TKR COLLEGE OF ENGINEERING & TECHNOLOGY
AN AUTONOMOUS INSTITUTION
Accredited by NBA and NAAC with A+ Grade.
(Sponsored by TKR Educational Society, Approved by AICTE, Affiliated to JNTU H)
Medbowli, Meerpet, Balapur, Hyderabad, Telangana – 500 097
Phone: 9100377790. email: info@tkrcet.ac.in. web site: www.tkrcet.ac.in

B.TECH-CIVIL ENGINEERING
R25 - DETAILED SYLLABUS

SEMESTER III

S.No.	Course Classification	Course Code	Name of the subject	L	T	P	C	CIE	SEE	Total Marks
1	BS	5BS3AA	Probability and Statistics	3	0	0	3	40	60	100
2	PC	5PC3AB	Building Planning and Construction	3	0	0	3	40	60	100
3	PC	5PC3AC	Strength of Materials	3	0	0	3	40	60	100
4	PC	5PC3AD	Surveying and Geomatics	3	0	0	3	40	60	100
5	PC	5PC3AE	Fluid Mechanics	3	0	0	3	40	60	100
6	BS	5BS311	Computational Mathematics Lab	0	0	2	1	40	60	100
7	PC	5PC312	Strength of Materials Lab	0	0	2	1	40	60	100
8	PC	5PC313	Surveying & Geomatics Lab	0	0	2	1	40	60	100
9	SD	5SD314	Design Thinking and Tinkering Lab	0	0	2	1	40	60	100
10	VAC (MC)	5MC315	Environmental Science	1	0	0	1	40	60	100
		Total		**16**	**0**	**8**	**20**	**400**	**600**	**1000**

SEMESTER IV

S.No.	Course Class.	Course Code	Name of the subject	L	T	P	C	CIE	SEE	Total Marks
1	PC	5PC4AA	Advanced Strength of Materials	3	0	0	3	40	60	100
2	PC	5PC4AB	Environmental Engineering	3	0	0	3	40	60	100
3	PC	5PC4AC	Hydraulics & Hydraulic Machinery	3	0	0	3	40	60	100
4	PC	5PC4AD	Structural Analysis-I	3	0	0	3	40	60	100
5	PC	5PC4AE	Concrete Technology	3	0	0	3	40	60	100
6	PC	5PC411	Concrete Technology Lab	0	0	2	1	40	60	100
7	PC	5PC412	Hydraulics & Hydraulic Machinery Lab	0	0	2	1	40	60	100
8	PC	5PC413	Environmental Engineering Lab	0	0	2	1	40	60	100
9	SD	5SD414	Digital Surveying Lab	0	0	2	1	40	60	100
10	PW	5PW415	Field Based Project/ Internship	0	0	4	2	40	60	100
		Total		**15**	**0**	**12**	**21**	**400**	**600**	**1000**

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PROBABILITY AND STATISTICS - 5BS3AA

B.Tech III Semester

L	T	P	C
3	0	0	3

Pre-requisites: Mathematics courses of first year of study.

COURSE OBJECTIVES: To learn

1. Understand the concepts of random variables and probability distributions for discrete and continuous cases.
2. Learn continuous probability distributions and sampling theory to support statistical analysis.
3. Understand estimation techniques to determine population parameters from sample data.
4. Learn hypothesis testing methods for means, proportions, and variances in large and small samples.
5. Understand and apply curve fitting, correlation, and regression techniques for statistical modeling.

COURSE OUTCOMES:
After learning the contents of this paper, the student must be able to:

1. Apply the concepts of random variables and probability distributions to compute and interpret mean and variance for discrete and continuous cases.
2. Apply continuous probability distributions and sampling distributions to analyze data and draw statistical inferences.
3. Apply estimation methods to determine population parameters for means, proportions, and variances using sample data.
4. Analyze and conduct hypothesis tests for means, proportions, and variances using appropriate large and small sample techniques.
5. Analyze data using curve fitting, correlation, and regression methods to model relationships and predict outcomes.

UNIT-I: Random Variables and Probability Distributions **8 L**

Concept of a Random Variable – Discrete Probability Distributions – Continuous Probability Distributions – Mean of a Random Variable – Variance of a Random Variable

Discrete Probability Distributions: Binomial Distribution – Poisson distribution.

UNIT-II: Continuous Distributions and Sampling **10 L**

Uniform Distribution – Normal Distribution – Areas under the Normal Curve – Applications of the Normal Distribution – Normal Approximation to the Binomial Distributions.

Fundamental Sampling Distributions: Random Sampling – Some Important Statistics – Sampling Distributions – Sampling Distribution of Means – Central Limit Theorem.

UNIT-III: Estimation **10 L**

Introduction – Statistical Inference – Classical Methods of Estimation – Single Sample: Estimating the mean – Standard error of a point Estimate. Two samples: Estimating the difference between two means – Single sample: Estimating a proportion – Two samples: Estimating the difference between two proportions – Two samples: Estimating the ratio of two variances.

UNIT-IV: Tests of Hypotheses (Large and Small Samples) **10 L**

Statistical Hypotheses: General Concepts – Testing a Statistical Hypothesis. Single sample: Tests concerning a single mean. Two samples: Tests on two mean (Unknown for equal variance). One sample: Test on a single proportion. Two samples: Tests on two proportions. Two-sample tests concerning variances: F-test, Chi-square test.

UNIT-V: Applied Statistics **10 L**

Curve fitting by the method of least squares – Fitting of straight lines – Second degree parabolas and more general curves. Correlation and Regression – Rank correlation.

TEXT BOOKS:

1. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.
2. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications.

REFERENCE BOOKS:

1. T.T. Soong, Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons, Ltd, 2004.
2. Sheldon M Ross, Probability and Statistics for Engineers and Scientists, Academic Press.

BUILDING PLANNING AND CONSTRUCTION - 5PC3AB

B.Tech III Semester

L	T	P	C
3	0	0	3

COURSE OBJECTIVES: This course is expected to enable the student to:

1. Provide fundamental knowledge about buildings and the influence of climate, orientation, and landscaping on building planning and design.
2. Impart understanding of planning principles
3. Familiarize students with the National Building Code (NBC), its structure and guidelines for residential buildings
4. Develop knowledge of key building components
5. Introduce various finishing works and temporary structures

COURSE OUTCOMES: Upon completion of this course, student should be able to

1. Understand the classification of buildings, criteria for site selection, the impact of climate on building design, and the role of orientation and landscaping in planning.
2. Apply the principles of planning and interpret building bye-laws to design functionally efficient, economical, and regulation-compliant buildings.
3. Interpret and implement provisions of the National Building Code (NBC) related to residential buildings and understand basic construction techniques including foundations and masonry.
4. Identify and analyze various types of floors, roofs, staircases, doors, windows, and lintels used in building construction and their suitability for different design conditions.
5. Demonstrate knowledge of finishing works such as plastering, pointing, and floor finishes, and explain the types, design, and safety aspects of scaffolding, formwork, and centering.

UNIT - I

Fundamentals of Buildings: Building, Classification of buildings, Site selection for Residential buildings, Climate and its influence on building planning; Elements of Climate, Climatic Zone of India, Climate and comfort, Earth and its motion, Directions and their characteristics, Landscaping.

Orientation of buildings: Orientation, Factors affecting orientation, Sun, Wind, Rain, CBRT suggestions orientation criteria for Indian conditions.

UNIT - II

Principles of planning and Bye Laws of buildings: Aspects, prospect, Privacy, Furniture Requirements, Roominess, Grouping, Circulation, Elegance, Economy, Practical consideration.

Buildings bye Laws: Introduction, Objective, Principles, Applicability of building bye Laws. Introduction to National Building Code, Objectives, Scope, Structure of NBC. General Building Requirements, Guidelines for Residential Buildings. Building Heights, Setbacks,

FAR/FSI. Open Spaces, room sizes, Lighting and Ventilation, Means of Access and service ducts. Classification of buildings for fire safety.

UNIT - III

Introduction to building construction and site preparation; components of Building, **Foundations:** Functions & Requirements,

Types of Shallow Foundations: isolated footings, combined footings, strap footings, wall footings, raft foundations.

Types of Deep Foundations: driven piles (timber, precast concrete, steel), bored cast-in-situ piles. Brick masonry – types – bonds; Stone masonry – types.

UNIT - IV

Floors, Roofs, Stairs, Doors, Windows: Types of floors – Ground and upper floors – Brick flooring, Cement concrete flooring, Stone flooring, Tiled flooring, Types of roofs – Flat, Pitched, Sloped, Curved roofs Components and classification of staircases – Straight flight, Dog-legged, Open well, Spiral staircases –Types of doors – Panelled, Flush, Glass, PVC, Aluminum, Steel, Sliding, Revolving, Collapsible, and Rolling shutter doors – Door frame materials and fittings. Types of windows.

UNIT - V

Finishing Works: Plastering – Purpose, types, tools and techniques – Defects in plastering. Pointing – Types and application areas – Differences between plastering and pointing.

Scaffolding, Formwork, and Centering: Scaffolding – Definition, purpose, components – Types: Single, Double, Cantilever, Suspended, Trestle, Steel and patented scaffolds – Safety considerations. Formwork – Functions, materials (timber, steel, aluminum, plastic), formwork for slabs, beams, columns, and walls – Centering: Definition and role in arches and domes.

TEXT BOOKS:

1. Benny Raphael (2022) Building Automation from Concepts to Implementation Routledge Publications.
2. Kumara Swamy N. and Kaneswaran Rao A., Building Planning and Drawing, Charotar Publishing House, Revised Edition, 2020.
3. B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, Building Construction, Laxmi Publications, 11th Edition, 2022.
4. S.S. Bhavikatti, Building Materials and Construction, Vikas Publishing House, 4th Edition, 2020.

REFERENCE BOOKS:

1. Sushil Kumar, Building Construction, Standard Publishers Distributors, 21st Edition, 2022.
2. Bindu Balan and R. Sathish Kumar, Climatology and Building Design, McGraw Hill Education, 1st Edition, 2020.

3. Gurcharan Singh, Building Planning, Designing and Scheduling, Standard Book House, 6th Edition, 2019.
4. Rangwala S.C., Building Construction, Charotar Publishing House, 33rd Edition, 2021.
5. M. Chakraborti, Building Planning and Drawing, Chakraborti Publications, 9th Edition, 2021.
6. Bureau of Indian Standards, National Building Code of India (NBC) – 2016, SP 7, Part 1 & 2, Reprint 2021.

STRENGTH OF MATERIALS - 5PC3AC

B.Tech III Semester

L	T	P	C
3	0	0	3

Pre-Requisites: Engineering Mechanics

COURSE OBJECTIVES: The objective of this course is to

1. Understand the nature of stresses developed in simple geometries such as bars, cantilevers and beams for various types of simple loads.
2. Calculate the elastic deformation occurring in simple members for different types of loading.
3. Show the plane stress transformation with a particular coordinate system for different orientation of the plane.
4. Know different failure theories adopted in designing of structural members.

COURSE OUTCOME: On completion of the course, the student will be able to:

1. Explain the concepts of stress, strain, and material elasticity, and interpret stress-strain diagrams for different materials.
2. Analyze and solve problems related to bars of varying section, composite bars, and calculate stresses and strains under axial loading, temperature change, and external forces.
3. Construct shear force and bending moment diagrams for various beam types and loading scenarios, and apply relationships between loading, shear force, and bending moment.
4. Determine flexural and shear stresses in beams, and evaluate the slope and deflection of beams using appropriate analytical methods.
5. Evaluate stresses and deformations in thin and thick cylindrical or spherical shells, and apply Lame's theory for the design of pressure vessels subjected to internal pressure.

UNIT – I

Simple Stresses and Strains: Concept of stress and strain- St. Venant's Principle-Stress and Strain Diagram – Elasticity and plasticity – Types of stresses and Strains – Hooke's law – stress-strain diagram for mild steel – Working stress – Factor of Safety – lateral strain, Poisson's ratio and volumetric strain – Pure shear and Complementary Shear – Elastic Moduli, Elastic constants and the relationship between them – Bars of varying section – composite bars – Temperature stresses.

Strain Energy: Resilience – gradual, sudden, and impact loadings – simple applications.

UNIT – II

Shear Force and Bending Moment: Types of beams – Concept of shear force and bending moment – S. F and B.M diagrams for cantilever, simply supported including overhanging beams subjected to point loads, uniformly distributed load, uniformly varying load, couple and combination of these loads – Point of contra flexure – Relation between S.F., B.M and rate of loading at a section of a beam.

UNIT – III

Flexural Stresses: Theory of simple bending – Assumptions – Derivation of bending equation- Section Modulus Determination of flexural/bending stresses of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses: Derivation of formula for shear stress distribution – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle and channel sections.

UNIT – IV

Deflection of Beams: Slope, deflection and radius of curvature – Differential equation for the elastic line of a beam – Double integration and Macaulay's methods–Determination of slope and deflection for cantilever and simply supported beams subjected to point loads, U.D.L, uniformly varying load and Couple – Mohr's theorems – Moment area method – Application to simple cases.

UNIT – V

Thin Cylinders: Thin seamless cylindrical shells – derivation of formula for longitudinal and circumferential stresses – hoop, longitudinal and volumetric strains – changes in diameter, and volume of thin cylinders – Thin spherical shells.

Thick Cylinders: Introduction – Lame's theory for thick cylinders – derivation of Lame's formulae – distribution of hoop and radial stresses across thickness – design of thick cylinders – compound cylinders – necessary difference of radii for shrinkage.

TEXT BOOKS:

1. Strength of Materials by B. Raghu Kumar, BS Publications.
2. Strength of Materials by B.S. Basavarajaiah and P. Mahadevappa, 3rd Edition, Universities Press.
3. Strength of Materials by R. K Rajput, S. Chand & Company Ltd.
4. Strength of Materials by R. Subramanian, Oxford University Press.

REFERENCE BOOKS:

1. Mechanics of Materials by R.C. Hibbeler, Prentice Hall publications
2. Engineering Mechanics of Solids by Egor P. Popov, Prentice Hall publications
3. Strength of Materials by T.D. Gunneswara Rao and M. Andal, Cambridge Publishers
4. Strength of Materials by R.K. Bansal, Lakshmi Publications House Pvt. Ltd.

SURVEYING AND GEOMATICS - 5PC3AD

B.Tech III Semester

L	T	P	C
3	0	0	3

COURSE OBJECTIVES: The objective of this course is to

1. Understand the fundamentals, objectives, principles, and classifications of surveying, along with necessary instruments.
2. Apply methods for measuring distances, angles, and directions using conventional and modern instruments.
3. Conduct levelling and contouring operations to determine elevations and prepare topographical maps.
4. Compute areas and volumes for engineering applications such as earthworks and reservoir studies.
5. Perform traversing and curve setting using theodolite, tachometry, Total Station, and GPS for precise data collection.

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

1. Classify and describe types and phases of surveying, including use of conventional symbols and scales.
2. Measure distances and directions using chains, tapes, compasses, EDM, and apply necessary corrections.
3. Perform levelling and contouring, and compute elevations by HI and Rise & Fall methods.
4. Calculate areas, volumes, earthwork, and reservoir capacities using standard methods and instruments.
5. Apply theodolite, tachometry, Total Station, and GPS for advanced survey tasks, including traverse and curve setting, while comparing modern and traditional methods.

UNIT – I

Introduction and Basic Concepts: Introduction, Objectives, classification and principles of surveying, Scales, Shrinkage of Map, Conventional symbols and Code of Signals, Surveying accessories, phases of surveying.

Measurement of Distances and Directions

Linear distances: Approximate methods, Direct Methods – chains, tapes, ranging, tape corrections, indirect methods – optical methods – E.D.M. method.

Prismatic Compass: Bearings, included angles, Local Attraction, Magnetic Declination and dip.

UNIT – II

Levelling and Contouring

Leveling: Basics definitions, types of levels and levelling staves, temporary adjustments,

methods of levelling, bookings and Determination of levels – HI Method, Rise and fall method, Effect of Curvature of Earth and Refraction.

Contouring: Characteristics and uses of Contours, Direct & Indirect methods of contour surveying, interpolation and sketching of Contours.

Computation of Areas and Volumes:

Areas: Determination of areas consisting of irregular boundary and regular boundary (coordinates, MDM, DMD methods), Planimeter.

Volumes: Computation of areas for level section and two-level sections with and without transverse slopes, determination of volume of earth work in cutting and embankments, volume of borrow pits, capacity of reservoirs.

UNIT – III

Theodolite Surveying: Types of Theodolites, Fundamental Lines, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical levelling when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations and adjustments, Gale's traverse table, Omitted measurements.

UNIT – IV

Tachometric Surveying: Principles of Tachometry, stadia and tangential methods of Tachometry.

Curves: Types of curves and their necessity, elements of simple curve, setting out of simple Curves.

UNIT – V

Modern Surveying Methods: Total Station and Global Positioning System: Basic principles, classifications, applications, comparison with conventional surveying. Electromagnetic wave theory – electromagnetic distance measuring system-principle of working and EDM instruments, Components of GPS – space segment, control segment and user segment, reference systems, satellite orbits, GPS observations. Applications of GPS.

TEXT BOOKS:

1. Surveying with Geomatics and R First Edition (2022) by Marcelo de Carvalho Alves, Luciana Sanchez.
2. Surveying and leveling by R. Subramanian, Oxford university press, New Delhi.
3. Chandra A M, "Higher Surveying", New age International Pvt. Ltd. Publishers, New Delhi, 2002.
4. Hoffman. B, H. Lichtenegga and J. Collins, Global Positioning System - Theory and Practice, Springer - Verlag Publishers, 2001.

REFERENCE BOOKS:

1. Arthur R Benton and Philip J Taety, Elements of Plane Surveying, McGraw-Hill, 2000.
2. Arora K R "Surveying Vol 1,2&3, Standard Book House, Delhi, 2004.
3. Surveying (Vol–1, 2&3), by B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.
4. Chandra A M, "Plane Surveying", New Age International Pvt. Ltd., New Delhi, 2002.
5. Surveying by Bhavikatti; Vikas publishing house ltd.
6. Duggal S K, "Surveying (Vol-1&2), Tata Mc Graw Hill Publishing Co. Ltd. New Delhi, 2004.
7. Surveying and leveling by R. Agor Khanna Publishers 2015.

FLUID MECHANICS - 5PC3AE

B.Tech III Semester

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. Introduce the fundamental concepts and importance of fluid mechanics in civil engineering applications.
2. Explain the principles of fluid statics, kinematics, and dynamics relevant to engineering problems.
3. Apply the laws of conservation of mass, energy, and momentum to analyze fluid flow systems.
4. Develop analytical skills to solve practical civil engineering problems involving fluid behavior.
5. Build a strong foundation for advanced courses in hydraulics, hydraulic machinery, and hydrology.

COURSE OUTCOMES: Upon completion of this course, students should be able to

1. Explain the fundamental properties of fluids and apply principles of fluid statics to determine pressure distribution and hydrostatic forces on various surfaces.
2. Analyze fluid kinematics and dynamics using continuity, Euler's, Bernoulli's, and momentum equations for ideal and real fluid flows.
3. Apply flow measurement principles through devices such as venturi meters, orifice meters, and weirs, and calculate forces exerted by fluid flow on pipe systems.
4. Evaluate flow through pipes considering major and minor losses, energy gradients, and apply numerical methods like the Hardy Cross method for pipe network analysis.
5. Distinguish between laminar and turbulent flows, interpret boundary layer concepts, and assess drag, lift, and flow separation for engineering applications.

UNIT – I

Properties of Fluid: Distinction between a fluid and a solid; Properties of fluids – Viscosity, Newton law of viscosity; vapour pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

Fluid Statics: Fluid Pressure: Pressure at a point, Pascal's law, Hydrostatic law, Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micro manometers. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces.

UNIT – II

Fluid Kinematics: Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; One, two- and three-dimensional flows;

Streamline, path line, streak line and stream tube; stream function, velocity potential function, flow net, One, two- and three-dimensional Continuity equations in Cartesian coordinates applications.

Fluid Dynamics: Surface and Body forces -Euler's and Bernoulli's equation; Momentum equation. Correction factors. Bernoulli's equation to real fluid flows.

UNIT – III

Flow Measurement in Pipes: Practical applications of Bernoulli's equation: venturi meter, orifice meter and pitot tube, applications of Momentum equations; Forces exerted by fluid flow on pipe bend, sudden enlargement in pipes.

Flow Over Notches & Weirs: Flow through rectangular; triangular and trapezoidal notches and weirs; End contractions; Velocity of approach. Broad crested weir.

UNIT – IV

Flow through Pipes: Reynolds experiment, Reynolds number, Loss of head through pipes, Darcy- Weisbach equation, minor losses, total energy line, hydraulic grade line, Pipes in series, equivalent pipes, pipes in parallel, siphon, branching of pipes, three reservoir problem, power transmission through pipes. Analysis of pipe networks: Hardy Cross method and EPANET, water hammer in pipes and control measures.

UNIT – V

Laminar & Turbulent Flow: Laminar flow through circular pipes, and fixed parallel plates.

Boundary Layer Concepts: Prandtl contribution, Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness concepts of laminar and turbulent boundary layers on a flat plate; laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control. Drag and Lift and types of drag, Magnus effect.

TEXT BOOKS:

1. Theory and Applications of Fluid Mechanics, K. Subramanian, Tata McGraw Hill
2. Fluid Mechanics by Modi and Seth, Standard Book House.
3. Fluid Mechanics by Streator.
4. Fluid Mechanics by R.C. Hibbeler, Pearson India Education Services Pvt. Ltd.

REFERENCE BOOKS:

1. Fluid Mechanics – Frank M. White – 8th Edition – McGraw-Hill Education.
2. Introduction to Fluid Mechanics and Fluid Machines by S K Som, Gautam Biswas, Suman Chakraborty, Mc Graw Hill Education (India) Private Limited
3. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
4. Fluid Mechanics & Hydraulic Machines, Domkundwar & Domkundwar Dhanpat Rai & Company.
5. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publication Pvt. Ltd.

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COMPUTATIONAL MATHEMATICS LAB - 5BS311
(Using Python/MATLAB software)

B.Tech III Semester

L	T	P	C
0	0	2	1

Pre-requisites: Matrices, Iterative methods and ordinary differential equations

COURSE OBJECTIVES: Upon completion of this course, students should be able to

1. Solve problems of Eigen values and Eigen Vectors using Python/MATLAB.
2. Solution of Algebraic and Transcendental Equations using Python/MATLAB
3. Solve problems of Linear system of equations
4. Solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients.

COURSE OUTCOMES: After learning the contents, the student must be able to

1. Develop the code to find the Eigen values and Eigen Vectors using Python/MATLAB.
2. Develop the code find solution of Algebraic and Transcendental Equations and Linear system of equations using Python/MATLAB
3. Write the code to solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients.

VISUALIZE ALL SOLUTIONS GRAPHICALLY THROUGH PROGRAMMES

UNIT-I: Eigen values and Eigen vectors: **6P**

Programs:

- Finding real and complex Eigen values.
- Finding Eigen vectors.

UNIT-II: Solution of Algebraic and Transcendental Equations **6P**

Bisection method, Newton Raphson Method

Programs:

- Root of a given equation using Bisection method.
- Root of a given equation Newton Raphson Method.

UNIT-III: Linear system of equations: **6P**

Jacobi's iteration method and Gauss-Seidal iteration method

Programs:

- Solution of given system of linear equations using Jacobi's method
- Solution of given system of linear equations using Gauss-Seidal method

UNIT-IV: First-Order ODEs **8P**

Exact and non-exact equations, Applications: exponential growth/decay,

Newton's law of cooling.

Programs:

- Solving exact and non-exact equations
- Solving exponential growth/decay and Newton's law of cooling problems

UNIT-V: Higher order linear differential equations with constant coefficients 6P

Programs:

- Solving homogeneous ODEs
- Solving non-homogeneous ODEs

TEXT BOOKS:

1. MATLAB and its Applications in Engineering, Rajkumar Basal, Ashok Kumar Geo, Manoj Kumar Sharma, Pearson publication.
2. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
3. Think Python First Edition, by Allen B. Downey, Orielly publishing.
4. Introduction to Python Programming, William Mitchell, Povel Solin, Martin Novak et al., NC Lab Public Computing, 2012.
5. Introduction to Python Programming, ©Jacob Fredslund, 2007.

REFERENCE BOOKS:

1. An Introduction to Python, John C. Lusth, the University of Alabama, 2011.
2. Introduction to Python, ©Dave Kuhlman, 2008.

STRENGTH OF MATERIALS LAB - 5PC312

B.Tech III Semester

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

1. Conduct the Tension test, Compression test on various materials
2. Conduct the Shear test, Bending test on determinate beams
3. Conduct the Compression test on spring and Hardness test using various machines
4. Conduct the Torsion test, Impact test on various materials.

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

1. Perform standard tests to determine mechanical properties of materials under different loading conditions.
2. Analyze structural elements like beams, springs, and continuous members for deflection and strength.
3. Evaluate material behavior in tension, compression, bending, torsion, shear, hardness, and impact.
4. Verify theoretical principles such as Maxwell's Reciprocal theorem through experimental observation.
5. Apply modern instrumentation (strain gauges, testing machines) for accurate stress–strain measurement.

LIST OF EXPERIMENTS:

1. Tension test
2. Bending test on (Steel/Wood) Cantilever beam.
3. Bending test on simple support beam.
4. Torsion test
5. Hardness test
6. Spring test
7. Compression test on concrete.
8. Impact test
9. Shear test
10. Verification of Maxwell's Reciprocal theorem on beams.
11. Use of electrical resistance strain gauges.
12. Continuous beam – deflection test.

REFERENCE BOOKS:

1. Material Testing Laboratory Manual by CB. Kukreja, K. Kishore, Ravi Chawala, Standard Publishers Distributors.

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SURVEYING & GEOMATICS LAB - 5PC313

B.Tech III Semester

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

1. Learn and understand the various basic concept and principles used in surveying like Chain Surveying, Compass Surveying, Plane Table Surveying, and Levelling Surveying.
2. Learn and understand about theodolite and total station in surveying.
3. Learn and understand how to calculate Area of plot and Ground.
4. Learn and understand about Horizontal Angle, Vertical Angle, Horizontal distance and Vertical distance to study the ground profile using total station.

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

1. Apply surveying instruments – Demonstrate accurate measurement of angles, distances, and elevations using theodolite and total station.
2. Compute field data – Process traverse observations, areas, and coordinates using methods like Gale's table and software tools.
3. Analyze inaccessible points – Determine distances and elevations through trigonometric, tacheometric, and missing line principles.
4. Design and set out works – Execute practical tasks such as stake-out, curve setting, profiling, and contouring for civil engineering projects.
5. Integrate modern technology – Utilize total station and DGPS for advanced surveying applications, enhancing precision and efficiency

CYCLE-I: THEODOLITE SURVEYING

a) Measurement of horizontal angles and vertical angles.
b) Distance between two inaccessible points.
c) Measurement of area by theodolite traversing (Gales traverse table).
d) Determination of tachometer constants.
e) Distance between two inaccessible points using the principles of tachometer surveying.
f) Distance between two inaccessible points using the principles of trigonometric surveying.

CYCLE-II: TOTAL STATION

a) Area Measurement
b) Stake Out
c) Remote Elevation Measurement
d) Missing Line Measurement
e) Longitudinal & Cross Section Profile
f) Contouring
g) Providing a Simple Circular Curve
h) Demonstration using DGPS

REFERENCE BOOKS:

1. Elements of Plane Surveying by Arthur R Benton and Philip J Taety, McGraw Hill.
2. Plane Surveying by Chandra A. M, New Age International Pvt. Ltd., New Delhi.
3. Surveying by Bhavikatti, Vikas Publishing House Ltd.
4. Surveying and Levelling by R. Subramanian, Oxford University Press, New Delhi.
5. Global Positioning System Theory and Practice by B. Hoffman, H. Lichtenegga & J. Collins, Springer - Verlag Publications
6. Surveying (Vol - 1, 2 & 3) by Arora K R, Standard Book House, New Delhi.
7. Advanced Surveying by Madhu & Gobi, Pearson India.

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DESIGN THINKING AND TINKERING LAB - 5SD314

B.Tech III Semester

L	T	P	C
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COURSE OBJECTIVES:

1. Introduce the principles and stages of design thinking, creativity, and user-centered innovation.
2. Develop the ability to identify problems and generate effective solutions through iterative and collaborative methods.
3. Encourage empathy-driven and human-centered approaches to solving design and engineering challenges.
4. Build skills in ideation, brainstorming, rapid prototyping, teamwork, and communication for innovative outcomes.
5. Foster critical reflection and systems thinking for addressing complex and real-world design problems.

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

1. Apply the stages of design thinking-empathize, define, ideate, prototype, and test - to address real-world challenges.
2. Analyze user needs using empathy-based research methods to inform effective and human-centered solutions.
3. Create innovative ideas and prototypes through collaborative ideation, systems thinking, and rapid experimentation.
4. Evaluate and refine design outcomes based on feedback, testing, and reflective analysis of team experiences.
5. Communicate and present design concepts persuasively to diverse audiences, demonstrating teamwork and problem-solving skills.

STUDENTS' RESPONSIBILITIES:

1. Forming diverse teams of 3–5 members each to work collaboratively throughout the semester.
2. Proactively engaging to observe the objects and interactions in their daily life and society from a design perspective.
3. Identifying general societal and social problems that may be effectively addressed using design thinking principles.
4. Presenting and reporting the tasks to the concerned faculty members using their creative communication and people skills.

ACTIVITIES:

1. Introduction and briefing (15 minutes)
2. Ice-breaker activity (20 minutes)
3. Introduction to Design Thinking (20 minutes)

4. Building empathy for the user (1 hour)
5. Define a problem statement (1 hour)
6. Ideation part 1: Generate ideas and potential solutions (1 hour) Presentation (5 minutes): What is ideation? Activity – worst possible idea (10 minutes) Activity – coming up with solutions (10 minutes) Activity – sharing ideas and getting feedback (10 minutes) Activity – refining your solution (10 minutes) Reflection and discussion (5 minutes)
7. Ideation part 2: User journey mapping (1 hour) Presentation (10 minutes): What is a user journey map? Activity – define the activities and steps in the customer's experience (15 minutes) Activity – group the steps into phases (10 minutes) Activity – adding goals and pain – points (15 minutes) Sharing user journey maps, reflection and discussion (10 minutes)
8. Prototype and test ideas (1 hour) Presentation (5 minutes): Activity – create mobile screens (15 minutes) Activity – add functionality to mobile screens (15 minutes) Activity – user testing (15 minutes) Activity – decide on a winning approach (10 minutes)
9. Debrief and outline next steps (15 minutes)

EXERCISES:

1. The Pin-Up Exercise
2. The Systems Thinking Exercise
3. The 48-Hour Crash Course Exercise
4. The Design with Empathy Exercise
5. The Tinker Toy Exercise
6. The Wallet Exercise
7. The Pitch Competition Exercise
8. "Yes, but" vs. "Yes, and" exercise
9. "Five whys" or "Nine Whys" exercise
10. The "Six Thinking Hats" exercise

TEXT BOOKS:

1. Kumandari Ranga Chari (2024) Applied Design Thinking for Problem Solving - A Tool Kit for Business Practitioners and Managers, BS Publications.
2. Tim Brown, "Change by Design", Harper Business, 2012 (ISBN: 978-0062337382).
3. Donald A. Norman, "The Design of Everyday Things", MIT Press, 2013 (ISBN: 978-0262525671).
4. Daniel Ling, "Complete Design Thinking Guide for Successful Professionals", Create Space Independent Publishing, 2015 (ISBN: 978-1514202739).
5. Design Thinking: A guide to creative problem solving for everyone, Andrew Pressman, Routledge Taylor and Francis group, 2019, 1st edition.
6. Engineering Design, George E. Dieter, Linda C. Schmidt, McGraw-Hill Education, 2019, 5th edition.
7. Product design and development, Ulrich, K., Eppinger, S. and Yang, M., 2020, 7th edition.

REFERENCE BOOKS:

1. Bruno Munari, "Design as Art", Penguin UK, 2009 (ISBN: 978-0141035819).
2. Tom Kelly, Jonathan Littman, "The Art of Innovation", HarperCollins Business, 2002 (ISBN: 978- 0007102938).
3. Thomas Lockwood, "Design Thinking: Integrating Innovation, Customer Experience, and Brand Value", Allworth Press, 2009 (ISBN: 978-1581156683).
4. Joost Groot Kromelink, "Responsible Innovation: Ethics, Safety and Technology", 2nd ed., TU Delft, Faculty of Technology, Policy and Management, 2019 (e-Book ISBN: 978-9463662024).
5. Jimmy Jain, "Design Thinking for Startups: A Handbook for Readers and Workbook for Practitioners", Notion Press, 2018 (ISBN: 978-1642495034).

Other Suggested Readings:

1. https://www.arvindguptatoys.com/
2. https://honeybee.org/
3. https://dschool.stanford.edu/resources/getting-started-with-design-thinking
4. https://designthinking.ideo.com/

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ENVIRONMENTAL SCIENCE - 5MC315

B.Tech III Semester

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1	0	0	1

COURSE OBJECTIVES: This Course provides elaborate analysis effect on environment and the ecosystem due to human interferences. The topics covered in this course are Biodiversity; Environmental Pollution; Natural Resources; Social Issues; Human Population and the Environment. At the end of the course, the student would be able to assess the various issues in the environment and engineer the solutions with regard to human activities.

COURSE OUTCOMES:

1. Explain the structure, function, and importance of ecosystems, and analyze energy flow, ecological interactions, and bio-geochemical cycles influencing environmental balance.
2. Identify and evaluate the sustainable utilization of natural resources including water, minerals, forests, and energy sources, emphasizing environmental impacts and conservation needs.
3. Assess biodiversity at genetic, species, and ecosystem levels, recognize threats to biodiversity, and apply conservation methods in alignment with the National Biodiversity Act.
4. Analyze different types of pollution and adopt appropriate environmental control technologies and management practices to mitigate global challenges such as climate change and ozone depletion.
5. Interpret environmental legislation, policies, and the Environmental Impact Assessment (EIA) process for effective environmental planning, risk assessment, and sustainable development.

UNIT – I

Ecosystems: Definition, Scope, and Importance of Ecosystem. Classification, Structure, and Function of an Ecosystem, Food Chains, Food Webs, and Ecological Pyramids. Flow of Energy, Bio-geochemical Cycles, Bio-accumulation, Bio-Magnification, Ecosystem Value, Services and Carrying Capacity.

UNIT – II

Natural Resources: Classification of Resources: Living and Non-Living Resources, Water Resources: Use and Over Utilization of Surface and Ground Water, Floods and Droughts, Dams: Benefits and Problems. Mineral Resources: Use and Exploitation, Environmental Effects of Extracting and Using Mineral Resources, Land Resources: Forest Resources, Energy Resources: Growing Energy Needs, Renewable and Non-Renewable Energy Sources, Use of Alternate Energy Source, Case Studies.

UNIT – III

Biodiversity and Biotic Resources: Introduction, Definition, Genetic, Species and Ecosystem Diversity. Value of Biodiversity; Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Optional Values. India as a Mega Diversity Nation, Hot Spots of Biodiversity. Threats to Biodiversity: Habitat Loss, Poaching of Wildlife, Man – Wildlife Conflicts; Conservation of Biodiversity: In-Situ and Ex-Situ Conservation. National Bio-Diversity Act.

UNIT – IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of Pollution, Air Pollution: Primary and Secondary Pollutants, Automobile and Industrial Pollution, Ambient Air Quality Standards. Water Pollution: Sources and Types of Pollution, Drinking Water Quality Standards.

Soil Pollution: Sources and Types, Impacts of Modern Agriculture, Degradation of Soil.

Noise Pollution: Sources and Health Hazards, Standards,

Solid Waste: Municipal Solid waste Management, Composition and Characteristics of E-waste and Its Management.

Pollution Control Technologies: wastewater Treatment Methods: Primary, Secondary and Tertiary. Overview of Air Pollution Control Technologies, Concepts of Bio-remediation. Global Environmental Issues and Global Efforts: Climate Change and Impacts on Human Environment. Ozone Depletion and Ozone Depleting Substances (ODS). Deforestation and Desertification.

UNIT – V

Environmental Policy, Legislation & EIA: Environmental Protection Act, Legal Aspects Air Act–1981, Water Act, forest Act, Wild Life Act, Municipal Solid waste Management and Handling Rules, Biomedical waste Management and Handling Rules, Hazardous waste Management and Handling Rules.

EIA: EIA Structure, Methods of Baseline Data Acquisition. Overview on impacts of Air, Water, Biological and Socio-Economic Aspects. Strategies for Risk Assessment, Concepts of Environmental Management Plan (EMP).

TEXT BOOKS:

1. Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, 2nd Edition, Pearson Education.
2. Benny Joseph, ‘Environmental Science and Engineering’, Tata McGraw Hill Publishing Co. Pvt. Ltd., New Delhi.
3. Textbook of Environmental Studies for Under Graduate Courses by Erach Bharucha for University Grants Commission.
4. Environmental Studies by R. Rajagopalan, Oxford University Press, New Delhi.

REFERENCE BOOKS:

1. Environmental Science: towards a Sustainable Future by Richard T. Wright. 2008, PHI Learning Private Ltd. New Delhi.
2. Environmental Engineering and Science by Gilbert M. Masters and Wendell P. Ela., PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley India Edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New Age.
5. Text Book of Environmental Science and Technology - Dr. M. Anji Reddy, BS Publications.
6. Introduction to Environmental Science by Y. Anjaneyulu, BS Publications.

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ADVANCED STRENGTH OF MATERIALS - 5PC4AA

B.Tech IV Semester

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Pre-Requisites: Strength of Materials

COURSE OBJECTIVES: The objective of this course is

1. To understand the nature of stresses developed in simple geometries shafts, springs, columns & cylindrical and spherical shells for various types of simple loads.
2. To calculate the stability and elastic deformation occurring in various simple geometries for different types of loading.
3. To understand the unsymmetrical bending and shear center importance for equilibrium conditions in a structural member of having different axis of symmetry.

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

1. Analyze and determine principal stresses, normal and tangential stresses under various loading conditions using analytical and graphical methods including Mohr's circle.
2. Evaluate structural safety through the application of different theories of failure such as maximum stress, strain, and energy-based criteria.
3. Apply torsion theory to design and analyze circular shafts and helical springs under combined loading conditions.
4. Calculate stresses and assess stability in structural elements such as columns, struts, dams, retaining walls, and chimneys under combined loading and bending conditions.
5. Examine and compute stresses due to unsymmetrical bending and locate the shear center for various structural sections.

UNIT – I

Principal Stresses: Introduction – Stresses on an oblique plane of a bar under axial loading – compound stresses – Normal and tangential stresses on an inclined plane for biaxial stresses – Two perpendicular normal stresses accompanied by a state of simple shear – Principal stresses – Mohr's circle of stresses – ellipse of Stress – Analytical and graphical solutions.

Theories of Failure: Introduction – Various theories of Failure – Maximum Principal Stress theory, Maximum Principal Strain Theory, Maximum shear stress Theory-Strain Energy and Shear Strain Energy Theory (VonMises Theory).

UNIT – II

Torsion of Circular Shafts: Theory of pure torsion – Derivation of Torsion Equation-Assumptions made in the theory of pure torsion – Polar section modulus – Power transmitted by shafts – Combined bending and torsion – Design of shafts according to theories of failure.

Springs: Introduction – Types of springs – deflection of close and open coiled helical springs under axial pull and axial couple – springs in series and parallel.

UNIT – III

Direct and Bending Stresses: Stresses under the combined action of direct loading and bending moment, core of a section – determination of stresses in the case of retaining walls, chimneys and dams – conditions for stability – Overturning and sliding – stresses due to direct loading and bending moment about both axes.

UNIT – IV

Columns and Struts: Introduction – types of columns – short, medium and long columns – Axially loaded compression members – Crushing load – Euler's theorem for long columns – assumptions- derivation of Euler's critical load formulae for various end conditions – Equivalent length of a column – slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Long columns subjected to eccentric loading – Secant formula – Empirical formulae – Rankine – Gordon formula – Straight line formula – Prof. Perry's formula.

UNIT – V

Unsymmetrical Bending: Introduction – Centroidal principal axes of section – Moments of inertia referred to any set of rectangular axes – Stresses in beams subjected to unsymmetrical bending – Principal axes – Resolution of bending moment into two rectangular axes through the centroid – location of neutral axis.

Shear Centre: Introduction – Shear center for symmetrical and unsymmetrical (channel, I, T and L) sections.

TEXT BOOKS:

1. Mechanics of Materials by Dr.B.C. Punmia, Dr. Ashok Kumar Jain and Dr. Arun Kumar Jain.
2. Strength of Materials by R. Subramanian, Oxford University Press.

REFERENCE BOOKS:

1. Mechanics of Materials by R.C. Hibbeler, Pearson Education
2. Engineering Mechanics of Solids by Popov E.P. Prentice-Hall Ltd
3. Strength of Materials by T.D. Gunneswara Rao and M. Andal, Cambridge Publishers
4. Strength of Materials by R.K. Bansal, Lakshmi Publications House Pvt. Ltd.
5. Fundamentals of Solid Mechanics by M.L. Gambhir, PHI Learning Pvt. Ltd.

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ENVIRONMENTAL ENGINEERING - 5PC4AB

B.Tech IV Semester

L	T	P	C
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COURSE OBJECTIVES:

1. To get knowledge of water sources, water treatment, design of distribution systems.
2. To understand various water & waste water treatments and their safe disposal methods.
3. To design various water and waste water treatment units.

COURSE OUTCOMES: The students completing the course will

1. Identify and analyze sources of water supply, water demands, and quality parameters, and apply standards for designing intake and distribution systems.
2. Apply principles of sedimentation, coagulation, filtration, and disinfection in the design and operation of water treatment units.
3. Examine the characteristics of sewage and design sewer systems, plumbing layouts, and appurtenances for efficient wastewater collection and disposal.
4. Design and evaluate primary and secondary wastewater treatment processes including sedimentation, biological treatment, sludge digestion, and septic systems.
5. Analyze air and noise pollution sources, effects, and control techniques, and evaluate their environmental impacts at local and global scales.

UNIT – I

Introduction: Waterborne Diseases – Protected Water Supply – Population Forecasts, Design Period – Types of Water Demand – Factors Affecting – Fluctuations – Fire Demand – Water Quality and Testing – Drinking Water Standards: Sources of Water – Comparison from Quality and Quantity and other Considerations – Intakes – Infiltration Galleries.
Sources: Surface and Subsurface Sources – Suitability with regard to Quality and Quantity.

UNIT – II

Layout and General Outline of Water Treatment Units – Sedimentation – Principles – Design Factors – Coagulation – Flocculation Clarifier Design – Coagulants – Feeding Arrangements. Filtration – Theory – Working of Slow and Rapid Gravity Filters – Multimedia Filters – Design of Filters – Troubles in Operation – Comparison of Filters – Disinfection – Theory of Chlorination, Chlorine Demand – other Disinfection Practices – Design of Distribution Systems – Pipe Appurtenances.

UNIT – III

Characteristics of Sewage – Wastewater Collection – Estimation of Wastewater and Storm Water Decomposition of Sewage, Examination of Sewage – B.O.D. Equation – C.O.D. Design of Sewers –Shapes and Materials – Sewer Appurtenances, Manholes – Inverted Siphon – Catch Basins – Flushing Tanks – Ejectors, Pumps and Pump Houses – House Drainage – Plumbing Requirements – Sanitary Fittings – Traps – One Pipe and Two Pipe

Systems of Plumbing – Ultimate Disposal of Sewage – Sewage Farming – Self-Purification of Rivers.

UNIT – IV

Wastewater Treatment Plant – Flow Diagram – Primary Treatment Design of Screens – Grit Chambers – Skimming Tanks – Sedimentation Tanks – Principles of Design – Biological Treatment Trickling Filters – ASP – Construction and Design of Oxidation Ponds. Sludge Digestion – Design of Digestion Tank – Sludge Disposal by Drying – Septic Tanks – Working Principles and Design – Soak Pits – Wet Land Management.

UNIT – V

Air Pollution – Classification of Air Pollution – Effects Air Pollution – Global Effects – Meteorological Parameters Affecting Air Pollution – Atmospheric Stability – Plume Behavior – Control of Particulates – Gravity Settlers, Cyclone Filters, ESPs – Control of Gaseous Pollutants, Automobile Pollution and Control. Global Effects of Air Pollution – Green House Effect, Heat Islands, Acid Rains, Ozone Holes.

Noise Pollution: Causes and effects of noise pollution – Measurement of noise pollution – standard values.

TEXT BOOKS:

1. Water Supply and Sanitary Engineering by G.S. Birdie, Dhanpat Rai Publications (P) Ltd.
2. Environmental Engineering Vol – I and II by BC Punmia, Standard Publications.
3. Water Supply Engineering by S.K. Garg, Khanna Publishers.
4. Environmental Engineering Vol – I by S.K.Garg, Khanna Publishers.

REFERENCE BOOKS:

1. Water Supply Engineering Vol – I & II by P.N. Modi, Standard Book House, New Delhi.
2. Water Supply Engineering by B.C. Punmia, Ashok K Jain and Arun K Jain, Laxmi Publications Pvt. Ltd.
3. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi.
4. Water Works Engineering Planning – Design and Operation by Syed R. Qasim and Edward M. Motley Guang Zhu, Prentice Hall (India), New Delhi.
5. Environmental Engineering by H.S Peavy, D. R. Rowe, G. Tchobanoglous, McGraw Hill.
6. Water and Waste Water Technology by Mark J Hammar and Mark J. Hammar Jr.Wiley.
7. Environmental Pollution and Control Engineering by CS Rao, Wiley Publications.
8. Environmental Engineering by P. Venugopal Rao, Prentice Hall (India).

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HYDRAULICS & HYDRAULIC MACHINERY - 5PC4AC

B.Tech IV Semester

L	T	P	C
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COURSE OBJECTIVES:

1. Define the fundamental principles of water conveyance in open channels.
2. Discuss and analyze the open channels in uniform and Non–uniform flow conditions.
3. Study the characteristics of hydroelectric power plant and its components.
4. Analyze and design of hydraulic machinery and its modeling.

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

1. Differentiate open channel flow from pipe flow, analyze uniform and critical flows, and compute normal and critical depths using empirical formulae and energy principles.
2. Apply dynamic equations to analyze gradually and rapidly varied flows, classify surface profiles, and evaluate hydraulic jumps and energy dissipation mechanisms.
3. Utilize dimensional analysis and similitude principles through Rayleigh's and Buckingham's π methods to model and analyze fluid flow problems.
4. Examine the construction, working principles, efficiencies, and performance characteristics of hydraulic turbines, including Pelton, Francis, and Kaplan types.
5. Analyze and evaluate the performance of centrifugal pumps, their classifications, efficiencies, specific speed, and operating conditions for practical engineering applications.

UNIT – I

Open Channel Flow-I: Introduction to Open channel flow – Comparison between open channel flow and pipe flow, Classification of open channel flows, Velocity distribution. Uniform flow – Characteristics of uniform flow, Chezy's, Manning's and Bazin formulae for uniform flow – Factors affecting Manning's Roughness Coefficient. Most economical sections. Computation of Uniform flow, Normal depth.

Critical Flow: Specific energy – critical depth – computation of critical depth – critical, sub critical and super critical Flows – Channel transitions (Theory only).

UNIT – II

Open Channel Flow–II: Non-uniform flow – Gradually Varied Flow – Dynamic equation for G.V.F; Classification of channel bottom slopes – Classification and characteristics of Surface profiles – Computation of water surface profiles by Numerical and Analytical approaches. Direct step method.

Rapidly varied flow: Elements and characteristics (Length and Height) of Hydraulic jump in rectangular channel – Types, applications and location of hydraulic jump, Energy dissipation and other uses.

UNIT – III

Dimensional Analysis and Hydraulic Similitude: Dimensional homogeneity – Rayleigh's method and Buckingham's π methods – dimensionless groups. Similitude, Model studies, Types of models. Application of dimensional analysis and model studies to fluid flow problems.

Basics of Turbo Machinery: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, Jet striking centrally and at tip, Velocity triangles at inlet and outlet, expressions for work done and efficiency.

UNIT – IV

Hydraulic Turbines – I: Elements of a typical Hydropower installation – Heads and efficiencies – Classification of turbines – Pelton wheel – Francis turbine – Kaplan turbine – working, working proportions, velocity diagram, work done and efficiency, hydraulic design. Draft tube – Classification, functions and efficiency.

Hydraulic Turbines–II: Governing of turbines – Surge tanks – Unit and specific turbines – Unit speed – Unit quantity – Unit power – Specific speed – Performance characteristics – Geometric similarity – Cavitation. Selection of turbines.

UNIT – V

Centrifugal Pumps: Pump installation details – classification – work done – Manometric head – minimum starting speed – losses and efficiencies – specific speed. Multistage pumps – pumps in series, parallel – performance of pumps – characteristic curves – NPSH – Cavitation.

TEXT BOOKS:

1. Fluid Mechanics by Modi and Seth, Standard Book House.
2. Fluid Mechanics and Hydraulic machines by Manish Kumar Goyal, PHI learning Private Limited, 2015
3. Fluid Mechanic & Fluid Power Engineering by D. S. Kumar (Kataria & Sons Publications Pvt. Ltd.)

REFERENCE BOOKS:

1. Fluid Mechanics by R.C. Hibbeler, Pearson India Education Services Pvt. Ltd.
2. Introduction to Fluid Mechanics and Fluid Machines by S K Som, Gautam Biswas, Suman Chakraborty, Mc Graw Hill Education (India) Private Limited.
3. Hydraulic Machines by Banga & Sharma (Khanna Publishers).
4. Open channel flow by V.T. Chow (McGraw Hill Book Company).

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STRUCTURAL ANALYSIS – I - 5PC4AD

B.Tech IV Semester

L	T	P	C
3	0	0	3

Prerequisites: Strength of Materials.

COURSE OBJECTIVES:

1. Explain the fundamental difference between statically determinate and indeterminate structures based on equilibrium and compatibility.
2. Understand the stress behavior and internal force distribution in perfect frames and three-hinged arches under various loading conditions.
3. Analyze the structural response of statically indeterminate members such as fixed and continuous beams subjected to different loadings.
4. Apply energy principles and theorems to formulate equations for solving structural analysis problems.
5. Evaluate the effects of static and moving loads on beams using the concept of influence lines.

COURSE OUTCOMES: Upon completion of this course, students should be able to

1. Analyze determinate pin-jointed plane frames using methods such as joints, sections, and tension coefficient under different loading conditions.
2. Apply energy theorems and unit load methods to compute deflections in beams and frames, and evaluate internal forces in three-hinged arches.
3. Determine static and kinematic indeterminacies of beams and analyze propped cantilever and fixed beams subjected to various types of loads.
4. Apply the theorem of three moments and slope deflection method to analyze continuous beams and portal frames, including effects of support sinking and sway.
5. Evaluate shear forces and bending moments in beams under moving loads using influence line diagrams to determine critical load positions and responses.

UNIT – I

Analysis of Perfect Frames: Types of frames – Perfect, Imperfect and Redundant pin jointed plane frames – Analysis of determinate pin jointed plane frames using method of joints, method of sections and tension coefficient method for vertical loads, horizontal loads and inclined loads.

UNIT – II

Energy Theorems: Introduction – Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces – Castigliano's Theorem – Unit Load Method – Deflections of simple beams and pin- jointed plane frames – Deflections of statically determinate bent frames.

Three Hinged Arches – Introduction – Types of Arches – Comparison between Three hinged and Two hinged Arches – Linear Arch - Eddy's theorem – Analysis of Three hinged arches – Normal Thrust and radial shear and bending moment – Geometrical properties of

parabolic and circular arches – Three hinged parabolic circular arches having supports at different levels.

UNIT - III

Propped Cantilever and Fixed Beams: Determination of static and kinematic indeterminacies for beams – Analysis of Propped cantilever and fixed beams, including the beams with different moments of inertia – subjected to uniformly distributed load – point loads – uniformly varying load, couple and combination of loads – Shear force, Bending moment diagrams and elastic curve for Propped Cantilever and Fixed Beams – Deflection of Propped cantilever and fixed beams – effect of sinking of support, effect of rotation of a support.

UNIT - IV

Continuous Beams: Introduction-Continuous beams – Clapeyron's theorem of three moments Analysis of continuous beams with constant and variable moments of inertia with one or both ends fixed-continuous beams with overhang – effect of sinking of supports.

Slope Deflection Method: Derivation of slope-deflection equation, application to continuous beams with and without sinking of supports – Determination of static and kinematic indeterminacies for frames – Analysis of Single Bay, Single storey Portal Frames by Slope Deflection Method including Side Sway – Shear force and bending moment diagrams and Elastic curve.

UNIT - V

Moving Loads and Influence Lines: Introduction maximum SF and BM at a given section and absolute maximum shear force and bending moment due to single concentrated load ,uniformly distributed load longer than the span, uniformly distributed load shorter than the span, two point loads with fixed distance between them and several point loads – Equivalent uniformly distributed load – Focal length – Definition of influence line for shear force and bending moment – load position for maximum shear force and maximum bending Moment at a section – Point loads, uniformly distributed load longer than the span, uniformly distributed load shorter than the span.

TEXT BOOKS:

1. Introduction to Structural Analysis First Edition Indeterminate Structures First Edition (2026) by Meesala Chakradhara Rao, CRC Press.
2. Theory of Structures by R S Khurmi, S Chand & Company Pvt. Ltd, 2020
3. Theory of Structures Vol I & II by G.S. Pandit and S.P. Gupta, Tata McGraw Hill Education Pvt. Ltd, 2017.

REFERENCE BOOKS:

1. Structural Analysis Vol–I & II by Vazarani and Ratwani, Khanna Publishers,1999
2. Strength of Materials and mechanics of solids Vol-2 by B.C. Punmia, Laxmi Publications, New Delhi, 2015
3. Structural Analysis-I & II by S.S. Bhavikatti, Vikas Publishing House Pvt. Ltd, 2021.

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Medbowli, Meerpet, Balapur, Hyderabad, Telangana – 500 097
Phone: 9100377790. email: info@tkrcet.ac.in. web site: www.tkrcet.ac.in

CONCRETE TECHNOLOGY - 5PC4AE

B.Tech IV Semester

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. Any civil engineering student shall have the basic knowledge about the preparation of concrete and the technology involved in it as concrete happens to be the widely used building material.
2. The subject is designed to give the basic knowledge as well as latest developments in concrete technology.

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

1. Identify the composition, hydration process, and physical properties of Portland cement and evaluate the effects of chemical and mineral admixtures on concrete performance.
2. Analyze aggregate characteristics such as grading, texture, strength, and deleterious content and assess their influence on concrete properties.
3. Evaluate the behavior of fresh concrete by measuring workability, segregation, and bleeding, considering the effects of temperature, time, and mixing conditions.
4. Assess the mechanical properties of hardened concrete including strength, elasticity, creep, and shrinkage using destructive and non-destructive testing methods.
5. Design concrete mixes using BIS and ACI methods, ensuring durability and quality control, and apply knowledge of special concretes for specific engineering applications.

UNIT – I

Cement: Portland cement – Chemical Composition – Hydration, Setting of Cement – Structure of Hydrate Cement – Test on Physical Properties – Different Grades of Cement.
Admixtures: Types of Admixtures – Mineral and Chemical Admixtures.

UNIT – II

Aggregates: Classification of Aggregate – Particle Shape & Texture – Strength & Other Mechanical Properties of Aggregate – Specific Gravity, Bulk Density, Porosity, Adsorption & Moisture Content of Aggregate – Bulking of Sand – Deleterious Substance in Aggregate – Soundness of Aggregate – Alkali Aggregate Reaction – Thermal Properties – Sieve Analysis – Fineness Modulus – Grading Curves – Grading of Fine & Coarse Aggregates – Gap Graded Aggregate – Maximum Aggregate Size.

UNIT – III

Fresh Concrete: Workability – Factors Affecting Workability – Measurement of Workability by Different Tests – Setting Times of Concrete – Effect of Time and Temperature on Workability – Segregation& Bleeding – Mixing and Vibration of Concrete – Steps in Manufacture of Concrete – Quality of Mixing Water.

UNIT – IV

Hardened Concrete: Water/Cement Ratio – Abram's Law – Gel-Space Ratio – Nature of Strength of Concrete – Maturity Concept – Strength in Tension & Compression – Factors Affecting Strength – Relation between Compressive & Tensile Strength – Curing.

Testing of Hardened Concrete: Compression Tests – Tension Tests – Flexure Tests – Splitting Tests – Pull-Out Test, Non-Destructive Testing (NDT) Methods – Codal Provisions for NDT. Elasticity, Creep & Shrinkage – Modulus of Elasticity – Dynamic Modulus of Elasticity – Poisson's Ratio – Creep of Concrete – Factors Influencing Creep – Relation between Creep & Time – Nature of Creep – Effects of Creep – Shrinkage – Types of Shrinkage.

UNIT – V

Mix Design: Factors in the Choice of Mix Proportions – Durability of Concrete – Quality Control of Concrete – Statistical Methods – Acceptance Criteria – Proportioning of Concrete Mixes by BIS Method and ACI Mix Design.

Special Concretes: Introduction to Light Weight Concrete – Cellular Concrete – No-Fines Concrete – High Density Concrete – Fiber Reinforced Concrete – Polymer Concrete – High Performance Concrete – Self Compacting Concrete.

TEXT BOOKS:

1. Concrete Technology by M. S. Shetty, S. Chand & Co.
2. Concrete Technology by M.L. Gambhir, Tata McGraw Hill Publishing Co. Pvt. Ltd., New Delhi.
3. Concrete Technology by AR. Shanta Kumar, Oxford University Press, New Delhi.
4. Properties of Concrete by A. M. Neville, Pearson.

REFERENCE BOOKS:

1. Concrete: Micro Structure, Properties and Materials, P.K. Mehta and J.M. Monteiro, Tata McGraw Hill Publishing Co. Pvt. Ltd., New Delhi.
2. Concrete Technology by Job Thomas, Cengage Learning India Pvt. Ltd.
3. IS: 10262-2009 – Concrete Mix Proportioning Guide Lines.
4. IS: 456-2000 – Plain and Reinforced Concrete Code of Practice.

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CONCRETE TECHNOLOGY LAB - 5PC411

B.Tech IV Semester

L	T	P	C
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PRE-REQUISITES: Concrete Technology

COURSE OBJECTIVE:

1. Imparting knowledge of material testing so that one can find the various properties of materials.
2. Developing the students in learning the various principles of concrete technology and an insight in understanding properties of materials so that they can characterize, transform and use the knowledge gained in solving the various related engineering problems.

COURSE OUTCOMES: The students will be able to

1. Perform standard tests on cement to assess quality and strength.
2. Evaluate aggregates through mechanical and physical property tests.
3. Determine concrete workability using slump, compaction factor, and Vee-Bee methods.
4. Assess concrete strength by compressive, tensile, and flexural tests.
5. Analyze and interpret test results to ensure compliance with IS codes and construction standards.

I. TESTS ON CEMENT

a) Normal Consistency and Fineness of Cement.
b) Initial Setting Time and Final Setting Time of Cement.
c) Specific Gravity of Cement.
d) Soundness of Cement.
e) Compressive Strength of Cement.

II. TESTS ON AGGREGATE

a) Bulking of Sand
b) Aggregate Crushing Value
c) Aggregate Impact Value
d) Attrition Test
e) Abrasion Test
f) Shape Test
g) Specific gravity and Water absorption Test

III. TESTS ON CONCRETE

a) Workability Test by Slump Cone, Compaction Factor & Vee-Bee Methods.
b) Compressive Strength Test
c) Tensile Strength Test
d) Flexural Strength Test

TEXT BOOKS:

1. Concrete Manual by M.L. Gambhir, Dhanpat Rai & Sons.

REFERENCE BOOKS:

1. Concrete Technology by M.S. Shetty, S. Chand & Co.
2. MS-2 Manual (2015) (7^{th} Edition), Asphalt Institute.
3. Highway Engineering by S. K. Khanna, C. E. G. Justo, Veera Ragavan, Khanna Publishers.
4. Highway Materials and Pavement Testing by SK. Khanna, SEG Justo and Veera Ragavan, Nem Chand Bros.
5. IS: 2386 Part 1, 2, 6 – Methods of Test for Aggregate for Concrete.
6. IS: 10262-2009 – Concrete Mix Proportioning Guide Lines.
7. IS: 4031 – Physical Test on Cements.

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HYDRAULICS & HYDRAULIC MACHINERY LAB - 5PC412

B.Tech IV Semester

L	T	P	C
0	0	2	1

PRE-REQUISITES: Fluid Mechanics and Hydraulic Machinery

COURSE OBJECTIVES: The objective of this Course is to

1. Identify the behavior of analytical models introduced in lecture to the actual behavior of real fluid flows.
2. Explain the standard measurement techniques of fluid mechanics and their applications.
3. Illustrate the students with the components and working principles of the Hydraulic machines different types of Turbines, Pumps, and other miscellaneous hydraulics machines.
4. Analyze the laboratory measurements and to document the results in an appropriate format.

COURSE OUTCOMES: Students who successfully complete this course will have demonstrated ability to:

1. Describe the basic measurement techniques of fluid mechanics and its appropriate application.
2. Interpret the results obtained in the laboratory for various experiments.
3. Discover the practical working of Hydraulic machines-different types of Turbines, Pumps, and other miscellaneous hydraulics machines.
4. Compare the results of analytical models introduced in lecture to the actual behavior of real fluid flows and draw correct and sustainable conclusions.
5. Write a technical laboratory report

LIST OF EXPERIMENTS:

1. Verification of Bernoulli's equation
2. Determination of Coefficient of discharge for a small orifice by a constant head method
3. Calibration of Venturimeter/ Orifice Meter
4. Calibration of Triangular/Rectangular/ Trapezoidal Notch
5. Determination of Minor losses in pipe flow
6. Determination of Friction factor of a pipeline
7. Determination of Energy loss in Hydraulic jump
8. Determination of Manning's and Chezy's constants for Open channel flow.
9. Impact of jet on vanes
10. Performance Characteristics of Pelton wheel turbine
11. Performance Characteristics of Francis turbine
12. Performance characteristics of Kaplan Turbine
13. Performance Characteristics of a single stage/multistage Centrifugal Pump

REFERENCE BOOKS:

1. Laboratory Manual of Fluid Mechanics and Machines, V. P. Gupta, J. Chandra, K. S. Gupta, CBS Publishers & Distributors Pvt. Ltd.
2. Hydraulics Laboratory Manual by S.K Likhi, New Age International (P) Limited.

ENVIRONMENTAL ENGINEERING LAB - 5PC413

B.Tech IV Semester

L	T	P	C
0	0	2	1

PRE-REQUISITES: Engineering Chemistry, Environmental Engineering

COURSE OUTCOMES:

1. To Quantify the Pollutant Concentration in Water and Wastewater.
2. To Recommend the Degree of Treatment Required for the Water and Wastewater.
3. To Analyze the Survival Conditions for the Micro-organism and its Growth Rate.
4. To Study the Growth of Micro-organism and its Quantification.
5. To Analyze the Characteristics of Water and Wastewater.

LIST OF EXPERIMENTS:

1. Characteristics, Sampling and Preservation methods and Significance of Characterization of Water and Waste Water.
2. Determination of pH
3. Determination of Electrical Conductivity
4. Determination of Acidity and Alkalinity
5. Determination of Hardness
6. Determination of Chlorides
7. Determination of Turbidity
8. Determination of Optimum Coagulant Dosage by Jar test
9. Determination of Suspended, Dissolved and Fixed Solids
10. Determination of available Chlorine in Bleaching Powder
11. Determination of Iron
12. Determination of Phosphate and Nitrates
13. Determination of Dissolved Oxygen
14. Determination of B.O.D
15. Determination of C.O.D Test

REFERENCE BOOKS:

1. IS 10500: 2012 - Indian Standards - Drinking Water Specifications
2. Manual for Water & Waste Water Treatment - CPHEEO.
3. Water Supply and Sanitary Engineering by G.S Birdie, Dhanpat Rai & Sons.
4. Water and Waste Water Technology by Mark J. Hammer, Mark J. Hammer Jr, Prentice Hall (India).

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DIGITAL SURVEYING LAB - 5SD414

B.Tech IV Semester

L	T	P	C
0	0	2	1

COURSE OBJECTIVES: The objective of this Course is to

1. Familiarize students with advanced survey instruments such as Total Station, Digital Level, and GPS.
2. Provide hands-on training in digital data collection and interpretation.
3. Enhance the capability of students in applying modern survey techniques in civil engineering practices.

COURSE OUTCOMES: After successful completion of this course, students will be able to:

1. Operate and calibrate modern digital surveying instruments like Total Station and GPS.
2. Measure distances, angles, coordinates, and perform traversing, levelling, and contouring with precision.
3. Compute areas, volumes, profiles, and cross-sections using digital survey data.
4. Process and plot survey data using AutoCAD/GIS software for mapping applications.
5. Execute a complete topographical survey project, including data collection, analysis, reporting, and presentation.

List of Experiments (Two Hours/Week):

1. Introduction and demonstration of digital surveying instruments.
2. Setting up and calibration of the Total Station.
3. Measurement of distances, angles, and coordinates using a Total Station.
4. Traversing and plotting with Total Station.
5. Area and volume computations using digital survey data.
6. Profile and cross-section levelling using Total Station.
7. Introduction to GPS surveying – types and working principles.
8. Static and dynamic GPS survey using handheld devices.
9. Route tracking and waypoint marking with GPS.
10. Digital levelling – procedure and applications.
11. Contouring using Total Station and digital level.
12. Data extraction and plotting in AutoCAD or similar software.
13. Group mini-project: topographical survey of a given area.
14. Project data processing and map/report preparation.
15. Project presentation and viva-voce.

SOFTWARE/TOOLS TO BE USED:

- Total Station (Leica, Sokkia, or equivalent)
- Digital Level
- GPS Devices (Handheld or DGPS)
- Surveying Software: AutoCAD / Civil 3D / GIS (optional introduction)

RECOMMENDED BOOKS AND MANUALS:

1. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Surveying Vol. 1 & 2, 18th Edition, 2020, Laxmi Publications Pvt. Ltd., ISBN: 9789380856596.
2. Satheesh Gopi, Advanced Surveying: Total Station, GIS and Remote Sensing, 2nd Edition, 2017, Pearson Education India, ISBN: 9789332587697.
3. R. Subramanian, Surveying and Levelling, 2nd Edition, 2014, Oxford University Press, ISBN: 9780199456154.
4. N.N. Basak, Surveying and Levelling, 3rd Edition, 2017, McGraw Hill Education (India), ISBN: 9789353161598.
5. Satheesh Gopi, GPS Surveying: Theory and Applications, 1st Edition, 2015, Pearson Education India, ISBN: 9789332541088.
6. Total Station and GPS Surveying – User Manuals, Manufacturer Guides (Leica Geosystems, Sokkia, Topcon, etc.).