UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Construction Materials
Credit: 3	**L-T-P: 3-0-0**
Pre-requisite Course:	

Syllabus

Stones- classification, natural bed, tests and preservation of stones; Bricks- raw materials, drying- burning, strength and durability, mortar for masonry, tiles; Timber- classification, seasoning, application, defects in timbers; Cement chemical composition, manufacturing, hydration, properties of cement compounds, types of cement; Concrete- proportioning, transportation and placing, sampling and acceptance for quality control, fresh concrete: batching, mixing, workability, effect of admixture, influence of aggregate on properties of concrete, hardened concrete: mechanical properties, corrosion, chloride and sulphate attack, water-cement ratio, porosity, curing of concrete, concrete mix design; Steel- types, properties, structural steel selection; Green materials concept of being green, concrete vs steel vs timber, low e- glasses, high reflectance material, concepts of reduce-reuse and recycle in construction; Advanced materials: newer and improved materials for construction, steel having greater ductility, tensile strength and corrosion resistance, high performance concrete, self-compacting concrete, chemicals, epoxies, latexes and bonding agents for repairs, geo-textiles and geo-membranes; Materials properties for automated concrete construction, Material for low cost buildings.

Course Outcomes

1. Be able to demonstrate knowledge of construction materials and their usages in building projects.
2. Be able to apply learning to further research in advancement of civil engineering materials field.
3. Understand characteristics of conventional building materials like stone, brick, wood etc.
4. Learn about new and composite materials and their value adding characteristic of being lightweight, energy efficient, speedy construction among others.

Text Books and References

1. Engineering Materials, Rangwala SC
2. Handbook of Concrete Mixes SP23, BIS Delhi
3. Concrete technology by A. M. Neville, Pearson education India
4. Concrete Technology by M.S. Shetty, S. Chand ltd. India
5. Sustainable Construction: Green Building Design and Delivery by C. Kibert, Wiley
6. National Building Code of India, BIS, Delhi.
7. Repair and Rehabilitation of RCC buildings CPWD, Delhi

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Construction Materials Laboratory
Credit: 1	**L-T-P: 0-0-2**
Pre-requisite Course:	

LIST OF EXPERIMENTS

Lab #	Name of the Experiment
1	To determine fineness, specific gravity and consistency of cement
2	To determine setting times, and comp strength of cement
3	To determine Specific gravity and Sieve Analysis and fineness modulus, and water absorption of sand and aggregates
	To determine aggregate crushing value and aggregate impact value
4	To determine silt content and bulking of sand
5	To determine slump, compaction factor, flow of concrete/mortar mix
6	To determine compression and flexural/split strength of concrete
7	To develop mix and cast bricks/pavers in lab
8	To Test compressive strength of bricks/pavers
9	To determine water absorption, efflorescence of bricks
10	To determine abrasion/ skid resistance of blocks
11	To develop stress-strain curve of Steel
12	Demonstration of Sustainable/Eco-friendly/recycled material

Course Outcomes

1. Able to identify different type of construction materials.
2. Able to measure different engineering properties of building materials like strength, water absorption, abrasion impact etc.
3. Able to analyze and choose different type of suitable material for construction projects.

References

1. Relevant IS codes, BIS, Delhi
2. SP 23 Handbook of concrete mix design, BIS, Delhi.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Structural Analysis
Credit: 4	**L-T-P: 3-1-0**
Pre-requisite Course: 22CET106 Mechanics of Solids	

Syllabus

General Concept of Static Equilibrium of Structures, Concept of Free Body Diagram, Slopes and deflections in determinate beams using conjugate beam method and moment area method; Generalized coordinate system; Principles of real and virtual work; Maxwell's reciprocal theorem; Betti's theorem; Castigliano's theorems; Method of Superposition; Strain energy expressions; Strain energy method and virtual work (unit load) method for slopes and deflections in statically determinate frames and trusses; Static indeterminacy and released structure; Force method-method of consistent deformation for analysis of statically indeterminate beams, frames and trusses; Slope deflection and moment deflection method; Three moment theorem; Column analogy method; Analysis of Arches and cable structures; Moving loads and influence lines; Application to statically determinate structures; Muller Breslau's principle.

Course Outcomes

1. To determine the static and kinematic indeterminacy of beam, truss and frame.
2. To analyze the deflections in determinate and indeterminate structures using various methods.
3. To analyze the beams under moving load and to draw influenced line diagram.
4. To evaluate the behavior of cable and arches under various loading systems.

Text Books

1. R. C. Hibbeler, "Structural Analysis", Pearson Press.
2. C. S. Reddy, "Basic Structural Analysis (10/e)", Tata McGraw Hill.
3. T.S. Thandavamoorthy, "Structural Analysis", Oxford publications.

References

1. S. P. Timoshenko and D. H. Young, "Theory of structures", McGraw Hill Education.
2. C. K. Wang, "Intermediate Structural Analysis", McGraw Hill

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Structural Analysis Laboratory
Credit: 1	**L-T-P: 0-0-2**
Pre-requisite Course:	

LIST OF EXPERIMENTS

Lab #	Name of the Experiment
1	To verify the reactions in a simply supported beam.
2	To measure deflections under unsymmetrical bending condition.
3	To verify Hooke's law and find Modulus of elasticity of a given wire material from load deflection graph.
4	To verify the buckling loads for the given struts.
5	To verify the centrifugal force formula
6	To determine Brinell's Hardness Test.
7	To draw influence lines for horizontal thrust of three hinge arch.
8	To verify of reciprocal theorem.
9	To verify deflections in curved members.
10	To verify Muller's Breslau's principle and to measure carry over factor for a prismatic beam.
11	To perform Charpy's impact test.
12	To determine tensile strength of steel bar and compressive strength of concrete using universal testing machine.
13	To determine fatigue load.
14	To determine torsional properties of cylindrical specimen.

Course Outcomes

1. Be able to verify and apply theorem of structural engineering.
2. Be able to measure hardness/strength/fatigue of different materials.
3. Be able to measure the deflection characteristics of different structural components.

References

Lab Manuals

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Building Technology
Credit: 2	**L-T-P: 2-0-0**
Pre-requisite Course:	

Syllabus

Classification of Buildings, low-rise and high-rise buildings, load bearing and framed construction; Building planning, building planning concepts, and Introduction to National building codes and byelaws; Concepts of various foundation types, foundation of walls, columns etc., foundation layout, foundation construction practices and failure issues; Stone and brick masonry construction, reinforced brick construction, lintel and arches; Roof construction and roofing materials, flat and pitched roofs, drainage of roofs, green roof concepts; Doors and windows Stairs and ramps, Lifts and Escalators, floors and floor finishes, wall finish; Thermal insulation, damp and fire proofing, Expansion and construction joints; Temporary supporting structures concepts for construction of buildings; Advances in building construction practices, prefabrication and pre-casting, modular construction.

Course Outcomes

1. Be able to apply the practical knowledge about manufacturing of concrete and other construction practices.
2. Be able to Visualize and imagine buildings as objects through drawings.
3. Be able to Monitor and execute construction activities in building projects.
4. Select suitable equipment for construction as per site conditions.

Text Books

1. Handbook of Building Construction Vol 1, M M Goyal, 2010, Jain Book Depot.
2. Brick and Reinforced Brick Structures Dayaratnam P, Oxford & IBH.

References

1. National Building Code of India, BIS, Delhi.
2. Building Construction Handbook, R Chudley and Roger Greeno, 2013

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Building Drawing – I
Credit: 1	**L-T-P: 0-0-2**
Pre-requisite Course:	

LIST OF EXPERIMENTS

Lab #	Name of the Experiment
1	Plan of a single storey house
2	Elevation of a single storey house
3	Section of a single storey house
4	Plan of an apartment building
5	Elevation of an apartment building
6	Section of an apartment building
7	Plan of an hospital building
8	Elevation of an hospital building
9	Section of an hospital building
10	M/E Drawing of a building
11	Plumbing Drawing of a building

Course Outcomes

1. Understand the basic concepts of building drawings.
2. Be able to illustrate the basic steps of building construction and their components.
3. Be able to produce different type of drawings required for construction of buildings.

References

1. Time Saver Standards.
2. Neuferts Architects Data
3. Building Planning and Drawings by Shah, Kale and Patki
4. NBC -2005

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Fluid Mechanics
Credit: 4	**L-T-P: 3-1-0**
Pre-requisite Course:	

Syllabus

Properties of Fluids, Newtonian and non-Newtonian fluids, Properties of Fluids continued, Examples/Numerical Problems, Fluid Statics-Introduction and Pressure Measurement, Fluid Statics-Hydrostatic Forces on submerged surfaces, Fluid Statics Buoyancy and Floatation, Problems on Fluid Statics, Flow-Classifications, terminologies, concepts, Flow-Classifications, terminologies, concepts (Contd.), Forces on a Fluid particle and Development of various equations including N.S. equations, Continuity Equation , Energy Equation, Momentum Equation, Problems of Kinematics of Fluid flow, Problems on Continuity equation/ Energy equation/ Momentum equations, Flow Measurements in Pipes, Flow Measurements in Open Channels, Problems on Flow Measurements, Major and Minor Losses in pipe flow/ Darcy Weisbach equation, Hydraulic Gradient, TEL etc., Analysis Pipe network and simple problems, Notches & Weirs, Orifices & Mouth pieces, Flow through nozzles & Jets, and problems, Dimensional Analysis – Introduction, Dimensional Analysis-Rayleigh's Method, Dimensional Analysis-Buckingham's PI Method, Similitude, Problems on Dimensions Analysis & Similitude, Flow Classification in pipes: Laminar Flow, turbulent flow & Brief Introduction to Boundary Layer Theory, Flow between parallel plates (Plain Poiseuelle Flow / Couette Flow), Laminar Flow Contd. (Hagen-Poiseuelle Flow), Open Channel Flow, Manning's Formula/ Chezy's formula and basics terminology, Most efficient prismatic channel sections, Open Channel Flow Problems, Review of Course/ Problems.

Course Outcomes

1. Be able to explain the basic properties and characteristics of incompressible fluid.
2. Be able to illustrate the basic fundamental theorems governing fluid flows i.e., continuity, energy and momentum.
3. Be able to analyze and evaluate fluid mechanics based problems based upon the measurement of different fluid properties using various type of equipment.
4. Be able to analyze the flow phenomenon through pipes and other systems.

Text Books

1. Fluid Mechanics by Streeter, Wylie and Bedford.
2. Principals of Fluid Mechanics by M.K. Natarajan.
3. Fluid Mechanics Thorough Problems by R.J. Garde
4. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar
5. Fluid Mechanics by A.K. Jain.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Fluid Mechanics Laboratory
Credit: 1	**L-T-P: 0-0-2**
Pre-requisite Course:	

LIST OF EXPERIMENTS

Lab #	Name of the Experiment
1	Experiments for Hydrostatics principles on a fluid.
2	Experiments on pressure measurement.
3	Experiments to study the flow through a variable area duct and verification of Bernoulli's energy equation.
4	Experiments for determination of coefficient of velocity & discharge for a Mouthpiece.
5	Experiments for determination of coefficient of velocity & discharge for an Orifice.
6	Experiments to determine the discharge coefficient for a V and rectangular notch.
7	Experiments on Flowmeter to determine the coefficient of discharge and coefficient of discharge for an obstruction flow meter namely orifice meter.
8	Experiments on Flowmeter to determine the velocity distribution for pipeline flow with a pitot static probe.
9	Experiments to determine coefficient of discharge for an obstruction flow meter e.g. venturi meter.
10	Experiments to determine the friction coefficients and head losses for pipes of different materials and diameters.
11	Experiments to determine the head loss (minor losses) in a pipe line due to sudden expansion/ sudden contraction/ elbows/ fittings / bend.

Course Outcomes

1. Be able to demonstrate the basic properties and characteristics of incompressible fluid in laboratory.
2. Be able to illustrate the fundamental theorems governing fluid flows i.e., continuity, energy and momentum in laboratory.
3. Be able to measure different fluid properties using various type of equipment like measurement of flow, pressure velocity and head loss.

References

1. Fluid Mechanics by Streeter, Wylie and Bedford.
2. Principals of Fluid Mechanics by M.K. Natarajan.
3. Fluid Mechanics Thorough Problems by R.J. Garde
4. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar
5. Fluid Mechanics by A.K. Jain

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Advanced Surveying
Credit: 2	**L-T-P: 2-0-0**
Pre-requisite Course:	

Syllabus

Theory of errors; Adjustment of surveying observations; Triangulation and Trilateration; Various triangulation schemes; Type of triangulations; Triangulation measurements; Adjustment of triangulation scheme; Principles of photogrammetry; Aerial photography, Interpretation, Measurements from aerial photographs; Introduction to astronomy; Terms of reference planes and astronomical coordinates; Astronomical triangle / shortest distance determination; Time in astronomy; Uses of Total Station and other Advance surveying instruments.

Course Outcomes

1. Be able to plan and execute triangulation surveying schemes and survey.
2. Be able to make measurements on satellite images and aerial photographs using photogrammetric concepts
3. Be able to employ advance surveying equipment for preparation of maps, determination of positions.
4. Be able to measure time and other astronomical observations

Text Books

1. Wolf, P. R., A text book on Photogrammetry, 4th edition, 2012.
2. C.D. Burnside, Electromagnetic Distance Measurement, Crosby Lockwood and Son Ltd., London.
3. Punmia, B.C., Surveying Vol. II & III, 2005.

Reference Books

1. Kavanagh, B., Surveying Principles and Applications, Seventh Edition, Prentice Hall, 8th edition, 2008.
2. G.L. Hosmer, Geodesy, John Wiley & Sons, New York, 1946.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Introduction to Satellite Based Positioning
Credit: 2	**L-T-P: 2-0-0**
Pre-requisite Course:	

Syllabus

Introduction; Signal structure; Satellite search; Basic GNSS measurements; Atmospheric effects and dual frequency measurements; Carrier phase positioning; Coordinate systems and time; Orbits and data message; Navigation solutions and its applications.

Course Outcomes

1. Be able to apply the methods of satellite data for positioning and surveying.
2. Understand how a complete navigation system works.
3. Understand the specific architecture of operational GNSS and WAAS systems.
4. Be able to illustrate the use of GNSS systems for the positioning, mapping and surveying.

Text Books

1. Global Positioning System: Signals, Measurements & Performance, Misra, 2e

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Advanced Surveying & GNSS Lab
Credit: 1	**L-T-P: 0-0-2**
Pre-requisite Course:	

LIST OF EXPERIMENTS

Lab #	Name of the Experiment
1	To determine Tacheometric constants, horizonal distance and vertical distance
2	Observations on Stereo-pair of photographs
3	Temporary adjustment of Total station and Angle, Distance and Coordinate measurement
4	Establishment of Horizontal control point by Traversing using Total station
5	To determine the instrument station, coordinate by Resection method (Angles only and Distances only)
6	Preparation of Contour map using Total Station
7	Setting out: by Coordinates, by Distance and angle, Points at equal length using Total station
8	Navigation and Feature collection using handheld GPS in mapping and surveying mode
9	GNSS Planning and traversing
10	Establishment of Ground Control Point using Static / Rapid Static differential GNSS survey by Lee Frog Method
11	Establishment of Ground Control Point using Static / Rapid Static differential GNSS survey by Trilateration method
12	Preparation of Planimetric map using Post Processed Kinematic (PPK) method

Course Outcomes

1. Be able to take precise measurements and capture accurate spatial data with Total Station.
2. Be able to take precise measurements and capture accurate spatial data with GNSS
3. Be able to compare the results between Total Station and GNSS.

References

1. Global Positioning System: Signals, Measurements & Performance, Misra, 2e
2. Understanding GPS/GNSS: Principles and Applications, Elliott and Christopher, Artech House

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Design of RCC Structures
Credit: 3	**L-T-P: 3-0-0**
Pre-requisite Course: Structural Analysis	

Syllabus

Properties of Concrete: Compressive strength, tensile strength, stress-strain behaviour, modulus of elasticity, shrinkage, creep, characteristic strength, grades of concrete, design stress-strain curve of concrete, reinforcing steel, types and grades, stress-strain behaviour, design stress-strain curve, basic properties of concrete, design of concrete mix. Basic philosophy of Working Stress and Limit state Methods for Design of concrete structures; Design of beams; singly and doubly reinforced Rectangular, T and L beams subjected to flexure, shear & torsion; Bond Strength and Development Length; Design of secondary & main beams, cantilevers, balconies and staircase; Design of slabs; one-way slabs; two-way slabs; Design of Continuous Slab; Design of lintel; Design of short and long columns; axially loaded and eccentrically loaded columns; effect of small and large eccentricities; Design of footings: isolated and combined footings; Portal frames with fixed and hinged supports.

Course Outcomes

1. Be able to understand and analyze the different properties of reinforced concrete.
2. Be able to design concrete structures using working stress and limit state methods
3. Be able to analyze and design different structural components.
4. Be able to apply recommendations of relevant BIS codes for the design of reinforced concrete structures.

Text Books

1. Pillai & Menon, “Design of RCC Structures (4/e)”, McGraw Hill Education.
2. N. Subramanian, “Design of RC Structures”, Oxford.

References

1. P. Dayaraatnam, “Design of Reinforced Concrete Structures (4/e)”, Oxford & IBH Publishing Co.
2. P. C. Varghese, “Limit State Design of Reinforced Concrete (2/e)”, Prentice Hall India Learning Private Limited.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** RCC Design, Drawing, and Detailing
Credit: 1	**L-T-P: 0-0-2**
Pre-requisite Course:	

LIST OF ASSIGNMENTS

Lab #	Name of the Lab Assignment
1	Design of singly and doubly reinforced beams
2	Design of cantilevers
3	Design of balconies
4	Design of staircases
5	Design of slabs and T-beam floors
6	Design of columns and beam-column connections
7	Design of isolated and combined footings
8	Design of portal frames

Course Outcomes

1. Acquire knowledge about design and drawings of real field concrete structures
2. Learn the design of various structural components of buildings
3. Be able to check and evaluate the structural detailing of reinforcement.

References

1. RCC by Jain & Jaykrishna
2. RCC by Krishnaraju
3. RCC by Sinha

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Hydraulics Engineering
Credit: 4	**L-T-P: 3-1-0**
Pre-requisite Course: Fluid Mechanics	

Syllabus

Comparison of Pipe and Channel Flows, Types of flows, Velocity distribution in Channels, Most Economical Channels: Rectangular and other geometrical channel sections, Concept of Specific Energy, Specific Force Concept, Gradually Varied Flow and Types Surface Profiles, Direct Step Method, Rapidly Varied Flow, Hydraulic jump and Surges. Navier-Stokes equation, Laminar & Turbulent Flow in pipes, Laminar Flow, Hagen Poiseuille Flow equation, Turbulent Flow, Hydro-dynamically Smooth and Rough pipes, Prandtl's mixing length theory, Moody's diagram. Boundary Layer (BL) theory, laminar sub-layer, various BL thicknesses, Application of equations in BL. including momentum integral equations, Establishment of flow, reduction of BL. Concept of Drag and lift, flow around immersed bodies. Hydraulic Machines- Introduction, Impact of free jets on flat and curved plates/ vanes, efficiency of water wheel, efficiency, Power and related concepts. Brief introduction to various Types of turbines and pumps.

Course Outcomes

1. Understand flow characteristics in open channels.
2. Be able to apply the concepts and characteristics of boundary layer, laminar flow and turbulent flow.
3. Be able to select the type of hydraulic machine (like pumps, ram and turbines) for a given application.
4. Able to analyze the performance of hydraulic machines.

Text Books

1. Open Channel Hydraulics by Subramanya
2. Hydraulics & Hydraulic Machines by Modi & Seth
3. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar
4. Open Channel Hydraulics by V.T. Chow

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Hydraulics Laboratory
Credit: 1	**L-T-P: 0-0-2**
Pre-requisite Course: Fluid Mechanics Laboratory	

LIST OF EXPERIMENTS

Lab #	Name of the Experiment
1	Experiments on determination of the performance characteristics of Pelton turbine: a. Production and analysis of graphs of inlet pressure, flow rate, torque and power against speed for a selection of nozzle positions. b. Determination of overall efficiency of conversion of fluid to mechanical energy, over a range of conditions.
2	Experiments on determination of the performance characteristics of Francis turbine: a. Efficiency of a Francis turbine. b. Performance of a Francis turbine at different flow rates. c. The effect of different guide vane settings on turbine performance.
3	Experiment for Demonstration of the water hammer effect to produce a pumping action in Hydraulic Ram pump.
4	Experiments on Two stage (series & parallel) pumps. a. Centrifugal pump performance and characteristics, typically head versus flow and efficiency versus flow. b. Non-dimensional performance characteristics c. Operation of centrifugal pumps in series. d. Operation of centrifugal pumps in parallel
5	Experiments on Water hammer & Pipe Surge.
6	Establishment of uniform flow in channels (Tilted bed flume).
7	Study of hydraulic jump in tilted bed flume.

Course Outcomes

1. Able to demonstrate the flow characteristic in open channels like hydraulic jump.
2. Able to evaluate pumps by drawing its performance characteristics.
3. Able to evaluate turbines and hydraulic ram by drawing its performance characteristics.

References

1. Open Channel Hydraulics by Subramanya
2. Hydraulics & Hydraulic Machines by Modi & Seth
3. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar
4. Open Channel Hydraulics by V.T. Chow

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Geotechnical Engineering – I
Credit: 4	**L-T-P: 3-1-0**
Pre-requisite Course:	

Syllabus

Soil Formation and Structure: Origin of geomaterials, soil mineralogy and morphology, clay water interactions, soil fabric and structure; Soil Index Properties; Soil Classification and Field Identification; Soil Phase Relations; Stresses in Soil; Capillarity: capillary rise and pressures in soils, soil water characteristic curve, vadose zone; Soil Permeability: Darcy's Law, lab and field determination, factors affecting k; Seepage in Soils: Laplace Eqn, flownets – construction & analysis, seepage in earth dams, piping, filter design; Stress Distribution in Soils: Boussinesq, Westergaard, Newmark, embankment loads, approximate methods, contact pressures; Compressibility and Consolidation: Oedometer, pressure void ratio curves, preconsolidation pressure, computing ultimate settlement, Terzaghi's 1-D Consolidation Theory, time rate of consolidation, secondary compression; Shear Strength of Soils: Coulomb Eqn, Direct Shear Test, Triaxial Compression Test, Mohr Coulomb Failure Theory, shear strength of sands and clays, UCS Test, pore pressure parameters, Vane Shear Test, stress paths; Soil Compaction: Compaction of fine and coarse soils, Proctor Tests, field compaction equipment and procedures, compaction control; Earthworks: Equipment, soil suitability in fills, light fills, deep fills, earthwork quantity estimates.

Course Outcomes

1. Understand relation between soil and water
2. Be able to compute stresses, stress distribution, and strains in soil
3. Be able to analyze the nature of strength of soil and be able to recommend the methods to improve it
4. Be able to anticipate the impact of in-situ soil conditions on its engineering properties

Books

1. V.N.S. Murthy, "Principles of Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors.
2. RF Craig, "Craig's Soil Mechanics", Spon Press
3. Holtz, Kovacs, Sheahan, "Introduction to Geotechnical Engineering", Pearson
4. BM Das, "Principles of Geotechnical Engineering", Cengage Learning
5. T. William Lambe, Robert V. Whitman, "Soil Mechanics", John Wiley and Sons.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Soil Mechanics Laboratory
Credit: 1	**L-T-P: 0-0-2**
Pre-requisite Course:	

LIST OF EXPERIMENTS

Lab #	Name of the Experiment
1	Moisture content and specific gravity determination
2	Sieve analysis and Atterberg limits
3	Hydrometer analysis
4	Falling head and Constant head permeability tests
5	Standard compaction test
6	Modified compaction test
7	In-situ soil density with core-cutter and sand replacement methods
8	Relative density of coarse soils using vibrating table
9	Unconfined compressive strength test
10	Consolidation test

Course Outcomes

1. Be able to determine soil index properties
2. Be able to classify soil type on the basis of soil index tests.
3. Be able to analyze compression characteristics of soil based on consolidation test.

References

1. Shamsher Prakash and P.K. Jain, “Engineering Soil Testing”, Nem Chand & Bros. Roorkee.
2. Head, K.H, “Manual of Soil Laboratory Testing”, John Wiley and Sons, New York.
3. T. William Lambe, “Soil Testing for Engineers”, Wiley Eastern Limited, New Delhi.
4. Joseph E. Bowles, “Engineering Properties of Soil and their Measurement”, McGraw Hill Inc., New York.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Environmental Engineering – I
Credit: 3	**L-T-P: 3-0-0**
Pre-requisite Course:	

Syllabus

Water supply; Demand; Sources; Quality standards; Water quality index; Water treatment: Method of purification of water; Screens, plain and coagulant aided sedimentation; Filtration-slow sand and rapid sand, disinfection; Water softening; Iron, Manganese, Fluoride, and Nitrate removal; Electro dialysis, R.O. and Ion-Exchange process, desalination. Different type of pipes and pipe joints, Pumping stations; Water distribution systems; Rural, Institutional and Industrial water supply management. Integrated water resource management.

Course Outcomes

1. Develop a comprehensive understanding of the principles and components involved in water treatment and supply systems.
2. Acquire knowledge about applicable codes, standards, and regulations related to water supply engineering, water quality analysis and various treatment methods used to ensure the provision of safe and potable water to communities.
3. Develop skills in designing water supply systems and analyzing their performance.
4. Enhance their problem-solving skills by applying engineering principles to real-world challenges in water supply systems.

Books

1. Manual of Water Supply by CPHEEO, Ministry of Urban Dev., GOI
2. Water Supply Engineering by P.N. Modi
3. Water Works Engineering S.R. Qasim, E.M. Motley and G. Zhu
4. MWH's Water Treatment: Principles and Design by John C. Crittenden, R. Rhodes Trussell, David W. Hand, Kerry J. Howe, George Tchobanoglous .

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Public Health & Engineering Lab
Credit: 1	**L-T-P: 0-0-2**
Pre-requisite Course:	

LIST OF EXPERIMENTS

Lab #	Name of the Experiment
1	Introduction to laboratory techniques, safety and equipment in Public Health Engineering Lab
2	Determine pH and TDS of water sample from different sources.
3	Determine the alkalinity of water samples.
4	Determine the hardness of water samples.
5	NO_3^- (Nitrate) Experiment: Analyze the nitrate levels in water samples and study the sources and potential environmental impact of nitrate pollution.
6	Breakpoint Chlorination and Residual Chlorine Experiment: Study the breakpoint chlorination process by gradually increasing the chlorine dosage and monitoring the reaction with organic compounds in water.
7	Dissolved Oxygen (DO) Experiment: Determine the dissolved oxygen levels in water samples to assess the oxygen availability for aquatic life and determine the water's overall health.
8	Chloride Experiment: Determine the chloride levels in water samples to identify potential sources of contamination and evaluate its impact on water quality.
9	Determining Turbidity of water
10	Jar Test for Coagulant Dosing: Perform jar tests using different coagulants and flocculants to determine the optimal dosage for effective water treatment and removal of turbidity.
11	Coliform Bacteria Experiment: Conduct microbiological analysis of water samples to detect the presence of coliform bacteria and assess the microbial safety and sanitary quality of the water.
12	Emerging contaminants in water: Determine the emerging contaminants e.g. heavy metals in water.

Course Outcomes

1. Gain practical knowledge of laboratory safety protocols and proper handling of laboratory equipment.
2. Perform water quality analysis by collecting and analyzing water samples, interpreting the results, and evaluating the water quality parameters.
3. Get familiar with advanced equipment for water analysis
4. Develop skills in preparing laboratory reports, documenting experimental procedures, analyzing data, and presenting findings effectively.

References

1. APHA.(1995). Standard methods for the examination of water and wastewater. 17th edition APHA, Washington DC.
2. Sawyer, C. McCarty, P., Parkin, G. (2017). Chemistry for Environmental Engineering and Science. McGraw Hill Education; 5th edition.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Transportation Engineering – I
Credit: 3	**L-T-P: 3-0-0**
Pre-requisite Course:	

Syllabus

Introduction: Highway Material subgrade soil, stone aggregates, Cement, Concrete & bituminous material viz. bitumen, tar, cut back emulsions, Significance, and application of various tests on soil, stone aggregate bitumen and modified Binders. Proportioning of materials by graphical method, Geometric Design: Highway classification, design, cross-sectional elements, horizontal & vertical alignment, sight distance, types of road crossings, roundabout, grade-separated intersections. Camber, Super-elevation, Radius of curve Horizontal and Transition Curves, Gradients, Valley curve, Summit curve. Design of pavement for Roads as per IRC SP:72. Soil stabilization for roads.

Course Outcomes

1. Be able to understand the difference between material characteristics of different types of highway materials i.e. aggregates bituminous materials.
2. Bee able to comprehend the basics for design of various geometric elements.
3. Be able to design transition curve, radius of curve, valley curve and summit curve.
4. Be able to design the pavement crust for roads as per IRC SP-72.

Books

1. Highway Engineering by S. K. Khanna and C.E.G Justo
2. Highway Materials by HMSO London.
3. IRC SP 72.

UG/PG: UG	**Department:** Civil Engineering
Course Code:	**Course Name:** Highway Materials Lab
Credit: 1	**L-T-P: 0-0-2**
Pre-requisite Course:	

LIST OF EXPERIMENTS

Lab #	Name of the Experiment
1	Proctor & Modified Proctor Test.
2	Sieve Analysis (Sieve Shaker)
3	Liquid Limit Test.
4	Plastic Limit Test.
5	California Bearing Ratio (CBR) Test.
6	Aggregate Impact Value Test.
7	Aggregate Abrasion Value Test.
8	Aggregate Crushing Value Test.
9	Specific gravity test (aggregates & bitumen) Pycnometer.
10	Flakiness & Elongation Index Test (Thickness Gauge, Length Gauge)
11	Bitumen Softening Point Test.
12	Bitumen Ductility Value Test.

Course Outcomes

1. Understood the different important engineering properties of road material like aggregate and binding materials
2. Able to demonstrate the different test procedures related to road materials.
3. Able to measure the engineering properties of road material in laboratory and provide recommendations accordingly.

References

1. Highway Engineering By S. K. Khanna and C.E.G Justo