MA301BS: PROBABILITY AND STATISTICS

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

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

Course Objectives: To learn

- The theory of Random Variable, and probability distributions of single random variables.
- The sampling theory and testing of hypothesis and making statistical inferences.
- The curve fitting, correlation and regression for the given data.

Course outcomes: After learning the contents of this paper, the student must be able to

- Apply the concepts of Random variable and distributions to some case studies.
- Correlate the concepts of one unit to the concepts in other units.
- Understood sampling theory and apply hypothesis testing in real-world scenarios
- Fit the curve, correlation and regression for the given data.

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-distribution

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

CE302PC: BUILDING PLANNING AND CONSTRUCTION

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives: This course is expected to enable the student to:

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

Course Outcomes: Upon completion of this course, student should be able to

- 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.
- Apply the principles of planning and interpret building bye-laws to design functionally efficient, economical, and regulation-compliant buildings.
- Interpret and implement provisions of the National Building Code (NBC) related to residential buildings and understand basic construction techniques including foundations and masonry.
- Identify and analyze various types of floors, roofs, staircases, doors, windows, and lintels used in building construction and their suitability for different design conditions.
- 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.

CE303PC: STRENGTH OF MATERIALS

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Pre-Requisites: Engineering Mechanics

Course Objectives: The objective of this Course is to

- understand the nature of stresses developed in simple geometries such as bars, cantilevers and beams for various types of simple loads.
- calculate the elastic deformation occurring in simple members for different types of loading.
- show the plane stress transformation with a particular coordinate system for different orientation of the plane.
- know different failure theories adopted in designing of structural members.

Course Outcome: On completion of the course, the student will be able to:

- Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, related to the strength of structured and mechanical components.
- Recognize various types loads applied on structural components of simple framing geometries and understand the nature of internal stresses that will develop within the components.
- To evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading.
- Analyze various situations involving structural members subjected to plane stresses by application of Mohr's circle of stress.

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 byT.D. Gunneswara Rao and M. Andal, Cambridge Publishers
4. Strength of Materials by R.K. Bansal, Lakshmi Publications House Pvt.Ltd.

CE304PC: SURVEYING AND GEOMATICS

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives: The objective of this Course is to

- Understand the fundamentals of surveying including its objectives, classifications, principles, and accessories used.
- Apply techniques for measurement of distances, directions, and angles using various conventional and modern instruments.
- Perform levelling and contouring to determine elevations and prepare topographical maps.
- Compute areas and volumes using different methods applicable in engineering projects like earthworks.
- Handle theodolite and tachometric surveys and perform traversing and curve setting.
- Use modern surveying instruments such as Total Station and GPS for accurate data collection and analysis.

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

- Classify and describe different types and phases of surveying, and explain conventional symbols and scales.
- Measure linear distances and directions using chains, tapes, compasses, and EDM methods, and apply corrections accurately.
- Perform differential levelling and contouring using various instruments and compute heights using HI and Rise & Fall methods.
- Calculate areas and volumes using MDM, DMD methods and Planimeter; compute earthwork quantities and reservoir capacities.
- Use theodolite for angle measurements, trigonometric levelling, and traverse computations including adjustments.
- Apply principles of tachometry and set out horizontal curves in the field.
- Utilize Total Station and GPS for advanced survey work and differentiate between modern and traditional surveying 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, booking 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 Sanches.
2. Surveying and leveling by R. Subramanian, Oxford university press, New Delhi.
3. Chandra A M, "Higher Surveying", Newage 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., NewDelhi,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.

CE305PC: FLUID MECHANICS

B.Tech. II Year I Sem.

L	T	P	C
3	0	0	3

Course Objectives: The objectives of the course are to

- Introduce the concepts of fluid mechanics useful in Civil Engineering applications.
- Provide a first level exposure to the students to fluid statics, kinematics and dynamics.
- Learn about the application of mass, energy and momentum conservation laws for fluid flows.
- Train and analyses engineering problems involving fluids with a mechanistic perspective is essential for the civil engineering students
- To obtain the velocity and pressure variations in various types of simple flows.
- To prepare a student to build a good fundamental background useful in the application-intensive courses covering hydraulics, hydraulic machinery and hydrology.

Course Outcomes: Upon completion of this course, students should be able to:

- Understand the broad principles of fluid statics, kinematics and dynamics.
- Understand definitions of the basic terms used in fluid mechanics and characteristics of fluids and its flow.
- Understand classifications of fluid flow.
- Be able to apply the continuity, momentum and energy principles.

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- Wies batch 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.

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TEXT BOOKS:

1. Theory and Applications of Fluid Mechanics, K. Subramanian, TataMcGrawHill
2. Fluid Mechanics by Modi and Seth, Standard Book House.
3. Fluid Mechanics by Streater
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 & Co
5. Fluid Mechanics and Hydraulic Machines, R.K. Bansal, Laxmi Publication Pvt. Ltd.

MA306PC: COMPUTATIONAL MATHEMATICS LAB
(Using Python/MATLAB software)

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

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

Course Objectives: To learn

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 of this paper, 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 Eigenvectors: **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., NCLab 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.

CE307PC: MATERIAL TESTING LABORATORY

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Course Objectives: The objectives of the course are to

- Know the various procedures to determine the characteristics of cement
- Understand the test procedures to evaluate the characteristics of aggregates
- Know the test procedures to find the properties of fresh concrete
- Understand the test procedures to find mechanical properties of hardened concrete

Course Outcomes: After completion of the course, the student should be able to

- Perform various tests required to assess the characteristics of cement
- Test and evaluate the properties of fine and coarse aggregates and determine its suitability for construction
- Evaluate the fresh and hardened properties of concrete
- Design the concrete mix for required strength and test its performance characteristics

LIST OF EXERCISES:

1. **Tests on Cement:**
   a) Soundness.
   b) Compressive strength.

2. **Tests on Aggregates:**
   a) Specific gravity of fine aggregate.
   b) Specific gravity of coarse aggregate.
   c) Bulking of fine aggregate.
   d) Grading of fine aggregate

3. IS method of mix design of normal concrete as per IS:10262

4. **Tests on Fresh Concrete:**
   a) Slump cone test.
   b) Compacting factor test.
   c) Vee-Bee consistometer test.

5. **Tests on Hardened Concrete:**
   a) Compressive &Tensile strength tests.
   b) Modulus of elasticity of concrete.
   c) Non-destructive testing of concrete.

CE308PC: STRENGTH OF MATERIALS LABORATORY

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Course Objectives: The objectives of the course are to

- Conduct the Tension test, Compression test on various materials
- Conduct the Shear test, Bending test on determinate beams
- Conduct the Compression test on spring and Hardness test using various machines
- Conduct the Torsion test, Impact test on various materials

Course Outcomes: After the completion of the course, students should be able to

- Determine the yield stress, ultimate tensile stress, percentage elongation of steel, compressive strength of brick and concrete
- Determine the ultimate shear stress, modulus of elasticity of steel
- Determine the stiffness of the close coiled helical spring and hardness number of mild steel, brass, copper and aluminum.
- Determine the modulus of rigidity and impact strength of steel**.**

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.

CE309PC: SURVEYING & GEOMATICS LABORATORY

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Course Objectives: The objectives of the course are to

- Learn and understand the various basic concept and principles used in surveying like Chain Surveying, Compass Surveying, Plane Table Surveying, and Levelling Surveying.
- Learn and understand about theodolite and total station in surveying.
- Learn and understand how to calculate Area of plot and Ground.
- 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:

- Prepare Map and Plan for required site with suitable scale.
- Prepare contour Map and Estimate the Quantity of earthwork required for formation level for Road and Railway Alignment.
- Judge which type of instrument to be used for carrying out survey for a Particular Area and estimate the area.
- Judge the profile of ground by observing the available existing contour map.

CYCLE-I

Theodolite surveying:

1. Measurement of horizontal angles and vertical angles.
2. Distance between two inaccessible points.
3. Measurement of area by theodolite traversing (Gales traverse table).
4. Determination of tachometer constants.
5. Distance between two inaccessible points using the principles of tachometer surveying.
6. Distance between two inaccessible points using the principles of trigonometric surveying

CYCLE-II

Total Station:

7. Area Measurement
8. Stake Out
9. Remote Elevation Measurement
10. Missing Line Measurement
11. Longitudinal & Cross Section Profile
12. Contouring
13. Providing a Simple Circular Curve
14. Demonstration using DGPS

CE310SD: DESIGN THINKING AND TINKERING LAB

B.Tech. II Year I Sem.

L	T	P	C
0	0	2	1

Course Objectives: The objectives of the course are to

- introduce students to the principles and stages of design thinking, creativity, and user-centered innovation.
- develop students' ability to frame problems and create solutions using iterative and collaborative methods.
- enhance empathy-driven approaches to design and engineering challenges.
- cultivate skills in rapid prototyping, brainstorming, ideation, and effective team collaboration.
- build communication and presentation skills through real-world pitch and innovation exercises.
- promote critical reflection and systems thinking in addressing complex design problems

Course Outcomes: At the end of the course student will be able to:

- Apply design thinking methodology (Empathize, Define, Ideate, Prototype, Test) to solve real-world problems.
- Use empathy-based research techniques to understand user needs and perspectives.
- Generate innovative ideas using ideation tools like "Yes, and", "Five/Nine Whys", and "Six Thinking Hats".
- Demonstrate the ability to collaborate in multidisciplinary teams and engage in constructive feedback.
- Rapidly prototype and test design concepts within constrained timeframes (e.g., 48-hour challenges).
- Present and pitch design solutions effectively to a target audience or jury.
- Analyze systems and complex problems using systems thinking tools to propose sustainable solutions.
- Reflect critically on team-based design experiences and iterate solutions based on feedback and testing.

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.

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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/