PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Graduates of the programme B E Civil Engineering will

I. Gain knowledge and skills in Civil engineering which will enable them to have a career and professional accomplishment in the public or private sector organizations
II. Become consultants on complex real life Civil Engineering problems related to Infrastructure development especially housing, construction, water supply, sewerage, transport, spatial planning.
III. Become entrepreneurs and develop processes and technologies to meet desired infrastructure needs of society and formulate solutions that are technically sound, economically feasible, and socially acceptable.
IV. Perform investigation for solving Civil Engineering problems by conducting research using modern equipment and software tools.
V. Function in multi-disciplinary teams and advocate policies, systems, processes and equipment to support civil engineering

PROGRAM OUTCOMES (POs)

PO#  Graduate Attribute
1  Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2  Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of Mathematics, natural sciences, and engineering sciences.
3  Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4  Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5  Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6  The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7 **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8 **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9 **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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

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

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

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

On successful completion of the Civil Engineering Degree programme, the Graduates shall exhibit the following:

**PSO1** Knowledge of Civil Engineering discipline

Demonstrate in-depth knowledge of Civil Engineering discipline, with an ability to evaluate, analyze and synthesize existing and new knowledge.

**PSO2** Critical analysis of Civil Engineering problems and innovation

Critically analyze complex Civil Engineering problems, apply independent judgment for synthesizing information and make innovative advances in a theoretical, practical and policy context.

**PSO3** Conceptualization and evaluation of engineering solutions to Civil Engineering Issues

Conceptualize and solve Civil Engineering problems, evaluate potential solutions and arrive at technically feasible, economically viable and environmentally sound solutions with due consideration of health, safety, and socio cultural factors

**PEO / PO Mapping:**

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1 – Low; 2 – Medium; 3 – High
## Mapping of Course Outcome and Programme Outcome

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### Notes
- **PO1** to **PO12** represent Program Outcomes.
- **PSO1** to **PSO3** represent Program Specific Outcomes.
| YEAR III | Design of Reinforced Concrete Structural Elements | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 2 | 3 | 3 | 3 | 3 |
| SEMESTER V | Structural Analysis I | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 |
| | Soil Mechanics | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 3 | 2 | 2 | 3 | 3 |
| | Hydrology and Water Resources Engineering | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 1 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| SEMESTER VI | Design of Steel Structural Elements | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 |
| | Structural Analysis II | 3 | 3 | 3 | 3 | 1 | 3 | 1 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 3 |
| | Foundation Engineering | 2 | 3 | 3 | 3 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 3 |
| | Highway and Railway Engineering | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 2 |
| | Professional Elective I | | | | | | | | | | | | | | | | |
| SEMESTER VII | Estimation, Costing and Valuation Engineering | 3 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Total Quality Management | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 |
| | Environmental Sciences and Sustainability** | 3 | 2 | 1 | 1 | - | 2 | 2 | - | - | - | - | 2 | - | - | - |
| | Professional Elective II | | | | | | | | | | | | | | | | |
| | Professional Elective III | | | | | | | | | | | | | | | | |
| SEMESTER VIII | Professional Elective IV | | | | | | | | | | | | | | | | |
| | Professional Elective V | | | | | | | | | | | | | | | | |
| | Human Values and Ethics | | | | | | | | | | | | | | | | |
| | Project Work | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |

1 - Low; 2 - Medium; 3 - High
ANNA UNIVERSITY, CHENNAI  
NON-AUTONOMOUS AFFILIATED COLLEGES  
REGULATIONS 2023  
B. E. CIVIL ENGINEERING (PART TIME)  
CHOICE BASED CREDIT SYSTEM  
CURRICULA AND SYLLABI FOR I TO VIII SEMESTERS

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**PROFESSIONAL ELECTIVE COURSES (PEC)**

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# EMPLOYABILITY ENHANCEMENT COURSES (EEC)

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## SUMMARY

### B.E. CIVIL ENGINEERING (PART-TIME)

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COURSE OBJECTIVES:

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I  MATRICES  9+3

UNIT II  DIFFERENTIAL CALCULUS  9+3

UNIT III  FUNCTIONS OF SEVERAL VARIABLES  9+3

UNIT IV  INTEGRAL CALCULUS  9+3
Definite and Indefinite integrals - Substitution rule - Techniques of Integration : Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications : Hydrostatic force and pressure, moments and centres of mass.

UNIT V  MULTIPLE INTEGRALS  9+3

TOTAL : 60 PERIODS

COURSE OUTCOMES:
At the end of the course the students will be able to
CO1 Use the matrix algebra methods for solving practical problems.
CO2 Apply differential calculus tools in solving various application problems.
CO3 Able to use differential calculus ideas on several variable functions.
CO4 Apply different methods of integration in solving practical problems.
CO5 Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXTBOOKS:
3. James Stewart, "Calculus : Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:

CO’s-PO’s & PSO’s MAPPING

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1-Low, 2-Medium,3-High

PTPH3151 ENGINEERING PHYSICS L T P C 3 0 0 3

COURSE OBJECTIVES:
- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I MECHANICS

UNIT II ELECTROMAGNETIC WAVES

The Maxwell’s equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS


UNIT IV BASIC QUANTUM MECHANICS

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

UNIT V APPLIED QUANTUM MECHANICS

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch’s theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students should be able to
CO1 Understand the importance of mechanics.
CO2 Express their knowledge in electromagnetic waves.
CO3 Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
CO4 Understand the importance of quantum physics.
CO5 Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:

2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.

REFERENCES:

## CO’s-PO’s & PSO’s MAPPING

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## PTCY3151 ENGINEERING CHEMISTRY

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### COURSE OBJECTIVES:
- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

### UNIT I WATER AND ITS TREATMENT

**Water: Sources and impurities, Water quality parameters:** Definition and significance of colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, fluoride and arsenic. **Municipal water treatment:** primary treatment and disinfection (UV, Ozonation, break-point chlorination). **Desalination of brackish water:** Reverse Osmosis. **Boiler troubles:** Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. **Treatment of boiler feed water:** Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralisation and zeolite process.

### UNIT II NANOCHEMISTRY

**Basics:** Distinction between molecules, nanomaterials and bulk materials; **Size-dependent properties** (optical, electrical, mechanical and magnetic); **Types of nanomaterials:** Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. **Preparation of nanomaterials:** sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. **Applications** of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

### UNIT III PHASE RULE AND COMPOSITES

**Phase rule:** Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system; lead-silver system - Pattinson process. **Composites:** **Introduction:** Definition & Need for composites; **Constitution:** Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). **Properties and applications of:** Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. **Hybrid composites** - definition and examples.
UNIT IV FUELS AND COMBUSTION

Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; Power alcohol and biodiesel.

Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; Ignition temperature: spontaneous ignition temperature, Explosive range; Flue gas analysis - ORSAT Method. CO₂ emission and carbon foot print.

UNIT V ENERGY SOURCES AND STORAGE DEVICES

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. Solar energy conversion: Principle, working and applications of solar cells; Recent developments in solar cell materials. Wind energy; Geothermal energy; Batteries: Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion battery; Electric vehicles-working principles; Fuel cells: H₂-O₂ fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.

TOTAL: 45 PERIODS

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

CO1 To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.

CO2 To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO3 To apply the knowledge of phase rule and composites for material selection requirements.

CO4 To recommend suitable fuels for engineering processes and applications.

CO5 To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TEXT BOOKS:

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PTGE3151 PROBLEM SOLVING AND PYTHON PROGRAMMING

COURSE OBJECTIVES:
- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS
Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.
UNIT V FILES, MODULES, PACKAGES

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter’s age validation, Marks range validation (0-100).

TOTAL : 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, students will be able to
CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and looping for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

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

COs- PO’s & PSO’s MAPPING

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1 - low, 2 - medium, 3 - high

PTMA3251 STATISTICS AND NUMERICAL METHODS

COURSE OBJECTIVES:
- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of solving algebraic and transcendental equations.
• To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
• To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

UNIT I TESTING OF HYPOTHESIS 9+3
Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9+3
One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

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

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

COURSE OUTCOMES:
Upon successful completion of the course, students will be able to:
CO1 Apply the concept of testing of hypothesis for small and large samples in real life problems.
CO2 Apply the basic concepts of classifications of design of experiments in the field of agriculture.
CO3 Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
CO4 Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
CO5 Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

TEXT BOOKS:

REFERENCES:

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**PTPH3201 PHYSICS FOR CIVIL ENGINEERING**

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**COURSE OBJECTIVES:**
- To introduce the basics of heat transfer through different materials, thermal performance of building and various thermal applications
- To impart knowledge on the ventilation and air conditioning of buildings
- To introduce the concepts of sound insulation and lighting designs
- To give an introduction to the processing and applications of new engineering materials
- To create an awareness on natural disasters and safety measures

**UNIT I THERMAL APPLICATIONS**

**UNIT II VENTILATION AND REFRIGERATION**
Requirements, principles of natural ventilation - ventilation measurements, design for natural ventilation - Window types and packaged air conditioners - chilled water plant - fan coil systems - water piping - cooling load - Air conditioning systems for different types of buildings - Protection against fire to be caused by A.C.Systems.

**UNIT III ACOUSTICS AND LIGHTING DESIGNS**
Methods of sound absorptions - absorbing materials - noise and its measurements, sound insulation and its measurements, impact of noise in multistoried buildings. Visual field glare, colour - day light calculations - day light design of windows, measurement of day-light and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.

**UNIT IV NEW ENGINEERING MATERIALS**
Composites - Definition and Classification - Fibre reinforced plastics (FRP) and fiber reinforced metals (FRM) - Metallic glasses - Shape memory alloys - Ceramics - Classification - Crystalline - Non Crystalline - Bonded ceramics, Manufacturing methods - Slip casting - Isostatic pressing - Gas
pressure bonding - Properties - thermal, mechanical, electrical and chemical ceramic fibres - ferroelectric and ferromagnetic ceramics - High Aluminium ceramics.

**UNIT V  NATURAL DISASTERS**

Seismology and Seismic waves - Earthquake ground motion - Basic concepts and estimation techniques - site effects - Probabilistic and deterministic Seismic hazard analysis - Cyclone and flood hazards - Fire hazards and fire protection, fire-proofing of materials, fire safety regulations and firefighting equipment - Prevention and safety measures.

**COURSE OUTCOMES:**
After completion of the course, the students should be able to

CO1 acquire knowledge about heat transfer through different materials, thermal performance of building and thermal insulation.

CO2 gain knowledge on the ventilation and air conditioning of buildings

CO3 understand the concepts of sound absorption, noise insulation and lighting designs

CO4 now about the processing and applications of composites, metallic glasses, shape memory alloys and ceramics

CO5 get an awareness on natural disasters such as earth quake, cyclone, fire and safety measures

**TEXT BOOKS:**

**REFERENCES:**

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**PTME3351  ENGINEERING MECHANICS**

**COURSE OBJECTIVES**
- To Learn the use scalar and vector analytical techniques for analyzing forces in Statically determinate structures
- To introduce the equilibrium of rigid bodies
- To study and understand the distributed forces, surface, loading on beam and intensity.
- To learn the principles of friction, forces and to determine the apply the concepts of frictional forces at the contact surfaces of various engineering systems.
- To develop basic dynamics concepts – force, momentum, work and energy;
UNIT I  STATICS OF PARTICLES  9
Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of
Particles - Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors. Equilibrium of a Particle- Newton’s First Law of
Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

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

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

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

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

COURSE OUTCOMES:
At the end of the course the students would be able to
CO1 Illustrate the vectorial and scalar representation of forces and moments
CO2 Analyse the rigid body in equilibrium
CO3 Evaluate the properties of distributed forces
CO4 Determine the friction and the effects by the laws of friction
CO5 Calculate dynamic forces exerted in rigid body

TOTAL: 45 PERIODS

TEXTBOOKS:
1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi,
Vector Mechanics for Engineers: Statics and Dynamics, McGraw Higher Education.,

REFERENCES:
1. Borese P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning,
2008.

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PTCE3302 CONSTRUCTION MATERIALS AND TECHNOLOGY

COURSE OBJECTIVES:

- To introduce students to various construction materials and the techniques that are commonly used in civil engineering construction.

UNIT I STONES - BRICKS - CONCRETE BLOCKS - LIME

UNIT II OTHER MATERIALS

UNIT III CONSTRUCTION PRACTICES & SERVICE REQUIREMENTS

UNIT IV CONSTRUCTION EQUIPMENTS
Selection of equipment for earthwork excavation, concreting, material handling and erection of structures – Dewatering and pumping equipment.

UNIT V CONSTRUCTION PLANNING
Introduction to construction planning – Scheduling for activities – Critical path method (CPM) and PERT network modelling and time analysis – Case illustrations.

TOTAL: 45 PERIODS
COURSE OUTCOMES

Students will be able to

CO1 Identify the good quality brick, stone and blocks for construction.

CO2 Recognize the market forms of timber, steel, aluminum and applications of various composite materials.

CO3 Identify the best construction and service practices such as thermal insulations and air conditioning of the building

CO4 Select various equipments for construction works conditioning of building

CO5 Understand the construction planning and scheduling techniques

TEXTBOOKS


REFERENCES:


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PTMA3351 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

COURSE OBJECTIVES

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - First order partial differential equations reducible to standard types - Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.
UNIT II        FOURIER SERIES  9 + 3
Dirichlet’s conditions – General Fourier series – Odd and even functions – Half range sine series and cosine series – Root mean square value – Parseval’s identity – Harmonic analysis.

UNIT III      APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  9 + 3
Classification of PDE – Method of separation of variables - Fourier series solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction (Cartesian coordinates only).

UNIT IV       FOURIER TRANSFORMS  9 + 3

UNIT V        Z - TRANSFORMS AND DIFFERENCE EQUATIONS  9 + 3

TOTAL: 60 PERIODS

COURSE OUTCOMES
Upon successful completion of the course, students should be able to:
CO1 Understand how to solve the given standard partial differential equations.
CO2 Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
CO3 Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
CO4 Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
CO5 Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

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PTCE3301 FLUID MECHANICS L T P C

3 0 0 3

COURSE OBJECTIVES:
- To introduce the students about properties and behaviour of the fluids under static conditions and to impart basic knowledge of the dynamics of fluids through the control volume approach and to expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends with an exposure to the significance of boundary layer theory and its applications.

UNIT I FLUIDS PROPERTIES AND FLUID STATICS 10

UNIT II BASIC CONCEPTS OF FLUID FLOW 10
Kinematics: Classification of flows – Streamline, streak-line and path-lines – Stream function and velocity potentials – Flow nets;
Dynamics: Application of control volume to continuity, energy and momentum – Euler’s equation of motion along a stream line – Bernoulli’s equation – Applications to velocity and discharge measurements – Linear momentum equation – Application to Pipe bends – Moment of momentum equation.

UNIT III DIMENSIONAL ANALYSIS AND MODEL STUDIES 7
Fundamental dimensions – Dimensional homogeneity – Rayleigh’s method and Buckingham Pi theorem – Dimensionless parameters – Similitude and model studies – Distorted and undistorted models.

UNIT IV INCOMPRESSIBLE VISCOUS FLOW 10

UNIT V BOUNDARY LAYERS 8
Definition of boundary layers – Laminar and turbulent boundary layers – Displacement, momentum and energy thickness – Momentum integral equation – Applications – Separation of boundary layer – Drag and Lift forces.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
- On completion of the course, the student is expected to
  - CO1 Demonstrate the difference between solid and fluid, its properties and behaviour in static conditions.
  - CO2 Apply the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.
  - CO3 Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performance of prototypes by model studies.
  - CO4 Estimate the losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel.
  - CO5 Explain the concept of boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface.

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-Low, 2-Medium, 3-High

PTCE3303 WATER SUPPLY AND WASTEWATER ENGINEERING L T P C
4 0 0 4

COURSE OBJECTIVES:
- To introduce students to various components and design of water supply scheme, water treatment methods, water storage distribution system, sewage treatment and disposal and design of intake structures and sewerage system.

UNIT I WATER SUPPLY
Estimation of surface and subsurface water resources - Predicting demand for water - Impurities of water and their significance - Physical, chemical and bacteriological analysis - Waterborne diseases - Standards for potable water. Intake of water: Pumping and gravity schemes.
UNIT II  WATER TREATMENT  
Objectives - Unit operations and processes - Principles, functions, and design of water treatment plant units, aerators of flash mixers, Coagulation and flocculation – Clariflocuclator - Plate and tube settlers - Pulsator clarifier - sand filters - Disinfection - softening, removal of iron and manganese - Defluoridation - Softening - Desalination process - Residue Management - Construction, Operation and Maintenance aspects

UNIT III  WATER STORAGE AND DISTRIBUTION 
Storage and balancing reservoirs - types, location and capacity. Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations - House service connections.

UNIT IV  PLANNING AND DESIGN OF SEWERAGE SYSTEM 
Characteristics and composition of sewage - Population equivalent - Sanitary sewage flow estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Storm drainage - Storm runoff estimation - Sewer appurtenances - Corrosion in sewers - Prevention and control – Sewage pumping-drainage in buildings - Plumbing systems for drainage

UNIT V  SEWAGE TREATMENT AND DISPOSAL  
Objectives - Selection of Treatment Methods - Principles, Functions, - Activated Sludge Process and Extended aeration systems - Trickling filters - Sequencing Batch Reactor(SBR) - UASB - Waste Stabilization Ponds - Other treatment methods - Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment - Construction, Operation and Maintenance aspects. - Discharge standards-sludge treatment -Disposal of sludge

TOTAL: 60 PERIODS

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

CO1  Understand the various components of water supply scheme and design of intake structure and conveyance system for water transmission

CO2  Understand on the characteristics and composition of sewage, ability to estimate sewage generation and design sewer system including sewage pumping stations

CO3  Understand the process of conventional treatment and design of water and wastewater treatment system and gain knowledge of selection of treatment process and biological treatment process

CO4  Ability to design and evaluate water distribution system and water supply in buildings and understand the self-purification of streams and sludge and septage disposal methods.

CO5  Able to understand and design the various advanced treatment system and knowledge about the recent advances in water and wastewater treatment process and reuse of sewage

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PTCE3351 SURVEYING AND LEVELLING

COURSE OBJECTIVES:
- To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers and to learn the various methods of plane and geodetic surveying to solve the real world problems. To introduce the concepts of Control Surveying. To introduce the basics of Astronomical Surveying

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING

UNIT II LEVELLING

UNIT III THEODOLITE SURVEYING

UNIT IV CONTROL SURVEYING AND ADJUSTMENT

UNIT V MODERN SURVEYING
Total Station: Digital Theodolite, EDM, Electronic field book – Advantages – Parts and accessories – Working principle – Observables – Errors - COGO functions – Field procedure and

TOTAL 45 Periods

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

CO1 Introduce the rudiments of various surveying and its principles.
CO2 Imparts knowledge in computation of levels of terrain and ground features
CO3 Imparts concepts of Theodolite Surveying for complex surveying operations
CO4 Understand the procedure for establishing horizontal and vertical control
CO5 Imparts the knowledge on modern surveying instruments

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PTCE3401 APPLIED HYDRAULICS ENGINEERING L T P C

3 1 0 4

COURSE OBJECTIVES:
- To impart basic knowledge to the students about the open channel flows with analysis of uniform flow, gradually varied flow and rapidly varied flow and to expose them to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, Centrifugal and Reciprocating pumps.

UNIT I UNIFORM FLOW

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Sub-critical, Super-critical and Critical flow - Velocity distribution in open channel - Steady uniform flow: Chezy’s equation, Manning equation - Best hydraulic sections for uniform flow - Computation in Uniform Flow - Specific energy and specific force.
UNIT II  VARIED FLOWS  9+3

UNIT III  RAPIDLY VARIED FLOWS  8+3
Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Positive and Negative surges.

UNIT IV  TURBINES  9+3
Turbines - Classification - Impulse turbine – Pelton wheel - Reaction turbines - Francis turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed – Minimum Speed to start the pump.

UNIT V  PUMPS  9+3
Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitatio’s in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Indicator diagrams and its variations - Air vessels - Savings in work done.

TOTAL: (L: 45+ T: 15) 60 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to
CO1 Describe the basics of open channel flow, its classification and analysis of uniform flow in steady state conditions with specific energy concept and its application
CO2 Analyse steady gradually varied flow, water surface profiles and its length calculation using direct and standard step methods with change in water surface profiles due to change in grades.
CO3 Derive the relationship among the sequent depths of steady rapidly varied flow and estimating energy loss in hydraulic jump with exposure to positive and negative surges.
CO4 Design turbines and explain the working principle
CO5 Differentiate pumps and explain the working principle with characteristic curves and design centrifugal and reciprocating pumps.

TEXT BOOKS:
2. Chandramouli P N, Applied Hydraulic Engineering, Yes Dee Publisher, 2017

REFERENCES:
3. Mays L. W., Water Resources Engineering, John Wiley and Sons (WSE), New York, 2019

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| CO3| 3   | 3   | 2   | 3   | 1   | 2   | 2   | 1   | 2   | 1   | 1   | 3   | 3   | 3   | 2   | 3   | 3   | 3   | PS 7| PS 8| PS 9|
| CO4| 3   | 3   | 3   | 3   | 1   | 2   | 2   | 1   | 2   | 1   | 1   | 3   | 3   | 3   | 2   | 3   | 3   | 3   | PS10| PS11| PS12|
| CO5| 3   | 3   | 3   | 3   | 1   | 2   | 2   | 1   | 2   | 1   | 1   | 3   | 3   | 3   | 2   | 3   | 3   | 3   | PS13| PS14| PS15|
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-Low,2-Medium,3-High

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COURSE OBJECTIVES:

- To learn the fundamental concepts of Stress in simple and complex states and to know the mechanism of load transfer in beams and the induced stresses due to simple bending and unsymmetrical bending and to determine the deformation in determinate beams and to know the basic concepts of analysis of indeterminate beams.

UNIT I SIMPLE AND COMPOUND STRESSES 9
Stresses in simple and compound bars – Thermal stresses – Elastic constants - Thin cylindrical and spherical shells – Biaxial state of stress – Principal stresses and principal planes – Mohr’s circle of stresses - Torsion on circular shafts.

UNIT II BENDING OF BEAMS 9
Types of beams and transverse loadings– Shear force and bending moment for simply supported, cantilever and over-hanging beams - Theory of simple bending – Bending stress distribution – Shear stress distribution.

UNIT III DEFLECTION OF BEAMS 9
Double Integration method – Macaulay's method – Area moment method – Conjugate beam method - Strain energy method for determinate beams.

UNIT IV INDETERMINATE BEAMS 9
Propped Cantilever and Fixed Beams – Fixed end moments reactions, slope and deflection for standard cases of loading — Continuous beams – support reactions and moments – Theorem of three moments – Shear Force and Bending Moment Diagrams.

UNIT V ADVANCED TOPICS 9
Unsymmetrical bending of beams - shear centerapplied - Thick cylinders - Theories of failure – Principal stress, principal strain, shear stress, strain energy and distortion energy theories – application problems.

COURSE OUTCOMES:

Students will be able to

CO1 Understand the concepts of stress and strain, principal stresses and principal planes.

CO2 Determine Shear force and bending moment in beams and understand concept of theory of simple bending.

CO3 Calculate the deflection of beams by different methods and selection of method for determining slope or deflection.

CO4 Analyze propped cantilever, fixed beams and continuous beams for external loadings and support settlements.

CO5 Determine the stresses due to Unsymmetrical bending of beams, locate the shear center, and study the various theories of failure

TOTAL: 45 PERIODS

TEXTBOOKS

REFERENCES:
5. Irwing H. Shames, James M. Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 2002

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- Low, 2 - Medium, 3 - High

PTCE3403 CONCRETE TECHNOLOGY

COURSE OBJECTIVES:
- To study the properties of concrete making materials.
- To have better knowledge about the chemical and mineral admixtures in concrete.
- To familiarize with the IS method of mix design as per the latest code.
- To understand the fresh and hardened properties of concrete. To know the importance and applications of special concretes

UNIT I CONSTITUENT MATERIALS
Cement-Different types-Chemical composition and Properties - Tests on cement-IS Specifications- Aggregates-Classification-Mechanical properties and tests as per BIS Grading requirements-Water-Quality of water for use in concrete.

UNIT II CHEMICAL AND MINERAL ADMIXTURES
Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline - Their effects on concrete properties

UNIT III PROPORTIONING OF CONCRETE MIX
Principles of Mix Proportioning-Properties of concrete related to Mix Design- Physical properties of materials required for Mix Design - Design Mix and Nominal Mix-BIS Method of Mix Design - Mix Design Examples

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE
Workability-Tests for workability of concrete-Slump Test and Compacting factor Test-Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete- Stress-strain curve for concrete-Determination of Modulus of elasticity.
UNIT V  
SPECIAL CONCRETES

TOTAL : 45 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to
CO1 Understand the requirements of cement, aggregates and water for concrete
CO2 Select suitable admixtures for enhancing the properties of concrete
CO3 Design concrete mixes as per IS method of mix design
CO4 Determine the properties of concrete at fresh and hardened state.
CO5 Know the importance of special concretes for specific requirements.

TEXTBOOKS:

REFERENCES:

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-Low,2-Medium,3-High

PTAG3601  
ENGINEERING GEOLOGY

COURSE OBJECTIVES:
- This course will familiarize the students on the role and importance of geology in civil engineering, apart from learning the techniques of surface and subsurface investigations using geological, geophysical and geomechanical methods.

UNIT I  
PHYSICAL GEOLOGY AND GEOMORPHOLOGY
Significance of Geology in Civil Engineering; Internal structure of the Earth; Weathering: types, engineering classification of weathered rocks and relevance to Civil Engineering; Fluvial, Marine, Glacial and Aeolian landforms and their importance in Civil Engineering; Plate tectonics and its relevance to earthquakes; Groundwater: types of aquifers, origin, movement and role of groundwater in Civil Engineering constructions.

UNIT II  
MINERALOGY AND PETROLOGY
Physical and Chemical properties of common rock forming minerals: Quartz family, Feldspar family, Mica (Muscovite, Biotite & Vermiculite), Pyroxene (Augite & Hypersthene), Amphibole (Hornblende), Calcite, Gypsum and Clay minerals and their significance. Formation of Igneous, Metamorphic and Sedimentary rocks; Description of important rocks: Granite, Syenite, Dolerite, Basalt, Quartzite,
UNIT III STRUCTURAL GEOLOGY AND ROCK MECHANICS
Attitudes of beds: Strike and Dip measurements and their relevance to civil engineering; Different types of folds, faults, joints and fractures in rocks and their significance in civil engineering constructions; Geomechanical properties of rocks: Rock Quality Designation (RQD), Rock Mass Rating (RMR) and Geological Strength Index (GSI) and their importance in various civil engineering projects.

UNIT IV GEOPROSPECTING
Geological mapping techniques; Remote Sensing: Fundamentals and its role in geological mapping; Geophysical methods for subsurface investigations: Electrical, Seismic & Ground Penetrating Radar (GPR); Subsurface logging and their importance in civil engineering projects.

UNIT V GEOLOGICAL CONSIDERATIONS AND GEOHAZARDS
Geological conditions necessary for designing and construction of important structures: Dams, Reservoirs, Tunnels, Road cuttings and Coastal protection; Landslides: Causes and mitigation; Earthquakes & Tsunamis: Causes and mitigation; Case studies for the above topics.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of this course, the students expected to be able to:

CO1 Knowing the internal structure of earth and its relation to earthquakes. Landforms created by various geological agents and their importance in civil engineering.

CO2 Getting knowledge on various minerals and rocks that can be used as construction materials and road aggregates. In addition, testing the suitability of rocks for foundation purposes.

CO3 Studying various geological structures and their impact in engineering constructions. Further, learning the geomechanical properties of rocks and their significance in engineering projects.

CO4 Gaining knowledge on the role of geological mapping, remote sensing and geophysics for surface and subsurface investigations. In addition, students will also gain knowledge on borehole logging techniques and their applications in civil engineering.

CO5 Applying geological knowledge for designing and constructing major civil engineering structures, and also mitigating various geological hazards such as earthquakes, landslides and tsunamis.

TEXT BOOKS:

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-Low,2-Medium,3-High

PTCE3501 DESIGN OF REINFORCED CONCRETE STRUCTURAL ELEMENTS

COURSE OBJECTIVE:
• To introduce the different design philosophy for reinforced concrete and discuss the limit state method of design of RC rectangular beams and to learn the concept in the design of RC flanged beams and design for shear and torsion and design of RC slabs and staircase, short RC columns, RC footing for walls, pad, sloped and combined rectangular footings.

UNIT I METHODS OF DESIGN OF CONCRETE STRUCTURES

UNIT II LIMIT STATE METHOD - FLANGED BEAM, SHEAR & TORSION
Analysis and design of flanged beams – Use of design aids for Flexure - Behaviour of RC members in bond and Anchorage - Design requirements as per current code - Behaviour of RC beams in shear and torsion - Design of RC members for combined bending, shear and torsion - serviceability.

UNIT III LIMIT STATE DESIGN OF SLABS AND STAIRCASE
Analysis and design of cantilever, one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions- Types of Staircases – Design of dog-legged Staircase –Introduction to Flat Slab.

UNIT IV LIMIT STATE DESIGN OF COLUMNS
Types of columns – Design of short Rectangular and circular columns for axial, uniaxial and biaxial bending.

UNIT V LIMIT STATE DESIGN OF FOOTING
Design of wall footing – Design of axially and eccentrically loaded rectangular pad and sloped footings – Design of combined rectangular footing for two columns only.

COURSE OUTCOMES:
At the end of the course the student will be able to
CO1 Know the various design concepts and design RC rectangular beams by working stress and limit state methods
CO2 Understand the design of flanged beams, design for shear and torsion, and anchorage and development length.
CO3 Design a RC slabs and staircase and draw the reinforcement detailing.
CO4 Design short columns for axial, uni-axial and bi-axial eccentric loadings
CO5 Design wall footings, isolated footings and combined rectangular footing.

TOTAL: 45 PERIODS
TEXT BOOKS:

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PTCE3502 STRUCTURAL ANALYSIS I

COURSE OBJECTIVE:
- To introduce the students to the basic theory and concepts of classical methods of structural analysis

UNIT I ANALYSIS OF TRUSSES

UNIT II SLOPE DEFLECTION METHOD
- Slope deflection equations – Equilibrium conditions - Analysis of continuous beams and rigid frames – Rigid frames with inclined members - Support settlements - symmetric frames with symmetric and skew-symmetric loadings.

UNIT III MOMENT DISTRIBUTION METHOD
- Stiffness - distribution and carry over factors — Analysis of continuous Beams- Plane rigid frames with and without sway – Support settlement - symmetric frames with symmetric and skew-symmetric loadings.
UNIT IV  FLEXIBILITY METHOD  
Primary structures - Compatibility conditions – Formation flexibility matrices - Analysis of indeterminate pin-jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.

UNIT V  STIFFNESS METHOD  
Restrained structure –Formation of stiffness matrices - equilibrium condition - Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method.

COURSE OUTCOMES:
Students will be able to
CO1  Analyze the pin-jointed plane and space frames.
CO2  Analyse the continuous beams and rigid frames by slope deflection method.
CO3  Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.
CO4  Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.
CO5  Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

TEXTBOOKS:

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PTCE3404  SOIL MECHANICS  L T P C  3 0 0 3

COURSE OBJECTIVES
- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of both finite and infinite slopes.
UNIT I  
SOIL CLASSIFICATION AND COMPACTION  

UNIT II  
EFFECTIVE STRESS AND PERMEABILITY  

UNIT III  
STRESS DISTRIBUTION AND SETTLEMENT  

UNIT IV  
SHEAR STRENGTH  
Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.

UNIT V  
SLOPE STABILITY  

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

CO1  Demonstrate an ability to identify various types of soils and its properties, formulate and solve engineering Problems

CO2  Show the basic understanding of flow through soil medium and its impact of engineering solution

CO3  Understand the basic concept of stress distribution in loaded soil medium and soil settlement due to consolidation

CO4  Show the understanding of shear strength of soils and its impact of engineering solutions to the loaded soil medium and also will be aware of contemporary issues on shear strength of soils.

CO5  Demonstrate an ability to design both finite and infinite slopes, component and process as per needs and specifications.

TEXTBOOKS:

REFERENCES:
COURSE OBJECTIVES:

- To introduce to the students, the concepts of hydrological processes, hydrological extremes and groundwater.
- To prepare the students to quantify, regulate and manage water resources.

UNIT I PRECIPITATION AND ABSTRACTIONS 9

UNIT II RUNOFF 9
Catchment: Definition, Morphological characteristics - Factors affecting runoff - Run off estimation using Strange’s table and empirical methods - SCS-CN method – Stage discharge relationship - Flow measurements - Hydrograph – Unit Hydrograph – IUH.

UNIT III HYDROLOGICAL EXTREMES 9

UNIT IV RESERVOIRS 9
Classification of reservoirs - Site selection - General principles of design - Spillways -Elevation-Area-Capacity curve - Storage estimation - Sedimentation - Life of reservoirs – Rule curve.

UNIT V GROUNDWATER AND MANAGEMENT 9
Origin - Classification and types - Properties of aquifers - Governing equations – Steady and unsteady flow - Artificial recharge - RWH in rural and urban areas.

TOTAL: 45 PERIODS

TEXT BOOKS:

REFERENCES
COURSE OUTCOMES:
On completion of the course, the student is expected to
1. Define the hydrological processes and their integrated behaviour in catchments
2. Apply the knowledge of hydrological processes to address basin characteristics, runoff and hydrograph
3. Explain the concept of hydrological extremes and its management strategies
4. Describe the principles of storage reservoirs
5. Understand and apply the concepts of groundwater management

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Low,2-Medium,3-High

PTCE3601 DESIGN OF STEEL STRUCTURAL ELEMENTS L T P C 3 0 0 3

COURSE OBJECTIVE
- To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections and to provide the students the tools necessary for designing structural systems such as roof trusses and gantry girders as per provisions of current code (IS 800 - 2007) of practice.

UNIT I INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS
General - Types of Steel - Properties of structural steel - I.S. rolled sections - Concept of Limit State Design - Design of Simple and eccentric Bolted and welded connections - Types of failure and efficiency of joint – prying action - Introduction to HSFG bolts

UNIT II DESIGN OF TENSION AND COMPRESSION MEMBERS
Behaviour and Design of simple and built-up members subjected to tension - Shear lag effect - Design of lug angles - tension splice - Behaviour of short and long columns - Euler's column theory - Design of simple and built-up compression members with lacings and battens - Design of column bases - slab base and gusseted base

UNIT III DESIGN OF BEAMS
Design of laterally supported and unsupported beams - Design of built-up beams - Design of plate girders

UNIT IV INDUSTRIAL STRUCTURES
Design of roof trusses – loads on trusses – purlin design using angle and channel sections – truss design. Design of joints and end bearings–Design of gantry girder - Introduction to pre-engineered buildings

UNIT V PLASTIC ANALYSIS AND DESIGN
Introduction to plastic analysis - Theory of plastic Analysis - Design of continuous beams and portal frames using plastic design approach

TOTAL: 45 PERIODS
COURSE OUTCOMES:
Upon completion of this course, students will be able to:

CO1  Recognize the design philosophy of steel structures and identify the different failure modes of bolted and welded connections, and determine their design strengths

CO2  Select the most suitable section shape and size for tension and compression members and beams according to specific design criteria

CO3  Apply the principles, procedures and current code requirements to the analysis and design of steel tension members, columns, column bases and beams

CO4  Identify and compute the design loads on Industrial structures, and gantry girder

CO5  Find out ultimate load of steel beams and portal frames using plastic analysis

TEXT BOOKS

REFERENCES
4. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016

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PTCE3602  STRUCTURAL ANALYSIS II  L T P C
3 0 0 3

COURSE OBJECTIVE:
- To learn the method of drawing influence lines and its uses in various applications like beams, bridges and plane trusses and to analyse arches and suspension bridges

UNIT I  INFLUENCE LINES FOR DETERMINATE STRUCTURES  9
Introduction to moving loads, Concept of Influence Lines, Influence lines for reactions in statically determinate structures –Influence lines for shear force and bending moment in beam section – Calculation of critical stress resultants due to concentrated and distributed moving loads - Influence lines for member forces in pin jointed plane frames.

UNIT II  INFLUENCE LINES FOR INDETERMINATE BEAMS  9
Muller Breslau’s principle - Influence line for support reactions, shearing force and bending moments for indeterminate beams - propped cantilevers, fixed beams and continuous beams.
UNIT III  ARCHES  9
Arches - Eddy’s theorem - Types of arches – Analysis of three-hinged, two-hinged and fixed arches - Parabolic and circular arches - influence lines, rib shortening– Settlement and temperature effects.

UNIT IV  SUSPENSION BRIDGES AND SPACE TRUSSES  9
Analysis of suspension bridges – Unstiffened cables and cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders - Introduction to analysis of space trusses using method of tension coefficients.

UNIT V  APPROXIMATE ANALYSIS OF FRAMES  9

COURSE OUTCOMES:
Students will be able to:
CO1 Draw influence lines for statically determinate structures and calculate critical stress resultants.
CO2 Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.
CO3 Analyse three hinged, two hinged and fixed arches.
CO4 Analyse the suspension bridges with stiffening girders
CO5 Analyse rigid frames by approximate methods for gravity and horizontal loads.

TEXTBOOKS:

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PTCE3503  FOUNDATION ENGINEERING  L T P C  3 0 0 3

COURSE OBJECTIVE:
- To impart knowledge to plan and execute a detail site investigation programme, to select geotechnical design parameters and type of foundations. Also to familiarize the students for the geotechnical design of different type of foundations and retaining walls.
UNIT I  SITE INVESTIGATION AND SELECTION OF FOUNDATION


UNIT II  BEARING CAPACITY OF SHALLOW FOUNDATION


UNIT III  FOOTINGS AND RAFTS

Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum depth for rigid behaviour – Applications – Floating foundation – Special foundations – Seismic force consideration – Codal provision.

UNIT IV  PILE FOUNDATION

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT, SCPT) – Negative skin friction – Uplift capacity - Group capacity by different methods (Field’s rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles – Capacity under compression and uplift – Codal provision.

UNIT V  RETAINING WALLS

Plastic equilibrium in soils – Active and passive states – Rankine’s theory – Cohesionless and cohesive soil – Coulomb’s wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls – Codal provision.

COURSE OUTCOMES:

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

CO1 Graduate will demonstrate an ability to plan and execute a detailed site investigation to select geotechnical design parameters and type of foundation

CO2 Graduate will demonstrate an ability to design shallow foundations, its component or process as per the needs and specifications.

CO3 Graduate will demonstrate an ability to design combined footings and raft foundations, its component or process as per the needs and specifications.

CO4 Graduate will demonstrate an ability to design deep foundations, its component or process as per the needs and specifications.

CO5 Graduate will demonstrate an ability to design retaining walls, its component or process as per the needs and specifications.

TEXTBOOKS:


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**PTCE3405**  
HIGHWAY AND RAILWAY ENGINEERING  
L T P C  
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**COURSE OBJECTIVE:**
- To give an overview about the highway and railway engineering with respect to, planning, design, construction and maintenance as per IRC standards, specifications and methods.

**UNIT I**  
HIGHWAY ENGINEERING  
9
Classification of highways – Institutions for Highway planning, design and construction at different levels – factors influencing highway alignment – Typical cross sections of Urban and Rural roads – Engineering surveys for alignment- Conventional and Modern method

**UNIT II**  
DESIGN OF HIGHWAY ELEMENTS  
9
Cross sectional elements – Horizontal curves, super elevation, transition curves, widening of curves – Sight distances – Vertical curves, gradients– pavement components and their role - Design practice for flexible and rigid pavements (IRC methods only).

**UNIT III**  
HIGHWAY CONSTRUCTION AND MAINTENANCE  
9

**UNIT IV**  
RAILWAY PLANNING AND CONSTRUCTION  
9
Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods-Geometric design of railway, gradient, super elevation, widening of gauge on curves (Problems)-Railway drainage- Level Crossings-Signalling.

**UNIT V**  
RAILWAY TRACK CONSTRUCTION MAINTENANCE AND OPERATION  
9

**TOTAL: 45 PERIODS**
COURSE OUTCOMES
On completion of the course, the student is expected to

CO1 Plan a highway according to the principles and standards adopted in various institutions in India.

CO2 Design the geometric features of road network and components of pavement.

CO3 Test the highway materials and construction practice methods and know its properties and able to perform pavement evaluation and management.

CO4 Understand the methods of route alignment and design elements in railway planning and constructions.

CO5 Understand the construction techniques and maintenance of track laying and railway stations.

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COURSE OBJECTIVE:
• The students will acquire knowledge in estimation, tender practices, contract procedures, and valuation and will be able to prepare estimates, call for tenders and execute works.

UNIT I QUANTITY ESTIMATION
Philosophy – Purpose – Methods of estimation – Centre line method – Long and short wall method – Types of estimates – Approximate estimates – Detailed estimate – Estimation of quantities for buildings, bituminous and cement concrete roads, septic tank, soak pit, retaining walls – Culverts (additional practice in class room using computer softwares- qE Pro)

UNIT II RATE ANALYSIS AND COSTING
Standard Data – Observed Data – Schedule of rates – Market rates – Materials and Labour – Standard Data for Man Hours and Machineries for common civil works – Rate Analysis for all Building works, canals, and Roads – Cost Estimates (additional practice in class room using Computer softwares) – (Analysis of rates for the item of work asked, the data regarding labour, rates of material and rates of labour to be given in the Examination Question Paper)

UNIT III SPECIFICATIONS, REPORTS AND TENDERS

UNIT IV CONTRACTS

UNIT V VALUATION

TOTAL : 45 PERIODS

COURSE OUTCOMES:
The student will be able to
CO1 Gain knowledge on types of contracts.
CO2 Understand types of specifications, principles for report preparation, tender notices types.
CO3 Rate Analysis for all Building works, canals, and Roads and Cost Estimate.
CO4 Estimate the quantities for buildings.
CO5 Evaluate valuation for building and land.

TEXTBOOKS:

REFERENCES:
3. Arbitration and Conciliation Act, 1996
5. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2019
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PTGE3752 TOTAL QUALITY MANAGEMENT

COURSE OBJECTIVES:
- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
- Describe Taguchi’s Quality Loss Function, Performance Measures and apply Techniques like QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION
Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM - Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES

UNIT III TQM TOOLS & TECHNIQUES I

UNIT IV TQM TOOLS & TECHNIQUES II
Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures - Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM

TOTAL: 45 PERIODS
COURSE OUTCOMES:
CO1: Ability to apply TQM concepts in a selected enterprise.
CO2: Ability to apply TQM principles in a selected enterprise.
CO3: Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking and FMEA.
CO4: Ability to understand Taguchi’s Quality Loss Function, Performance Measures and apply QFD, TPM, COQ and BPR.
CO5: Ability to apply QMS and EMS in any organization.

TEXT BOOK:

REFERENCES:

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PTGE3451 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY L T P C 2 0 0 2

COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.
UNIT I ENVIRONMENT AND BIODIVERSITY 6

UNIT II ENVIRONMENTAL POLLUTION 6

UNIT III RENEWABLE SOURCES OF ENERGY 6
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 6
Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols- Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V SUSTAINABILITY PRACTICES 6

TOTAL : 30 PERIODS

COURSE OUTCOMES:
CO1 To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
CO2 To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
CO3 To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
CO4 To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
CO5 To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

TEXTBOOKS:
5. Bradley, A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
REFERENCES

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PTGE3791 HUMAN VALUES AND ETHICS L T P C
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COURSE DESCRIPTION
This course aims to provide a broad understanding about the modern values and ethical principles that have evolved and are enshrined in the Constitution of India with regard to the democratic, secular and scientific aspects. The course is designed for undergraduate students so that they could study, understand and apply these values in their day to day life.

COURSE OBJECTIVES:
- To create awareness about values and ethics enshrined in the Constitution of India
- To sensitize students about the democratic values to be upheld in the modern society.
- To inculcate respect for all people irrespective of their religion or other affiliations.
- To instill the scientific temper in the students’ minds and develop their critical thinking.
- To promote sense of responsibility and understanding of the duties of citizen.

UNIT I DEMOCRATIC VALUES
Reading Text: Excerpts from John Stuart Mills’ On Liberty

UNIT II SECULAR VALUES
Understanding Secular values – Interpretation of secularism in Indian context - Disassociation of state from religion – Acceptance of all faiths – Encouraging non-discriminatory practices.
Reading Text: Excerpt from Secularism in India: Concept and Practice by Ram Puniyani
UNIT III  SCIENTIFIC VALUES

Reading Text: Excerpt from The Scientific Temper by Antony Michaelis

UNIT IV  SOCIAL ETHICS
Application of ethical reasoning to social problems – Gender bias and issues – Gender violence – Social discrimination – Constitutional protection and policies – Inclusive practices.

Reading Text: Excerpt from 21 Lessons for the 21st Century by Yuval Noah Harari

UNIT V  SCIENTIFIC ETHICS
Transparency and Fairness in scientific pursuits – Scientific inventions for the betterment of society - Unfair application of scientific inventions – Role and Responsibility of Scientist in the modern society.


TOTAL: 30 PERIODS

REFERENCES:
4. The Civic Culture: Political Attitudes and Democracy in Five Nations by Gabriel A. Almond and Sidney Verba, Princeton University Press,
5. Research Methodology for Natural Sciences by Soumitro Banerjee, IISc Press, January 2022

COURSE OUTCOMES
Students will be able to
CO1 : Identify the importance of democratic, secular and scientific values in harmonious functioning of social life
CO2 : Practice democratic and scientific values in both their personal and professional life.
CO3 : Find rational solutions to social problems.
CO4 : Behave in an ethical manner in society
CO5 : Practice critical thinking and the pursuit of truth.

COURSE OBJECTIVE:
- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

STRATEGY:
The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

TOTAL: 90 PERIODS
COURSE OUTCOMES:
- On Completion of the project works students will be in a position to take up any challenging practical problems and find solution by formulating proper methodology.

CO1 Identify civil engineering problems reviewing available literature.
CO2 Identify appropriate techniques to analyze complex civil engineering problems.
CO3 Apply engineering and management principles through efficient handling of Project have a clear idea of his/her area of work and they are in a position to carry out the work in a systematic way.

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PTCE3003 PREFABRICATED STRUCTURES

COURSE OBJECTIVE:
- To introduce the basic concepts of prefabrication
- To acquire the knowledge of prefabrication components and systems
- To understand the design principles in prefabrication
- To perceive the types of joints and connections in structural members
- To impart knowledge about the structural stability.

UNIT I INTRODUCTION

UNIT II PREFABRICATED COMPONENTS AND SYSTEMS
Behaviour and types of structural components– roof and floor slabs – Walls panels - Shear walls – Beams - Columns – skeletal system- portal frame system-Large panel systems- block system

UNIT III DESIGN PRINCIPLES
Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems- Design for stripping , stacking ,transportation and erection of elements

UNIT IV JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS
Types of Joints – based on action of forces - compression joints - shear joints - tension joints - based on function - construction joints , contraction joints, expansion joints. Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.

UNIT V DESIGN FOR ABNORMAL LOADS
Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse - case study.

TOTAL: 45 PERIODS
OUTCOMES:
Students will be able to
CO1 Understand concepts about principles of prefabrication, production, transportation, erection.
CO2 Acquire knowledge about panel systems, slabs, beams, shear walls and columns used in precast construction.
CO3 Acquire knowledge about design of cross section, joint flexibility.
CO4 Acquire knowledge about joints and connection in precast construction.
CO5 Acquire knowledge about structural stability.

TEXTBOOKS:
2. Lewitt,M. " Precast Concrete - Materials, Manufacture, Properties And Usage ,CRC Press, 2019

REFERENCES:
2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.

COs- PO's & PSO's MAPPING

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-Low,2-Medium,3-High

PTCE3004 PRESTRESSED CONCRETE STRUCTURES L T P C 3 0 0 3

COURSE OBJECTIVE
- To understand the methods and types of prestressing and to enable the students to design prestressed concrete structural elements and systems

UNIT I INTRODUCTION – THEORY AND BEHAVIOUR 9
Basic principles of prestressing – Classification and types – Advantages over ordinary reinforced concrete – Materials – High strength concrete and high tensile steel – Methods of prestressing – Freyssinet, Magnel, Lee-McCall and Gifford Udall anchorage systems – Analysis of sections of stresses by stress concept, strength concept and load balancing concept – Losses of prestress in post-tensioned and pre-tensioned members.

UNIT II DESIGN FOR FLEXURE AND SHEAR 9
Basic assumptions of flexural design – Permissible stresses in steel and concrete as per I.S.1343 Code – Different Types of sections - Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for flexural capacity based on I.S. 1343 Code – Influence of Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear based on I.S. 1343 Code.
UNIT III  DEFLECTION AND DESIGN OF ANCHORAGE ZONE
Factors influencing deflections – Short-term deflections of uncracked members – Prediction of long-term deflections due to creep and shrinkage – Check for serviceability limit states. Determination of anchorage zone stresses in post-tensioned beams by Magnel’s method, Guyon’s method and I.S. 1343 code – design of anchorage zone reinforcement – Check for transfer bond length in post-tensioned beams– design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT IV  COMPOSITE BEAMS AND CONTINUOUS BEAMS

UNIT V  MISCELLANEOUS STRUCTURES
Role of prestressing in members subjected to Tensile forces and compressive forces – Design of Tension members and Compression members - Design of Tanks, Pipes, Sleepers and Poles – Partial prestressing – methods of achieving partial prestressing, merits and demerits of partial prestressing.

COURSE OUTCOMES:
Students will be able to
CO1 Design a prestressed concrete beam accounting for losses.
CO2 Design for flexure and shear.
CO3 Design the anchorage zone for post-tensioned members and estimate the deflection in beams.
CO4 Design composite members and continuous beams.
CO5 Design water tanks, pipes, poles and sleepers.

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-Low,2-Medium,3-High
COURSE OBJECTIVE

- To understand the behaviour of structures under dynamic, earthquake loading and design the structures as earthquake resistant as per codal provisions.

UNIT I INTRODUCTION TO DYNAMICS

Dynamics - Degree of freedom – Free and forced vibration - Idealization of structure as Single Degree of Freedom (SDOF) and Multi degree of freedom (MDOF) system – D’Alemberts Principles - Formulation of equation of motion for SDOF system and MDOF system — Evaluation of natural frequencies and modes - Effect of damping.

UNIT II SEISMOLOGY


UNIT III EARTHQUAKE EFFECTS ON STRUCTURES


UNIT IV EARTHQUAKE LOAD ANALYSIS

Design spectra – Codal provision – Different methods of earthquake analysis — Analysis of structure by Equivalent static method – Analysis of structure by Response spectrum method – Introduction to time-history method of analysis

UNIT V EARTHQUAKE RESISTANT DESIGN

Philosophy of earthquake resistant design - Planning considerations and Architectural concepts - Design and detailing as per codal provisions - Design and detailing of typical flexural member and column member, Ductile detailing of beam-column joints and footing – Concept and principle of shear wall - Introduction to performance based seismic design - Seismic isolation principles and methods.

COURSE OUTCOMES:

Upon completion of this course, students will be able to:

CO1 Develop the equations of motion for SDOF and MDOF system and to evaluate the natural frequencies and mode shapes.

CO2 Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.

CO3 Explain the behavior of various types of structures under earthquake

CO4 Determine the forces in a structure due to earthquake

CO5 Design earthquake resistant building structures

TEXTBOOKS:


REFERENCES:

Publication of Bureau of Indian Standards:
a. IS 4326: 2013 Earthquake Resistant Design And Construction Of Buildings – Code of Practice
c. IS 13920:2016 Ductile Design And Detailing Of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice.

COs- PO’s & PSO’s MAPPING

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PTCE3010 SUSTAINABLE CONSTRUCTION AND LEAN CONSTRUCTION L T P C 3 0 0 3

COURSE OBJECTIVE:
- To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.

UNIT I INTRODUCTION & MATERIALS USED IN SUSTAINABLE CONSTRUCTION
Introduction and definition of Sustainability - Carbon cycle - role of construction material: concrete and steel, etc. - CO2 contribution from cement and other construction materials - Recycled and manufactured aggregate - Role of QC and durability - Life cycle and sustainability.

UNIT II ENERGY CALCULATIONS
Components of embodied energy - calculation of embodied energy for construction materials - Energy concept and primary energy - Embodied energy via-a-vis operational energy in conditioned building - Life Cycle energy use.

UNIT III GREEN BUILDINGS
Control of energy use in building – National Building Code (NBC), ECBC code, codes in neighboring tropical countries - OTTV concepts and calculations – Features of LEED and TERI – Griha ratings - Role of insulation and thermal properties of construction materials - influence of moisture content and modeling -Performance ratings of green buildings - Zero energy building

UNIT IV CORE CONCEPTS IN LEAN
Introduction to the Course; Lean Overview; Need for Productivity Measurement and improvement; Productivity Measurement System (PMS).
UNIT V LEAN CONSTRUCTION TOOLS AND TECHNIQUES

TOTAL: 45 PERIODS

COURSE OUTCOMES:
- On completion of the course, the student is expected to be able to
  
  CO1 Describe the various sustainable materials used in construction.
  
  CO2 Explain the method of estimating the amount of energy required for building.
  
  CO3 Describe the features of LEED, TERI and GRIHA ratings of buildings.
  
  CO4 Explain the core concepts of lean construction tools and techniques and their importance in achieving better productivity.
  
  CO5 Apply lean tools & techniques to achieve sustainability in construction projects.

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PTCE3012 CONSTRUCTION MANAGEMENT AND SAFETY

COURSE OBJECTIVE
- To study and understand the formulation, costing of construction projects, scheduling and various safety concepts and its requirements applied to construction projects.

UNIT I GENERAL OVERVIEW AND PROJECT ORGANIZATION

UNIT II ESTIMATION OF PROJECT COST & ECONOMICS

UNIT III PLANNING AND SCHEDULING
UNIT IV  SAFETY DURING CONSTRUCTION  6
Basic terminology in safety - types of injuries - safety pyramid - Accident patterns - Planning for safety budget, safety culture - Introduction to OSHA regulations - Site safety programs - Job hazard analysis, accident investigation & accident indices-violation, penalty.

UNIT V  SAFE OPERATING PROCEDURES  6

TOTAL: 30 PERIODS

LAB
Ex 1 Introduction to various construction management software
Ex 2 Planning and creating new project
Ex 3 Scheduling and constraints using PRIMAVERA
Ex 4 Project cost management using PRIMAVERA
Ex 5 Construction project safety management using BIM

TOTAL: 30 PERIODS

COURSE OUTCOMES:
At the end of the course the student will be able to
CO1  Perform formulations of projects.
CO2  Analyze project costing.
CO3  Identify and estimate the activity in the construction.
CO4  Develop the knowledge on accidents and their causes.
CO5  Plan, assess, analyze and manage the construction project sites.

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

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PTCE3014  ENERGY EFFICIENT BUILDINGS  L T P C
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COURSE OBJECTIVE
- To provide an understanding of the concept of energy consumption in buildings and design an energy efficient building
UNIT I  INTRODUCTION

UNIT II  PASSIVE SOLAR HEATING AND COOLING

UNIT III  DAYLIGHTING AND ELECTRICAL LIGHTING

UNIT IV  HEAT CONTROL AND VENTILATION

UNIT V  DESIGN FOR CLIMATIC ZONES

TOTAL: 45 PERIODS

COURSE OUTCOMES
On completion of this course, the student is expected to be able to
CO1 Explain environmental energy supplieson buildings
CO2 Explain the passives of arheating,cooling system
CO3 Discuss the various aspects of day-lighting and electrical lighting in abuilding
CO4 Predict and design building ventilation and heat control for indoor comfort
CO5 Design a building for climatic zone and apply simulation programs of buildings to perform energy alculations

REFERENCES
PTCE3016  GROUND IMPROVEMENT TECHNIQUES  L T P C  3 0 0 3

COURSE OBJECTIVE:
- Students will be exposed to various problems associated with soil deposits and methods to evaluate them. The different techniques will be taught to them to improve the characteristics of difficult soils as well as design techniques required to implement various ground improvement methods.

UNIT I  HYDRAULIC MODIFICATIONS  9
Scope and necessity of ground improvement in Geotechnical engineering basic concepts. Drainage – Ground Water lowering by well points, deep wells, vacuum and electro-osmotic methods. Stabilization by thermal and freezing techniques - Applications.

UNIT II  MECHANICAL MODIFICATIONS  9
Insitu compaction of granular and cohesive soils, Shallow and Deep compaction methods – Sand piles – Concept, design, factors influencing compaction. Blasting and dynamic consolidation design and relative merits of various methods – Soil liquefaction mitigation methods.

UNIT III  PHYSICAL MODIFICATION  9

UNIT IV  MODIFICATION BY INCLUSIONS  9
Reinforcement – Principles and basic mechanism of reinforced earth, simple design: Synthetic and natural fiber based Geotextiles and their applications. Filtration, drainage, separation, erosion control.

UNIT V  CHEMICAL MODIFICATION  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to
CO1 identify and evaluate the deficiencies in the deposits of the given project area and improve its characteristics by hydraulic modifications
CO2 improve the ground characteristics by mechanical modifications using various method and design the system
CO3 improve the ground characteristics by physical modifications using various method and design the system

CO4 improve the characteristics of soils by various reinforcement techniques and design

CO5 Analyse the ground and decide the suitable chemical method for improving its characteristics

REFERENCES:
1. Pappala, A.J., Huang, J., Han, J., and Hoyos, L.R., Ground Improvement and Geosynthetics; Geotechnical special publication No.207, Geo Institute, ASCE, 2010
11. Han, J., Principles and Practice of Ground Improvement, John Wiley and Sons, New Jersey, Canada 2015.

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PTCE3017 SOIL DYNAMICS AND MACHINE FOUNDATIONS L T P C

3 0 0 3

COURSE OBJECTIVE:
- To design different types of machine foundations based on the dynamic properties of soils and to get an exposure on vibration isolation techniques.

UNIT I THEORY OF VIBRATION 9

UNIT II DYNAMIC SOIL PROPERTIES 9
UNIT III  MACHINE FOUNDATIONS

UNIT IV  DESIGN OF MACHINE FOUNDATION

UNIT V  VIBRATION ISOLATION

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to:
CO1 Acquire knowledge to apply theories of vibration to solve dynamic soil problems.
CO2 Evaluate the dynamic properties of soil using laboratory and field tests.
CO3 Acquire basic knowledge about machine foundations and design various types of machine foundation.
CO4 To know and capable of selecting the types of vibration isolation materials.
CO5 To apply vibration isolation techniques for various field problems.

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-Low,2-Medium,3-High
COURSE OBJECTIVES:
- At the end of this course, students are expected to analyse and design rigid, flexible earth retaining structures, slurry supported trenches and deep cuts.

UNIT I  EARTH PRESSURE THEORIES  9
Introduction – State of stress in retained soil mass – Earth pressure theories – Classical and graphical techniques (Culmann's method) – Active and passive cases – Earth pressure due to external loads.

UNIT II  COMPACTION, DRAINAGE AND STABILITY OF RETAINING STRUCTURES  9
Retaining structure – Selection of soil parameters - Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. – Stability analysis of retaining structure both for regular and earthquake forces.

UNIT III  SHEET PILE WALLS  9
Types of sheet piles - Analysis and design of cantilever and anchored sheet pile walls – free earth support method – fixed earth support method. Design of anchor systems - isolated and continuous.

UNIT IV  SUPPORTED EXCAVATIONS  9
Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos – Soil anchors – Soil pinning –Basic design concepts.

UNIT V  SLURRY SUPPORTED EXCAVATION  9
Slurry supported trenches-basic principles-slurry characteristics-specifications-diaphragm walls-bored pile walls-contiguous pile wall-wall-secant piles-stability analysis.

TOTAL: 45 PERIODS

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

CO1 Analyse the earth pressure acting on retaining structures by applying classical theories considering all influencing parameters and suggest the earth pressure to be considered for the design of retaining structures.

CO2 Apply the knowledge of engineering and earth pressure to analyse and design rigid retaining structures considering effect of compaction, wall flexibility, pore water pressure and earth quake forces.

CO3 Apply the knowledge of engineering and earth pressure to analyse and design flexible earth retaining walls and also acquire the knowledge of design of anchors

CO4 Apply the knowledge on lateral earth pressure behind and around excavation to analyse and design braced excavations, slurry supported excavations and underground utilities.

CO5 To understand the role of slurry in supporting excavations and to perform stability analysis by considering the actual shape of slurry support

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**PTCE3020 PILE FOUNDATION**

**COURSE OBJECTIVES:**
- The student will be exposed to the design of piles, pile groups and caissons with respect to vertical and lateral loads for various field conditions.

**UNIT I PILE CLASSIFICATIONS AND LOAD TRANSFER PRINCIPLE**


**UNIT II AXIAL LOAD CAPACITY OF PILES AND PILE GROUPS**

Allowable load of piles and pile groups – Static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae - limitation – Wave equation application – evaluation of axial load capacity from field test results - Settlement of piles and pile group.

**UNIT III LATERAL AND UPLIFT LOAD CAPACITIES OF PILES**

Piles under Lateral loads – Broms method, elastic, p-y curve analyses – Batter piles – response to moment – piles under uplift loads – under reamed piles – Drilled shaft – Lateral and pull out capacity from load test.

**UNIT IV STRUCTURAL DESIGN OF PILE AND PILE GROUPS**

Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- Reinforcement details of pile and pile caps — pile subjected to vibration.
UNIT V  CAISSONS

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to
CO1 Explain the importance of pile foundation and various functions and responsibilities of geotechnical engineer and contractor, in addition to the piling equipments.
CO2 Determine the vertical load carrying capacity of pile and pile group- keeping the settlement of pile as an important criteria based on field practices and codal provisions.
CO3 Apart from vertically loaded piles, the structures are exposed to the peculiar pile subjected to lateral and uplift load with reference to codal provision and case studies.
CO4 Understand the design of pile and pile caps, considering the wind and seismic loads.
CO5 Explain the importance of caisson foundation and checking the stability of caissons based on codal provisions.

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PTCE3021  TUNNELING ENGINEERING  L T P C 3 0 0 3

COURSE OBJECTIVES:
- Students mainly focused in visualizing and critically analyzing the behavior of underground structures with reference to various supporting systems under different loading conditions due to induced earth pressure on the underground structures.
- To give idea about the equipment used in underground excavations
UNIT I  TUNNELS AND UNDERGROUND SPACE APPLICATION 9
History-caves-tunnels for transport-water,power supply-storage of LPG –nuclear waste disposal-
defence facilities-submerged tunnels-underground library,museums.

UNIT II  EXCAVATION TECHNIQUES 9
Types and purpose of tunnels-choice of excavation methods-soft ground tunneling-hardrock
 tunneling-tunnel drilling-blasting-impact hammers-problems encountered and remedial measures.

UNIT III  PLANNING AND GEOMETRIC DESIGN OF TUNNELS 9
Topographical –geological survey-rock sampling-testing-determination of location size shape and
alignment-subsidence problem on soft ground –tunneling design in hard rock.

UNIT IV  CONSTRUCTION OF TUNNEL 9
Advanced drilling techniques –TBM-cuttability assessment-shield tunneling-advantages-types of
shield tunneling-factors affecting selection of shield-twin tunnel-NATM.

UNIT V  DESIGN OF TUNNEL SUPPORTING SYSTEMS AND VENTILATION 9
Classification of supports-active –passive-permanent-temporary-excavation support-steel supports-
lining-grouting-ground freezing-environment in underground-various methods of ventilation.

TOTAL: 45 PERIODS

COURSE OUTCOME:

- On completion of the course, the student is expected to be able to
- CO1 To Understand need of utilization of underground space for various applications.
- CO2 To study various methods of excavations and tunneling methods.
- CO3 Planning and design process of tunnels.
- CO4 To identify the suitable method of tunneling.
- CO5 To study various types of support system and its merit and demerits.

REFERENCES:
1. Underground infrastructure planning design construction- R.K.Goel, Bhavani singh, Jian
Zhao, Butterworth heinemunn publishers.
3. Introduction to tunnel construction, David chapran, Nicole metse and Alfred stark,Spor
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PTCE3028  SMART CITIES  L T P C
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COURSE OBJECTIVE:
- To help the leaners to understand the concepts of smart city and to introduce the students
  about application of technologies in smart cities
UNIT I INTRODUCTION
Urbanisation, need of focused development, role of Authorities, Smart city, Opportunity and Challenges- Smart infrastructures for city- Smart Cities Mission

UNIT II SMART PHYSICAL INFRASTRUCTURE
Infrastructure development in Smart Cities - Physical Infrastructure, Land Use - Compact/mixed-use development, Transit oriented development (TOD); Smart City Management-Transportation Unified governance structure (UMTA). Smart public transportation, Smart parking, Intelligent traffic management, Detour management; Low emission vehicles, Electric Mobility - Environmental projects etc

UNIT III SUSTAINABILITY AND SMART PLANNING
Relationship Between Sustainability and Smart planning - Place making project guidelines- Surveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services;

UNIT IV APPLICATION OF TECHNOLOGIES IN SMART CITIES
Role of Technologies in Smart Cities - Integrated Command and Control Center (ICCC), Data Analytics, Data driven strategies implementation in smart cities

UNIT V SMART CITIES PROJECT MANAGEMENT
Need for project management, Philosophy and concepts; Project phasing and stages; Project organizational structuring: Planning and Scheduling: Project cost analysis; Procurement and Contracting: PPP: Project Monitoring and Evaluation: Risk Management; Case studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1 Understand the basics of Urbanisation and the role of smart cities.
CO2 Gain knowledge on implementation of smart physical infrastructure.
CO3 Understand the role of smart planning for sustainable development.
CO4 Comprehend the knowledge of Technologies in Smart City planning
CO5 Reviewing the case studies of smart city projects.

REFERENCES
1. P Sharma , “Sustainable Smart cities in India, Challenges and Future Perspectives”, Springer Link, 2017
2. Sameer Sharma,“Smart Cities Unbounded- Ideas and Practice of Smart Cities in India”, Bloomsbury India, 2018.
3. Binti Singh, ManojParmar, “Smart City in India Urban Laboratory, Paradigm or Trajectory? Routledge India,2019
5. https://smartnet.niua.org/learn/library

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COURSE OBJECTIVE:

- To learn the fundamentals of ITS.
- To study the ITS functional areas
- To have an overview of ITS implementation in developing countries

UNIT I INTRODUCTION TO ITS

UNIT II DATA COLLECTION THROUGH ITS
Sensors & its application in traffic data collection - Elements of Vehicle Location and Route Navigation and Guidance concepts - ITS Data collection techniques – vehicle Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, RFID, video data collection, Internet of Things (IOT)

UNIT III ITS IN TRAFFIC MANAGEMENT
ITS User Needs and Services and Functional areas –Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS)- Autonomous Vehicles- Autonomous Intersections

UNIT IV ITS IN TRANSPORTATION PLANNING
ITS and safety, ITS and security- Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations – public transportation applications- Weight–in Motion

UNIT V ITS APPLICATION IN LOGISTICS
Commercial vehicle operations and intermodal freight-Fleet Management- IT application in freight logistics-E commerce

COURSE OUTCOMES
CO1 Understand the fundamentals of ITS and its benefits.
CO2 Gain knowledge on data collection using sensors and its applications.
CO3 Acquainted with the knowledge of ITS in Traffic Management
CO4 Application of ITS in Transportation Planning
CO5 Able to gain knowledge on application of ITS in Logistics

TEXT BOOKS:

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**PTCE3030**

**PAVEMENT ENGINEERING**

**L T P C**

| 3003 |

**COURSE OBJECTIVE:**

- Student gains knowledge on various IRC guidelines for designing rigid and flexible pavements. Further, the student will be in a position to assess quality and serviceability conditions of roads.

**UNIT I**

**PAVEMENT MATERIALS AND SUBGRADE ANALYSIS**


**UNIT II**

**DESIGN OF FLEXIBLE PAVEMENTS**


**UNIT III**

**DESIGN OF RIGID PAVEMENTS**

Cement concrete pavements Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India.

**UNIT IV**

**PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE**


**UNIT V**

**STABILIZATION OF PAVEMENTS**


**TOTAL:** 45 PERIODS

**COURSE OUTCOMES**

- **CO1** Get knowledge about types of rigid and flexible pavements.
- **CO2** Able to design of rigid pavements
- **CO3** Able to design of flexible pavements.
- **CO4** Determine the causes of distress in rigid and flexible pavements.
- **CO5** Understand stabilization of pavements, testing and field control.
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PTCE3032 CLIMATE CHANGE ADAPTATION AND MITIGATION

COURSE OBJECTIVE:
- To impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students

UNIT I INTRODUCTION

UNIT II ELEMENTS RELATED TO CLIMATE CHANGE

UNIT III IMPACTS OF CLIMATE CHANGE
Effects of Climate Changes on living things – health effects, malnutrition, human migration, socioeconomic impacts- tourism, industry and business, vulnerability assessment- infrastructure, population and sector – Agriculture, forestry, human health, coastal areas

UNIT IV MITIGATING CLIMATE CHANGE
UNIT V ALTERNATE FUELS AND RENEWABLE ENERGY


TOTAL: 45 PERIODS

COURSE OUTCOMES

The students completing the course will have

CO1 an insight into carbon cycle, physical basis of the natural greenhouse effect, including the meaning of the term radiative forcing, climate change, global warming and measures to adapt and to mitigate the impacts of climate change

CO2 understanding on the growing scientific consensus established through the IPCC as well as the complexities and uncertainties

CO3 ability to plan climate change mitigation and adaptation projects including the use of alternate fuels and renewable energy

CO4 Gain in-depth knowledge on climate models

CO5 Post process the model outputs for climate impact assessment, know about adaptation strategies

TEXTBOOKS:

REFERENCES:
2. Thomas E, Lovejoy and Lee Hannah “Climate Change and Biodiversity”, TERI Publishers, 2005

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PTCCE333 ENVIRONMENTAL IMPACT ASSESSMENT

COURSE OBJECTIVES:
- To expose the students to the need, methodology, documentation and usefulness of environmental impact assessment and to develop the skill to prepare environmental management plan.
- To participate in the performance of an environmental assessment process (EIA or SEA), given the disciplinary knowledge and skills in natural sciences and engineering the student have achieved in other courses.
UNIT I  INTRODUCTION  9

UNIT II  IMPACT IDENTIFICATION AND PREDICTION  10

UNIT III  SOCIO-ECONOMIC IMPACT ASSESSMENT  8
Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements. factors and methodologies- individual and family level impacts. communities in transition-rehabilitation

UNIT IV  EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN  9
Environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project audit – documentation of EIA findings – ethical and quality aspects of environmental impact assessment

UNIT V  CASE STUDIES  9
Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to
CO1 carry out scoping and screening of developmental projects for environmental and social assessments
CO2 explain different methodologies for environmental impact prediction and assessment
CO3 assess socio-economic investigation of the environment in a project
CO4 plan environmental impact assessments and environmental management plans
CO5 knowledge to prepare environmental impact assessment reports for various projects

REFERENCES:
3. World Bank –Source book on EIA
PTCE3033 SOLID AND HAZARDOUS WASTE MANAGEMENT

COURSE OBJECTIVE

- To impart knowledge and skills relevant to minimization, storage, collection, transport, recycling, processing and disposal of solid and hazardous wastes including the related regulations, engineering principles, design criteria, methods and equipment.

UNIT I WASTE CLASSIFICATION AND REGULATORY REQUIREMENTS

SOURCES and types of solid and hazardous wastes - need for solid and hazardous waste management – salient features of latest Indian legislations on management and handling of solid wastes, hazardous wastes, biomedical wastes, electronic wastes, construction and demolition wastes, plastics and discarded lead acid batteries – elements of integrated waste management and roles of stakeholders - seven elements and seven step approach to integrated solid waste management planning.

UNIT II WASTE CHARACTERIZATION SOURCE REDUCTION AND RECYCLING


UNIT III WASTE COLLECTION TRANSPORT AND MATERIAL RECOVERY

Door to door collection of segregated solid wastes - analysis of hauled container and stationery container collection systems - compatibility, storage, labeling and handling of hazardous wastes – principles and design of transfer and transport facilities - hazardous waste transport and manifests - mechanical processing and material separation technologies – Size reduction – size separation - density separation - magenic separation – compaction – principles and design of material recovery facilities – physico chemical treatment of hazardous wastes - solidification and stabilization – case studies on waste collection and material recovery

UNIT IV BIOLOGICAL AND THERMAL PROCESSING OF WASTES

Biological and thermos-chemical conversion technologies – composting – biomethanation – incineration – pyrolysis- plasma arc gasification –principles and design of biological and thermal treatment facilities - MSW processes to energy with high-value products and specialty By-products - operation of facilities and environmental controls - treatment of biomedical wastes – case studies and emerging waste processing technologies.

UNIT V WASTE DISPOSAL

Sanitary and secure landfills - components and configuration– site selection - liner and cover systems - geo synthetic clay liners and geo membranes - design of sanitary landfills and secure
landfills, leachate collection, treatment and landfill gas management – landfill construction and operational controls - landfill closure and environmental monitoring – landfill bioreactors – rehabilitation of open dumps and biomining of dumpsites-remediation of contaminated sites- Case studies

**TOTAL: 45 PERIODS**

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

**CO1** Explain the various functional elements of solid and hazardous waste management including the associated legal, health, safety, and cultural issues as well as responsibilities of different stakeholders

**CO2** Apply the knowledge of science and engineering fundamentals to characterize different types of solid and hazardous wastes, assess the factors affecting variation and assess performance of waste treatment and disposal systems

**CO3** Design of systems and processes to meet specified needs of waste minimization, storage, collection, transport, recycling, processing and disposal.

**CO4** Select appropriate methods for processing and disposal of solid and hazardous wastes, taking into account the impact of the solutions in a sustainability context

**CO5** Conduct research pertinent to solid and hazardous waste management and communicate effectively to different stakeholders as well as engage in independent lifelong learning

**REFERENCES:**

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COURSE OBJECTIVES:

- The course will analyze the legislative and judicial responses to environmental problems and the administrative system of environment related laws such as air, water, land, and hazardous substances etc. Environment advocacy and approaches for using litigation in environment protection will receive special attention.

UNIT I  INTRODUCTION TO ENVIRONMENTAL LEGISLATIONS AND INTERNATIONAL SCENARIO  9

UNIT II  INDIAN CONSTITUTIONS AND ENVIRONMENTAL PROTECTION  9
Indian Constitution and Environmental Protection - Constitutional provisions concerning Environment Articles 14, 15, (2) (b) 19 (e), 21, 31, 32, 38, 39, 42, 47, 48-A, 49, 51, 51-A: Indian Environmental Policy 2006 Administrative machinery for pollution control Common Law & Criminal Law - Nuisance, Negligence, Strict liability and Absolute liability, Provisions of IPC relating to environmental problems (public nuisance u/s 268 and others (Sections 269, 270, 277, 284, 285, 286, 425 to 440) Section 133 of Cr.P.C.

UNIT III  REMEDIES FOR ENVIRONMENTAL POLLUTION  9

UNIT IV  MAJOR INDIAN LEGISLATIONS  9

UNIT V  ENVIRONMENT AND DEVELOPMENT CASE LAWS  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Understand origins and sources of environmental laws, and understand how and by whom environmental laws are made and interpreted.

CO2 Understand the key principles of, and actors within, environmental laws.

CO3 Understand the National Environmental Policy and Various Legislations enacted in line with Policy.

CO4 Critically analyze environmental laws within various contexts and to evaluate laws against procedural and substantive criteria.

CO5 Understand and the Legal system operating in India and will be in a position to prepare compliance reports for getting environmental clearance.
REFERENCES
1. Leelakrishnan P., Environmental Law in India, Butterworths, 1998

**COs- PO’s & PSO’s MAPPING**

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**PTCE3036 GROUNDWATER ENGINEERING**

**COURSE OBJECTIVE:**
- The objective of this course is enable the student to understand the principles of Groundwater governing Equations, Characteristics of different aquifers and techniques of groundwater model development and management.

**UNIT I HYDROGEOLOGICAL PARAMETERS**

**UNIT II WELL HYDRAULICS**

**UNIT III GROUNDWATER MANAGEMENT**

**UNIT IV GROUNDWATER QUALITY**
- Ground water chemistry - Origin, movement and quality - Water quality standards – Drinking water Industrial water – Irrigation water - Groundwater Pollution and legislation - Environmental Regulatory requirements

**UNIT V GROUNDWATER CONSERVATION**
- Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) – Aquifer Storage and Recovery (ASR) Seawater Intrusion and Remediation – Ground water Basin management and Conjunctive use – Protection zone delineation, Contamination source inventory and remediation schemes

**TOTAL: 45 PERIODS**
COURSE OUTCOMES:
On completion of the course, the student is expected to be able to:

CO1 Define the groundwater system basic, types of aquifers, aquifer parameters, movement and its potential for confined and unconfined aquifers

CO2 Apply the knowledge of groundwater flow in steady and unsteady flow characteristics of well hydraulics

CO3 Explain the concept of groundwater model development and data base management for groundwater management

CO4 Describe the importance of artificial recharge and groundwater quality concepts

CO5 Apply the creative and innovative technique on conservation of groundwater

TEXTBOOKS

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PTCE3037 WATER RESOURCES SYSTEMS ENGINEERING

COURSE OBJECTIVE:
- To introduce the student to the concept of Mathematical approaches for managing the water resources system and apply to operate a water resource system optimally.

UNITI SYSTEM APPROACH
Definition, classification, and characteristics of systems - Philosophy of modelling – Goals and Objectives – Basics of system analysis concept – steps in systems engineering.

UNITII LINEAR PROGRAMMING
Introduction to Operation research - Linear programming Problem Formulation-graphical solution Simplex method – Sensitivity analysis - application to operation of single purpose reservoir

UNITIII DYNAMIC PROGRAMMING
Bellman’s optimality criteria, problem formulation and solutions – Water Allocation for three state (user), Forward and Backward Recursion techniques in Dynamic Programming - Shortest pipe line route problem - Application to reservoirs capacity expansion
UNITIV SIMULATION
Basic principles and concepts – Monte Carlo techniques – Model development – Inputs and outputs – Single and multipurpose reservoir simulation models – Deterministic simulation – Rule Curve development for reservoir

UNITIV ADVANCED OPTIMIZATION TECHNIQUES
Integer and parametric linear programming – Goal programming types – Applications to reservoir release optimization – Application of evolutionary algorithms like Genetic algorithm, Particle swarm, Simulated Annealing to reservoir release optimization

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On completion of the course, the student is expected to be able to:
CO1 Define the economic aspects and analysis of water resources systems for comprehensive and integrated planning of a water resources project.
CO2 Apply the concept of linear programming for optimisation of water resources problems.
CO3 Explain the concept of dynamic programming and apply in water resource system.
CO4 Develop the simulation model based on deterministic and stochastic simulation for reservoir operating policy.
CO5 Apply advance optimisation techniques like goal programming, heuristic algorithm in the field of water resources planning and management.

TEXT BOOKS

REFERENCES:

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PTCE3038 WATERSHED CONSERVATION AND MANAGEMENT

COURSE OBJECTIVES:
• To provide the technical and sociological understanding of a watershed.
• To provide a comprehensive discourse on the engineering practices of watershed management for realizing the higher benefits.
UNIT I  WATERSHED CONCEPTS  9
Watershed – Definition, Need and Elements – Principles - Influencing Factors: Geology – Soil –
Morphological Characteristics - Toposheet - Delineation – Codification – Prioritization – Watershed
Atlas.

UNIT II  SOIL CONSERVATION MEASURES  9
Types of Erosion – Water and Wind Erosion: Causes, Factors, Effects and Management – Soil
Conservation Measures: Agronomical and Mechanical – Design of Terraces and Bunds - Estimation
of Soil Loss – USLE Equation - Sedimentation.

UNIT III  WATER HARVESTING AND CONSERVATION  9
Yield from a Catchment - Traditional Water Harvesting Techniques – Micro-Catchments - Design of
Small Water Harvesting Structures: Farm Ponds, Percolation Tanks, Check dams, Grassted
Waterways.

UNIT IV  GIS FOR WATERSHED MANAGEMENT  9
Applications of Remote Sensing and Geographical Information System - Role of Decision Support
System – Conceptual Models and Case Studies.

UNIT V  WATERSHED MANAGEMENT  9
Project Proposal Formulation - Watershed Development Plan – Entry Point Activities – Watershed
Approach in Government Programmes – People’s Participation – Evaluation of Watershed

TOTAL: 45 PERIODS

COURSE OUTCOME :

• On Completion of the course the student is expected to

  CO1 Recognize and Interpret the morphological features of a watershed.

  CO2 State, design and sketch the soil conservation structures.

  CO3 Describe the micro catchment and apply the concepts to design the small water harvesting
     structures.

  CO4 Illustrate the application of modern tools and technology in the management of watershed.

  CO5 Classify the management activities and to develop an integrated watershed development
     plan.

TEXTBOOKS:

1. Ghanashyam Das, Hydrology and Soil Conservation Engineering, Prentice Hall of India
2. Suresh, R. Soil and Water Conservation Engineering, Standard Publishers and Distributors

REFERENCES:

1. Glenn O Schwab. etal, Soil and Water Conservation engineering, Wiley India Private Limited,
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PTCE3039 INTEGRATED WATER RESOURCES MANAGEMENT L T P C 3 0 0 3

COURSE OBJECTIVE

- Students will be introduced to the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory settings.

UNIT I CONTEXT FOR IWRM

- Water as a global issue: Key challenges – Definition of IWRM within the broader context of development – Key elements of IWRM - Principles – Paradigm shift in water management - Complexity of the IWRM process – UN World Water Assessment - SDGs.

UNIT II WATER ECONOMICS

- Economic view of water issues: Economic characteristics of water good and services – Non-market monetary valuation – Water economic instruments – Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies.

UNIT III LEGAL AND REGULATORY SETTINGS


UNIT IV WATER AND HEALTH WITHIN THE IWRM CONTEXT

- Links between water and health: Options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases - Health impact assessment of water resources development projects – Case studies.

UNIT V AGRICULTURE IN THE CONCEPT OF IWRM

- Water for food production: ‘blue’ versus ‘green’ water debate – Water foot print - Virtual water trade for achieving global water and food security - Climate Smart Agriculture - Current water pricing policy– Scope to rethink pricing.

TOTAL: 45 PERIODS

COURSE OUTCOMES

On completion of the course, the student is expected to

CO1 Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.

CO2 Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.
CO3 Apply law and governance in the context of IWRM.
CO4 Discuss the linkages between water-health; develop a HIA framework.
CO5 Analyse how the virtual water concept pave way to alternate policy options.

TEXTBOOKS:

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-Low,2-Medium,3-High