc-power supply design.
2019-23 Batch

Unit 2: Transistor & Applications  
(07 Lecture Hours)
Introduction to transistor: Construction and operation, Common-Base(CB) configuration of Transistor, Transistor amplifying action, Common Emitter(CE) Configuration. Amplification factors for CB and CE configurations, Common Collector (CC) configuration, Limits of operation, Transistor Biasing: Fixed Biasing, Emitter Biasing and Voltage Divider Biasing, Transistor Applications

Unit 3: Boolean Algebra  
(09 Lecture Hours)
Number system and codes, Boolean algebra and minimization techniques: Boolean logic operations, Basic laws of Boolean algebra, De Morgan’s Theorems; Logic gates: AND, OR, NAND, NOR. Half Adder and Full Adder.

Text Books
1. J B Gupta, Basic Electrical and Electronics Engineering, S K Kataria and Sons. 3rd Ed.

Reference Books
1. Santiram Kal, Basic Electronics, 2013, PHI

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

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1 = weakly mapped, 2 = moderately mapped, 3 = strongly map
Course Objectives

- To help the students to understand and identify the functional units of a Computer System.
- To enable students to understand the concepts of procedure oriented programming using C Language.
- To empower students with the expertise of experimentation using C programming skills.
- To expose students with the ability to design programs involving decision structure, loops and functions.
- To equip students with necessary engineering skills such as solving engineering problems through implementing concepts of arrays, pointers, structures and union in C programming language.

Course Outcomes

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

CO1. Comprehend the fundamentals of Computers with concepts of algorithm, flowcharts and develop efficient algorithms for solving a problem.
CO2. Interpret the Control of flow statements and decision constructs with C programming techniques.
CO3. Identify the various concepts of Programming like Arrays, Structures and Unions and Strings.
CO4. Apply concepts of functions and pointers to resolve mathematical problems.
CO5. Analyze the real life problem and write a program in ‘C’ language to solve the problem

Catalog Description

This course will cover a variety of fundamental concepts of ‘C’ programming language to demonstrate various principles. The course will cover basic programming terminologies and constructs in C language focusing into solving problems through programs. Classroom activities are designed to encourage students to actively build upon their skills and knowledge.

Course Content

Unit 1 (07 Lecture Hours)
Introduction – Generation and classification of computers, Basic computer organization, Number system (Binary, Octal, Decimal, Hexadecimal conversion problems), Need for logical analysis and thinking, Algorithm, pseudocode, flowchart.
2019-23 Batch

Unit 2  (08 Lecture Hours)

Unit 3  (07 Lecture Hours)
Arrays and Strings: Arrays – initialization, Declaration one dimension and two dimensional arrays. String and string operations, string arrays, simple programs – sorting, searching, matrix operations.

Unit 4  (06 Lecture Hours)

Unit 5  (08 Lecture Hours)

Text Books

References Books
4. http://learn.upes.ac.in Blackboard – LMS

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

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

- To impart hands-on skills in performing experiments, data acquisition and interpretation of the data.
- To design the circuits and study about various experimental procedures involved.
- Significance of the experimental results to understand and verify theoretical formulation and prediction.
- To develop curiosity and creative ability through experimentation and investigation based on the virtual experiments.

Course Outcomes

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

CO1. Demonstrate the dual nature of light by verifying the various phenomena associated with it.

CO2. Apply the concepts of electromagnetics to study the various electrical and magnetic properties of Materials.

CO3. Evaluate and compare the universal constants by using the principle of modern physics.

CO4. Design virtual Physics based experiments to illustrate the photoelectric effect.

CO5. The students will be able to develop good presentation skills.

Catalog Description

The laboratory practice has been an important part of professional and engineering undergraduate education, an ideal platform for active learning. The purpose of the Physics practical sessions are to give students hands-on experience with the experimental basis of engineering physics and, in the process, to deepen their understanding of the relations between experiment and theory. The focus of this course is to improve the skills of the students in collecting, analyzing, interpreting and presenting findings and data.

Sonometer is a useful apparatus for investigating the vibration of a string or wire under tension. The student will be able to measure the AC mains frequency using sonometer and electromagnet in the lab. The experiment allows the change in length of the string in accordance with the variation in the tension. The student will demonstrate the Hall’s effect in the laboratory, finds Hall’s coefficient and apply this to calculate carrier density in the given semiconductor material. Hall
Effect experiment is extremely useful in determining the carrier density, mobility of carriers in the semiconductor, which is a precursor of semiconductor electronic devices. There are numerous industrial applications of Hall’s effect in IC switches, ignition sensors, automotive industry for level/tilt measurement sensor, aerospace industry in temperature and pressure sensor, magnetic card reader, and semiconductor industry so on. Experiments based on electromagnetic theory focusses on the applications of the well-defined laws e.g. Faraday’s Law, in studying the induced emf produced due to change in the velocity of the magnet. The study of variation of magnetic field along the axis of a circular coil is demonstrated by using the Stewart-Gee coil. The virtual labs develop a curiosity and creative ability through experimentation and investigation on the photo electric effect experiment. Additionally, the virtual lab experiment provides an insight to use the simulator to understand the photo electric effect. The virtual experiment on photoelectric effect explains the basic interaction of light and matter. The absorption coefficient of the given liquid is studied in the Absorption coefficient experiment. Experiment on magnetic susceptibility comprehends the basic magnetization phenomenon. The solar cell trainer is a typical setup, which converts light energy to electrical power. A solar cell or photovoltaic cell is used to converts light energy into electrical energy, basing on the principle of the photovoltaic effect. The student will analyze the characteristics of solar cell and its efficiency in the laboratory. The device has wide application in sensor applications. Solar cells diverged from the silicon technology is used for terrestrial panels, the spacecraft application and a power source. The experiment on Planck’s constant using LEDs determines the Planck’s constant, which is very useful in explaining about the radiation and correlates the photon energy with wavelength. The particle nature of light using light emitting diodes (LEDs) will be demonstrated by observing the reverse photo-electric effect and find the value of Plank’s constant.

List of Experiments

**Experiment No: 01 Sonometer**  
Aim: To determine the frequency of AC mains by using a sonometer.

**Experiment No: 02 Hall Effect**  
Aim: To study the Hall effect and hence determine the Hall coefficient (R_h) and carrier density (n) of a given semiconductor material.

**Experiment No: 03 Faraday’s Laws**  
Aim: (a) To study the induced emf as a function of velocity of the magnet passing through the coil (Faraday’s Law).  
(b) To study the charge delivered due to electromagnetic induction.

**Experiment No: 04 Circular Coil**  
Aim: To study the variation of magnetic field with distance along the axis of a current carrying circular coil and hence estimate the radius of the coil.
Experiment No: 05 Photoelectric Effect (Virtual lab)
Aim: To study the variation of magnetic field with distance along the axis of a current carrying circular coil and hence estimate the radius of the coil.

Experiment No: 06 Newton’s Rings
Aim: To determine the wavelength of a given light by forming Newton’s Rings.

Experiment No: 07 Diffraction Grating
Aim: To determine the wavelength of a given light by using a Diffraction grating in its normal incidence position.

Experiment No: 08 Solar Cell
Aim: Study of both the current - voltage characteristic and the power curve to find the maximum power point (MPP) and efficiency of a solar cell.

Experiment No: 09 Planck’s Constant
Aim: To find the Planck’s constant by using LEDs.

Experiment No: 10 Presentation
Aim: Presentation related to any science concept.

Text Books:

Reference Books:

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

<table>
<thead>
<tr>
<th>Components</th>
<th>Continuous Evaluation</th>
</tr>
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<tbody>
<tr>
<td>Weightage (%)</td>
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Relationship between the Program Outcomes (POs), Program Specific Outcomes (PSO) and Course Outcomes (COs)

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<tr>
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<th>PO 1</th>
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</table>

1=weakly mapped  2= Moderately mapped  3=Strongly mapped
<table>
<thead>
<tr>
<th>Course Objectives</th>
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</thead>
<tbody>
<tr>
<td>• To help second language learners develop the ability to understand spoken language through computer aided Language learning.</td>
</tr>
<tr>
<td>• To enable students to communicate with clarity and precision in diverse communication scenarios.</td>
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<tr>
<td>• To help students in sifting through a variety of texts to filter and synthesize important information.</td>
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</table>

<table>
<thead>
<tr>
<th>Course Outcomes</th>
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</thead>
<tbody>
<tr>
<td>On completion of this course, the students will be able to:</td>
</tr>
<tr>
<td>CO1. Recognize &amp; demonstrate the articulatory skills needed to participate in an oral presentation.</td>
</tr>
<tr>
<td>CO2. Interpret &amp; apply phonemic transcriptions based on the International Phonetic Alphabet (IPA) for accurate pronunciation.</td>
</tr>
<tr>
<td>CO3. Analyze &amp; apply the skills &amp; approaches of a successful listener by taking notes for comprehension and filtering important information to make inferences and predictions</td>
</tr>
<tr>
<td>CO4. Design &amp; exhibit technical poster.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Catalog Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>This course focuses on the development of students’ language &amp; articulatory skills, critical thinking, and problem solving skills through the understanding of four pillars of English Language viz. Listening, Speaking, Reading and Writing. Students will also be assessed on their presentation skills, using various technological tools, ability to work in a team and present their work with conviction.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>This focusses on the four pillars of English Language viz. Listening, Speaking, Reading and Writing.</td>
</tr>
</tbody>
</table>
Unit 1: Intro - Lab & Seating Plan/Ice-breaking  1L (f2f)
Course plan is discussed with the students, along with seat allotment in the respective Labs.

Unit 2: Speaking and Listening Skills  1L (f2f)
An overview on Speaking and Listening Skills Introduction, Discussion & Ted Ed Videos to develop an understanding about the basic speaking skills and to sensitize students’ basic listening ability.

Unit 3: International Phonetic Alphabet- 1  1L (f2f)
Introduction-Basic Sounds of English-Introduction to Phonetics: Sounds in English; IPA- Self-Assessment-Transcription Exercise

Unit 4: International Phonetic Alphabet - 2  1L (f2f)
Phonemes,-Allophones-Stress & Intonation -General Use of Falling and Rising Tones Vocal Cues-Graded Exercise

Unit 5: Extempore  1L (f2f)
Graded Exercise; Impromptu speaking based on a given topic or theme.

Unit 6: Basic Ear training  1L (f2f)
Briefing on Listening Skills, Types of Listening and types of Listeners – Sample Listening exercise based on Announcements (Railway, Airport, Telephonic Conversations, Meetings)

Unit 7: Listening Practice  1L (f2f)
Listening to selected TED talks.

Unit 8: Listening Graded Exercise  1L (f2f)
To assess the impact of the listening practice –Graded Exercise

Unit 9: Introduction to Technical Poster  1L (f2f)
Discussion about the Components-Abstract-Background Study-Literature Review and writing of references.

Unit 10: Speaking Assessment-Picture Comprehension  1L (f2f)
Graded Exercise- speaking activity based on the comprehension of given, Pictures. To assess the students’ speaking skills on a certain rubric.

Unit 11: Technical Poster Presentation  1L (f2f)
Process of working on a theme or a topic for poster presentation

Unit 12: Technical Poster Presentation  1L (f2f)
Presentation of Technical Poster; Graded Activity
Text Books


Reference Books


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

Examination Scheme:

<table>
<thead>
<tr>
<th>Components</th>
<th>Oral Presentation</th>
<th>Content Creation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weightage (%)</td>
<td>50% (3 Speaking activities)</td>
<td>50% (1 Quiz, 1 Poster making)</td>
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</table>
2019-23 Batch

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

<table>
<thead>
<tr>
<th>PO/C O</th>
<th>PO 1</th>
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<th>PO1 11</th>
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</table>

1 = weakly mapped, 2 = moderately mapped, 3 = strongly mapped
Course Objectives

- Visualize the V-I characteristics of the basic electronic components like diode and transistor.
- Develop the application-based circuits like switch, rectifier by using diode and transistor.
- Design DC-Power supply by using rectifiers and discrete electronics components.
- Analyse and make simple Circuits and Systems of Electronics Engineering, Interpret the logics used in the Digital Circuits and Systems

Course outcomes

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

CO1. Understand the fundamentals of basic electronics equipment’s and electronic components.
CO2. Analyze the analog circuits based on diodes and bipolar junction transistors (BJTs) etc.
CO3. Implementation of digital combinational circuits by using basic logic gates.

Catalogue Description

The aim of the course is to introduce the basic concepts of semiconductor devices within the context of engineering especially computer Science students. The objective of this course is to equip the students with the required mathematical tools/formulas necessary to understand and analyze basic analog electronic components and circuits such as diodes, transistors etc. Emphasis is on analysis and application of electronic circuits utilizing semiconductor diodes, operational amplifiers, and transistors. During the delivery of the course, the students will be provided with examples of day-to-day devices to cover and demonstrate the fundamentals of basic electronic circuits. A student who completes the course successfully will be able to demonstrate the basic electronic components, their device structure, principle of operations and analysis, circuit representations etc. and understand the analog electronics and their corresponding circuit analysis. This course provides a platform to understand basic electronics which may provide the students good career options as electronics professional.

List of Experiments

Experiment No. 1: To study the various electronics components (diode, resistor, transistor, Capacitors, IC’s etc.) and measuring instruments (Multimeter, CRO, DSO etc.)
Experiment No. 2: To study the PN junction diode characteristics under Forward & Reverse bias conditions.

Experiment No. 3: To Study and set up a half wave and full wave rectifier circuit. And to calculate its Form factor, Ripple factor and efficiency.

Experiment No. 4: To Design constant DC power supply circuit using Voltage regulator IC.

Experiment No. 5: To Study the characteristics of NPN transistor in common emitter configuration and to plot the input/output characteristics.

Experiment No. 6: To Study the characteristics of NPN transistor in common base configuration and to plot the input/output characteristics.

Experiment No. 7: Study of logic gates and to verify the truth table.

Experiment No. 8: Implementation of AND, OR, NOT Gate using NAND & NOR (Universal gates)

Experiment No. 9: Implementation of half and full adder digital circuits.

Experiment No. 10: Implementation of half and full substractor digital circuits.

Value Added Experiment

Experiment No. 11: To design amplifier with Common emitter NPN transistor and compute the gain for various Emitter resistances.

Experiment No. 12: To design clipper and clamper circuits of various configuration.

Text Books

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

<table>
<thead>
<tr>
<th>Components</th>
<th>Tutorial/Faculty Assessment</th>
<th>Class Tests</th>
<th>MSE</th>
<th>ESE</th>
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## Relationship between the Program Outcomes (POs), Program Specific Outcomes (PSO) and Course Outcomes (COs)

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<thead>
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1=weakly mapped  
2= Moderately mapped  
3=Strongly mapped
Course Objectives

- The overall objective of the modules is that the student should be able to understand basic computer fundamentals and functional units of computers with basic skills development in C Programming.

Course Outcomes

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

CO1. Identify the functional units of computer system.
CO2. Understand the concepts of procedure oriented programming using C.
CO3. Implement the basic concepts of C programming language.
CO4. Design programs involving decision structures, loops and functions.
CO5. Implement the concepts of arrays, pointers, structures in C programming language.

Catalog Description

Knowledge about the C programming knowledge is the building block of the students to build their programming skills. And enable the students to enhance the programming skills of the students and make them comfortable to adopt the new language for programming in future.

List of Experiments

Experiment No. 1: Basic understanding of Linux/Unix commands
Experiment No. 2: Basics of flow charts, Algorithms
Experiment No. 3: Understanding introduction to C programming
Experiment No. 4: Control Statements using if.. if.. else, switch… case
Experiment No. 5: Looping using while, do..while and for
Experiment No. 6: Array
Experiment No. 7: Strings
2019-23 Batch

Experiment No. 8: Functions
Experiment No. 9: Pointers
Experiment No. 10: Structure and union
Experiment No. 11: File handling

Text Books / Reference Books
2. Peter Norton, Introduction to Computers, TMH, fifth Ed.
3. E Balaguruswamy, Programming in ANSI C, TMH
4. Yashavant Kanetkar, Let us C, Ninth Ed. BPB

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

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Description</th>
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</table>

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

<table>
<thead>
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<th>PO/C O</th>
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</table>

1 = weakly mapped, 2 = moderately mapped, 3 = strongly mapped
Course Objectives

- To understand the making of the Democratic Republic India as it stands today.
- To help students in understanding the Basic structure of the Indian Constitution, the principles it holds.
- To appreciate and understand the law of the land and due process of law in India.

Course Outcomes

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

CO1. Create patriotic value in the youth.
CO2. Help students in understanding the functioning of the Indian Government, and division of power between State & Centre.
CO3. Appreciate the fundamental rights and duties and the directive principle of state policy.
CO4. Appreciate the electoral system of India and its effect and outcomes.

Catalog Description

The Indian Constitution is the lengthiest documented constitution of the world. The comprehensive document has 448 articles in 25 parts and 12 schedules. There are 101 amendments have been made in the Indian constitution. This subject shall focus on making the students understand the principles laid by the Chief Rule book of India i.e. The Constitution - starting with the history of the making of Indian Constitution and the Constituent Assembly. The Preamble as the Preface and then each of the sub-principles of the Indian Constitution will be dealt with including Fundamental Rights & Duties, Directive principles of state policy, the Legislature, the Executive and the Judiciary will be discussed. Some important amendments, Emergency Powers of the Indian Constitution will be discussed.

Course Content

Unit 1: Introduction to Indian Constitution (2 Hours Online)
Constituent assembly and the framing of the Indian Constitution, adopting and executing the supreme Law of the land
Unit 2: Citizenship
Laying the parameters for providing the citizenship of India after partition in 1947, Provisions for citizens of India, single citizenship, acquiring and giving up citizenship.

Unit 3: Fundamental Rights & Duties
Basic rights and legal rights, duties of every Indian citizenship

Unit 4: Directive Principles
Principles or ideals on which the provisions of Constitution are based

Unit 5: The Union
Separation of power between Centre and State in India, subjects in Central list. Legislative, executive and Judiciary.

Unit 6: The State
Subjects in the state list; Legislature, Executive and Judiciary.

Unit 7: Emergency Provisions
Emergency provisions and change in the Federal structure of the country, Constitutional breakdown, Financial Emergency, National Emergency.

Text Book:

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

Examination Scheme:

<table>
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Relationship between the Program Outcomes (POs), Program Specific Outcomes (PSO) and Course Outcomes (COs)

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Course Objectives

- To enable students to understand theory and application of integral transforms.
- To help the students understand the concepts of mathematical logic.
- To make the students able to understand theory of poset and lattice.
- To enable the students solve recurrence relation

Course Outcomes

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

CO1. Use the technique of integral transforms to solve differential and difference equations.
CO2. Apply the basic theory of mathematical logic in validity of arguments and tautology.
CO4. Apply the techniques to form and solve difference equations using various methods.

Catalog Description

This course covers the solution ordinary differential equations using transformation tools like Laplace transformation, a glimpse of Z-transforms to solve difference equations and a good insight of discrete mathematics. The students become well versed with the understanding of mathematical logic by realizing the importance of quantifiers and their uses. The subject enables the student to understand and classify the set structure with the help of poset and lattice. Apart from the discrete analogue of continuous real function, several methods are discussed to solve the recurrence relation associated to them.

Course Content

Unit 1: Integral Transforms

Laplace Transform, Laplace transform of derivative and integral of a function, Inverse Laplace Transform, Convolution Theorem, Unit Step Function, Dirac-Delta Function, Periodic Functions and their Laplace transform, Solution of Linear Differential Equations.

Concept of Z-transform, Z-transform of common functions, inverse Z-transform, initial and final value theorems, applications to solution of difference equations, Pulse transfer function.
2019-23 Batch

Unit 2: Mathematical Logic (05 Lecture Hours)
Proposition, logical connectives, Truth tables, tautology, contradiction, Normal forms (conjunctive and disjunctive), Converse, inverse, contrapositive, Validity of an argument, Universal and existential quantifiers.

Unit 3: Posets and lattice (08 Lecture Hours)
Partial order relation, Hasse diagram, Posets, Well ordered set, maximal and minimal element, greatest and least element, least upper bound, greatest lower bound, Lattices, properties of Lattices, Isomorphism, Some special lattices: Bounded lattice and complemented lattices, distributive lattice Modular lattice, Complete lattice.

Unit 4: Recurrence relation (08 Lecture Hours)
Discrete numeric function, basis operations, convolution, recurrence relation, solution by iteration method, undetermined coefficient method, operator method, generating function method, matrix method.

Text Books:

Reference Books:

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

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

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

- To inculcate human values and professional ethics in students.
- To facilitate the development of a Holistic perspective among students towards life based on a correct understanding of the Human reality and the rest of Existence.
- To develop moral responsibilities and ethical vision towards self and society.

Course Outcomes

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

CO1. Understand the importance of values, ethics, harmony and lifelong learning in personal and professional life

CO2. Apply the knowledge of values and ethics in daily lives.

Catalog Description

Nowadays the world is facing tremendous values crisis and so many unsatisfactory occurrences have been arising due to lack of human values and character. This course will help the students to inculcate human values and professional ethics by understanding the importance of Values and Ethics in day-to-day life. It will benefit our new generation to keep aside their conflicts & problems and inspire them to lead a successful life in real sense. The course will also aid in taking informed decisions in life based on correct values and ethics, which is going to make them not only a better professional at the workplace but also a better human being.

Course Content

Unit 1: Introduction of Human Values (3 Hours f2f + 6 Hours Online)


Unit 2: Contemporary society and Human Values (3 Hours f2f + 6 Hours Online)

Indian System of Values, Science, Technology and Human Values, Holistic Development, Indian Constitution & Ethics, Cannons of Ethics

Unit 3: Humanism & Human Values (3 Hours f2f + 6 Hours Online)
Human Rights & Human Values, Work Ethics, Engineering Ethics, Human Values and Freedom, Love and Wisdom, Moral Dilemma,

**Unit 4: Management by Values (3 Hours f2f + 6 Hours Online)**

Interpersonal relationship at Workplace, Professional Excellence, Leadership & Teamwork, and Conflict Resolution.

**Text Books**


**Modes of Evaluation: Quiz/Assignment/ Seminar/Written Examination Scheme: Blended Mode: 1 F2f + 2 Online**

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

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

- To present the fundamentals of concrete technology in a simplified manner.
- Expose the students into the basic concepts of concrete technology.
- To give them an idea about Concrete mix design aspects in the field and use of those techniques in infrastructural development plans.
- To create awareness about principles of advanced concrete technology and provide knowledge about the application of different advanced mix design methods employed for engineering projects.
- To provide knowledge about various Nondestructive testing of concretes.

Course Outcomes

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

CO1. Understand the behavior and properties of fresh & hardened concrete
CO2. Identify the quality control, testing & durability requirements of concrete
CO3. Design concrete mix using design codes

Catalog Description

Concrete is most widely used construction material because of its versatility, raw material availability, strength & durability. It can withstand harsh environmental condition while taking on imaginable shapes & forms. Scientist & engineer are working continuously for better concrete using chemical admixtures & innovative cementitious materials. The use of supplementary cementitious material reduces the carbon dioxide emission as a result of reduction in manufacturing of Portland cement. Strict air pollution control & regulations have compelled the engineers to use the industrial byproducts such as fly ash, silica fume, blast furnace slag, rice husk & natural pozzolana which can be incorporated in concrete as partial cement replacement. The utilization of these supplementary materials is to reduce the cement content, improve workability, enhance durability through hydraulic activity & increase the properties of concrete in fresh & hardened state.

Course Content

Unit 1: Materials

Concrete materials, various physical tests on cement, Aggregates properties & various tests on aggregates, water its characteristics, suitability & mixing for good concrete.
Unit 2: Fresh & hardened concrete (06 Lecture Hours)

Unit 3: Durability of concrete (04 Lecture Hours)
Causes of deterioration & durability problems in concrete, factors affecting durability, cracking & its mechanism & effects, alkali aggregate reaction, degradation by freezing & thawing effects, durability under sea water

Unit 4: Concrete mix design (06 Lecture Hours)
Principles of concrete mix design, parameters & factors influencing mix design, IS method of mix design, Acceptance criteria, various provisions of IS code for sound concrete.

Unit 5: Special concrete (02 Lecture Hours)

Unit 6: Miscellaneous topic (02 Lecture Hours)
Introduction to non-destructive testing, rebound hammer tests, ultrasonic pulse velocity tests, pull out tests, echo tests, failure of concrete under low stress, micro cracking in concrete, crack propagation & stress concentration

Text Books
1. Properties of concrete by A.M. Neville
2. Concrete technology by M.S. Shetty.
3. Concrete Technology by M.L. Gambhir
4. Concrete technology by A.R. Santakumar IIT Madras
5. Advance concrete technology by ZONGJIN Li

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination

Examination Scheme:

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

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

- To learn about engineering materials.
- To provide students with exposure to testing of materials.
- To discuss and evaluate the materials used for construction

Course Outcomes

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

CO1. Understand the properties and manufacturing processes of Civil Engineering Materials.
CO2. Test the materials as per IS codes and ascertain their qualities
CO3. To understand standard testing and evaluation procedures

Catalogue Description

Material Testing and Evaluation is basic course for Civil Engineers, as it covers all the necessary aspects of materials that are generally used in construction. Quality of the material to be used and its source is learnt. The course covers three main aspects of Material used in Civil Engineering, Construction, manufacture, testing and standardization.

Course Content

Unit 1: Introduction (08 Lecture Hours)
Introduction to Engineering Materials covering, Cements, M-Sand, Concrete (plain, reinforced and steel fiber/ glass fiber-reinforced, light-weight concrete, High Performance Concrete, Polymer Concrete) Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics, Structural Steel and other Metals, Paints and Varnishes, Acoustical material and geotextiles, rubber and asbestos, laminates and adhesives, Graphene, Carbon composites and other engineering materials including properties and uses of these

Unit 2: Properties of Material (08 Lecture Hours)
Introduction to Material Testing covering, What is the “Material Engineering”?: Mechanical behavior and mechanical characteristics; Elasticity – principle and characteristics; Plastic deformation of metals; Tensile test – standards for different material (brittle, quasi-brittle, elastic and so on) True stress – strain interpretation of tensile test; hardness tests; Bending and torsion test; strength of ceramic; Internal friction, creep – fundamentals and characteristics; Brittle fracture of steel – temperature transition approach; Background of fracture mechanics; Discussion of
fracture toughness testing – different materials; concept of fatigue of materials; Structural integrity assessment procedure and fracture mechanics

**Unit 3: Testing of Material**
(08 Lecture Hours)
Standard Testing & Evaluation Procedures covering, Discussion about mechanical testing; Naming systems for various irons, steels and nonferrous metals; Discussion about elastic deformation; Plastic deformation; Impact test and transition temperatures; Fracture mechanics – background; Fracture toughness – different materials; Fatigue of material; Creep.

**Text Books/Reference Books:**
3. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc.
4. corresponding to materials used for Civil Engineering applications
7. Edition
9. Related papers published in international journals

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

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

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

- To be able to visualize different views of a body and to be able to construct the body provided with the views of the body
- To give knowledge of Auto CAD software for making drawing for Civil Engineering structural and non-structural elements.
- To be able to read design drawing.
- To be able to implement the reinforcement detailing in the field.

Course Outcomes

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

CO1. Understand the basic commands, principles and features behind AutoCAD.
CO2. Sketch scaled drawings and demonstrate various components of the buildings and their sectional views, plan and elevations using AutoCAD.
CO3. Understand and sketch drawings of various types of the buildings like residential building, office buildings, godowns etc. using AutoCAD.
CO4. Examine the structural drawings of various components of the building.

Catalog Description

The civil engineering work will always require computerized skills in the drafting and design of civil engineering buildings and structures. The Computer-Aided Drafting and Design as a part of this course will enable our students to prepare CAD-based drawings, which can be readily used for civil engineering constructions. This course will prepare students with the skills necessary to learn engineering and architectural drafting capability including their competency in modern design process with a background of both engineers and architects. The emphasis of this course is on engineering graphics and drawing, architectural building drawings and structural drawings.

Course Content

Unit 1: Introduction to AutoCAD (03 Lecture Hours)
AUTOCAD screen, Setting the options, Menu commands, Opening a drawing, Drawing tools, Editing tools, Creating drawings using wizards, Dimensioning, Text in AUTOCAD, Layers concept, Blocks, Hatching, Working with Multiple drawings, Drawing 2D objects using above tools.
Unit 2: Drawing components of building (03 Lecture Hours)
Symbols used in Civil Engineering drawing, Masonry Bonds (Brick and Stone masonry), pointing Types, masonry Columns and wall Junctions. Drawing following components of building using AUTOCAD tools - Masonry foundations, Doors and Windows, Staircases.

Unit 3: Building drawings (03 Lecture Hours)
Drawing plans of buildings using drawing tools, creating openings in plans using modify tools, creating and inserting blocks of doors and windows, Inserting text and dimensions, Drawing elevation and sections, Creating sanction drawing. Preparation of working drawings of single story and double storey residential buildings.

Unit 4: Structural drawings (03 Lecture Hours)
Preparation of column lay out and excavation drawings, footing, lintel and chejja, beams and slabs of framed structures

Text Books/Reference Books:
3. Building Design and Civil Engineering Drawing by Dr. Balagopal T.S. Prabhu & Dr. K. Vincent Paul
4. Class notes
5. AutoCAD software Manual Provided by the faculty

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

Examination Scheme:

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

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

- Develop in the engineering student the ability to analyse any problem in a simple and logical manner
- Analyze system of forces in statics
- Understand the effect of friction on various engineering applications
- Analyze the dynamics of a body under the action of various types of forces
- Compute the kinematics of connected bodies

Course Outcomes

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

CO1. Understand the basic concepts of statics and dynamics of rigid bodies.
CO3. Analyze forces, motion, work and energy problems and their relationship to engineering applications.

Catalog Description

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

Unit 1: Mechanics (06 Lecture Hours)
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

Unit 2: Basic Structural Analysis (06 Lecture Hours)
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.

Unit 3: Centroid and Centre of Gravity (06 Lecture Hours)
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 4: Friction (06 Lecture Hours)
Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack and differential screw jack.

Unit 5: Virtual Work and Energy Method (06 Lecture Hours)
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 6: Review of particle dynamics (06 Lecture Hours)
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).

Unit 7: Introduction to Kinetics of Rigid Bodies (06 Lecture Hours)
Basic terms, general principles in dynamics; Types of motion, Instantaneous center 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 8: Mechanical Vibrations covering (06 Lecture Hours)
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 pendulum.

Text Books/Reference Books:

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

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<th>Components</th>
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Relationship between the Program Outcomes (POs), Program Specific Outcomes (PSO) and Course Outcomes (COs)

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

- To focus on the core activities of engineering geologists – site characterization and geologic hazard identification and mitigation
- To couple geologic expertise with the engineering properties of rock and unconsolidated materials in the characterization of geologic sites for civil work projects
- To quantify processes such as rock slides, soil-slope stability, settlement, and liquefaction
- To provide knowledge about various components of hydropower station

Course Outcomes

On completion of this course, the students will be able to:
CO1. Learn Earth Science and Meteorology and their Components.
CO2. Provide knowledge on Geological Structures, Land Form, landslides
CO3. Study earthquake causes and seismic Zoning and role of groundwater in Geology
CO4. Study Basics of Geology and Hydrology related to Dams construction.

Catalog Description

Engineering geology is an applied geology discipline that involves the collection, analysis, and interpretation of geological data and information required for the safe development of civil works. Engineering geology also includes the assessment and mitigation of geologic hazards such as earthquakes, landslides, flooding; the assessment of timber harvesting impacts; and groundwater remediation and resource evaluation. Engineering geologists are applied geoscientists with an awareness of engineering principles and practice.

Course Content

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<th>Unit 1: Meteorology</th>
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<tr>
<th>Unit 2: Geological Structure, Land Forms, Weathering, Landslides</th>
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<tr>
<td>Physical Geology- Weathering, Erosion and Denudation. Factors affecting weathering and product of weathering. Water fall and Gorges, River meandering, Alluvium, Glacial deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Clay with flints, Solifluction deposits, mudflows, Coastal deposits. Description and classification of folds,</td>
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faults, joints, unconformities, fault planes, geometrical destruction, etc. Geological Hazards-Rock Instability and Slope movement. Types of landslide and its protection

**Unit 3: Earthquakes and Role of Ground Water**  
(04 Lecture Hours)  

**Unit 4: Site Selection**  
(02 Lecture Hours)  
Geology of dam and reservoir site- Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Site and treatment giving to such structures.

**Text Books/Reference Books:**


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

**Examination Scheme:**

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

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

- To prepare the students to effectively link theory with practice and application & to demonstrate the background of the theoretical aspects.
- To prepare the students to generate and analyze data using experiments and to apply elements of data statistics.
- To prepare the students to have hands on experience of equipment and machines.
- To prepare the students to solve problems including design elements and related to their course work.
- To encourage the students to use computers in analyzing the data
- To emphasize the knowledge and application of safety regulations.

Course Outcomes

On completion of this course, the students will be able to:
CO1. Assess the quality of the concrete through laboratory tests.
CO2. Design the mix proportion for the required concrete strength
CO3. Assess the strength of concrete through destructive tests
CO4. Assess the strength & quality of concrete through non-destructive tests

Catalog Description

It has been said that, “One test results are worth than hundred expert opinions”, but this is only true if such a result is truly accurate & relevant for its application. In practice, it is essential that tests results are clearly specified & that their field of application & limitations are clearly understood. It is in this context that experiments are performed. The Lab aims in testing the properties of various ingredients of concrete. Cement is tested for its consistency. Fine aggregates are tested for their fineness. Coarse aggregate is tested for its mechanical properties. Concrete is tested in both its fresh and hardened states. Fresh concrete is tested for its consistency and workability. Hardened concrete is tested for its compressive and tensile strength.

List of experiments

Experiment No: 01 Fineness test and Consistency test
Determination of fineness by specific surface by Blaine air permeability method as per IS: 4031 (Part 2). To determine the normal consistency as per IS: 4031 (Part 4),

Experiment No: 02 Soundness test & Initial and Final Setting time tests
To determined Soundness of cement by Le-Chatelier method as per IS: 4031 (Part 3) – 1988 & initial setting & final setting time as per IS: 4031 (Part 5) of a given sample of cement.

**Experiment No: 03 Compressive strength test and Tensile strength test**
To determine the compressive strength of 1:3 Cement sand mortar cubes after 3 days and 7 days curing as per IS: 4031 (Part 6, 7 & 8).

**Experiment No: 04 Specific Gravity of Cement, specific gravity and bulking of sand, moisture content of aggregates.**
To determine the Specific Gravity of Cement, specific gravity and bulking of sand, moisture content of aggregates

**Experiment No: 05 workability of concrete**
To determine the workability of the cement concrete by slump test/ to measure the consistency of concrete by using slump cone as per IS: 1199

**Experiment No: 06 & 07**
Standard test method for compressive strength of concrete cube as per IS 516. Determining the flexural strength of moulded concrete flexure test specimens as per IS 516

**Experiment No: 08 Flexure test**
Determining the flexural strength of moulded concrete flexure test specimens as per IS 516.

**Experiment No: 09 Modulus Elasticity**
To determine the Modulus of elasticity of Concrete

**Experiment No: 10 Non-Destructive Test**
To determine strength of hardened concrete by rebound hammer as per IS: 13311 (Part 2) To determine strength of hardened concrete by Ultrasonic Pulse Velocity as per IS: 13311

**Text/ Reference Books**
2. B.L Gupta & Amit Gupta. *Concrete Technology*.

**Modes of Evaluation: Class tests/Assignment/Tutorial Assessment/Written Examination**
**Examination Scheme:**
Continuous Lab Evaluation is there to assess the students’ performance in the lab

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<th>Components</th>
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### Relationship between the Program Outcomes (POs), Program Specific Outcomes and Course Outcomes (COs)

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1. Weakly Mapped  
2. Moderately Mapped  
3. Strongly Mapped
Course Objectives
- To give detailed understanding of materials and their properties by conducting laboratory experiments
- To provide knowledge about the structure-property-application relationships
- To give exposure of various established material testing techniques.

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

CO1. Determine hardness and tensile strength of engineering materials
CO2. Determine shear, torsional and impact strength of engineering materials
CO3. Compute the compressive strength of engineering materials
CO4. Compute the stiffness of spring system

Catalog Description
Materials are the basics of any construction and knowledge about them and their mechanical properties is an essential aspect to be studied in civil engineering. In this laboratory course, students will perform number of tests to practically determine the various mechanical properties of materials and will also be able to develop better understanding about the materials from the point of view of mechanics.

List of Experiments

Experiment No: 01 Hardness Measurement
To determine the hardness of the given specimen using Rockwell Hardness Testing Machine.

Experiment No: 02 Hardness Measurement
To determine the hardness of the given specimen using Brinell Hardness Testing Machine.

Experiment No: 03 Spring Testing Machine
To find the spring constant and Modulus of Rigidity of a given spring using spring testing Machine

Experiment No: 04 Universal Testing Machine (UTM)
To conduct the tensile test on a UTM and determine the ultimate tensile strength and percentage elongation for a steel specimen.
Experiment No: 05 Torsion Testing Machine
To conduct Torsion test on Mild steel or cast iron specimen to find out modulus of rigidity

Experiment No: 06 Impact testing Machine
To Conduct the Izod Impact test on Impact testing machine and find the impact strength and modulus of rupture of a given specimen.

Experiment No: 07 Impact testing Machine
To conduct the Charpy Impact test on Impact testing machine and find the Impact strength of a given specimen.

Experiment No: 08 Universal Testing Machine (UTM)
To analyze the performance of given specimen by shear test on UTM.

Experiment No: 09 Universal Testing Machine (UTM)
To conduct the compression test on a UTM and determine the ultimate compressive strength for a given specimen (C.I, Brick, wooden).

Text Books/Reference Books:

2. Timoshenko and Gere, Mechanics of Materials, CBS Publishers, New Delhi
3. Relevant Indian Standards

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

Examination Scheme:
Continuous Lab Evaluation is there to assess the student’s performance in the lab

<table>
<thead>
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<th>Components</th>
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Course Objectives

- To be able to visualize different views of an object and to be able to construct the object provided with the views of the object
- To give knowledge of Auto CAD software for making drawing for Civil Engineering structural and non-structural elements.
- To be able to read design drawing.
- To be able to implement the reinforcement detailing in the field.

Course Outcomes

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

CO1. Understanding the basic commands, principles and features behind AutoCAD
CO2. Implementing CAD software for scaled drawing
CO3. Preparing building drawings using CAD software
CO4. Preparing Structural drawings using CAD software

Catalog Description

CAD (Computer Aided Design) provides a convenient mean to create designs for almost every engineering discipline. It can be used for architectural design, landscape design, interior design, civil and surveying etc. This subject will include introduction to AutoCAD software, drawing civil engineering structure elements like foundation, brickwork, masonry, doors, staircase. Drawings of sections for these elements and structural drawings with the detailing of reinforcement.

List of Experiments

Unit 1: Introduction to AutoCAD
AUTOCAD screen, Setting the options, Menu commands, Opening a drawing, Drawing tools, Editing tools, Creating drawings using wizards, Dimensioning, Text in AUTOCAD, Layers concept, Blocks, Hatching, Working with Multiple drawings, Drawing 2D objects using above tools.

Unit 2: Drawing components of building
Symbols used in Civil Engineering drawing, Masonry Bonds (Brick and Stone masonry), pointing Types, masonry Columns and wall Junctions. Drawing following components of building using AUTOCAD tools - Masonry foundations, Doors and Windows, Staircases.
Unit 3: Building drawings
Drawing plans of buildings using drawing tools, creating openings in plans using modify tools, creating and inserting blocks of doors and windows, Inserting text and dimensions, Drawing elevation and sections, Creating sanction drawing. Preparation of working drawings of single story and double storey residential buildings.

Unit 4: Structural drawings
Preparation of column lay out and excavation drawings, footing, lintel and chejja, beams and slabs of framed structures

Modes of Evaluation: Class tests/Assignment/Tutorial Assessment/Written Examination
Examination Scheme:
Continuous Lab Evaluation is there to assess the students’ performance in the lab

<table>
<thead>
<tr>
<th>Components</th>
<th>Continuous evaluation</th>
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<td>Weightage (%)</td>
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<td>Viva, Lab experiment performance, quiz.</td>
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Relationship between Course Outcomes (COs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

- To acquire practical knowledge on geology and on various types of rocks and minerals.
- To interpret and classify various geological features
- To acquire knowledge on geological maps and plot contour maps and profile section

Course outcomes

On completion of this course, the students will be able to:
CO1. Categorize minerals and rocks by their origin and engineering properties.
CO2. Categorize types of folds, faults and fractures in rocks
CO3. Measure strike and dip of the bedding planes
CO4. Interpret geological maps and plot various geological features

Catalog Description

The material in this course will provide the student with a fundamental background in the engineering Geology. The classification of rocks and minerals will enable their use as engineering materials. Student will be familiar with different type of geological features like folds, faults, fractures, dip, strikes, etc. It is expected that student will be able to correctly apply the lecture course content so as to evaluate potential industrial applications. Real life applications of these fundamental concepts will be introduced. Interpretation of results from experiments will also be emphasized.

List of Experiments

**Experiment No: 01 Rock Identification**
Identification of mineral (Rock forming) in hand specimens using physical properties.

**Experiment No: 02 Mineral Identification**
Identification of mineral (Ore forming) in hand specimens using physical properties.

**Experiment No: 03 Igneous Rock Identification**
Identification of Igneous rock in hand specimen using physical properties of the rocks.

**Experiment No: 04 Metamorphic Rock Identification**
Identification of Metamorphic rock in hand specimen using physical properties of the rocks.

**Experiment No: 05 Sedimentary Rock Identification**
Identification of Sedimentary rock in hand specimen using physical properties of the rocks.

**Experiment No: 06 Mineral Identification**
Identification of mineral in thin section using optical properties.

**Experiment No: 07 Wood Properties**
Fold, fault & fractures in wooden blocks and hand specimen

**Experiment No: 08 Dip and Strike Measurement**
Measurement of Dip and Strike with the help of Brunton Compass.

**Experiment No: 09 Contouring and Map Analysis**
Construct the Contour and geological map analysis.

**Experiment No: 10 Interpretation of Geological Features**
Draw the Profile section along the given plane and interpret the geological features.

**Text Books / Reference Books**
- Structural Geology Manual.

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

**Examination Scheme:**
Continuous Lab Evaluation is there to assess the students’ performance in the lab

<table>
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<th>Components</th>
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**Relationship between Course Outcomes (COs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)**

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1=weakly mapped  2=moderately mapped  3=strongly mapped
SEMESTER IV
UCIE 0301  |  VENTURE IDEATION  |  L  |  T  |  P  |  C  
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Pre-requisites/Exposure  |  Basic knowledge of English and computer applications such as Internet Explorer and MS Office  
Co-requisites  |  --  

Course Objectives

- To help the students understand what it takes to be an Entrepreneur
- To enable students to find the right business opportunity
- To empower students to do a technical feasibility study and thereby developing a prototype
- To help students in identifying their customers using primary and secondary research methods.
- To expose students various factors of market and competition with the help of market feasibility study, forecasting techniques, business model canvass and insights about financial statements.
- To prepare students with finalizing their entrepreneurial Portfolio

Course Outcomes

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

CO1. Assess personal capacity in the context of the entrepreneurial process
CO2. Assess characteristics of successful entrepreneurs and entrepreneurial forms and processes
CO3. Apply resources, research and tools for Entrepreneurial ventures
CO4. Analyze and apply opportunity identification techniques, feasibility terminology, processes and models
CO5. Develop Ideation and planning documents for entrepreneurial venture

Catalog Description

Entrepreneurship gives students the opportunity to examine the entrepreneurial mindset and to compare their skills, strengths and goals to those of successful entrepreneurs. In this highly engaging media rich Signature Product course students will progress through a series of modules that will help them to both identify and develop a business idea using practical skills.

Course Content

Unit 1: Do You Have It in You  (04 Lecture Hours)

Create an entrepreneurial peer network, Assess personal capacity for entrepreneurship, Analyze the impact of self-assessment results on entrepreneurial pursuits, Analyze entrepreneurial forms and processes, Assess characteristics of successful entrepreneurs, Explain differences between self-assessments and characteristics of successful entrepreneurs, Create a personal entrepreneurial action plan
Unit 2: Finding the Right Opportunity for You  
(04 Lecture Hours)  
Apply creative brainstorming techniques, Evaluate entrepreneurial opportunities, Evaluate whether entrepreneurial opportunities align with personal characteristics.

Unit 3: Will Your Idea Work?  
(04 Lecture Hours)  
Create an elevator pitch for a product or service, Evaluate technical feasibility of a product or service. Develop measures of technical feasibility. Evaluate measures of technical feasibility. Create a prototype for an entrepreneurial opportunity, Evaluate entrepreneurial prototypes, Analyze intellectual property laws applicable to entrepreneurial pursuits.

Unit 4: Who Are Your Customers?  
(04 Lecture Hours)  
Apply secondary market research resources to an entrepreneurial opportunity, Apply primary market research techniques for an entrepreneurial opportunity, Analyze market segmentation, targeting, and positioning for an entrepreneurial opportunity. Evaluate the market feasibility for an entrepreneurial opportunity.

Unit 5: Who Are Your Competitors?  
(02 Lecture Hours)  
Analyze industry factors that influence the feasibility of an opportunity, Assess attractiveness of an industry using an industry analysis model, Evaluate product or service based on industry analysis.

Unit 6: What Do The Numbers Tell You?  
(04 Lecture Hours)  
Apply revenue forecasting techniques, Generate a pro forma income statement, Analyze a pro forma income statement for sensitivity, Evaluate income statement outcomes based on personal expectations and needs, Evaluate financial feasibility for potential ventures, Create a personal entrepreneurial action plan.

Unit 7: More Than Just An Idea  
(02 Lecture Hours)  
Create a business model for an entrepreneurial venture, Create a timeline for venture implementation, Analyze challenges associated with starting an entrepreneurial venture, Evaluate entrepreneurial business models, Create an executive summary for an entrepreneurial venture, Evaluate executive summaries for entrepreneurial ventures, Re-assess personal capacity for entrepreneurship.

Text Books/Reference Books:  
Reading Material along with videos is available online to students through Blackboard.
Modes of Evaluation: Quiz/Assignment/ presentation/ extempore/ Written Examination

Examination Scheme:

<table>
<thead>
<tr>
<th>Components</th>
<th>Continuous Assessment (course era)</th>
<th>Summative Assessment (Video pitch for a business venture concept, Business model for a start-up using theories on creativity, design and entrepreneurship.)</th>
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</thead>
<tbody>
<tr>
<td>Weightage (%)</td>
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Relationship between the Program Outcomes (POs), Program Specific Outcomes (PSO) and Course Outcomes (COs)

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

- To help the students to develop cognizance of the importance of human behavior in framing policies.
- To enable students to describe how people behave under different conditions and understand why people behave as they do.
- To provide the students to analyze specific strategic organizational resources demands for future action.
- To enable students to synthesize related information and evaluate options for the most logical and optimal solution such that they would be able to predict and control human behavior and improve results.

Course Outcomes

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

CO1. Understand the concept of organizational behavior and expected people behavior at workplace.
CO2. Demonstrate how the organizational behavior can integrate in understanding the motivation (why) behind behavior of people in the organization.
CO3. Analyze the complexities associated with management of individual behavior in the organization.
CO4. Analyze the complexities associated with management of the group behavior in the organization.

Catalog Description

The main objective of Management I (Organizational Behavior) course is to introduce students to basics of organizational behavior. It shall also help the student cope with the challenges of a new environment and acquire skill to make rational decisions related to organizational behavior. Students shall observe the behaviour of individuals and groups as part of the social and technical system in the workplace. They examine individual and group behaviour, communication, conflict and various management styles, motivational techniques and coordination in the work environment and apply these concepts to the development of an organization's structure.
2019-23 Batch

Course Content

Unit 1: Introduction (02 Lecture Hours)
Meaning, Fundamental concepts, Characteristics & limitations of OB, Models of OB, Challenges & Opportunities of OB. Personality: Definition, Features, Big five model, Johari Window, Managerial Implications of Personality.

Unit 2: Perception and Attributes (02 Lecture Hours)

Unit 3: Attitude, Motivation and Leadership (03 Lecture Hours)
Attitude: Definition, Features, ABC model of Attitude, Managerial Implications of Attitude. Motivation: Concept, Definition, Features, Types of Motivation, Managerial Implications of Motivation. Leadership: Concept, Definition, Leadership Styles, Transactional and Transformational Leadership, Leadership development and its importance in organizational behavior.

Unit 4: Conflict Resolution (02 Lecture Hours)
Groups and Teams: Definition, Features, Group development stages, Group vs. Teams. Conflict Management: Definition, Features, Types of Conflict, Conflict Resolution Strategies

Unit 5: Organizational Culture and Change (03 Lecture Hours)
Organizational Culture: Elements and dimensions of organizational culture, Importance of organizational culture in shaping the behavior of people. Organizational Change: Understanding the issues and managing change, Approaches to organizational change.

Text/Reference Books
2019-23 Batch

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

<table>
<thead>
<tr>
<th>Components</th>
<th>Tutorial/Faculty Assessment</th>
<th>Class Tests</th>
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Relationship between the Program Outcomes (POs), Program Specific Outcomes (PSO) and Course Outcomes (COs)

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


Course Objectives

- To present various concepts and impart proficiency in basic fluid mechanics concepts.
- Expose the students to various real world applications of fluid mechanics.
- To provide basic concepts about uniform & non-uniform flow

Course Outcomes

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

CO1. Apply the properties and applications of fluid mechanics
CO2. Compute problems related to hydrostatics and kinematic forces
CO3. Solve problems related to hydrodynamic forces
CO4. Implement dimension analysis on prototype and models

Catalog Description

The subject of Fluid Mechanics occupies an important position in many engineering disciplines such as civil, mechanical, chemical and aeronautical engineering. It deals with the flow of fluid, which is present all around. This fluid is mostly in the form of water, air & oil and most of the analysis are based on them. It is essential to have a good understanding of the mechanics of fluids. Fluid Mechanics also laid down the foundation for other subjects like water resources engineering, hydraulic structures, etc. This subject is also filled with advanced mathematics especially calculus. Students will be dealing with the topics like laminar and turbulent flow. Flow around Submerged bodies, Boundary layer flow, Non-uniform flow and the hydraulic machines. It requires mathematical aptitude and sharp mind as the analysis carried out is going to large implications on real life applications.

Course Content

Unit 1: Introduction (04 Lecture Hours)
Fluid properties: mass density, specific weight, specific volume and specific gravity, surface tension, capillarity, pressure inside a droplet and bubble due to surface tension, compressibility viscosity, Newtonian and Non-Newtonian fluids, real and ideal fluids.
Unit 2: Fluid Statics  (06 Lecture Hours)
Pressure-density-height relationship, gauge and absolute pressure, simple differential and sensitive manometers, two liquid manometers, pressure on plane and curved surfaces, center of pressure, Buoyancy, stability of immersed and floating bodies, determination of metacentric height, fluid masses subjected to uniform acceleration, free and forced vortex.

Unit 3: Kinematics of Fluid Flow  (06 Lecture Hours)
Steady & unsteady, uniform and non-uniform, laminar & turbulent flows, one, two & three dimensional flows, stream lines, streak lines and path lines, continuity equation in differential form, rotation and circulation, elementary explanation of stream function and velocity potential, rotational and irrotational flows, graphical and experimental methods of drawing flownets.

Unit 4: Dynamic of Fluid Flow  (12 Lecture Hours)
Euler's equation of motion along a streamline and its integration, limitation of Bernoulli’s equation, Pitot tubes, Venturimeter, Orificemeter, flow through orifices & mouth pieces, sharp crested weirs and notches, aeration of nappe.

Unit 5: Dimensional Analysis and Hydraulics Similitude  (08 Lecture Hours)
Dimensional analysis, Buckingham theorem, important dimensionless numbers and their significance, geometric, kinematic and dynamic similarity, model studies, physical modeling, similar and distorted models.

Text Books/Reference Books

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

Examination Scheme:

<table>
<thead>
<tr>
<th>Components</th>
<th>Internal</th>
<th>Mid term</th>
<th>End Term examination</th>
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## Relationship between the Course Outcomes (COs), Program Outcomes (POs) and Program Specific Objectives (PSOs)

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

- To learn about the strength parameters of materials, concept of stress, strain and deformation of solid and state of stress
- To know the concepts of strain energy, principal stress, principal planes, principle strain and failure theories
- To learn the bending moment, shear force and the corresponding stress distribution for different types of beams
- To understand the theory of torsion and stresses in springs
- To learn the concept of thin pressure vessels (thin cylinders and shells) and shear center
- To determine the deflection in determinate beams (using double integration, Macaulay’s method, moment area method) & deflection in curved beams (strain energy method)

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

CO1. Observe the different types of material behavior such as elastic, plastic, ductile and brittle members, to predict the strength of materials.
CO2. Analyze problems of torsion, axially loaded columns, combined loading & pressure vessel
CO3. Analyze bending stresses and shear stresses, and draw the SFD and BMD for various members.
CO4. Determine the deflection in determinate beams & curved beams

Catalog Description
Solid Mechanics is a branch of mechanics that studies the effect of external loading has on a body. This is important to be studied by a civil engineer, as it helps determine the material to be used for construction, and also exploring new materials for construction. The behavior of the material and members under various loading is to be understood and member sizes defined for any structure, for safe, functional structures at optimal costs and resources. Today’s continually changing global scenario dictates that a civil engineer consider sustainable construction, and minimal carbon footprint of construction sector. To achieve this goal, it is important that the student should learn and be able to ascertain the behavior of various materials and members under varying loading conditions.
Course Content

Unit 1: Strength Properties of material & complex stress & strains (08 Lecture Hours)
Brief about the course, Definition of stress and strain, True stress and strain, Engineering stress and strain, Ductile and brittle materials, Elasticity, proof stress, types of stress strain curve, resilience, toughness and their modulus, Creep, Fatigue, S N Curve, Types of failure in tension and compression test, Types of stresses, Elastic constants- Young’s modulus, poisons ratio, Types of modulus for stress strain curve, Stress and strain, complementary stress, differential strain, stress matrix and strain matrix, Application of hooks law.

Unit 2: Compound Stresses and Strains (05 Lecture Hours)

Unit 3: Bending moment and Shear Force Diagrams (07 Lecture Hours)
Different types of support system, finding reactions, sign convention, stability. Relation between shear force, Bending moment & Loading and guidelines to draw SFD and BMD with elastic curve, Shear force and Bending moment diagram for compound beams, Overhanging Beams, Cantilever beams, simply supported beams, curved beams and determinate frames. Assumption in simple bending theory and derivation of bending equation, bending capacity of a cross section, Bending Stress Distribution across a Section, Shear Stresses in Beams.

Unit 4: Theory of Torsion (04 Lecture Hours)
Concept of pure torsion. Torsion equation, Torsion capacity, Shafts in series and parallel arrangements. Determination of shear stress and angle of twist of shafts of circular section, hollow shafts, indeterminate shafts.

Unit 5: Deflection of Beams (06 Lecture Hours)
Double integration method, Macaulay’s Method, Moment Area method and problems. Strain energy calculations and deflection in curved beams.

Unit 6: Pressure vessels, Combined loading & Columns (06 Lecture Hours)
Thin walled cylinders and spheres. Stress due to internal pressure, state of stress due to combined loading. Introduction to buckling effect, Euler’s theory & Rankine’s formula for axially loaded columns with different end conditions. Concept of equivalent length.

Textbooks

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

**Examination Scheme:**

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<th>Internal</th>
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**Relationship between the Course Outcomes (COs) and Program Outcomes (POs) & Program Specific Outcomes (PSOs)**

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

- Describe the function of surveying in civil engineering construction,
- Work with survey observations, and perform calculations.
- Calculate azimuths, latitudes and departures, error of closure; adjust latitudes and departures and determine coordinates for a closed traverse,
- Perform traverse calculations; determine latitudes, departures, and coordinates of control points and balancing errors in a traverse. Use appropriate software for calculations and mapping,
- Calculate, design and layout horizontal and vertical curves, Understand, interpret, and prepare plan, profile, and cross-section drawings, Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities.

Course Outcomes

On completion of this course, the students will be able to;
CO1. Understand levelling, contouring and triangulation, photogrammetry, remote sensing and field of astronomy
CO2. Compute area and volumes using the various concepts of surveying
CO3. Apply the concepts of theodolite and tachometry for angular and linear measurements of field
CO4. Apply various methods for curve settings for proper alignment of roads.

Catalog Description

Surveying is one of the oldest arts practiced by man. It is one of the oldest and the most used discipline of engineering. It is the basic and foremost requirement of any engineering project. The art of surveying has become an important profession. An introduction to the principles and practices of surveying is, therefore, desirable as an integral part of engineering education and training, irrespective of the branch of specialization. This subject helps in learning the concepts of traversing, levelling, tachometry and setting out of curves. It will help the student to calculate distances, angles (or bearings) and linear measurements at any type of terrain. Geomatics is the higher branch of surveying and it covers area like photogrammetry and remote sensing. In the time of digitization, various sorts of data are stored in digital formats. Digitized maps of area are being made. Real time tracking is done with the help of GPS. Geomatics covers all the areas like triangulation. Trigonometry, Photogrammetry, Remote Sensing and Astronomy. It is an emerging and exciting field of study. It also employs real time modelling. Topics like astronomy make this
subject more interesting and fun to learn. However, it requires higher level of precision and accuracy in its processes at the same time. This subject serves as the repository of data to be used for the construction work of any sort. Knowledge of surveying trains the ability of engineers to visualize, think logically and pursue the engineering approach. Geomatics will help the students to remain updated with modern trends in technology, which is applied in surveying.

Course Content

Unit 1: Introduction to Surveying (15 Lecture Hours)
Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Levelling: Plane table surveying, Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross-sectioning. Digital and Auto Level, Errors in levelling; contouring Characteristics, methods, uses; areas and volumes.


Unit 2: Curves (08 Lecture Hours)
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 3: Modern Field Survey Systems (04 Lecture Hours)
Principle of Electronic Distance Measurement, Modulation, and 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 4: Photogrammetry Surveying (06 Lecture Hours)
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 stereo-plotting instruments, mosaics, map substitutes.

Unit 5: Remote Sensing (03 Lecture Hours)
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.
Textbooks


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

Examination Scheme:

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<th>Components</th>
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Relationship between the Program Outcomes (POs), Program Specific Outcomes (PSO) and Course Outcomes (COs)

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

- Develop ability to value the contribution of thermodynamic engineering principles to Civil Engineering profession
- Develop ability to apply the laws of thermodynamics in solving heat related problems in systems
- Ability to comprehend the thermodynamics and their corresponding processes that influence the behaviour and response of structural components
- Ability to design and conduct experiments, as well as to analyze and interpret data

Course Outcomes

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

CO1. Understand the basic concepts of thermodynamics
CO2. Analyse the physical system, component or process based on thermodynamic principle
CO3. Compare the various thermodynamic processes and cycles.

Catalogue Description

Thermodynamics are important in many scientific and technological problems and can be applied to any discipline, technology, applications or the processes. Thermodynamic is used to understand many energy exchanges accompanying a wide range of mechanical and chemical processes. In thermodynamic we study mainly interactions between the thermodynamic system and surrounding in the form of heat and work. Due to interaction between system and surrounding properties of the system will change and we can study all qualitative and quantitative changes within the system by laws of thermodynamics.

Course Content

Unit 1: Fundamentals (05 Lecture Hours)

Unit 2: First Law of Thermodynamics (08 Lecture Hours)
Unit 3: Second Law of Thermodynamics (12 Lecture Hours)
Thermal energy reservoirs, heat engines energy conversion, Kelvin’s and Clausius statements of second law, the Carnot cycle, the Carnot Theorem, the Carnot heat engine, efficiency, the Carnot refrigerator and heat pump, COP. Clausius inequality, concept of entropy, principle of increase of entropy – the increase of entropy principle, perpetual-motion machines, reversible and irreversible processes, isentropic processes, property diagrams involving entropy, entropy change of liquids and solids, the entropy change of ideal gases, available energy.

Unit 4: Properties of Pure Substance (05 Lecture Hours)
Properties of pure substances. Thermodynamic properties of pure substances in solid, liquid and vapour phases. Thermodynamic properties of steam

Unit 5: Power Cycles (06 Lecture Hours)
Vapor power cycle: Rankine cycle, gas power cycle-Brayton cycle, Air standard cycle

Text Books/Reference Books

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

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

- Knowledge of contemporary issues.
- Ability to function effectively in multidisciplinary projects.
- Understanding of professional and ethical responsibility.

Course Outcomes

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

CO1. To develop an interdisciplinary vision towards sciences.
CO2. Understand about the cellular machinery and functions, which is eventually accountable for various activities.
CO3. Develop efficiency for identifying and solving some biological problems through engineering proficiency.
CO4. Develop a moral code of conduct for various scientific practices.
CO5. Inculcate team spirit with the multidisciplinary fields.

Catalog Description

The ever changing world of advancement poses a challenge for the engineers of the future to provide a multi-disciplinary engineering solution, which is optimal as well as sustainable. In order to achieve a sustainable solution, it is necessary that the student should be exposed to a course which teaches them about the interdisciplinary nature of sciences and the role of biology in their vision and solutions. It is imperative that the engineer be able to develop a moral code of conduct which is inclusive of various scientific practices. This course has been developed with the objective to address these requirements. The student shall be able to identify and solve biological problems through engineering proficiency.

Course Content

Unit 1: Basic Cell Biology and Molecular Biology (12 Lecture Hours)
Structure and function of cell and organelles, Eukaryotic and prokaryotic cells, Central Dogma of molecular biology, DNA, RNA & Protein synthesis
Unit 2: Bio-Organic Chemistry, Enzymes and Industrial Applications  (06 Lecture Hours)
Introduction to Carbohydrates, fats, proteins – their structure, function and classification. Enzymes: Biological catalysts, Classification of Enzymes, Proteases, Carbonic anhydrase, Restriction enzymes. Enzyme immobilization, Michaelis-Menten kinetics.

Unit 3: Data Alignment and Application  (06 Lecture Hours)
Collecting and Storing Sequence Data: Sequence assembly; Submission of Sequences; Sequence accuracy; Sequence databases; Sequence formats. Dynamic programming methods for global and local alignments tools- FASTA, BLAST, statistical and Biological significance.

Unit 4: Mathematical Modelling  (03 Lecture Hours)
The value of models, Types of models, Steps in modelling process, Examples of Models and Empirical observations

Unit 5: Bio-Mems  (06 Lecture Hours)
Bio-electromechanical sensing of cell behavior, Micro-engineered biosensors, Tissue micro-engineering, Micro-engineering in cell biology

Unit 6 Bioethics  (03 Lecture Hours)
Bioethical education and programs, Ethical issues, Clinical Ethics and Law, Ethics Committees and Consultation. Environmental ethics.

Text Books/Reference Books
2. P. F. Stanbury, A. Whitaker, and SJ Hall, Principles of Fermentation Technology, 2nd Edition,
3. Butterworth-Heinemann, Bioethics, An introduction to the History, Methods and Practice, 2nd edition, Publisher: Jones and Bartlett.2

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

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### Course Objectives

- To provide practical knowledge in verification of principles of fluid flow and its characterization.
- To impart knowledge in measuring pressure, discharge and velocity of fluid flow
- To understand Major and Minor Losses in pipe flow

### Course Outcomes

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

CO1. Calibrate flow measuring devices used in pipes, channels and tanks
CO2. Determine fluid and flow properties
CO3. Classify laminar and turbulent flows
CO4. Compute the various losses in pipe flow

### Catalog Description

The material in this course will provide the student with a fundamental background in the statics and dynamics of fluids. The basic conservation laws of mass, momentum and energy are analyzed in control volume and differential form. It is expected that student will be able to correctly apply the lecture course content so as to evaluate potential industrial applications. Real life applications of these fundamental concepts will be introduced. Interpretation of results from experiments and numerical simulation of fluid flows will also be emphasized.

### List of Experiments

**Experiment No: 01 Law of Conservation of Energy**
To verify the Bernoulli’s equation using the Venturimeter

**Experiment No: 02 Coefficient of Discharge**
To determine the Coefficient of discharge $C_d$, Velocity $C_v$ and Contraction $C_c$ of various types of Orifices and Mouthpieces.

**Experiment No: 03 Reynolds Number**
To study the Reynolds number in different flow conditions.

**Experiment No: 04 Discharge Coefficients**
To determine the discharge coefficients of V-notch and Rectangular Notch (U).

**Experiment No: 05 Darcy’s Law**
To verify Darcy’s law and to find out the coefficient of permeability of the given medium.
Experiment No: 06 Variation of Friction Factor
To study the variation of friction factor, ‘f’ for turbulent flow in smooth and rough commercial pipes

Experiment No: 07 Head Loss Coefficient
To determine the minor head loss coefficient for different pipe fittings.

Experiment No: 08 Variation of Coefficient of Discharge
To calibrate an Orifice meter and study the variation of coefficient of discharge with Reynolds number

Experiment No: 09 Calibration of Venturimeter
To calibrate a Venturimeter and to study the variation of coefficient of discharge with the Reynolds Number

Text Books

Reference Books

Modes of Evaluation: Class Tests/Assignment/Tutorial Assessment/Written Examination Examination Scheme:
Continuous Lab Evaluation is there to assess the students’ performance in the lab

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1=weakly mapped  
2=moderately mapped  
3=strongly mapped
Course Objectives
- To give detailed understanding engineering properties of bema by conducting laboratory experiments
- To provide knowledge about the structure-property-application relationships
- To understand shear, stress & strain in structure, experimentally.

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

CO1. Determine engineering properties of given specimens
CO2. Determine shear forces, stress & Strain of given specimen
CO3. Assess deflection in determinate beam
CO4. Find the behavior of steel bar under bending

Catalog Description
A structure refers to a system of connected parts used to support a load. Before designing, the structure must be analyzed to ensure that it has its required stiffness and strength. This lab helps in understanding and visualizing the principles of various engineering properties on engineering under various application of load like stress, sheer, strain, etc. The practically determine the various engineering properties of structure will develop better understanding about the materials from the point of view of mechanics.

List of Experiments

Experiment No: 01 Bending Test
Bending tests on simply supported beam and Cantilever beam.

Experiment No: 02 Hooke’s Law
Investigation of Hook’s law that is the proportional relation between force and stretching in elastic deformation.

Experiment No: 03 Tension test
Perform the tension test on nominal concrete mix.

Experiment No: 04 Compression test on concrete
Perform the compression test on nominal concrete mix
Experiment No: 05 Shear Forces in Beam
Determine the force for shear failure in concrete mix.

Experiment No: 06 Yield/tensile strength of steel bar
Measure the yield / tensile strength of steel bar

Experiment No: 07 Measurement of deflections in statically determinate beam
To measurement the deflections in statically determinate beam for applied load

Experiment No: 08 Strain in a Bar
Measurement of strain in a bar

Experiment No: 09 Bend Test on steel bar
Measurement of Bend of steel bar on application of load

Text Books/Reference Books

Modes of Evaluation: Class Tests/Assignment/Tutorial Assessment/Written Examination
Examination Scheme:
Continuous Lab Evaluation is there to assess the students’ performance in the lab

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

- To present the fundamentals of surveying in a simplified manner with its necessity and basics like levelling
- Expose the students into the basic concepts of surveying applicability and contour importance.
- To give knowledge of finding horizontal and vertical angles using various instruments.
- To understand tachometry with respect field survey and its applicability.
- To create awareness about curve surveying and its setting methods

Course Outcomes

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

CO1. Conduct surveying using various survey instruments in the field works.
CO2. Plot curves for roads and marking of buildings on site
CO3. Prepare Longitudinal Section (LS), Cross Section (CS) for the road works and contour map for the given area
CO4. Carry out the horizontal and vertical angle calculations of a traverse

Catalog Description

Surveying is one of the oldest arts practiced by man. It is one of the oldest and the most used discipline of engineering. It is the basic and foremost requirement of any engineering project. The art of surveying has become an important profession. This lab helps in learning the concepts of traversing, levelling and tacheometry. It will help the student to calculate distances, angles (or bearings) and linear measurements at any type of terrain. This subject serves as the repository of data to be used for the construction work of any sort. Knowledge of surveying trains the ability of engineers to visualize, think logically and pursue the engineering approach

List of Experiments

Experiment No: 01 Map Study
To study different types of maps published by Survey of India and Conventional Symbol Charts.

Experiment No: 02 Chain Surveying
To study instruments used in conventional chain and compass surveying and to measure distance between two points by ranging.
Experiment No: 03 Traversing
To measure the bearing of sides and length of a given traverse by prismatic compass and tape, and plotting of the traverse after adjustment.

Experiment No: 04 Theodolite Survey
To conduct temporary adjustments of a Vernier Theodolite and measure Horizontal and Vertical angles by Reiteration method.

Experiment No: 05 Repetition Method
To measure Horizontal angle by repetition method.

Experiment No: 06 Dumpy/IOP level Surveying
To find out the reduced levels of given points using Dumpy/IOP level (Reduction by height of Collimation method and Rise and Fall method) and transfer of bench mark

Experiment No: 07 Tacheometric Survey
To determine the Tacheometric constants of a given tacheometric instrument and measurement of distance between two points by Tacheometry.

Experiment No: 08 Plane Table Survey
To plot details using radiation and intersection methods in plane tabling.

Experiment No: 09 Plane Table Traverse Survey
To solve two point/three point problem in plane table traverse survey.

Experiment No: 10 Profile and Cross-section
To determine and draw the longitudinal profile and cross-section along a given route.

Text Books/Reference Books

Modes of Evaluation: Quiz/Assignment/presentation/extempore/ Written Examination
Examination Scheme:
Continuous Lab Evaluation is there to assess the students’ performance in the lab

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1=weakly mapped 2= moderately mapped 3=strongly mapped
SEMESTER V
Course Objectives

- To determine the deformation of beams and frames
- To perform analysis the determinate and indeterminate truss structure and to find the deflection in trusses.
- To perform analysis the indeterminate beam
- To perform the analysis of arches
- To understand the influence line diagrams and their applicability to real life situations

Course Outcomes

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

CO1. Determine the deformation of beams, frames and trusses.
CO2. Analyze determinate and indeterminate trusses
CO3. Analyze indeterminate beams by using force methods
CO4. Understand the influence line diagrams for beams, trusses arches.

Catalog Description

A structure refers to a system of connected parts used to support a load. Before designing, the structure must be analyzed to ensure that it has its required stiffness and strength. The results of the analysis are used for redesign the structure, accounting for a more accurate determination of the weight of the members and their size and simultaneous optimization. This course includes determination of deflection in different structure systems, analysis of determinate and indeterminate trusses, indeterminate beams. Analysis of arches and basics of cable analysis. Utilization of influence line diagram for moving loads on the analysis of the structural system.

Course Content

Unit 1: Deflection in Beams and Frames (08 Lecture Hours)
Relation between bending moment, slope and deflection, deflection in determinate beams by double integration method. Concept of moment area method and use of moment area method to calculate deflections of beam such as simply supported, over hanging and of uniform cross sections and different cross sections. Conjugate beam method and application of conjugate beam method to simply supported, overhanging beam. Energy methods for deflection: Concept of strain energy, Maxwell’s reciprocal theorem, Castiglino’s second theorem. Use of strain energy and unit load methods for finding out of deflections for beams & frames.
Unit 2: Analysis of Determinate and Indeterminate Truss Structure and To Find the Deflection In Trusses (12 Lecture Hours)
Assumptions in trusses, types of trusses and Zero force members, Analysis of trusses by method of section & by method of joints. Deflection of trusses – Deflections of statically determinate plane trusses by Castigliano’s second theorem and by unit load method. Deflection of trusses for Lack of fit and temperature. Analysis of redundant trusses by Castigliano’s second theorem (degree of indeterminacy maximum up to 2 only) and by Principle of virtual work.

Unit 3: Analysis of Indeterminate Beams (10 Lecture Hours)
Analysis of Indeterminate Beams and Frame by Energy concept (Up to 2 D.O.I), Fixed beams – concept, advantages and disadvantages. Nature of B.M. diagrams, Fixed end moment due to various types of loads such as point, uniformly distributed, uniform varying, couples for beams of uniform c/s and stepped cross sections. Continuous Beams – Concept, Nature of B.M. Diagrams.Claperon’s Theorem of Three Moments for Beams of Constant Cross Sections for different c/s, for different spans due to Concentrated Load, UDL. Effect of Sinking of supports, plotting of B.M. & S. F. diagrams.

Unit 4: Analysis of Arch (09 Lecture Hours)
Three hinged arch & Girder - Concept of three hinged arch as a haunched beams, support reaction. B.M., S.F. and axial thrust diagrams for circular and parabolic. Influences lines for B.M., S.F. and axial thrust. Maximum B.M., S.F. and axial thrust due to point loads & UDL only.

Unit 5: Influence Line Diagrams and Its Application (09 Lecture Hours)

Text Books
2. R. C. Hibbler, *Structural Analysis*
4. S Ramamurtham, *Theory of Structures*
5. D Menon, *Structural Analysis*

Modes of Evaluation: Class Tests/Assignment/Tutorial Assessment/Written Examination

Examination Scheme:

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2019-23 Batch

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

- To determine the static degree of indeterminacy, kinematic degree of indeterminacy, to understand concept of force method and displacement method
- To be able to perform analysis of indeterminate beams, frames using slope deflection method, energy method and to perform approximate analysis for beams, frames, and trusses by approximate method
- To be able to create stiffness matrix and flexibility matrix and perform the analysis by the matrix methods
- To perform the plastic analysis and its application in real life situations

Course Outcomes

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

CO1. Determine the Degree of Static and Degree of Kinematic Indeterminacy for any structure and ability to select suitable method for analysis.
CO2. Perform analysis of indeterminate beams, frames by slope deflection method, moment distribution method, Kani’s Method and approximate analysis for frames.
CO3. Analyze the structure by flexibility and stiffness methods.
CO4. Determine plastic strength of a section, plastic mechanisms, plastic analysis and its application

Catalog Description

A structure refers to a system of connected parts used to support a load. Before designing, the structure must be analyzed to ensure that it has its required stiffness and strength. The results of the analysis are used for redesign the structure, accounting for a more accurate determination of the weight of the members and their size and simultaneous optimization. This course includes determination of degree of static and kinematic indeterminacy, understanding displacement and force method of analysis. Analysis of indeterminate beams, frames by slope deflection method, moment distribution method and approximate methods. Analysis by stiffness and flexibility matrix method and plastic analysis.
Course Content

Unit 1: Basic Concepts of Structural Analysis  (03 Lecture Hours)

Unit 2: Slope Deflection Method and Approximate Methods  (12 Lecture Hours)
Slope deflection method, applied to continuous and rigid jointed frames, transverse and rotational yielding of supports. (up to three unknown). Moment distribution & Kani’s method applied to continuous beams and rigid jointed rectangular frames, transnational and rotational yielding of supports. Approximate analysis of trusses and multistory frames for vertical and lateral loads, substitute frame, portal frame and cantilever method.

Unit 3: Fundamental Concept of Flexibility  (06 Lecture Hours)
Method for structural analysis, flexibility coefficient, matrix formulation for flexibility methods, degree of freedom. Choice of redundant forces, compatibility equations, effect of settlement and rotation of supports, hand solution of simple problems on beams and rigid jointed frames (involving not more than three unknown).

Unit 4: Fundamental Concept of Stiffness  (09 Lecture Hours)
Method of stiffness analysis, stiffness coefficient, matrix formulation for stiffness methods, degree of freedom. Stiffness matrix for frames with inclined member, physical significance of stiffness, effect of settlement and rotation on rigid jointed plane frames (involving not more than three unknown).

Unit 5: Plastic Analysis of Steel Structures  (06 Lecture Hours)
Introduction, Shape factor, plastic hinge, collapse mechanism, upper bound and lower bound theories, application to continuous, fixed and single bay single storey rectangular frames.

Text Books
1. S.S. Bhavikatti, Structural Analysis Vol-2, 3rd Edition
2. R. C. Hibbler, Structural Analysis
3. Aslam Kasimali, Structural Analysis, 4th Edition
4. S Ramamurtham, Theory of Structures
5. D Menon, Structural Analysis

Modes of Evaluation: Class Tests/Assignment/Tutorial Assessment/Written Examination

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1=weakly mapped  
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3=Strongly mapped
Course Objectives

- To present various concepts and impart proficiency in basic fluid mechanics concepts.
- Expose the students to various real world applications of fluid mechanics.
- To provide basic concepts about uniform & non-uniform flow.

Course Outcomes

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

CO1. Apply the concepts of flow in laminar and turbulent flow
CO2. Interpret the concept of boundary layer theory
CO3. Analyze the concepts of uniform & non-uniform flow in open channel hydraulics

Catalog Description

The subject of Fluid Mechanics occupies an important position in many engineering disciplines such as civil, mechanical, chemical and aeronautical engineering. It deals with the flow of fluid, which is present all around. This fluid is mostly in the form of water, air & oil and most of the analysis are based on them. It is essential to have a good understanding of the mechanics of fluids. Fluid Mechanics also laid down the foundation for other subjects like water resources engineering, hydraulic structures, etc. This subject is also filled with advanced mathematics especially calculus. Students will be dealing with the topics like laminar and turbulent flow. Flow around Submerged bodies, Boundary layer flow, Non-uniform flow and the hydraulic machines. It requires mathematical aptitude and sharp mind as the analysis carried out is going to large implications on real life applications.

Course Content

Unit 1: Laminar Flow (04 Lecture Hours)

Laminar flow through: circular pipes, annulus and parallel plates, Stoke’s law, Measurement of viscosity.

Unit 2: Turbulent Flow (04 Lecture Hours)

Unit 3: Boundary Layer Analysis (04 Lecture Hours)
Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

Unit 4: Dimensional Analysis and Hydraulic Similitude (05 Lecture Hours)
Dimensional homogeneity, Rayleigh method, Buckingham’s Pi method and other methods. Dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problem.

Unit 5: Introduction to Open Channel Flow (06 Lecture Hours)
Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section.

Unit 6: Uniform Flow (06 Lecture Hours)

Unit 7: Non-Uniform Flow (08 Lecture Hours)

Unit 8: Hydraulic Jump (06 Lecture Hours)

Unit 9: Flow through Pipes (05 Lecture Hours)
Loss of head through pipes, Darcy-Weisbach equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem.
Text Books/Reference Books


Modes of Evaluation: Class Tests/Assignment/Tutorial Assessment/Written Examination

Examination Scheme:

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

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

- To establish and understand the fundamental concepts of mechanics of soil particles; including the behaviour of soil in multiphase and constitutive behaviour of soil.
- To provide students the exposure to the systematic methods for solving engineering problems in geotechnical engineering
- To discuss the basic mechanical principles underlying modern geotechnical engineering

Course Outcomes

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

CO1. Understand the soil classification and soil properties
CO2. Comprehend and apply the concept of stability of slope and modes of failure
CO3. Determine permeability and compaction characteristics of soil mass and its application
CO4. Apply the concepts of on various theories & principles to analyze the response of soil under shear and earth pressure
CO5. Analyze consolidation properties of soil mass and its application in structures design

Catalog Description

Loads of any civil engineering structure will need to be transferred to and carried by earth through a foundation system. Foundation engineering requires knowledge of soil and its behavior i.e. geotechnical engineering. The objective of this course is to introduce the basics of geotechnical engineering to the students. Some of the topics that students will learn are soil structure, compaction, consolidation, permeability, seepage through soil and fundamental behavior of soil under stress. After successful completion of this course students will be able to apply fundamentals of geotechnical engineering in the analysis and design of civil engineering projects.

Course Content

Unit 1: Introduction (06 Lecture Hours)

Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity, mass specific gravity, etc. Relationship between volume weight, voids ratio- moisture content, unit weight- percent air voids, saturation- moisture content, moisture content- specific gravity etc. Determination of various parameters such as:

**Unit 2: Plasticity Characteristics of Soil**  
(04 Lecture Hours)  

**Unit 3: Permeability of Soil**  
(04 Lecture Hours)  

**Unit 4: Effective Stress Principle**  
(04 Lecture Hours)  
Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition

**Unit 5: Compaction of Soil**  
(04 Lecture Hours)  
Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.

**Unit 6: Stresses in soils**  
(04 Lecture Hours)  
Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq’s equation, Newmark’s Influence Chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory.

**Unit 7: Consolidation of Soil**  
(04 Lecture Hours)  
Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi’s theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

**Unit 8: Shear Strength**  
(04 Lecture Hours)  
Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test,
triaxial compression tests, test behaviour of UU, CU and CD tests, pore-pressure measurement, computation of effective shear strength parameters. Unconfined compression test, vane shear test

**Unit 9: Stability of Slopes**
(04 Lecture Hours)
Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

**Text Books/Reference Books**

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

**Examination Scheme:**

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

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

- To provide knowledge of Construction Project management & its unique features
- To make aware and provide knowledge for Construction Project planning techniques
- To provide detail knowledge on construction projects monitoring & control
- To make aware for the cost - time analysis, quality and risk management with respect to construction projects

Course Outcomes

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

CO1. Understand features of management of construction projects & contract management
CO2. Understand knowledge on basics of Construction project planning techniques
CO3. Demonstrate network techniques in Construction Management
CO4. Apply knowledge to evaluate construction project on Time - cost analysis, basics of quality management and risk management

Catalog Description

Construction Project is a mission, undertaken to create a unique facility, product or service within specified scope, quality, time and cost. Knowledge area needed to manage such projects comprise of project management techniques, general management practices and technology related subjects. The project management technique of planning, scheduling and controlling are the tools and devices that bind the subject’s knowledge areas. The construction industry accounts for 6-9% of the Gross Domestic Product (GDP) in India. Lack of knowledge of construction planning & management results time & cost overrun. More over in various businesses, the rate of business failure of construction project is one of the highest. One of the reason for this high rate of failure is lack of knowledge of construction planning & Management.

There is vast scope for improving performance through knowledge of planning & management in the construction industry, where men, materials, machinery, money and management work together to build a facility. This subject will be helpful for the students to acquire knowledge about construction project overview, construction project planning technique and Cost –time analysis in construction industry.
Course Content

Unit 1: Basics of Construction Project Management (05 Lecture Hours)

Unit 2: Construction Project Planning (08 Lecture Hours)
Introduction, Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, estimating durations, sequence of activities, activity utility data.
Technique of planning: Bar charts, CPM Networks - basic terminology, types of precedence relationships- finish to start, start to start, finish to finish, start to finish, preparation of CPM networks: activity on link and activity on node representation, analysis of single relationship (finish to start) networks, computation of float values, critical and semi-critical paths, Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations.

Unit 3: Network Techniques in Construction Management (08 Lecture Hours)
Introduction, network techniques, work break down, classification of activities, rules for developing networks, network development-logic of network, allocation of time to various activities, Fulkerson's rule for numbering events, network analysis, determination of project schedules, critical path, float in activities, Updating of plans: purpose, frequency and methods of updating.
S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling.

Unit 4: Contract Management- Basics (05 Lecture Hours)
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.

Unit 5: Construction Cost & Time-Cost Analysis (06 Lecture Hours)
Cost versus time, direct cost, indirect cost, total project cost and optimum duration, contracting the network for cost optimization, steps in time cost optimization, illustrative examples.

Unit 6: Quality & Risk Management (04 Lecture Hours)
Introduction to quality management, principles of inspection, enforcement of specifications, stages in inspection and quality control, testing of structures, statistical analysis. Project Risk Management.
Text Books

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

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

- To present various concepts involved in water supply scheme and sewerage system designing for a city
- To provide knowledge about the qualitative analysis of water and waste water
- To teach students about the treatment processes involved in purification of water supplies and treatment of sewage
- To provide knowledge in detail about the air quality, its control and monitoring practices
- To teach students about the basic concepts of noise, measurement procedures and various control methods
- To provide knowledge about the solid waste generation, its impact and management strategies

Course Outcomes

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

CO1. Understand the various components of water supply and sewerage system
CO2. Compare the various components/units of water treatment and sewage treatment plant
CO3. Understand the air and noise quality concepts along with their monitoring and control methods
CO4. Compare the various solid waste management practices
CO5. Design the components of water supply scheme and sewerage system

Catalog Description

Environmental Engineering in civil engineering deals with the major infrastructure components i.e. water supply system and sewerage system for a city. It also covers study of processes adopted in water treatment plant for purification of water as well as in sewage treatment plant for treatment of sewage. It also provides knowledge to the students regarding air and noise quality concepts along with their monitoring and control procedures. Additionally, knowledge about the solid waste and management strategies will also be provided to the students under the course. In this course, the focus will be on developing the understanding of the students regarding concepts of environmental engineering systems.
2019-23 Batch

Course Content

Unit 1: Water (11 Lecture Hours)
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 2: Sewage (12 Lecture Hours)
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 3: Air (05 Lecture Hours)
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.

Unit 4: Noise (02 Lecture Hours)
Basic concept, measurement and various control methods.

Unit 5: Solid Waste Management (06 Lecture Hours)
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.

Text Books/Reference Books

**Modes of Evaluation:** Class Tests/Assignment/Tutorial Assessment/Written Examination
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1=weakly mapped 2=Moderately mapped 3=Strongly mapped
Course Objectives

- To present the fundamentals of Transportation Engineering in a simplified manner with historic development aspects, and different types of surveys used in transportation engineering.
- To provide the students into the basic concepts of Transportation Engineering with road ways and types.
- To give knowledge of geometric design and pavement materials.
- To give them an idea about elements bridges and their classification.
- To create awareness about various elements of bridge, design and construction

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

CO1. Understand the concepts of highway development, planning and materials
CO2. Implement geometric design of roads and traffic engineering
CO3. Evaluate highway construction and maintenance
CO4. Design flexible and rigid pavements according to IRC codes

Catalog Description
Transportation Engineering is the application of scientific processes; like observation, analysis and deduction to the planning, design, operation and management of transportation facilities. It is also multidisciplinary and requires knowledge from specialized filed such as psychology, economics, ecology and environment, sociology, management, optimization, graph theory, probability theory, statistics, computer simulation and other areas of civil engineering such as structural and geotechnical engineering.

Course Content

Unit 1: Highway Development and Planning (06 Lecture Hours)
Historical Development, road patterns, master plans, road development plans, PMGSY, engineering surveys, highway projects. Highway Materials and Testing: Subgrade soil, sub base and base course materials, bituminous materials, testing of soil, stone aggregates and bitumen.

Unit 2: Highway Geometric Design (08 Lecture Hours)
Cross section elements, sight distances, horizontal and vertical alignment.
2019-23 Batch

Unit 3: Traffic Engineering (06 Lecture Hours)
Traffic characteristics, road user & vehicular characteristics, traffic studies, accident studies, traffic operations, traffic control devices, intelligent transport systems, pollution due to traffic.

Unit 4: Design of Highway Pavements (06 Lecture Hours)

Unit 5: Highway Construction (06 Lecture Hours)
Construction of various layers, earthwork, WBM, GSB, WMM, various types of bituminous layers, joints in rigid pavements.

Unit 6: Highway Maintenance (06 Lecture Hours)
Various type of pavement failures, evaluation and remedial measures.

Text Books/Reference Books

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

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

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

- To impart knowledge in measuring discharge and velocity of fluid flow using Hydraulic flume
- To gain knowledge in performance testing of Hydraulic Turbines and Hydraulic Pumps at constant speed and Head
- To understand the phenomenon of scouring

Course outcomes

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

CO1. Apply the concept of non-uniform flow in an open channel
CO2. Demonstrate the characteristics of different types of Turbines
CO3. Demonstrate characteristics of different types of pumps
CO4. Interpret the phenomenon of scouring

Catalog Description

The material in this course will provide the student with a fundamental background in the statics and dynamics of fluids. The basic conservation laws of mass, momentum and energy are analyzed in control volume and differential form. Student will be familiar with different type of hydraulic machines. It is expected that student will be able to correctly apply the lecture course content so as to evaluate potential industrial applications. Real life applications of these fundamental concepts will be introduced. Interpretation of results from experiments and numerical simulation of fluid flows will also be emphasized.

List of Experiments

**Experiment No: 01 Coefficient of Discharge**
To determine the coefficient of discharge for flow over a board crested weir

**Experiment No: 02 Hydraulic Jump**
To study the characteristics of a hydraulic jump on a horizontal floor and sloping glacis

**Experiment No: 03 Manning’s Coefficient (n)**
To determine manning’s coefficient of roughness n for the bed of a given flume

**Experiment No: 04 Kaplan Turbine**
To study the characteristics of Kaplan Turbine
**Experiment No: 05 Pelton Wheel Turbine**
To study the characteristics of Pelton Wheel Turbine

**Experiment No: 06 Scouring Around Bridge Pier**
To study the scouring phenomenon around a bridge pier

**Experiment No: 07 Scouring Past a Spur**
To study the scouring phenomenon for flow past a spur

**Experiment No: 08 Triangular Weir**
To calibrate triangular weir

**Experiment No: 09 Flow Over a Hump**
To study the flow over a hump placed in an open channel

**Experiment No: 10 Flow Over a Free Overfall**
To study the characteristics of flow over a free overfall in a channel and also to determine the end depth

**Text Books**
4. *Fluid Mechanics Manual*

**Reference Books**

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

**Examination Scheme:**
Continuous Lab Evaluation is there to assess the students’ performance in the lab

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<tr>
<th>Components</th>
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1=Weakly mapped  
2= Moderately mapped  
3=Strongly mapped
Course Objectives

- To understand composition and structure of soil, water flow and hydraulic properties
- To obtain stress in soil, compaction, compressibility of soils, and consolidation characteristics
- To obtain settlement analysis and shear strength of soils

Course Outcomes

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

CO1. Execute collection of soil samples from field/site for testing
CO2. Classify soil based on standard geotechnical engineering practice.
CO3. Execute laboratory compaction, permeability and in-place density tests for quality control.
CO4. Determine shear strength of soil by various standard testing

Catalog Description

The material in this course will provide the students with the fundamental background of soil mechanics. Student will acquire the basic knowledge to carry out field investigations and to identify different type of soils. It is expected that after completion of this course student will have the knowledge and ability to perform laboratory test needed to determine soil design parameters. Student will also be able to conduct experiments as well as analyze and interpret data.

List of Experiments

**Experiment No: 01 Moisture Content**
To determine the moisture content of a given soil sample by oven drying method

**Experiment No: 02 Specific Gravity**
To determine the specific gravity of a given soil sample by Pycnometer method

**Experiment No: 03 Permeability**
To determine the permeability of a given soil sample

**Experiment No: 04 Unit Weight by Core cutter**
To find the field unit weight of soil mass by core cutter method

**Experiment No: 05 Unit Weight by Sand Replacement**
To find the field unit weight of soil mass by sand replacement method
Experiment No: 06 Sieve Analysis
To determine the particle size distribution by sieve analysis (wet and dry both)

Experiment No: 07 Sedimentation Analysis
To determine the particle size distribution by sedimentation analysis

Experiment No: 08 Atterberg Limits
To determine the atterberg limits (plastic limit, liquid limit, shrinkage limit) of a given soil sample

Experiment No: 09 Compaction Test
To perform the standard compaction test on a given soil sample

Experiment No: 10 Shear Strength
To determine the direct shear strength of soil on a given soil sample

Experiment No: 11 Triaxial Shear Strength
To determine the triaxial shear strength of soil on a given soil sample

Experiment No: 12 Consolidation
To determine the rate of magnitude of soil consolidation on a given soil sample

Reference Books
4. V. N. S. Murthy, Geotechnical Engineering.
5. Shamsher Prakash and Hari D. Sharma, Pile Foundation in Engineering Practice

Modes of Evaluation: Continuous Evaluation
Continuous Lab Evaluation is there to assess the student’s performance in the lab

<table>
<thead>
<tr>
<th>Components</th>
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## Relationship between the Course Outcomes (COs), Program Outcomes (POs) and Program Specific Outcomes (PSOs)

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

- To give detailed understanding of quality analysis study of water and waste water
- To make students aware about the common environmental experiments related to water and wastewater quality
- To impart practical knowledge and understanding about the various environmental quality parameters determining techniques/instruments

Course Outcomes

On completion of this course, the students will be able to:
CO1. Estimate the pollutant concentration in water and waste water
CO2. Quantify different physical parameters of water and correlate with the BIS standards
CO3. Quantify different chemical parameters of water and correlate with the BIS standards
CO4. Conduct the sound level measurement process

Catalog Description

Qualitative analysis of water and waste water is an essential aspect of water supply and waste water engineering domain. In this laboratory course, students will perform number of tests to practically determine the various parameters (such as turbidity, pH etc.) of water and waste water and will also be able to develop better understanding about the techniques and instruments required for the determination purpose.

List of Experiments

Experiment No: 01 Alkalinity Measurement
To determine the alkalinity of water sample by titrating with standard sulphuric acid.

Experiment No: 02 Chloride Concentration
To determine the Chloride content of water sample by titrating with Standard Silver Nitrate solution.

Experiment No: 03 Conductivity Measurement
To determine the conductivity of the given water sample
Experiment No: 04 pH and Colour Determination
To determine the pH and colour of the given water sample

Experiment No: 05 Total Hardness
To determine Total Hardness of the given water sample

Experiment No: 06 Turbidity Measurement
To determine the turbidity of the given water sample

Experiment No: 07 Chemical Oxygen Demand
To determine Chemical Oxygen Demand (COD) in the given water sample

Experiment No: 08 Biochemical Oxygen Demand
To determine Biochemical Oxygen Demand (BOD) in the given water sample

Experiment No: 09 Dissolved Oxygen
To determine Dissolved oxygen (DO) in the given water sample

Experiment No: 10 Total Dissolved Solids and Total Suspended Solids
To determine total dissolved and suspended solids in the given water sample

Experiment No: 11 Sound Level Measurement
To measure the sound level of a location with sound level meter

Reference Books
3. Pradeep Kumar and Indu Mehrotra, Water and Wastewater Analysis.
4. Peavy and Rowe, Environmental Engineering

Modes of Evaluation: Class Tests/Assignment/Tutorial Assessment/Written Examination
Examination Scheme:
Continuous Lab Evaluation is there to assess the student’s performance in the lab

<table>
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<th>Components</th>
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### Relationship between the Program Outcomes (POs), Program Specific Outcomes and Course Outcomes (COs)

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

- To study the physical and mechanical properties of highway materials viz. aggregates, soil and Bitumen.
- To be able to identify suitability of given highway materials based on the outcomes of the various experiments.

Course Outcomes

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

CO1. Execute shape tests on aggregates
CO2. Execute mechanical property tests on aggregates
CO3. Execute property tests on bitumen
CO4. Execute CBR test on a given soil sample

Catalog Description

The material in this course will provide the students with the fundamental background of transportation engineering. Student will acquire the basic knowledge to carry out field investigations and to identify different type of materials used in road construction. It is expected that after completion of this course student will have the knowledge and ability to perform laboratory test needed to determine quality of road materials. Student will also be able to conduct experiments as well as analyze and interpret data.

List of Experiments

**Experiment No: 01 Aggregate Impact Value**
To determine the aggregate impact value of given aggregate as per IS 2386 (Part IV): 1963

**Experiment No: 02 Aggregate Crushing Strength**
To determine crushing strength of a given aggregate as per IS: 2386 (part – IV): 1963

**Experiment No: 03 Los Angeles Abrasion Test**
To determine the abrasion value of given aggregate sample by conducting Los Angeles Abrasion Test as per I.S.-2386 (part-IV): 1963
Experiment No: 04 Flakiness, Elongation and Angularity for Aggregate
   A. To determine the flakiness Index of a given aggregates sample as per IS 2386 (PART-I): 1963
   B. To determine the Elongation Index of the given aggregate sample as per IS 2386 (PART-I): 1963
   C. To determine the Angularity Number of the given aggregate sample as per IS 2386 (PART-I): 1963

Experiment No: 05 CBR Value
To determine California Baring Ratio (C.B.R.) value of a given soil sample as per IS 2720 (part XVI): 1987

Experiment No: 06 Specific Gravity of Bitumen
To determine the Specific gravity of given Bituminous material as per IS 1202: 1978

Experiment No: 07 Bitumen Grade
To determine the grade of a given binder as per IS 1203: 1978

Experiment No: 08 Softening Point
To determine the softening point of given paving bitumen as per IS 1205: 1978

Experiment No: 09 Property of Bitumen
To determine the property of a given bituminous material as per IS 1206: 1978

Experiment No: 10 Ductility of Bitumen
To conduct ductility test on given bitumen sample as per IS 1208: 1978

Experiment No: 11 Flash and Fire Point of Bitumen
To determine the flash and fire point of a given bituminous material as per IS 1209: 1978

Experiment No: 12 Optimal Binder Content
To determine optimum binder content of given bituminous mix by Marshall Method of Mix Design

Experiment No: 13 Roughness of Road
To determine the Roughness of road by Merlin Apparatus

Experiment No: 14 Deflection of Road
To determine the deflection of road by Benkelman Beam Apparatus

Text Books
   1. S K Khanna & CEG Justo, *Highway Engineering*
Modes of Evaluation: Class Tests/Assignment/Tutorial Assessment/Written Examination

Examination Scheme:

Continuous Lab Evaluation is there to assess the students’ performance in the lab.

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1=weakly mapped
2=Moderately mapped
3=Strongly mapped
SEMESTER VI
Course Objectives

- To know the general elements of rainfall and its characteristic from India’s point of view.
- To study precipitation, infiltration and evapotranspiration.
- To discuss about various parameters of Runoff and hydrographs.
- To study about soil water relationships and irrigation practices in India.
- To study about canal outlets and their design

Course Outcomes

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

CO1. Estimate precipitation and evapotranspiration  
CO2. Implement the concepts of infiltration, runoff, hydrograph and design flood  
CO3. Analyze the various irrigation system and soil-water relationship  
CO4. Design irrigation canal

Catalog Description

Water Resources in one of the most important aspects for a nation. Its study becomes more important for a monsoon dependent nation like ours. The processes affecting rainfall and runoff and their quantification is one of the most challenging tasks for a water resources engineer. As rainfall is a stochastic process, its prediction is a very complex process indeed. All these challenges are reflected in this course. This course also deals with Evapotranspiration, infiltration, flood forecasting, hydrographs and irrigation engineering with topics like canal irrigation and river training. Each of the aforementioned components are indispensable for a nation and its careful study and analysis thus should be the duty of a water resource engineer.

Course Content

Unit 1: Introduction  
(02 Lecture Hours)  
Hydrologic cycle, water-budget equation, history of hydrology, world water balance, applications in engineering, sources of data.
Unit 2: Precipitation (08 Lecture Hours)
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.

Unit 3: Abstractions from precipitation (08 Lecture Hours)
Evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.

Unit 4: Runoff (10 Lecture Hours)
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.

Unit 5: Water Withdrawals and Uses (10 Lecture Hours)
Water for energy production, water for agriculture, water for 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 6: Distribution Systems (10 Lecture Hours)

Text Books/Reference Books

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

Examination Scheme:

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<th>Components</th>
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Relationship between the Course Outcomes (COs), Program Outcomes (POs) and Program Specific Objectives (PSOs)

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Course Objectives

- To provide knowledge of basic principles of economics and managerial economics and their application in civil engineering
- To provide knowledge on methods of estimation of quantities for different civil structures
- To impart knowledge on rate analysis of different civil structures & components and tender preparation for the planned projects
- To provide knowledge on various cost estimates for civil engineering projects

Course Outcomes

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

CO1. Understand the concepts of basic economics and its applications in Civil Engineering
CO2. Understand Cost estimation and bill of quantities for civil engineering projects
CO3. Estimation of civil quantities for buildings, and other civil engineering works like roadwork, canal, etc.
CO4. Estimation rate analysis and schedule of rates and understanding of civil engineering projects

Catalog Description

During construction project planning and implementation, there is need to know the quantities and costs of various items required to determine the direct cost of project which can be utilized for planning & execution. During the life cycle of a project, different parties for various reasons require an estimate. Management decision are based on these estimate & costing. Sometime methods of construction also to be reviewed /revised make project economical. This lab will provide detail of the project cost estimate with quantity & rate analysis and Schedule of rates.

Course Content

Unit 1: Basic Principles and Methodology of Economics (06 Lecture Hours)
and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes

Unit 2: Elements of Business/Managerial Economics and forms of organizations (06 Lecture Hours)

Unit 3: Estimation of Quantities (06 Lecture Hours)
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, Estimation of civil quantities in single room building, two roomed building with different sections of walls, foundation, floors and roofs, R.B. and R.V.C.C. works, Plastering, White-washing, Distempering and painting, doors and windows, lump sum items, Estimates of canals, roads etc., Estimating earthwork and foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works, 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 4: Specifications (06 Lecture Hours)
Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures.

Unit 5: Rate Analysis (06 Lecture Hours)
Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity, Rate analysis for various civil works - Earthwork, concrete works, R.C.C. works, reinforced brick work, plastering, painting, finishing (white-washing, distempering).

Unit 6: Cost Estimates (06 Lecture Hours)
Cost estimate for projects of civil engineering – to estimate total cost of building on basis of estimate of quantities and DSR/ schedule of rate. Introduction to Acts pertaining to - Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.

Text Books/Reference Books

1. B.S. Patil, Building & Engineering Contracts
3. M Chakravarty, Estimating, Costing Specifications & Valuation
2019-23 Batch

5. Typical PWD Rate Analysis documents.
6. FIDIC Contract Conditions.

**Modes of Evaluation: Continuous Evaluation**

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1=weakly mapped  2= Moderately mapped  3=Strongly mapped
Course Objectives:
- To study the stress strain behaviour of steel and concrete.
- To understand the concept of limit state methods.
- To gain the knowledge of limit state design for flexure, shear, torsion, bond and anchorage.
- To understand the behaviour of columns subjected to eccentric load and use of interaction diagrams.
- To study the design of various foundations

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

CO1. Acquire knowledge of concepts of limit state method.
CO2. Develop knowledge for the design of concrete elements like beams, slabs and columns using IS codes 456, SP-16, & SP-34.
CO3. Design the reinforced concrete structures like staircase & footings
CO4. Design RCC structural elements.

Catalog Description:
The purpose of this course is to develop an in-depth knowledge in the area of design of concrete structure with the latest code of practice as per the Indian Standard. On completion of this course student gain good confidence in designing major components of concrete structures like beam, column, foundation, slab; buildings structures, support structures, high rise structures and pre-engineered structures. Design of structural elements will be done as per IS Code 456: 2000 and SP 16 and detailing as per SP 34. Limit state method will be discussed for all the structural elements,

Course Content

Unit 1: Introduction  (14 Lecture Hours)
(A) Introduction to various design philosophies of R.C. structures: working stress method, ultimate load method, limit state method, limit state of collapse, limit state of serviceability, limit state of durability, characteristic strength, characteristic load, partial safety factors for material strengths and loads. Study of structural properties of concrete.
(B) Limit state method for flexure: (Singly Reinforced Rectangular Section)
Assumptions, stress & strain diagram, MR of Balanced, under reinforced & over reinforced RC sections.
(C) Moment of resistance of Doubly reinforced & flanged section

Unit 2: Design of Beams  (10 Lecture Hours)
Design of beams for flexure, shear and bond
(A) For simply supported & cantilever beams.
(B) For continuous beams using IS code coefficient method.

Unit 3: Design of Slabs  (10 Lecture Hours)
(A) Design of one way simply supported, cantilever & continuous slabs
(B) Design of Two way simply supported & continuous slabs
(C) Design of dog legged stair case.

Unit 4: Design of Columns & Footing  (14 Lecture Hours)
(A) Column: Introduction, strain and stress variation diagrams, axially loaded column with minimum eccentricity requirements, Design of column for axial load.
(B) Design of column for axial load, uniaxial & biaxial bending.
(C) Design of isolated pad footing.

NOTE: All designs in units II, III & IV shall be performed according to limit state design philosophy.

Text Books

Reference Books
1. Reinforced Concrete Design – Pillai and Menon, TMH, New Delhi
2. IS 456:2000, 'Plain and Reinforced Concrete' BIS, New Delhi.
3. SP-16(S&T)-1980, 'Design Aids for Reinforced Concrete to IS:456, BIS, New Delhi.
4. SP-34(S&T)-1987 'Handbook on Concrete Reinforcement and Detailing', BIS, New Delhi.

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

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

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

- Making student familiar with tools of project management
- Provide exposure to project planning tools
- Provide a hands on experience to the project management tools used in construction projects

Course Outcomes

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

CO1. Develop construction project schedule by activities creation & inter relationship in project planning software
CO2. Execute construction project schedule by resource assignment & levelling in project management software
CO3. Analyze construction project updated schedule through project management software
CO4. Demonstrate schedule page setup & various reports through project management software

Catalog Description

It is been said knowledge is power. But, unless until it is applied, all knowledge is in vain. So phrase could be read as “Applied knowledge is power”. In today modern era, application of theoretical knowledge in field or making it use practically is very important. So practice at lab is integrated part of academy. In Construction planning & management lab, practice on the usage of tools of project management shall be emphasized. In this lab theoretical knowledge on project management tools and relevant practical challenges shall be cover & making student understand for it through case studies.

List of Experiments

Experiment No.: 01 Use of Advance Excel In Project Management

1. Introduction to advance excel commands /formulas to use in Project planning & management
2. Draw Bar chart for construction of single storey building work or Road Work.
3. Update for construction of single storey Building work or road work project using bar chart

Experiment No.: 02 Project Scheduling By Primavera for Construction Project

1. Introduction of primavera & its features, EPS, project creation
2019-23 Batch

2. Work breakdown structure, activity creation, assign predecessor/successor, duration assignment, find critical path, etc. for construction of single storey building project or road project
3. Resource assignment & resource levelling for project
4. Updating the project & generate reports

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

Examination Scheme:

Continuous Lab Evaluation is there to assess the students’ performance in the lab

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

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PROFESSIONAL ELECTIVE I
Course objectives

- To learn the concept of structural analysis learnt in Mechanics of solids & structures
- To learn the fundamental concept of matrix structural mechanics, such as flexibility & stiffness method
- To understand the analysis of statically determinate & indeterminate structures such as determinate & indeterminate structures such as trusses, beams, & plane stress problems.
- To learn the concept of stiffness method & apply it to a variety of structural problems involving trusses, beams, frames & plane truss.

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

CO1. Perform the structural analysis of determinate & indeterminate structures using classical compatibility methods.
CO2. Perform structural analysis using the stiffness method.
CO3. Solve multi degree of freedom two dimensional problem involving trusses, beams & frames.

Catalog Description
The concepts & notations of matrix algebra have for a long time been standard analytical tools of the applied mathematicians. In the period before 1940 a few papers appeared in which these ideas were applied to structural problems, but in an age without automatic computers the approach attracted little attention from practicing engineers. Indeed, a generation of designers which has recently been liberated from tedious manual calculations by the introduction of moment distribution was hardly likely to be enthusiastic about a method which required formal manipulations of large arrays of coefficients. The advent of digital computer in late 1940’s produced a change in the criteria for judging whether a method of analysis was good or bad.

This method is introduce to learn the element approach, which was comprehensively deal with system approach. By this subject student can able to apply comprehensively the concept for Finite element method which is based on direct stiffness approach.
Course Content

Unit 1: General Theorems  
(04 Lecture Hours)
Generalized Measurements- Degrees of freedom, Constrained Measurements - Behavior of structures - Principle of superposition- Stiffness and flexibility matrices in single, two and n-coordinates - Structures with constrained measurements

Unit 2: Strain Energy Methods  
(04 Lecture Hours)
Stiffness and flexibility matrices from strain energy - Betti’s law and its applications- Determinate and indeterminate structures - Transformation of element matrices to system matrices - Transformation of system vectors to element vectors

Unit 3: Force Method  
(08 Lecture Hours)
Flexibility method applied to statically determinate and indeterminate structures – Choice of redundant -Transformation of redundant-Internal forces due to thermal expansion and lack of fit.

Unit 4: Displacement Method  
(08 Lecture Hours)
Internal forces due to thermal expansion and lack of fit - Application to symmetrical structures- Comparison between stiffness and flexibility methods.

Unit 5: Analysis Using Stiffness & Flexibility  
(12 Lecture Hours)
Analysis by substructures using the stiffness method and flexibility method with tri-diagonalization- Analysis by Iteration method - frames with prismatic members - non-prismatic members.

Text Books
7. Dr. D.S Rajender Prasad, *Matrix methods of structural analysis*, Sapna publishers, Bangalore
Modes of Evaluation: Class Tests/Assignment/Tutorial Assessment/Written Examination

Examination Scheme:

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

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

- To understand the concept of structural action given by retained materials (Soil, earth, water etc.)
- To understand the mechanism of load transferring of action given by the load material.
- To understand the structural behavior & interconnection between the different elements of retaining structures.
- To understand the design of transportation structures
- To understand & analyze the internal stress developed in the structural member due to seismic loading.

Course Outcomes

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

CO1. Design & detailing of earth and liquid retaining structures
CO2. Design of Storage bins structures using various theories.
CO3. Design of environmental structures.
CO4. Design of transportation structures.
CO5. Design & detailing of structure subjected to seismic loading as per IS codes.

Catalog Description

The course intends to supplement the basic course of reinforced concrete structures & provide a structural specialist level of knowledge. One of the objectives is to strengthen the capacity of students to design by introducing concept related to project & construction system. A particular emphasis is given to the general method of design, especially suitable for areas of discontinuity. This method is applied to the study of structural elements with geometric or mechanical discontinuity. In the structural analysis, some aspects are studied such as the effects of pre-stressing in statically intermediate structures as well as long term behavior, nonlinear behavior, construction effects, and the design of structures partially pre-stressed, taking into account the service & limit states. The limit states not studied in basic course such as punching & fatigue are taught in bridge. Finally, the chapter dedicated to earthquake design, ductility, confinement, structural calculations & arrangements of reinforcement to ensure proper behavior of resisting mechanisms.
Course Content

Unit 1: Earth Retaining Structures (08 Lecture Hours)
Retaining walls- types - cantilever and counterfort - design - drainage and other construction details.

Unit 2: Liquid Retaining Structure (08 Lecture Hours)
Water tanks types - square, rectangular, circular, Design of underground and elevated tanks - design of staging - spherical & conical roof for circular tanks.

Unit 3: Material Storage Structures (06 Lecture Hours)
Determination of lateral pressure on side walls of bunker by Rankine's theory - design of bunker - design of circular silo using Jansen's theory.

Unit 4: Environmental Structures (04 Lecture Hours)
Chimneys, Principles and Design - Design of long columns.

Unit 5: Transportation Structures (05 Lecture Hours)
Bridges - Slab Bridge - Design of single span slab bridge - Tee Beam Bridge - Design of Tee Beam Bridge with stiffness - Tee beam bridge with cross girders

Unit 6: Seismic Design Concepts (05 Lecture Hours)
Cyclic loading behavior of RC, Steel and Pre-stressed Concrete elements - Response Spectrum-Design spectrum - capacity based design. Provision of Seismic Code frames, shear walls, Braced frames, Combinations - Torsion.

Text Books
2. P. Dayaratnam, Design of Reinforced Concrete Structures
5. Syal & Goel, Reinforced concrete structures, S. Chand publishers.
6. Pillai & Menon, Reinforced Concrete design, Tata McGraw hill publishers

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

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2019-23 Batch

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

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

- To develop concept of prestressing including materials and systems with losses and serviceability requirements.
- To impart knowledge regarding design of prestressed slabs and beams.
- To impart knowledge for the design of prestressed composite and continuous beams and their construction techniques.
- To impart knowledge for the design of prestressed tension and compression members.
- To develop concept of circular prestressing and its application in design and construction of water tanks and pipes.

Course Outcomes

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

CO1. Understanding of the behavior of prestressed concrete structures
CO2. Compute effect of pre-stressing on statically determinate & indeterminate structures.
CO3. Apply the techniques, skill & modern engineering tools necessary for pre-stressing

Catalog Description

Prestressed concrete technology has slowly taken over the traditional RCC construction technology, due to its inherent advantages. Prestressed concrete members are usually crack free and possess better resistance to impact, shock and weathering action of atmosphere resulting in high durability and long life as compared to RCC. Further high compressive strength of concrete and high tensile strength of steel are used effectively for developing prestressing systems that make it more economical at the same time.

This course is aimed at developing the concept of prestressing in the students, and also to impart technical knowledge such that they can design the various structures in prestressed concrete. Also included in the course is the basic knowledge of construction techniques for various prestressed concrete structures.

Course Content

Unit 1: Introduction
Principles of prestressing - Materials of prestressing - Systems of prestressing - Loss of prestress - Deflection of Prestressed Concrete members.
Unit 2: Beam & Slab (08 Lecture Hours)
Slabs - Pre-tensioned and Post-tensioned beams - Design for flexure, bond and shear - IS code provisions - Ultimate flexural and shear strength of prestressed concrete sections - Design of end anchorage zones using IS code method.

Unit 3: Composite Beam (08 Lecture Hours)

Unit 4: Compression & Tension Member (06 Lecture Hours)
Design of compression members and tension members.

Unit 5: Circular Prestressing (08 Lecture Hours)
Water tanks - Pipes - Analysis and design - IS Coidal provisions.

Text Books
4. Krishna Raju, *Prestressed Concrete*, CBS Publishers and Distributors

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

Examination Scheme:

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

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

- To develop the concept of functional planning of bridges.
- To impart knowledge regarding the effect of primary and secondary loading on bridges.
- To develop the design concept of normal and skew bridges.
- To develop concept regarding configuration and design of long span bridges including recent trends in bridge engineering.
- To impart knowledge for the design of bridge substructure for normal and skew bridges.

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

CO1. Understand standard specifications & components for bridge design
CO2. Acquire knowledge on requirement for bridge construction, quality control & maintenance aspects for bridges.
CO4. Design bridge substructures, bearings & joints.

Catalog Description:

Bridges allow people and communities to interact together, easing transportation and development of trade. It is considered to be the vital component of a transportation system, as its capacity governs the capacity of entire transport system. It is therefore necessary to develop the concept of functional design of bridge from the point of view of convenience, safety and sustainability, besides adequate strength and cost economics.

This course is intended to develop the above capability, besides imparting knowledge of bridge design principles.

In addition to normal bridges, recent developments in design of skew and long span bridges are also covered in this course.

Course Content

Unit 1: Introduction (06 Lecture Hours)
Components of bridge - Classification - Need for investigation - Bridge site - Data collection - design discharge - linear waterway - economical span - scour depth - traffic projection - choice of bridge type.
Un 2:  Loads On Bridges  
Indian Road Congress (IRC) bridge codes - dimensions - dead and live loads - impact effect - wind and seismic forces - longitudinal and centrifugal forces - hydraulic forces - earth pressure - temperature effect and secondary stresses. Bridge Rules and loading on metro bridges.

Unit 3:  Slab and T - Beam Bridges  

Unit 4:  Long Span Bridges  
Introduction to Long span bridges: Hollow girder bridges - balanced cantilever bridges - continuous girder bridges - rigid frame bridges - arch bridges - bow string girder bridges, steel bridge.  
Design of Prestressed concrete segmental bridges - recent trends- Balanced cantilever constructions, span by span construction.

Unit 5:  Bearings And Substructure  

Text Books  
4. IRC Standard Specifications and Code of Practice for Road Bridges SP 6  

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

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1=weakly mapped 2=moderately mapped 3=strongly mapped
Course Objectives:

- To recognise the importance of temporary structures and their relationship to the permanent structures
- To identify the formwork components, materials and accessories
- To design wall formworks, column formworks, beam formwork system
- To understand the basics of special formwork like slip formwork, tunnel, metro, cooling tower and planning methodology of formwork

Course Outcomes:

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

CO1. Understand the importance of formwork structures and types of formwork.
CO2. Estimate loads on formwork, design and planning methodology of formwork.
CO3. Understand the assembly of the different formworks, their components and safety aspects.
CO4. Understand the concepts, assembly of footing, tunnel formworks and slip formworks
CO5. Develop concepts of special formworks regarding their use, assembly, impact on the project.

Catalog Description:

Formwork development has paralleled the growth of concrete construction throughout the twentieth century. Earlier the formwork was destroyed after erection of the structure but now days its economy depends upon how many times the same formwork is used. Today these temporary structures plays a important role in construction sector as wide variety of architectural shapes are utilized throughout the world and corresponding development of formwork with incorporation of safety, quality and economy becomes the role of civil engineer. This course will start with introduction to different formwork system, design of formwork, building assembly for the formwork, planning of formwork system and special type of formwork.
**Course Content**

**Unit 1: Introduction** (04 Lecture Hours)
Significance of formwork in construction, Brief on formwork system / components / Applications, Estimation of formwork / BOM, Program Formwork costing, Productivity monitoring (Materials / Labour), Upkeep/ Maintenance of formwork, Do’s/Don’ts in formwork, Preparation of scheme drawings for various applications, Special forms / Plastic form / aluminium form , etc.

**Unit 2: Design of Forms and Shores** (10 Lecture Hours)
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.

**Unit 3: Building and Erecting the Form Work** (07 Lecture Hours)
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 - Design deficiencies - Permitted and gradual irregularities.

**Unit 4: Forms For Tunnels, Slip Forms and Scaffolds** (08 Lecture Hours)
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

**Unit 5: Planning Methodology for Formwork** (07 Lecture Hours)
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.

**Text Books**

1. Formwork for Concrete, by M. K. Hurd
2. Formwork for Concrete Structures, by Kumar. Neeraj Jha
3. Formwork Of Concrete Structures, by Peurifoy
4. Design and Construction of Formwork for Concrete Structures, by A.E. Wynn and George Philip Manning
5. Formwork for Concrete Structures, by Garold (Gary) D. Oberlender and Robert L Peurifoy
Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination

Examination Scheme:

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1=weakly mapped   2=moderately mapped   3=strongly mapped
PROFESSIONAL
ELECTIVE II
Course Objectives

- To present various concepts and impart proficiency in designing of sewerage system and its various components
- To provide knowledge about the qualitative analysis of sewage and their standard permissible limits before disposal
- To teach students in detail about the processes involved in treatment of sewage
- Expose the students to various real world applications of Environment Engineering II

Course Outcomes

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

CO1. Analyze the relevant physical and chemical characteristics of sewage
CO2. Analyze sewage disposal and sludge digestion processes
CO3. Design the various components of sewerage system
CO4. Design various components/units of sewage treatment plant

Catalog Description

Environmental Engineering II in civil engineering deals with one of the major infrastructure components i.e. sewerage system for a city. It also covers qualitative analysis study of sewage and processes adopted in sewage treatment plant for treatment of sewage. In this course, the focus will be on developing the understanding of the students regarding sewerage system and detailed study of its various components,

Course Content

Unit 1: Design of Sewerage System  
(08 Lecture Hours)
Sewerage schemes and their importance, collection & conveyance of sewage, storm water quantity, fluctuation in sewage flow, flow through sewer, design of sewer, construction & maintenance of sewer, sewer appurtenances, pumps & pumping stations

Unit 2: Quality and Characteristics Of Sewage  
(10 Lecture Hours)
Characteristics and analysis of waste water, cycles of decomposition, physical, chemical & biological parameters. Oxygen demand i.e. BOD & COD, TOC, TOD, Th OD, Relative Stability, population equivalent, instrumentation involved in analysis, natural methods of waste water
disposal i.e. by land treatment & by dilution, self-purification capacity of stream, Oxygen sag analysis.

**Unit 3: Treatment of Sewage (Preliminary and Primary Treatment)** *(07 Lecture Hours)*

Unit operations for waste water treatment, preliminary treatment such as screens, grit chamber, floatation tank, sedimentation and chemical clarification, role of micro-organism in biological treatment, Sewage filtration-theory & design

**Unit 4: Treatment Of Sewage (Secondary Treatment)** *(11 Lecture Hours)*

Methods of Biological Treatment (Theory & Design) - Activated Sludge process, Oxidation ditch, stabilization ponds, aerated lagoon, anaerobic lagoons, septic tank & Imhoff tank, sources & treatment of sludge, sludge thickening and digestion sludge drying beds, sludge disposal.

**Text Books/Reference Books**

1. Sewage Disposal and Air Pollution Engineering, by S.K. Garg
2. Waste Water Engineering, by Metcalf and Eddy
3. Environmental Engineering, by K N Duggal
4. Environmental Engineering, by N N Basak
5. Environmental Engineering, by P Venugopala Rao

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

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

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

- To provide better understanding to students about air pollution and noise pollution and aspects related to them
- To make students aware about the different stability conditions of environment in reference to air pollutants diffusion
- To teach students in detail about the air quality, its control and monitoring practices
- To provide better understanding to students about noise pollution and aspects related to it
- To provide knowledge about the noise pollution sources, measurement procedures and various control methods

Course Outcomes

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

CO1. Understand and identify the sources of air and noise pollution and their possible adverse effects on ecosystem
CO2. Understand the plume behavior for different environmental stability conditions in atmosphere
CO3. Understand the air and noise quality monitoring and control methods

Catalog Description

Air and Noise Pollution and Control deals with study and management of air and noise quality. It covers detailed study about air and noise quality, standards, sources responsible for their degradation and measures/practices adopted for their quality control and monitoring. In this course, students will also learn about environmental stability conditions in reference to air pollutants dispersion as well as sampling and analysis techniques for air quality assessment.

Course Content

Unit 1: Air Pollution (03 Lecture Hours)
Air pollution, Air pollutants, Sources and Classification of Air pollutants

Unit 2: Effects (05 Lecture Hours)
Effects on health, vegetation, materials and atmosphere, Pollutant reactions in the atmosphere and their effects-Smoke, smog and ozone layer disturbance etc.
Unit 3: Diffusion and Stability (06 Lecture Hours)
Diffusion of air pollutants and stability of environments, Air sampling and pollution measurement methods, principles and instruments, Air quality and emission standards; Air pollution legislations

Unit 4: Removal of Gaseous Pollutants (07 Lecture Hours)
Removal of gaseous pollutants by adsorption, absorption, reaction and other methods. Particulate emission control, settling chambers, cyclone separation, Wet collectors, fabric filters, electrostatic precipitators and other removal methods.

Unit 5: Noise Pollution (03 Lecture Hours)
Noise pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels

Unit 6: Noise Pollution Sources and Effects (08 Lecture Hours)
Plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit

Unit 7: Monitoring and Control Methods (04 Lecture Hours)
Noise instrumentation and monitoring procedure. Noise indices. Noise control methods

Text Books/Reference Books
1. Sewage Disposal and Air Pollution Engineering by S.K. Garg
2. Air pollution: Air quality management by Arthur C Stren

Modes of Evaluation: Class Tests/Assignment/Tutorial Assessment/Written Examination

Examination Scheme:

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

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

- To provide knowledge about Environmental Impact Assessment (EIA) and Risk Analysis study.
- To make students aware about the environmental factors importance in the decision-making process.
- To teach students in detail about the Environmental Impact Assessment (EIA) study and its importance in construction projects along with some real life projects discussion.
- To provide knowledge about Life Cycle Assessment (LCA) study and its environmental relevance.

Course Outcomes

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

CO1. Understand the EIA, its relevance and various methods of environmental risk analysis
CO2. Comprehend environmental aspects to be considered for the EIA study
CO3. Understand the methodology to prepare rapid EIA, EIA reports and environmental management plans
CO4. Understand the LCA study and its management and control strategies

Catalog Description

Environmental Impact Assessment (EIA) deals with assessment of the environment consequences (positive or negative) of any construction project which is one of the major requirements before commencement of a construction project. On the other hand, Life Cycle Assessment (LCA) deals with the assessment of environmental impacts associated with all the stages of the life-cycle of a commercial product, process, or service. This course covers the detailed study about EIA and LCA, their importance and method of preparation/assessment along with necessary environmental management plans.

Course Content

Unit 1: Environmental Impact Assessment- Description And Framework (08 Lecture Hours)
Evolution of EIA: Concepts of EIA methodologies, Screening and scoping; Rapid EIA and Comprehensive EIA; General Framework for Environmental Impact Assessment, Characterization and site assessment
Unit 2: Risk Analysis  
(08 Lecture Hours)  
Environmental Risk Analysis, Definition of Risk, Matrix Method. Checklist method, Fault tree analysis, Consequence Analysis; Socioeconomic aspects, measures of effectiveness of pollution control activities

Unit 3: Environmental Management and Legislation  
(10 Lecture Hours)  
Environmental Legislation; Introduction to Environmental Management Systems; Environmental Statement - procedures; Environmental Audit; Cost Benefit Analysis, Case Studies on EIA

Unit 4: Life Cycle Assessment  
(09 Lecture Hours)  
Life Cycle Assessment; Resource Balance, Energy Balance & Management Review; Operational Control

Text Books
2. Environmental Impact Assessment by Canter  
3. Environmental Impact Assessment by J.Glasson  

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

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

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

- To provide knowledge about basic Environmental/ecological concepts
- To make students aware about the beginning and development of environmental laws.
- To teach students in detail about the Environmental laws as per provisions of Indian Constitution
- To explain the application of environmental legislation to construction/infrastructure sector

Course Outcomes

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

CO1. Understand the basic concepts of ecosystem and legislation
CO2. Explain the origination and evolution of environmental law and Indian constitutional provisions related to environment
CO3. Apprise the significance of environmental legislation in current industrial scenario
CO4. Summarize various environmental laws, acts, guidelines and rules/regulations applicable to construction/infrastructure sector

Catalog Description

Sustainable development is one of the key requirements for every kind of business in modern industrial world. India, being a developing country and key drivers of global economy in progressing rampantly in infrastructure development like concept of smart cities, etc. Hence, it is utmost important to manage this growth without compromising on environmental resources. In this course, students will be able to understand environmental laws and policies applicable for management of environmental resources and sustainable development.

Course Content

Unit 1: Introduction to Environment and Concepts of Legislation  (06 Lecture Hours)
Definition and Concept of Environment - Components of Environment, Biosphere and Ecosystem, Types of Environment, Concept of Ecosystem and ecology, Introduction to law – Different theories about law - Understanding legal system – Various organs of legal system - Indian Legal system – Law enforcement in India - Fundamentals of Indian constitution – Statutes, Rules and Notification
Unit 2: History and development of environmental law  (11 Lecture Hours)
International environmental laws, sources of international law, Major conventions and treaties: The Stockholm Declaration of 1972; United Nations Conference on Environment and Development 1992; Rio de Janeiro (Rio Declaration, Agenda 21); Montreal Protocol 1987; Kyoto Protocol 1997; Copenhagen and Paris summits; Ramsar convention: CITES 1973; Provisions under Constitution of India provisions – Article 48A (The protection and improvement of environment and safeguarding of forests and wildlife); Article 51 A(g) (Fundamental duties), The right to livelihood, The right to a Wholesome Environment, The Right to Intergenerational Equity, Division of power between the Centre and the States in matters of forest and wildlife, and water

Unit 3: Environmental Legislation in India  (10 Lecture Hours)

Unit 4: Application of Environmental Laws in Construction/Infrastructure Development Sectors  (09 Lecture Hours)
Review of applicable laws to construction/infrastructure development sector- BOCW Act and Rules and sections referring to Environmental Protection Act and rules made there under; CPCB guidelines, NGT- case studies of infrastructure projects.

Text Books
4. P Sands, J Peel, Principles of International Environmental Law, CUP 2018

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

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1=weakly mapped  2= moderately mapped  3=strongly mapped
2019-23 Batch

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**Course Objectives**

- To provide comprehensive overview of solid, biomedical and hazardous waste management.
- To provide knowledge on solid waste management design aspects.
- To learn about the different methods of solid waste management.

**Course Outcomes**

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

CO1. Provide comprehensive and historical overviews of hazardous wastes management from both scientific and engineering principles.

CO2. Characterize solid and hazardous wastes from technical and regulatory points of view.

CO3. Identify current statutory and regulatory cradle to grave framework related to hazardous waste management.

CO4. Interpret factors which will determine the characterization, the distribution and fate of chemical compounds in the environment.

CO5. Analyze quantitative risk assessments are conducted for toxic substances and their adverse effects on living organisms and the environment, and the limitations of the results of these analyses.

**Catalog Description**

Solid and hazardous waste are defined. Technology, health, and policy issues associated with solid waste and hazardous materials are examined. Methods of managing solid and hazardous waste are introduced and regulations presented where appropriate. The characteristics of hazardous and solid waste materials, health frameworks, and the distribution of contaminants in the environment are reviewed. Although its engineering subject, this course is not a treatment course; it is a management course. The course is extremely broad in scope spanning laws, regulations, treatment technologies and risk assessment. While treatment technologies are presented, and basic process design information is covered, the course is designed for breadth, not depth, in process design and hazardous waste management. This course consists of students with a tremendous variety of backgrounds. Undergraduate students from CEE department take this class as a part of the requirement for Environmental Engineering (EnvE) major and Civil Engineering (CE) major with an Environmental Engineering emphasis. Undergraduate students from other engineering majors,
and non-engineering majors in College of Humanities & Sciences (e.g. Chemistry, Environmental Science, Environmental Studies, and Biological Science), have never had any courses in EnvE, will also complement their knowledge by learning the technology, health, policy and regulatory issues associated with hazardous waste management.

Course Content

Unit 1: Solid Wastes (04 Lecture Hours)
Origin, Analysis, Composition and Characteristics.

Unit 2: Integrated Solid Waste Management System (07 Lecture Hours)
Collection, Storage, Segregation, Reuse and Recycling possibilities, Transportation, Treatment / Processing and Transformation Techniques, Final Disposal.

Unit 3: Management of waste (08 Lecture Hours)
Municipal, Biomedical, Nuclear, Electronic and Industrial Solid Wastes and the rules and regulations. Introduction to Hazardous wastes, Definition of Hazardous waste, the magnitude of the problem.

Unit 4: Hazardous waste (10 Lecture Hours)

Unit 5: Site Remediation (07 Lecture Hours)
Quantitative risk assessment, site and subsurface characterization, Containment, remedial alternatives.

Text Books
2. Class note handouts, and other handout materials.

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

Examination Scheme:

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- 1=weakly mapped
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- 3=Strongly mapped
PROFESSIONAL ELECTIVE III
Course Objectives

- To learn about types and purposes of different foundation systems and structures.
- To provide students with exposure to the systematic methods for designing foundations.
- To discuss and evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behaviour.
- To build the necessary theoretical background for design and construction of foundation systems.

Course Outcomes

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

CO1. Understand the concepts and theories of different foundation systems and structures
CO2. Acquire knowledge of methods for Foundation Engineering Solutions
CO3. Evaluate the feasibility of foundation solutions under varying soil conditions
CO4. Design a foundation system considering the effect of soil type and time effect on the system

Course Description

Foundation Engineering is a fundamental subject consisting of selection of proper type of foundation as per sub-soil profile and type of structure. Any civil engineering structure needs strong and stable foundation, which depends on proper understanding of soil behavior, determination and interpretation of soil parameters, determination of stresses in soil. The design of any foundation system is based on understanding of soil parameters and its implication based on through interaction with type of structure. The course on Foundation Engineering provides the students basic knowledge on foundation selection, foundation forces, foundation design and its stability under seismic forces. Various types of foundation and their analytical solution helps the student to design suitable foundation with respect to soil and site condition.

Course Content

Unit 1: Shallow Foundations (06 Lecture Hours)
Location and Depth of Foundation, Determination of Bearing Capacity of Shallow Foundation on Cohesive and Cohesionless Soils, Contact Pressure and related study for rigid and flexible foundation. Floating or compensating foundations.
2019-23 Batch

Unit 2: Deep Foundations (08 Lecture Hours)
Well Foundations: Types and Components of Well. Determination of Depth, Size and Number of Wells under a Heavy Footing or Pier, Phenomena of Bottom Heaving. Well Sinking and related problems of Sinking of Well Foundations.

Unit 3: Foundation on Expansive Soils (06 Lecture Hours)

Unit 4: Machine Foundations (06 Lecture Hours)
Types of Machines, Free and Forced Vibrations, Vibration Isolations, Design Consideration for Simple Machine Foundations under Reciprocating, Centrifugal and Impact Type Machines.

Unit 5: Recent Developments in Foundation Engineering (04 Lecture Hours)
Classical and modern analysis method for bearing capacity, importance of geology and geotechnical ground condition, emerging construction technologies.

Unit 6: Retaining Walls (06 Lecture Hours)
Types (types of flexible and rigid earth retention systems: counter fort, gravity, diaphragm walls, sheet pile walls, soldier piles and lagging).

Text Books/Reference Books

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

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2019-23 Batch

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

- To develop knowledge for the design of shallow and deep foundations.
- To develop understanding of analyses of various foundations.
- To develop understanding of well foundation design.
- To understand the soil dynamics and design of machine foundations.

Course Outcomes

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

CO1. Design well foundation using IS Codes
CO2. Design machine foundations using IS Codes
CO3. Design retaining walls, Highway and airport pavements

Course Description

This course will cover analysis and design of shallow foundations and limitations of methods, analysis methods of single piles and pile groups, structural design of Mat foundations, analysis and construction methods of sheet pile walls. This course will also cover a basic background of soil mechanics including principles of critical state soil mechanics. In addition, it will introduce students to the analysis of foundations using numerical methods. After completion of this subject students who have a special interest in geotechnical engineering can pursue a higher degree in civil engineering with emphasis on geotechnical engineering.

Course Content

Unit 1: Shallow Foundations (06 Lecture Hours)
Design criteria of shallow foundation, IS code methods, Computation of settlements (Immediate & Consolidation); Permissible settlements, Allowable total and differential settlement of structures.

Unit 2: Deep Foundations (06 Lecture Hours)
Pile foundation construction of piles foundation, load transfer mechanism from pile to soil, Estimation of load capacity of piles by static formulae, Estimation of load capacity of piles by dynamic formulae, Group actions in pile, Settlement of pile group, Under-reamed pile foundation design and construction techniques, IS code methods
Unit 3: Well Foundation (06 Lecture Hours)
Caissons, shapes and components of well foundation, Depth of well foundation, Design and construction of well foundation, Stability analysis of well foundation, Tilting and shifting of well foundation

Unit 4: Soil Dynamic and Machine Foundations (08 Lecture Hours)
Strength and deformation of soil under dynamic loads, Determination of dynamic coefficients, shear modulus and elastic constants of soil, Transient/shock loading on cohesionless soil, Damping in soil – geometrical and internal damping, Vibration theory related to machine foundations, design of foundation for reciprocating and rotary machines, foundation for impact type loading; vibration isolation technique.

Unit 5: Advanced Design Principles (10 Lecture Hours)
Integrated design of retaining walls, pavements, and materials for airports, highways, dams, or other facilities

Text Books

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

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

- To provide basic understanding of rock mechanics and its effect on civil engineering structures
- To provide students with exposure to the systematic methods of finding different properties of rocks
- To discuss and evaluate the feasibility of foundation of structures on rocks
- To discuss the importance of the knowledge of rock mechanics in design of construction in rock mass.

Course Outcomes

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

CO1. Understand classification of rocks for engineering purposes.
CO2. Comprehend the different testing of rocks in laboratory and in-situ conditions
CO3. Acquire Knowledge on various methods on stabilization of rocks
CO4. Analyze the different theories on design of pressure on and around tunnels.

Course Description

Rock Mechanics course focus on mechanics of rocks. The focused area of this course is characterization of geological environment for engineering investigation. Various topics that are covered in this course are different exploration tools and methods for rocks, field and laboratory measurements of material properties, collection and analysis of existing engineering data, rock slope stability analysis, stress – strain and failure of rock, rock excavation, blasting and blast monitoring etc. After completion of this course students will have the basic knowledge of rock mechanics.

Course Content

Unit 1: Introduction (05 Lecture Hours)

Unit 2: Testing Of Rocks (08 Lecture Hours)
Various methods of obtaining rock cores, methods of sample preparation, method of removing end friction of the rock samples. Compression testing machine, uniaxial compression strength of rock samples, methods of finding tensile strength-direct and indirect methods, Brazilian test, shear box test, triaxial shear test, punch shear test.
Unit 3: In-Situ Techniques for Testing Of Rock (10 Lecture Hours)
Field direct shear test on rock blocks, field triaxial strength, use of flat jacks, chamber test, plate load test, cable jacking test. Stress Evaluation In Field: Stress-relief technique (over coring), use of strain gauges, bore hole, deformation cell, photo-elastic stress meter, stress measurement with flat jack. Hydraulics Fracturing Techniques.

Unit 4: Stabilization of Rocks (08 Lecture Hours)

Unit 5: Pressure on Roof of Tunnels (05 Lecture Hours)
Trap door experiment, Terzaghi's theory, Bieraumer, kommerel, Protodyakanov theory. Stress around the Tunnels. Basic design and Principles of tunnels in rocks, design of pressure tunnels in rocks.

Text Books
1. Engineering Rock Mechanics: An Introduction to the Principles by J. A. Hudson and J. P. Harrison
2. Rock Mechanics: For Underground Mining by Barry H.G. Brady

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

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1=weakly mapped  2= Moderately mapped  3=Strongly mapped
PROFESSIONAL ELECTIVE IV
Course Objectives

- To impart knowledge on design of pavement, design philosophies and concepts
- To impart knowledge on design of flexible pavement
- To impart knowledge on design of rigid pavements

Course Outcomes

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

CO1. Understand road construction according to code
CO2. Analyze road construction methods, evaluation and maintenance
CO3. Design flexible pavements
CO4. Design rigid pavements

Catalog Description

Pavement Design is an essential part of Highway Engineering, which will expose the student to design philosophies and concept, using the Indian Road Congress method. The performance of the road majorly depends on the road pavement design. Indian Roads congress has specified road design methodology for flexible and rigid pavement that are dealt with in this course. The student is made familiar with road construction techniques and pavement evaluations as well.

Course Content

Unit 1: Design of Highway Pavement (10 Lecture Hours)

Unit 2: Design of Rigid Pavement (10 Lecture Hours)
Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design. (IRC: 58 2002).

Unit 3: Road Construction Methods (08 Lecture Hours)
WBM, Surface dressing, bituminous carpeting, Bituminous Bound Macadam and Asphaltic Concrete, Cement Concrete road construction.
Unit 4: Pavement Evaluation and Strengthening (08 Lecture Hours)
Failures in flexible and rigid pavements, pavement evaluation, deflection survey, serviceability rating techniques, strengthening techniques, maintenance, overlays, and replacements.

Text Books:

Modes of Evaluation: Class Tests/Assignment/Tutorial Assessment/Written Examination

Examination Scheme:

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

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

- To provide knowledge on basics related to Traffic Engineering Sector.
- Provide exposure on principle with respect to traffic surveys.
- To provide knowledge on traffic signals on road intersections
- To provide insight about management and regulation of traffic and accident studies

Course Outcomes

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

CO1. Understand traffic engineering and its applications
CO2. Comprehend surveys methods for traffic data collection
CO3. Understand the causes of accidents and their prevention
CO4. Design traffic signals for four legged intersections and demarcate traffic signs

Catalog Description

Traffic Engineering is that branch of engineering that involves Collection, analysis and interpretation of data pertaining to traffic, traffic and transport planning, traffic design, implementing measures for operation of traffic, administration for its successful operation. Research has to be conducted to understand traffic trends. Traffic safety measures have to be considered during design of traffic system. Study of accidents and prevention methods have to be handled.

Course Content

Unit 1: Introduction to Traffic Engineering (09 Lecture Hours)
Properties of Traffic Engineering Elements and road users characteristics, Road Vehicle performance, Traffic Surveys: Volume studies, Speed studies, Origin and destination studies and parking studies, Traffic Forecast: General travel forecasting principles, different methods of traffic forecast - Mechanical and analytical methods, Demand relationships, methods for future projection;

Unit 2: Road Signs And Pavement Markings (06 Lecture Hours)
Traffic Sign, Road Markings, Traffic Control Aids, Street furniture, Road Arboriculture -
Traffic Regulation through road signs and pavement markings, Cost Effective Management Measures – Traffic Systems Management

**Unit 3: Traffic Signals**
(09 Lecture Hours)
Design of Intersection – At grade intersection – Uncontrolled, Traffic Signal Control, Signal Coordination, Capacity studies - Capacity of different highway facilities including unsignalled and signalised intersections.

**Unit 4: Traffic Controls Aids, Street Furniture and Traffic Regulations**
(06 Lecture Hours)
Various Traffic Control devices, Principles of Intersection Design, Design of signalized and unsignalized intersections, Signal Coordination.

**Unit 5: Road Accidents- Causes and Preventions**
(06 Lecture Hours)
Accidents, Lighting, Capacity and Level-of-service analysis Accident Analysis: Analysis of individual accidents and statistical data; Methods of representing accident rate; Factors in traffic accidents; influence of roadway and traffic conditions on traffic safety; accident coefficients; Driver strains due to roadway and traffic conditions.

**Text Books/ Reference Books**
5. S K Sharma, *Highway Engineering*

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

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<th>Examination Scheme:</th>
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### Relationship between the Program Outcomes (POs), Program Specific Outcomes (PSO) and Course Outcomes (COs)

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

- To provide understanding on basics of planning related to Transportation Sector.
- To give exposure on surveying related to urban transportation planning.
- To provide knowledge on the elements of trip like assignment, generation and distribution and modal split

Course Outcomes

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

CO1. Understand the importance of urban transport planning and surveys
CO2. Understand, modal split and mass rapid transit systems
CO3. Apply traffic assignment techniques
CO4. Analytically Work on trip distribution and trip generation

Catalog Description

Urban Transportation planning consists of applications of science and art, where a great deal of judgement coupled with its technical elements is required to arrive at a meaningful decision in order to develop transportation infrastructure facilities. Transport planning aims to ensure need for mobility for all sections of people in the society. All major areas of surveys, trip elements are made using transport planning. The challenges faced in rapid urbanization may be effectively handled with the proper transport planning.

Course Content

Unit 1: Transport Planning Process

Unit 2: Trip Generation, Distribution and Assignment
Trip purpose. Factors affecting trip generation. Trip generation estimation by multiple linear regression analysis, brief review of category analysis, advantages and limitations of these methods. Trip Distribution: Methods of trip distribution. Basic concepts of uniform factor method, average factor method and opportunity model. Trip distribution by gravity model. Traffic Assignment:
Principles of assignment. Assignment techniques. All or nothing assignment. Brief review of multipath assignment, capacity restraint assignment and diversion curves.

**Unit 3: Modal Split**  
(12 Lecture Hours)  
General considerations for modal split. Factors affecting modal split. Brief introduction to various methods of modal split. **Evaluation:** Need for evaluation. Several plans to be formulated. Testing. Considerations in evaluation. Economic evaluation, basic principles, brief introduction to various methods of economic evaluation, comparison.

**Unit 4: Mass Rapid Transit Systems**  
(03 Lecture Hours)  
Problems of Urban Transport. Introduction to MRTS. Requirements of MRTS. Types of MRTS. MRTS in India

**Text Books / Reference Books**

4. C. Venkataramaiah, *Transportation Engineering Part-I*
5. S. K. Sharma, *Highway Engineering*

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

**Examination Scheme:**

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

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1=weakly mapped  
2=moderately mapped  
3=strongly mapped
Course Objectives
- To understand concepts of planning for airports
- To understand the types of aircrafts and their effect on airport design
- To give understanding for design of airport elements
- To give understanding about visual aids at airports

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

CO1. Understand airport planning and site selection for all types of airports
CO2. Comprehend concepts and components for designing an airport
CO3. Understand the necessity of others airport amenities
CO4. Design the runway and taxiway

Catalog Description
Airport Engineering is associated with the engineering aspects of airway as a means of mass transportation. An airport is defined as a place where an aircraft can take off and land for operating commercial services. Facilities for passengers and freight, as well as the maintenance of aircraft are also provided at airports. The engineering study of the various components of an airport, such as terminal building, taxiway, hangars, wastewater/runoff water management system, noise reduction structures, and safety systems. The study of all these aspects is part of airport engineering.

Course Content

Unit 1: Introduction and Aircraft characteristics (08 Lecture Hours)
Air transport development in India, national and international organizations in air transport, aircraft characteristics and their impact on planning of an airport, selection of site for an airport.

Unit 2: Airport Planning (10 Lecture Hours)
Terminal Building, Area, Vehicular circulation, parking apron, hanger, blast consideration, airport capacity and configuration, airport obstruction, imaginary surfaces, runway orientation clam period and wind coverage.
Unit 3: Geometric Designs (10 Lecture Hours)
Runway design, runway intersection design, taxiway geometric designs, exit taxiway, its design and fillet curves, runway configuration, separation clearance, design of apron and their layouts.

Unit 4: Airport Traffic Control Aids (08 Lecture Hours)
Visual aids, marking and lighting of runway and apron area, wind and landing direction indicator. Airport traffic control, and aids

Text books:

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

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

- To provide the students the knowledge about basic concepts of Railway System including the administrative set-up, various components of permanent way and its relative contribution to Railways operations.
- To provide the knowledge about Design and construction-related aspects of Railway Systems.
- To give understanding related to the various system of rail operations, signaling and telecom.

Course Outcomes

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

CO1. Understand basic concepts of Indian Railways system
CO2. Comprehend the necessity of construction of railway, its components and properties
CO3. Apply concepts of railway track engineering
CO4. Design railway geometrics and application for railway engineering

Catalog Description

Railway Engineering is concerned with successful implementation of planning a network, surveying for alignment, selection of railway track components, geometric design, construction, operation and maintenance of a railway track.

Course Content

Unit 1: Introduction, Permanent Way and Component (06 Lecture Hours)
History and administrative setup of Indian Railways; rail gauges, permanent way – functions, requirements, sections in embankment and cutting (single/double track), electrified tracks, locomotives, wheel and axle arrangement, coning of wheels, components – rails, sleepers, ballast and formation.

Unit 2: Resistances and Stresses in Tracks, Hauling Capacity (08 Lecture Hours)
Types of resistances to traction, stresses in different components of track, hauling capacity of a locomotive, tractive effort. Joints and Fastenings: Types of joints, short welded rails, long welded rails and continuous welded rails, rail to rail and rail to sleeper fastenings, elastic fastenings.
Unit 3: Track Geometrics, Turnouts and Crossings (10 Lecture Hours)
Railway alignment, vertical alignment – gradients and grade effects, horizontal alignment – horizontal curves, super-elevation, concepts of cant excess and deficiency, safe permissible speed, transition curves, widening of gauges and track clearances, points and crossings – terminologies, types of turnouts, design of turnouts, types of crossings, design of crossings.

Unit 4: Track Signaling and Train Operations (06 Lecture Hours)
Track Safety, High Speed Tracks, Urban Railways: Signals classification and their functions, train operation control systems – absolute, automatic block systems, centralized train control system, ATS, interlocking of tracks – principle of interlocking, types of interlocking.

Unit 5: High Speed Trains and Urban Railways (06 Lecture Hours)
High-speed tracks – track requirements, speed limitations, high-speed technologies, urban railway - railway systems in urban areas.

Text Books/ Reference Books

Modes of Evaluation: Class Tests/Assignment/Tutorial Assessment/Written Examination

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

- To evaluate the impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively
- To ascertain the extent of Infrastructure, its requirements for energy and how they are met: past, present and future
- To understand the Sustainability of the Environment, including its Aesthetics
- To gauge the potentials of Civil Engineering for Employment creation and its Contribution to the GDP
- To help comprehend the Built Environment and factors impacting the Quality of Life
- To impart the precautions to be taken to ensure that the above-mentioned impacts are not adverse but beneficial
- To learn professional and responsible judgement and take a leadership role

Course Outcomes

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

CO5. Awareness of the importance of Civil Engineering and the impact it has on the Society and at global levels
CO6. Awareness of the impact of Civil Engineering for the various specific fields of human endeavor
CO7. Need to think innovatively to ensure Sustainability

Catalog Description

The course is designed to provide a better understanding of the impact which Civil Engineering has on the Society at large and on the global arena. Civil Engineering projects have an impact on the Infrastructure, Energy consumption and generation, Sustainability of the Environment, Aesthetics of the environment, Employment creation, Contribution to the GDP, and on a more perceptible level, the Quality of Life. It is important for the civil engineers to realise the impact which this field has and take appropriate precautions to ensure that the impact is not adverse but beneficial.
Course Content

Unit 1: Introduction (03 Lecture Hours)
Understanding the past to look into the future: Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis.

Unit 2: Global Impacts of Civil Engineering (03 Lecture Hours)
The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering

Unit 3: Infrastructure (08 Lecture Hours)
Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability.

Unit 4: Environment (07 Lecture Hours)
Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and nonstationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.

Unit 5: Built environment (05 Lecture Hours)
Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability.

Unit 6: Civil Engineering Projects (04 Lecture Hours)
Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment/projects, facilities management, Quality of
products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development.

Text Books/Reference Books


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

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Course Objectives

- 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 and To understand Impacts of Disasters

Course Outcomes

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

CO1. Develop better understanding about disaster and risk analysis
CO2. Learn and analyze the key concepts for disaster prediction and risk mitigation
CO3. Develop ability to identify possible impacts of disaster on environment
CO4. Analyze the planning aspects, acts and policies adopted for disaster management

Catalog Description

Disaster Management deals with the organization and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies (preparedness, response, and recovery) in order to reduce the harmful effects of all hazards/disasters. It covers detailed study about disaster, risk analysis and prediction studies for the same. In this course, students will also learn about approaches/aspects adopted for disaster risk mitigation and effective disaster management.

Course Content

Unit 1: Introduction (04 Lecture Hours)
Concepts and definitions: disaster, hazard, vulnerability, risks - severity, frequency and details, capacity, impact, prevention, mitigation).

Unit 2: Disasters - Disasters classification (06 Lecture Hours)
Natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade 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 3: Disaster Impacts (06 Lecture Hours)
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 4: Disaster Risk Reduction (DRR) (06 Lecture Hours)
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 5: Disasters, Environment and Development (06 Lecture Hours)
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 / Reference Books
2. Disaster Management – Jagbir Singh
3. National Disaster management Plan
4. National Disaster management Policy

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

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

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Course Objectives

- To have an overview of Metro Systems
- To understand the need for Metros for any growing economy
- To be able to understand the process for Routing studies
- To impart the concepts involved in the basic Planning and Financials
- To emphasize the importance of inter-disciplinary involvements for a Metro Project
- To understand and analyze various available construction technologies for a Metro Project

Course Outcomes

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

CO1. Understand the requirement of metro for a city
CO2. Understand the basic planning, routing and financing involved for a Metro Project
CO3. Understand the various inter-disciplinary involvements required for a Metro Project
CO4. Analyze the available construction technologies for Metro Projects

Catalog Description

The growing cities in a densely populated urban region, in any developing nation, requires safe and efficient public transportation. Elevated light rails have been a popular choice in India since past two decades. The Metro Projects of all major cities in India are a hallmark of growing economy. It is imperative to teach civil engineers the basics involved for planning, and financing a metro project. The various construction methodologies available and how to analyze and select a suitable one. The various inter-disciplinary components involved in a metro project and the basic concepts of their working. The student shall be able to grasp these concepts and apply them in conjunction with their knowledge of civil engineering to have a better understanding of a metro project.

Course Content

Unit 1: Civil Engineering (14 Lecture Hours)
Overview and construction methods for: Elevated and underground Stations; Viaduct spans and bridges; Underground tunnels; Depots; Commercial and Service buildings. Initial Surveys & Investigations; Basics of Construction Planning & Management, Construction Quality & Safety
2019-23 Batch

Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way. Facilities Management

Unit 2: Electronics and Communication Engineering (10 Lecture Hours)
Signaling systems; Automatic fare collection; Operation Control Centre (OCC and BCC); SCADA and other control systems; Platform Screen Doors.

Unit 3: Mechanical & TV + AC (06 Lecture Hours)
Rolling stock, vehicle dynamics and structure; Tunnel Ventilation systems; Air conditioning for stations and buildings; Fire control systems; Lifts and Escalators

Unit 4: Electrical (06 Lecture Hours)
OHE, Traction Power; Substations- TSS and ASS; Power SCADA; Standby and Back-up systems; Green buildings, Carbon credits and clear air mechanics.

Reference Books

1. Satish Chandra, Railway Engineering
2. C Venkataramaiah, Transportation Engineering – II
3. Saxena, Railway Engineering

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

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

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

- To guide the students to work in a team and to identify a problem statement for the project work.
- To provide practical/real-life situations related to civil engineering domain and assist the students in solution of the work and development of model type
- To develop better understanding about the literature review, project report preparation, presentation related to the project work
- To develop ability to apply principles, tools and techniques to solve the problem statement

Course outcomes

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

CO1. Understand and assess the real-life situations/practical problems and research approach
CO2. Analyse the problem statement and work on the solution for the same by using the principles, tools and techniques
CO3. Develop better understanding about the literature review and project report preparation
CO4. Work effectively in a team

Catalog description

Major project – I aims at providing student with the practical knowledge of the civil engineering domain. In major project student will take the real life problem related to civil engineering and will provide the solution for it. In major project students will be divided into groups and they will collectively work to find the solution of the problem provided to them.

Modes of evaluation: Evaluation will be assessed by Project work presentation, detailed report of the work and viva of the students regarding their project work.

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

- To develop the higher cognitive abilities that is analysis, synthesis and evaluation.
- To develop the ability of responding that is valuing, organizing.
- To develop the ability of keen observation, experience, feeling to present them effectively.
- To develop the ability to seek clarification and defend the ideas of other effectively.

Course outcomes

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

CO1. Identifying a problem in civil engineering, and researching a journal article addressing the same
CO2. Comprehend the literature review, methodology and experiment design adopted in the selected paper
CO3. Comprehend the results and the methodology adopted for interpretation and the future scope of the work
CO4. Prepare technical presentation of the selected journal paper

Catalog description

This course is to check the technical knowledge of the student of different civil engineering subjects. Students will give presentation on the topic of their interest. Students will be asked technical questions by the panel. This is an individual exercise for each student. Each student will be evaluated by his/her technical skills.

Modes of Evaluation: Evaluation will be by Seminar topic presentation, detailed report of the topic and viva of the students regarding respective topic.

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

- To enhance technical skills of students in real time environment
- To gain in-depth technical knowledge & analytical skill by real time work and workshop
- To acquire basics of how to work as a team member to complete given tasks in industrial environment and its work culture

Course outcomes

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

CO1. Interpret plans and execute works
CO2. Estimate quantities at site
CO3. Design structural elements using software
CO4. Examine finished works

Catalog description

All organizations are looking for graduates who are technically sound, creative and analytical. Organizations want to put graduates on job, directly or by minimal training/orientation, to meet the organizational / project goal. But, in general, theoretical knowledge of students not make them capable to cop up to industrial environment. Quality solution for this gap is industrial exposure and gain practical knowledge through internship. An internship enables student to gain first-hand exposure of working in the real world & allows students to harness the skill, knowledge, and theoretical practice they learnt in university.

Modes of Evaluation: Evaluation through report, presentation by students & assessment provided by industry.

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PROFESSIONAL ELECTIVE V
### Course Objectives

- To understand the provisions of IS800-2007 code of practice for the design of Compression, Tension and Flexural members using various cross-sections.
- To study the behavior and design of compression and tension members using simple and built-up sections.
- To understand behavior of flexural members and the design laterally restrained and unrestrained beams.
- To study the design of bolted and welded connections.

### Course Outcomes

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

- CO1. Design of bolt and weld connections by using IS code
- CO2. Design of tension and compression members by using IS code
- CO3. Design of beams and beam columns by using IS code
- CO4. Design of built up members and roof truss by using IS code

### Catalog Description

Topics covered in this course include behavior of steel structure and techniques of steel structures, and industrial buildings. The concepts of structure stability and buckling of columns, the stability concepts for beam-columns, buckling analysis of frames using IS code methods, lateral torsional buckling of steel beams, design of crane-supporting steel girders, plate girders, and steel connections. In this course, limit state method is used by using revised code of steel.

### Course Content

**Unit 1: Introduction**  
(07 Lecture Hours)  
Steel structures and IS800-2007- Material specifications - Rolled sections – Section classifications - Permissible stresses in tension, compression, bending and shear.

**Unit 2: Bolted Connection**  
(07 Lecture Hours)  
Types of bolts - Resistance of bolted connections under various failure modes – design of beam splice, seated shear connections at the supports.

**Unit 3: Welded Connection**  
(06 Lecture Hours)  
Types - strength of welds - design of fillet and butt welds - shear and moment resistant joints - design and detailing of connections.
Unit 4: Tension Members (06 Lecture Hours)
Types- strength of tension members-Design of Tension Members-Angle Section, Channel Section Design-Block Shear Analysis.

Unit 5: Compression Members (08 Lecture Hours)
Compression members - Slenderness ratio – Design - Simple and built-up sections - lacings and battens.

Unit 6: Flexural Members (06 Lecture Hours)
Rolled sections - built-up beams - Design for strength and serviceability, web crippling, web yielding, bearing stiffeners.

Unit 7: Roof Truss (08 Lecture Hours)
Components - Loads - Design of purlins using channel and angle sections, and truss members - End connections at the supports.

Text Books

3. S S Bhavikatti, Design of Steel Structures: By Limit State Method as Per IS: 800 – 2007

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

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Course objectives

- To develop concept of industrial structures, their planning, loadings and general requirements.
- To impart knowledge regarding steel industrial buildings, including the design of gantry girders, and trussed roofs.
- To impart knowledge for the principles and methods of design of emission and storage structures.
- To impart knowledge for the design of transmission structures.

Course Outcomes

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

CO1. Design steel gantry girders and portal frames
CO2. Design connections for different loading conditions
CO3. Design storage structures, bunkers and silos
CO4. Design light weight metal structures

Catalog Description

Development of industries is a key parameter for economic growth. It opens up numerous job opportunities and provides lively hood to society. Industries require a basic structure to be built on which other service facilities can be mounted. Modern industrial buildings generally have framed structures, with a reinforced concrete, steel, or combined skeleton. The choice of skeleton depends on operating conditions, considerations related to saving on major construction materials, and optimizing the service requirements. This course is intended to develop concept of students regarding various types of industrial buildings and to impart knowledge regarding their principles and methods of design.

Course Content

Unit 1: Planning and Functional Requirements (08 Lecture Hours)
Classification of Industries and Industrial structures – Loadings on industrial structures-General requirements of Industrial Structures as per IS code. Design of connections-Shear and Flexure Design.

Unit 2: Industrial Buildings (12 Lecture Hours)
Steel structures- Gantry Girder, Crane Girders –Design of trusses
Unit 3: Emission & Storage Structures  
(08 Lecture Hours)  

Unit 4: Transmission Structures  
(08 Lecture Hours)  
Analysis and design of transmission towers - Sag and Tension calculations.

Text Books
5. Arya and Azmani, Design of Steel Structures, Nem Chand Brothers, Roorkee, 2004

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

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

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

- To present the fundamentals of dynamic design in a simplified manner.
- To expose the students into the basic concepts of structural dynamics.
- To create awareness about principles and methods of dynamic design and provide knowledge about the application of different types of design methods employed for engineering projects.

Course Outcomes

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

CO1. Apply knowledge of mathematics, science & engineering by developing the equation of motions for vibratory systems & solving for the free & forced response
CO2. Interpret dynamic analysis results for design, analysis & research purposes.
CO3. Apply structural dynamics theory to earthquake analysis, response & design of structures.
CO4. Create simple models for engineering structures using knowledge of structural dynamics

Catalog Description

Structures are often subjected to dynamic forces of one form or the other during their lifetime. This course introduces the theory of dynamic response of structures with emphasis on physical insight into the analytical procedures and with particular application to earthquake engineering. The structural dynamics component of the course includes free and forced vibration response of single and multi-degree of freedom systems. The earthquake-engineering component considers seismic analysis methods, earthquake resistant design philosophy and includes elements of engineering seismology.

Course Content

| Unit 1: Single Degree Of Freedom (Sdof) Systems | (06 Lecture Hours) |
| Dynamic analysis - Elements of vibratory systems and simple Harmonic Motion- Mathematical models of SDOF systems - Principle of Virtual displacements - Evaluation of damping resonance. |

| Unit 2: Theoretical Analysis of Sdof | (10 Lecture Hours) |
| Fourier series expression for loading - (blast or earthquake) - Duhamel’s integral - Numerical evaluation - Expression for generalized system properties - vibration analysis Rayleigh’s method - Rayleigh - Ritz method. |
Unit 3: Vibration Analysis  (10 Lecture Hours)
Differential equation of motion - Beam flexure including shear deformation and rotatory inertia - Vibration analysis using finite element method for beams and frames Evaluation of structural property matrices - Natural vibration - Solution of the eigen value problem - Iteration due to Holzer and Stodola Idealization of multi-storeyed frames.

Unit 4: Blast Analysis  (10 Lecture Hours)
Analysis to blast loading - Deterministic analysis of earthquake response - lumped SDOF system – Analysis of earthquake resistant structures.

Text Books
4. Madhujit Mukhopadhyay, *Structural Dynamics*
5. Martin Williams, *Structural Dynamics*

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination
Examination Scheme:

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1= Weakly Mapped  2= Moderately Mapped  3= Strongly Mapped
Course Objectives

- To introduce the engineering seismology, building geometrics & characteristics, structural irregularities,
- To introduce tips on earthquake engineering - do’s and don’ts
- To introduce cyclic loading behaviour of RC elements
- To discuss code provisions and their application on different types of structures

Course Outcomes

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

CO1. Understand the concept of base isolation
CO2. Apply seismic coefficient method & response spectrum methods for analysis of multi-storied buildings
CO3. Apply concepts of ductility in the design of multi-storied frames
CO4. Analyse the RC structures based on latest earthquake loads

Catalog Description

Earthquake engineering is the ultimate challenge for civil engineers. Even if natural phenomena involve great uncertainties, civil engineers need to design buildings, bridges, and dams capable of resisting the destructive forces produced by them. These disasters have created a new awareness about the disaster preparedness and mitigation. Before a building, utility system, or transportation structure is built, engineers spend a great deal of time analyzing those structures to make sure they will perform reliably under seismic and other loads. The purpose of this subject is to provide civil engineers with tools and information to improve current building and bridge design and construction practices and enhance their sustainability during and after seismic events. This subject explains the latest theory, design applications and Code Provisions. "Earthquake Engineering and Seismic Design of Structures" features seismic design and retrofitting techniques for low and high-rise buildings, single and multi-span bridges, dams and nuclear facilities.

Course Content

Unit 1: Earthquakes and Ground Motion (08 Lecture Hours)
Engineering Seismology (Definitions, Introduction to Seismic hazard, Earthquake Phenomenon), Seismotectonics and Seismic Zoning of India, Earthquake Monitoring and Seismic
2019-23 Batch

Instrumentation, Characteristics of Strong Earthquake Motion, Estimation of Earthquake Parameters, Microzonation.

Unit 2: Effects of Earthquake On Structures (06 Lecture Hours)
Dynamics of Structures (SDOFS/ MDOFS), Response Spectra - Evaluation of Earthquake Forces as per codal provisions - Effect of Earthquake on Different Types of Structures - Lessons Learnt From Past Earthquakes.

Unit 3: Earthquake Resistant Design of Masonry Structures (06 Lecture Hours)

Unit 4: Earthquake Resistant Design of RC Structures (09 Lecture Hours)

Unit 5: Vibration Control Techniques (07 Lecture Hours)
Vibration Control - Tuned Mass Dampers – Principles and application, Basic Concept of Seismic Base Isolation – various Systems- Case Studies, Important structures.

Text Book

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

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

- To introduce system engineering in context to civil engineering
- To introduce engineering economics and their application in civil engineering
- To introduce formulation and solution of civil engineering problems
- To introduce mathematical modelling and optimization techniques for analyzing civil engineering problems

Course Outcomes

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

CO1. Understand the concepts of systems engineering
CO2. Apply the concepts of engineering economics to civil engineering
CO3. Analyze civil engineering problems using optimization techniques
CO4. Design solutions for civil engineering problems using mathematical modelling and optimization techniques for arriving at a system-wide optimal solution

Catalog Description

Systems engineering is the bird’s eye view that a civil engineer shall have to adopt in order to arrive at an economical and optimal solution for any project or problem. The application of this subject are from the planning phase of any project, for conducting the feasibility studies, impact analysis and assessment, to the design, construction, maintenance and management phase of any civil engineering project. Any problems encountered by a civil engineer needs to be solved optimally with minimum cost and the topics covered in this subject shall aid the student in arriving at such a solution.

Course Content

Unit 1: Systems Engineering  
Introduction to systems engineering, Problem formulation, needs assessment, life-cycle models/analysis, stakeholders, system integration, systems engineering management, QA, continuous improvement, life-cycle planning and estimating. Database management, deployment, operations and maintenance. Trade-off analysis, modelling and simulation Applications in civil engineering.
Unit 2: Engineering Economics (10 Lecture Hours)  
Introduction, economic analysis, present worth method, future worth method, annual equivalent method, rate of return method, depreciation, replacement analysis, life-cycle cost analysis, project analysis, project management, value analysis, application in civil engineering.

Unit 3: Optimization Methods & Mathematical Modelling (16 Lecture Hours)  
Introduction, classical optimization, unconstrained optimization, constrained optimization, linear programming, graphical solution, formulation of primal and dual, simplex method, network analysis, decision theory, dynamic programming, and application in civil engineering.

Text Book  
1. Alexander Kossiakoff, Systems Engineering Principles and Practice  
3. William T. Morris, Engineering Economic Analysis  
4. Godfrey C. Onwubolu, B. V. Babu, New Optimization Techniques in Engineering  
5. L.R. Fould, Optimization Techniques

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

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## 2019-23 Batch

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

- To introduce the physics governing groundwater flow and characteristics of different aquifers
- To understand the techniques of development and management of groundwater

Course Outcomes

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

CO1. Understand the aquifer properties and its dynamics
CO2. Apply the knowledge groundwater hydrology to artificial recharge and groundwater quality concepts.
CO3. Analyze the parameters of groundwater flow

Catalog Description

This course covers fundamentals of subsurface flow and transport, emphasizing the role of groundwater in the hydrologic cycle, the relation of groundwater flow to geologic structure, and the management of contaminated groundwater. The course will cover the following topics: Darcy equation, flow nets, mass conservation, the aquifer flow equation, heterogeneity and anisotropy, storage properties, regional circulation, unsaturated flow, recharge, stream-aquifer interaction, well hydraulics, flow through fractured rock, numerical models, groundwater quality.

Course Content

Unit 1: Introduction (09 Lecture Hours)

Unit 2: Movement of Groundwater (09 Lecture Hours)
2019-23 Batch

Unit 3: Well Hydraulics (09 Lecture Hours)
Steady and Unsteady Flow to a Well in a Confined and Unconfined Aquifer - Partially Penetrating Wells - Wells in a Leaky Confined Aquifer

Unit 4: Groundwater Management (09 Lecture Hours)

Text Books

Modes of Evaluation: Quiz/Assignment/ Seminar/Written Examination Scheme:

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1=weakly mapped  2= moderately mapped  3=strongly mapped
Course objectives
- To know the general elements of rainfall and its characteristic from India’s point of view.
- To study precipitation, infiltration and evapotranspiration.
- To discuss about various parameters of Runoff and hydrographs.

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

CO1. Estimate of precipitation and evapotranspiration
CO2. Implement the hydrological concepts for the determination of infiltration, runoff, hydrograph and design flood

Catalog Description
Surface Hydrology in one of the most important aspects for a nation. Its study becomes more important for a monsoon dependent nation like ours. The processes affecting rainfall and runoff and their quantification is one of the most challenging tasks for an engineer. As rainfall is a stochastic process, its prediction is a very complex process indeed and since it is indispensable for agriculture, its correct estimation becomes very important. All these challenges are reflected in this course. This course also deals with Evapotranspiration, infiltration, flood forecasting, hydrographs. Each of the aforementioned components are indispensable for a nation and its careful study and analysis thus should be the duty of an engineer.

Course Content

Unit 1: Introduction (04 Lecture Hours)

Unit 2: Precipitation (12 Lecture Hours)
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.

Unit 3: Abstractions from precipitation (10 Lecture Hours)
Evaporation Process, Evaporimeters, Analytical Methods of Evaporation Estimation, Reservoir Evaporation and Methods for its Reduction, Evapotranspiration, Measurement of
Evapotranspiration, Evapotranspiration Equations, Potential Evapotranspiration over India, Actual Evapotranspiration, Interception, Depression Storage, Infiltration, Infiltration Capacity, Measurement of Infiltration, Modelling Infiltration Capacity, Classification of Infiltration Capacities, Infiltration Indices.

Unit 4: Runoff (10 Lecture Hours)

Text Books

Modes of Evaluation: Quiz/Assignment/ Seminar/Written Examination Scheme:

<table>
<thead>
<tr>
<th>Components</th>
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<th>End Term examination</th>
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<td>Weightage (%)</td>
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Relationship between the Program Outcomes (POs), Program Specific Outcomes (PSO) and Course Outcomes (COs)

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<tr>
<th>CO/PO</th>
<th>PO 1</th>
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1=weakly mapped 2= moderately mapped 3=strongly mapped
Course Objectives

- To guide the students to work in a team and to identify a problem statement for the project work.
- To provide practical/real-life situations related to civil engineering domain and assist the students in solution of the work and development of model type
- To develop better understanding about the literature review, project report preparation, presentation related to the project work
- To develop ability to apply principles, tools and techniques to solve the problem statement

Course Outcomes

CO1. Understand and assess the real-life situations/practical problems and research approach
CO2. Analyze the problem statement and work on the solution for the same by using the principles, tools and techniques
CO3. Develop better understanding about the literature review and project report preparation
CO4. Work effectively in a team

Catalog Description

Major project – II aims at providing student with the practical knowledge of the civil engineering domain. In major project student will take the real life problem related to civil engineering and will provide the solution for it. In major project students will be divided into groups and they will collectively work to find the solution of the problem provided to them.

Modes of Evaluation: Class Tests/Assignment/Tutorial Assessment/Written Examination

Examination Scheme:

Evaluation will be assessed by Project work presentation, detailed report of the work and viva of the students regarding their project work.

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

- To understand the basic concepts of Instrumentation and Measurement system.
- To understand the applications of various sensors and transducers.
- To be able to design a smart sensing solutions for civil engineering applications.

Course Outcomes

CO1. Identify the basic elements and functions of measurement system.
CO2. Investigate and elaborate the principle and working of various analog/digital meters and transducers.
CO3. Understand the physical system, and identify the physical parameters to be measured.
CO4. Analyze the given process, identify and design measurement system for the structure monitoring.

Catalog Description

Sensors are increasingly used by practicing civil engineers to monitor, measure, and remotely observe the world around them. Applications such as assessment and mitigation of geologic hazards such earthquakes, landslides, flooding; the assessment of timber harvesting impacts; and groundwater remediation and resource evaluation.

Course Content

Unit 1: Sensor Data Analysis (08 Lecture Hours)
Introduction, Sensor level data processing and management, In-network data communication and management, Persistent data management and retrieval, Bayesian inference and monitoring data analysis, Data reduction, Data fusion, Further trends

Unit 2: Analytical Techniques for Damage Detection and Localization (08 Lecture Hours)
Linear time invariant systems, Modal form, Relation between the complex and the normal mode models, Damage detection, Damage localization, Future trends, Time-frequency (TF) methods: STFT, EMD and HT, Modal identification of linear time invariant (LTI) and linear
time variant (LTV) systems using EMD/HT and STFT, wavelets, Experimental and numerical validation of modal identification of LTI and LTV systems using STFT, EMD, wavelets and HT.

Unit 3: Life Cycle Assessment and Multi-Sensor Systems (08 Lecture Hours)
Statistical and probabilistic aspects for efficient prognosis, Decision analysis based on availability of SHM data, Life-cycle analysis using monitoring data, Need for health monitoring of transportation infrastructure, Sensor systems background, VOTERS mobile sensor system overview, Hierarchical multi-tiered architecture, Bulk data handling, Enabling sensor fusion

Text Books/Reference Book
1. Ming L. Wang Jerome P. Lynch Hoon Sohn, Sensor Technologies for Civil Infrastructures, Elsevier Press
2. Alan S Morris, Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann
3. S. Tumanski , Principle of Electrical Measurement, Taylor & Francis
4. Ilya Gertsbakh, Measurement Theory for Engineers, Springer
5. Satya Sheel “Instrumentation Theory and applications” Narosa publications

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

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1=weakly mapped    2= Moderately mapped    3=Strongly mapped
PROFESSIONAL ELECTIVE VII
### Course Objectives
- To provide knowledge about the new technology concepts/techniques applied in construction industry
- To study about the various constructions equipment’s and temporary works required to expedite the construction process
- To study different methods of construction and their suitability in various areas
- To develop their better understanding and knowledge in the sector of advanced construction techniques

### Course Outcomes
On completion of this course, the students will be able to;

CO1. Gain knowledge of specialized construction techniques as applied to real life problems.
CO2. Assimilate knowledge of various technical aspects related to underground and offshore constructions
CO3. Compare various methods of bridge construction and erection techniques
CO4. Analyze precast and prefabricated construction technology

### Catalog Description
Modern construction technology deals with the study of advanced construction practices adopted in real life construction projects. It covers detail study about specialized construction techniques, and also about the various underground & offshore construction aspects. In this course, students will also learn about practices involved in modern bridge construction, precast technology & will able to effectively correlate the practical & theoretical knowledge in civil engineering

### Course Content

<table>
<thead>
<tr>
<th>Unit 1: Specialized Construction Techniques</th>
<th>(06 Lecture Hours)</th>
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</thead>
<tbody>
<tr>
<td>Construction aspects and procedures of specialized construction techniques like box pushing, box type retaining walls, slip form for chimney and silo construction, sheet piling and diaphragm walls, well and caisson, underpinning, shotcrete &amp; guniting, vacuum dewatering- finishing &amp; curing methods.</td>
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</tbody>
</table>
Unit 2: Underground Construction (07 Lecture Hours)
Site investigation & geological studies: drilling. Pneumatic breakers, explosives, blasting, tunneling technology mechanized, shield, micro, special methods, Hazards and safety.

Unit 3: Offshore Construction (08 Lecture Hours)
Equipment: Crane barges, derrick barges, drilling vessels; underwater construction; Stages of offshore structure, construction, facilities and methods of fabrication.

Unit 4: Bridge Construction and Erection Techniques (07 Lecture Hours)
Types, bridge construction methods: in-situ and pre-cast construction methods, balanced cantilever methods, span-by-Span method, incremental launching method.

Unit 5: Pre-Cast and Pre-Fabrication Construction (08 Lecture Hours)
Planning analysis & design consideration for pre-cast and pre-fab construction, Material mould and modular co-ordination, standardization. Joints in pre-cast & pre-fab construction, curing technique. Industrial structures with skeletal and large panels, Handling, transportation and erection techniques, Pre-cast and pre-fabricating technology for low cost and mass housing schemes, case studies, Fabrication and erection of steel structural elements.

Text Books
2. M. K. Hurd, Formwork for Concrete, Detroit American Concrete Institute
4. Roy Chudley and Roger Greeno, Advanced Construction Techniques, Pearson
6. Richardson, J.G., Pre-cast concrete Production, Cement and Concrete Association

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

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## 2019-23 Batch

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

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

- To provide knowledge of Construction Project management & its unique features
- To make aware and provide knowledge for Construction Project planning techniques
- To provide detail knowledge on network techniques in construction projects
- To make aware for the cost - time analysis, inspection, quality and risk management with respect to construction projects

Course Outcomes

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

CO1. Understand features of management of construction projects.
CO2. Understand knowledge on basics of Construction project planning techniques
CO3. Demonstrate network techniques in Construction Management
CO4. Evaluate construction project on Time - cost analysis, basics of inspection & quality and risk management

Catalog Description

Construction Project is a mission, undertaken to create a unique facility, product or service within specified scope, quality, time and cost. Knowledge area needed to manage such projects comprise of project management techniques, general management practices and technology-related subjects. The project management technique of planning, scheduling and controlling are the tools and devices that bind the subject’s knowledge areas.

The construction industry accounts for 6-9% of the Gross Domestic Product (GDP) in India. Lack of knowledge of construction planning & management results time & cost overrun. More over in various businesses, the rate of business failure of construction project is one of the highest. One of the reason for this high rate of failure is lack of knowledge of construction planning & Management.

There is vast scope for improving performance through knowledge of planning & management in the construction industry, where men, materials, machinery, money and management work together to build a facility. This subject will be helpful for the students to acquire knowledge about construction project overview, construction project planning technique and Cost –time analysis in construction industry.

<table>
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<tr>
<th>CIVL 4055</th>
<th>CONSTRUCTION PROJECT PLANNING &amp; SYSTEM</th>
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<tr>
<td>Pre-requisites/Exposure</td>
<td>Basic of civil engineering, Basic knowledge of Building Material, Mathematics</td>
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<td>Co-requisites</td>
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Pre-requisites/Exposure

Basic of civil engineering, Basic knowledge of Building Material, Mathematics

Co-requisites

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Course Content

Unit 1: Basics of Construction Project Management (05 Lecture Hours)

Unit 2: Construction Project Planning (08 Lecture Hours)
Introduction, Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, estimating durations, sequence of activities, activity utility data.
Technique of planning: Bar charts, CPM Networks - basic terminology, types of precedence relationships- finish to start, start to start, finish to finish, start to finish, preparation of CPM networks: activity on link and activity on node representation, analysis of single relationship (finish to start) networks, computation of float values, critical and semi-critical paths, Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations.

Unit 3: Network Techniques in Construction Management-I CPM (08 Lecture Hours)
Introduction, network techniques, work break down, classification of activities, rules for developing networks, network development-logic of network, allocation of time to various activities, Fulkerson's rule for numbering events, network analysis, determination of project schedules, critical path, float in activities, updating, resources allocation, resources smoothing and resources leveling.

Unit 4: Network Techniques in Construction Management-II PERT (05 Lecture Hours)
Probability concept in network, optimistic time, pessimistic time, most likely time, lapsed time, deviation, variance, standard deviation, slack critical path, probability of achieving completion time, central limit theorem

Unit 5: Cost-Time Analysis (06 Lecture Hours)
Cost versus time, direct cost, indirect cost, total project cost and optimum duration, contracting the network for cost optimization, steps in time cost optimization, illustrative examples.

Unit 6: Inspection &Quality Control (04 Lecture Hours)
Introduction, principles of inspection, enforcement of specifications, stages in inspection and quality control, testing of structures, statistical analysis. Project Risk Management

Text Books

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

- To understand building bylaws, their applicability and consequences when bylaws are not followed for general buildings.
- To understand the organization and enforcement of department of buildings, permits and inspection for construction, construction process and alternative materials etc.
- To give them an idea about development control rules and general building requirements for structural design and materials etc.
- Basic understanding about contracts, contract laws and engineering ethics.

Course Outcomes

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

CO1. Understand building bylaws, applicability and consequences
CO2. Understand about department of buildings, permits and inspection process
CO3. Knowledge of development control rules and general building requirements for structural design and materials etc.
CO4. Assimilating about contracts, contract laws and engineering ethics

Catalog Description

The building bye-laws set standards for building work. Their aim is to ensure the health and safety of people in and around buildings by setting requirements for building design and construction. Professional ethics encompass the personal, organizational, and corporate standards of behavior expected by professionals. This subject covers study of bylaws their applicability and consequences, respective government bodies, development control rules, contracts and professional ethics.

Course Content

Unit 1: Building Laws, Applicability And Consequences  (07 Lecture Hours)
Introduction to Building Bylaws, Applicability of Building Bylaws, Terms used in building bylaws, Consequences when bylaws are not followed. Case studies for change in local bylaws

Unit 2: Department Of Building, Administration and Enforcement  (07 Lecture Hours)
Overview of Body of Department of buildings, Administration of Department of buildings, Overview of Different Law bodies Surrounding Design, Construction, Management, Permits and Permit process, Documentation required, Inspection process.

Unit 3: Development Control Rules (09 Lecture Hours)
General Building requirements, Land Use Classification, Geometric rules, Setbacks etc., Rules in Residential and Commercial Zones, Rules for buildings of high importance, New Materials and their properties, Changes in Structural design and Case study.

Unit 4: Contracts (04 Lecture Hours)
Introduction to contract and types of contract, General understanding of Contract laws, Case Study

Unit 5: Engineering Ethics (09 Lecture Hours)
General and Special Conditions & Case Study, Ethics & Case Study, Contact Administration & Case Study, Claims & Case Study, Disputes Resolutions & Case Study, Arbitration and Appeal Process & Case Study

Reference Books
1. National Building Code 2005
2. Unified building byelaws for Delhi 2014
3. Unified building byelaws for Delhi 2016
4. Model Building byelaws – Ajith Prakashan
5. Building planning scheduling and designing – Gurucharan Singh

Modes of Evaluation: Quiz/Assignment/ Presentation/ Extempore/ Written Examination

Examination Scheme:

<table>
<thead>
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### Relationship between the Course Outcomes (COs) and Program Outcomes (POs) & Program Specific Outcomes (PSOs)

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1= Weakly Mapped  
2= Moderately Mapped  
3= Strongly Mapped
Course Objectives

- To make aware and provide knowledge about Design of various types of Dams - Gravity Dam, Earth Dam, Arch dam, Rock fill dam, Buttress dam etc. & their failures
- To impart knowledge about various types of Spillways and their design
- To impart knowledge on various river training works and reservoir planning
- To provide knowledge about various components of hydropower station

Course Outcomes

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

CO1. Understand various components of hydraulic structures
CO2. Analyze various components of hydraulic structures
CO3. Design various components of hydraulic structures

Catalog Description

India has unequal distribution of rain fall of rainfall over the country- varying from less than 25 mm in some regions to about 1150 cm in the north eastern region. Substantial variations in the quantity, incidence and duration of rainfall in individual tracts from year to year, make irrigation of supreme necessity in the country.

Large scale optimum use of rain-water requires the study of hydraulic structures. Hydraulic structures like dam, barrages, etc, helps in the storage and diversion of this water. This water is supplied through spillway, diversions works, canals, etc. This subject will be helpful for the students to learn about the design of all these hydraulic structures.

Course Content

Unit 1: Gravity Dams (08 Lecture Hours)
Design Criteria, forces acting on gravity dams, elementary profile, low and high gravity dams, stability analysis, evaluation of profile by method of zoning, practical profile, foundation treatment, construction joints, galleries in gravity dams.
2019-23 Batch

Unit 2: Earth and Rock Fill Dams (06 Lecture Hours)
Earth Dams: Types, causes of failure and design criteria, soils suitable for earth dam construction, construction methods, foundation requirements, typical earth dam sections, estimation of seepage through and below the dam, seepage control, stability of slopes by slip circle method of analysis, pore pressures, sudden draw down, steady seepage and construction pore pressure condition.
Rock fill dams: Types, merits and demerits, conditions favorable for their adoption.

Unit 3: Arch, Buttress and Other Types of Dams (04 Lecture Hours)
Arch dams: Types, theories of design, thin cylinder theory, Trial load method of analysis, constant radius, constant angle and variable radius arch dams, Dome dams.
Buttress dams, steel and timber dams: Types, merits and demerits, conditions favorable for their adoption.

Unit 4: Spillways, Energy Dissipators and Gates (08 Lecture Hours)
Types of Spillways; Ogee spillway and its design, details of syphon, shaft, chute and side channel spillways, emergency spillways. Principles of energy dissipation, Energy dissipators based on tail water rating curve and jump height curves. Spillway crest gates - vertical lift and radial gates, their design principles and details.

Unit 5: River Training (05 Lecture Hours)
Classification of river training works and its objectives, classification of river training works, methods of river training, marginal embankments, guide banks, spurs, cutoffs, bank pitching and launching apron.

Unit 6: Hydropower Plants (05 Lecture Hours)
Hydropower development, assessment of power potential, types of hydropower plants, general features of hydro-electric schemes, selection of turbines, draft tubes, surge tanks, penstocks, power house dimensions, development of micro hydel stations, tidal plants, pumped storage plants and their details.

Text Books


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

Examination Scheme:

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

- To know the general elements of river mechanics and flood.
- To study the different processes affecting the morphology of river.
- To study about metrological parameters.
- To discuss about various ways to predict flood and flood warning system.
- To develop knowledge about flood mitigation through various means.

Course Outcomes

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

CO1. Study the river morphology and its sediments characteristics
CO2. Apply the probabilistic methods in evaluating hydrologic data
CO3. Study the flood mitigation by river protection and reservoir
CO4. Develop the flood forecasting and warning systems
CO5. Evaluate the economic aspects of the flood control projects

Catalog Description

River engineering enables to keep check on the indispensable resource which is water. It helps in the efficient management of river and the hydraulic structures. In the case of flood, proper management of the downstream area of a dam is warranted else the magnitude of disaster greatly increases. This subject deals with the flood forecast and flood mitigation through various means. It shows light on the morphology of a river and help in understanding the nature of flow and type of sediments which it carries.

COURSE CONTENT

Unit 1: Introduction (04 Lecture Hours)
Indian rivers, flood, flood problems, river morphology, behavior of river flow, role of sediments in rivers, changes in regimes, river gauging, causes of flood and losses, alleviation of flooding.

Unit 2: Hydrologic Statistics (05 Lecture Hours)
Probabilistic treatment of hydrologic data, frequency & probability functions, statistical parameters, fitting a probability distribution, probability distribution fort hydraulic variables.
Unit 3: Flood Mitigation by River Protection

Basis of river engineering, flow types, resistance flow, energy slope, backwater effect, three dimensional flow, circular and helicoidal flow, river improvement works, river survey, protection by embankment, discharge capacity, design of dyke, stability analysis of dykes, bank protection, bank recession, types of bank protection works, channel improvement, cutoffs diversion, bypass channel, cutoff channel, floored ways, flood plain zeroing, spreading grounds.

Unit 4: Flood Mitigation by Reservoirs

Design factors, storage capacity determinations, sequent peak algorithm method, live storage, ripple mass curve flood routing, flood storage, dead storage, reservoir classification, reservoir sedimentation, distribution of sediments in reservoirs, measurement of sediment yields, sediment load measurement, Mood's method, life of reservoir, reservoir operation based on annual storage and regulation, single and multi-purpose reservoirs, gate operation schedule, maximum and minimum flow operation, multi-purpose reservoir operation, reservoir economics-cost benefit ratios, optimization of benefits.

Unit 5: Flood Forecasting & Warning

Basic data, communication network, forecasting techniques and procedures, forecast of rainfall, runoff from rainfall, forecasting stages, peak travel time, forecast reporting flood warning, Engineering methods for flood fighting.

Unit 6: Engineering Economics Of Flood Control

Estimation of flood damages, estimation of benefits of flood control, cost benefit analysis of flood control project.

Text Books


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

Examination Scheme:

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2019-23 Batch

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

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

- To apply technical knowledge for estimation of safety of structures in marine conditions.
- To impart knowledge for estimation of loads from offshore structures.
- To impart knowledge for design of members and joint and offshore structures.
- To develop design concepts for pipeline and risers.

Course Outcomes

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

PO13. Understand the behavior of waves & its effect on structures.
PO14. Analyze the various offshore structural components
PO15. Design the various offshore structures

Catalog Description

Every activity that we try to do requires some kind of energy. Oil and gas are still today a major source of energy around the world, and will continue to remain so in foreseeable future. While crude oil and natural gas exploration has been ongoing since last century, recent developments in exploration of shale gas reserves in Arctic ocean, has added a new dimension for design and construction of Offshore structures in hostile environments.

This course is intended to develop concept of students regarding various types of offshore structures that are built for the purpose of exploration of oil and gas and to impart knowledge regarding their principles and methods of design and construction techniques including installation and materials used.

Course Content

Unit 1: Hydrodynamics And Dynamic Analysis (08 Lecture Hours)

Unit 2: Loads On Offshore Structures (06 Lecture Hours)
Wind Loads; Wave and Current Loads, Calculation based on Maximum base Shear and Overturning Moments, Fatigue Load and Seismic loads.
Unit 3: Fixed Bottom Offshore Structures (08 Lecture Hours)

Steel Tubular Member Design: Allowable stresses and Partial Safety Factors, Tubular Members, Slenderness effects, Column Buckling, Design for combined axial and bending stresses. (API RP 2A guidelines).

Tubular Joint Design for Static and Cyclic Loads: Simple tubular joints, Design using allowable loads; stress concentration factors; S-N curves and f-S-N curves and fatigue damage calculations fatigue damage calculations.

Unit 4: Floating Offshore Structures (06 Lecture Hours)

Introduction to floating structures: Semi-submersible, TLPS, FPSOs, Spars, General concepts on estimation of loads and Hydrostatic Stability, Semi-submersibles.

Stabilized structures: Design of pontoons; Tension leg platforms; Tethers selection and design, Spar hulls; classic, truss and cell spar.

Code compliance: FPSOs; Turret and spread moored units, Design aspects, Selection of mooring system for floating structures, Design and installation of moorings.

Unit 5: Pipeline And Riser Engineering (08 Lecture Hours)

Introduction to subsea pipelines, Pipeline arrival and discharge conditions.

Pipeline hydraulics: Pipeline sizing; Friction loss, Temperature profile, Slug formation and control

Installation of pipelines: S and J lay methods, Pipe lay barges and vessels, Pipeline initiation and termination, Pipeline design for stresses in service conditions, Static and dynamic Stability, Pipeline flexibility and span analysis.

Rigid and flexible risers: Design of risers, Cathodic protection design.

Text Books

4. Dynamic analysis and design of offshore structures
5. R Srinivasan, *Advanced Marine Structures*

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

Examination Scheme:

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1=weakly mapped  
2= Moderately mapped  
3=Strongly mapped
**Course Objectives**

- To develop concept of configuration of fixed and floating offshore structures
- To impart knowledge regarding the configuration of jack up rig structures.
- To impart knowledge regarding the construction and installation of floating offshore structures.
- To impart knowledge of installation of pipeline and riser of offshore structures.
- To develop concept of safety against accidentals loading of offshore structure.

**Course Outcomes**

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

CO1. Understand configuration and construction of fixed bottom offshore structures
CO2. Develop concept of configuration of jack up rig structures
CO3. Understand construction and installation of floating offshore structures
CO4. Comprehend installation of pipeline and riser of offshore structures using ACI and DNV codes
CO5. Acquire knowledge of construction aspect of safety against accidental loading of offshore structure using ACI and DNV codes

**Catalog Description**

Every activity that we try to do requires some kind of energy. Oil and gas are still today a major source of energy around the world, and will continue to remain so in foreseeable future. While crude oil and natural gas exploration has been ongoing since last century, recent developments in exploration of shale gas reserves in Arctic ocean, has added a new dimension for design and construction of Offshore structures in hostile environments. This course is intended to develop concept of students regarding various types of offshore structures that are built for the purpose of exploration of oil and gas and to impart knowledge regarding their principles and methods of design and construction techniques including installation and materials used.
Course Content

**Unit 1: Fixed Bottom Offshore Structures**  
(06 Lecture Hours)  

**Unit 2: Jackup Rigs**  
(08 Lecture Hours)  
Configuration and operation of jackup rigs: Simplified analysis, Spudcan penetration and extraction, Spudcan – pile interaction, Cathodic protection for jack-ups.

**Unit 3: Floating Offshore Structures**  
(08 Lecture Hours)  
Construction Details of Semi-submersible, FPSOs, pontoons; Tension leg platforms; Spar hulls; classic, truss and cell spar, Spar hull compartments, FPSOs; Turret and spread moored units, Installation of moorings for floating structures.

**Unit 4: Pipelines And Risers**  
(07 Lecture Hours)  
**Installation of pipelines:** S and J lay methods, Pipe lay barges and vessels, Pipeline initiation and termination.  
**Rigid and flexible risers:** Installation of risers, Intelligent pegging, Pipeline corrosion monitoring, Transportation & Load-out.

**Unit 5: Construction Aspects For Safety Against Accidental Loads (Fire, Blast And Collision)**  
(07 Lecture Hours)  
Behaviour of steel at elevated temperature; Fire Rating for Hydrocarbon fire; Safety of structures for high temperature; Blast Mitigation-Blast walls; Collision of Boats and energy absorption; Platform survival capacity.

**Text Books**

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

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