Mechanics of Solids

Semester III **Hours of Instruction / week: 3T+1Tu**
21BEVS01 **No. of Credits: 4**

Course Learning Objectives:

CLO1: To impart knowledge on effects of force and motion on rigid bodies

CLO2: To develop the capacity to understand the theory of stress and strain

UNIT I SYSTEM OF FORCES 12

Introduction – system of forces - Equivalent systems of forces - Free body diagram-Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions-Equilibrium of a particle – Equilibrium of a particle in space. Application of equilibrium equations in analysis of simple system of sliding frictional forces.

UNIT II PROPERTIES OF SURFACES AND SOLIDS 12

Centroids and Centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section – Parallel axis theorem and perpendicular axis theorem.

UNIT III STRESS AND STRAIN 12

Stress and strain – Hooke's Law - elastic constants – Stress-Strain Diagram for Mild Steel, TOR steel, Concrete – Factor of Safety – Thermal Stresses – Compound Bar.2 D State of Stress – 2 D Normal and Shear Stresses on any plane – Principal Stresses and Principal Planes – Mohr's circle. Strain energy due to axial load – Stress due to suddenly applied and impact load.

UNIT IV FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Beams and Bending- Types of loads, supports – Shear Force and Bending Moment Diagrams for statically determinate beam with concentrated load, UDL, uniformly varying load. Theory of simple bending- Analysis of determinate beams for stresses- Shear and Bending Stress distribution at a cross section with different loading conditions.

UNIT V DEFLECTION 12

Double integration method - Macaulay's methods - Area moment method - Conjugate beam method for computation of slopes and deflections of determinate beams.

Total Hours:60

Textbooks:

1. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)
2. R.K. Bansal, "Strength of Materials", Laxmi Publications Pvt. Ltd., New Delhi, 2018

3. S.Rajasekaran and G. Sankarasubramanian, "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
4. R.K. Rajput, "Strength of Materials", S.Chand and Co, New Delhi, 2015

Reference Books:

1. R.C. Hibbeller and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
2. Irving H. Shames and Krishna Mohana Rao. G, "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.
3. F.P. Beer and E.R. Johnston Jr., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi, 2004.
5. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, SMTS – I Strength of Materials, Laxmi publications, New Delhi, 2015.
6. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

Course Outcomes:

At the end of the Course**,** the students will be able to

CO1: Analyse and apply the resultant of forces for friction problems

CO2: Calculate centroid, moment of inertia for various cross section

CO3: Determine stress, strain for steel and concrete, 2D state of stress, bending moment and shear force, shear stress, bending stress and deflection for beams

CO- PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	H	H		M								H	H	
CO2	H	H		M								H	H	
CO3	H	M		L								H	H	

Mechanics of Fluids

Semester III **Hours of Instruction / week: 3T**
21BEVS02 **No. of Credits: 3**

Course Learning Objective:

CLO1: To impart properties of fluid and the principles of fluid statics, kinematics and dynamics

UNIT I FLUID PROPERTIES AND ITS MEASUREMENTS 9

Fluid properties - Types of fluids - Dimensions and units. Fluid Pressure and Its Measurement: Hydrostatic law; Pascal's law; Atmospheric, Absolute, Gauge and Vacuum pressures, Measurement of pressure by various types of manometers and mechanical gauges.

UNIT II FLUID STATICS 9

Total pressure on plane and curved surfaces - Centre of pressure for vertical and inclined plane surfaces. Buoyancy and floatation: Buoyancy and Meta centre - Determination of Meta centric height - Analytical and experimental methods - Conditions of equilibrium of submerged and floating bodies.

UNIT III FLUID KINEMATICS 9

Classification of fluid flow - Stream line, Streak line and Path lines - Continuity equation - Velocity potential function and Stream function - Flow net and its uses.

UNIT IV FLUID DYNAMICS 9

Energy possessed by a fluid body in motion - equations of motion - Euler's equation of motion - Bernoulli's equation and its applications - Discharge measurement – Venturimeter - Orifice meter. Simple problems using CFD (open source software – Open FOAM)

UNIT V DIMENSIONAL ANALYSIS, SIMILITUDE AND MODEL ANALYSIS 9

Methods of Dimensional Analysis, Rayleigh's method, Buckingham's theorem, Hydraulic Similitude, model analysis, dimensionless numbers, Model testing of partially submerged bodies, types of models.

Total Hours: 45

Textbooks:

1. R.K. Bansal, Fluid Mechanics and Hydraulic Machines. 9th edition., Laxmi ,2015 Publications, New Delhi, R.K. Rajput, A Fluid Mechanics, S Chand & Co., New Delhi, 2004
2. K.L. Kumar, Engineering Fluid Mechanics, Eurasia Publishing House (P) Ltd., New Delhi, 1995.

Reference Books:

1. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria & Sons, New Delhi, 2013.
2. P.N.Modi, "Hydraulics and Fluid Mechanics including Hydraulic Machines", 19th Revised and Enlarged edition, Standard Publishers Distributors, 2013.
3. www. spoken tutorial. org

Course Outcomes:

At the end of the course, the student will be able to

CO1: Compile and measure various properties of fluid pressure

CO2: Solve problems related to continuity and energy equation in flow through conduits

CO3: Perform dimensional analysis for fluid flow problems

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M		L							H		M	
CO2	H	M		L	L						H		M	
CO3	H	M		L							H		M	

Construction Materials and Technology

Semester III **Hours of Instruction / week: 3T**

21BEVS03 **No. of Credits: 3**

Course Learning Objective:

CLO1: To impart knowledge on properties and testing methods on various types of building materials.

UNIT I SUB STRUCTURE CONSTRUCTION 9

Functions of foundation – Types of shallow and deep foundations – Caissons and cofferdam – Causes for failures of foundations and remedial measures – Setting out of foundation – Excavation and timbering – Dewatering techniques – Box jacking and Pipe jacking techniques.

UNIT II MASONRY AND PLASTERING 9

Stones – Types – Characteristics–Stone masonry – Classification – Supervision of stone masonry – **Bricks** – Composition – types – BIS tests– Brick masonry – Classification – Supervision of brick masonry – Defects in brick masonry.

Hollow blocks–Composite masonry – Types of wall – Arches and Lintels.

Plastering –Materials and Methods of plastering – Types of plastering – Tools for plastering – Preparation and uses of cement mortar–Defects in plastering – pointing.

UNIT III FLOORING AND ROOFING 9

Cement –Sand – River sand, M sand and Eco sand – Coarse aggregate – Concrete –

Floors – Requirements of good floor – Floor finishing materials – Classifications – Terrazzo flooring – Marble flooring – Cement concrete flooring – Tiled flooring – Suitability of floors for various applications.

Damp Proof Course – Causes and effect of dampness –Materials and Methods of damp proofing – Anti-termite treatment.

Roofs– Roofing materials – Requirements –Types– Pitched roof –Flat roof – Flat and Ribbed slab.

Stairs – Requirements – Dimensions – Classifications of stairs – Ramps and Escalators.

UNIT IV DOORS, WINDOWS AND PAINTING 9

Timber–Defects – Causes of decay – Seasoning – Preservation – Laminated wood products – Properties – Types – Fibre board – Particle boards – Hard boards – A.C boards – Aluminium products – UPVC – Glass – Types – Properties – Applications.

Doors and Windows –Types – Fixtures and Fastening – Ventilators.

Painting – Paints and painting – Classification of paints– Painting on new and old surfaces of steel, timber and masonry wall – Defects in painting.

UNIT V CONSTRUCTION PRACTICES 9

Centering and shuttering– Formwork– Scaffolding–Plumbing Services. Structural steel and High Tensile Steel Properties – Types – Market forms of steel–Fabrication and erection of steel trusses – Frames– Launching girders.

Total Hours:45

Textbooks:

1. P. Purushothama Raj, "Building Construction materials and techniques", 2016 Pearson Education, India
2. Dr. B.C. Punmia, Ashok K Jain, Dr. Arun K Jain "Building Construction", 2017 Lakshmi Publications.

Reference Books:

1. S.C. Rangwala, "Engineering Materials", Charotar Publishing House, 2009.
2. P.C. Varghese, "Construction Materials" Prentice Hall of India, New Delhi, 2006.
3. M.S. Shetty, "Concrete Technology Theory and Practice", S. Chand and Company Ltd, New Delhi, 2005.

Course Outcomes:

At the end of the course, the students will able to

CO1: Outline the manufacturing process, types various characteristics and tests conducted on the construction materials.

CO2: Identify and evaluate various construction techniques and practices involved in sub structure and super structure constructions.

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H					M	H	M	M			H	L	H
CO2	H					M	H	M	M			H	L	H

Strength of Materials Practicals

Semester III **Hours of Instruction / week: 3P**
21BEVS04 **No. of Credits: 1.5**

Course Learning Objectives:

CO1: To impart knowledge on strength properties of different construction materials like steel, concrete, brick and plywood

CO2: To impart knowledge on stiffness properties of springs, hardness properties of various metals by conducting experiments in laboratory

List of Experiments

1. Tension test on mild steel & tor steel rod
2. Torsion test on mild steel rod
3. Impact test on metal specimen
4. Hardness test on metals
5. Compression and bending test on wooden and steel specimens
6. Compression test on helical spring
7. Tension test on helical spring
8. Stress- strain curve for concrete
9. Compressive test on brick
10. Test on plywood
11. Deflection test on RC beam

Total Hours: 45

Reference Books:

1. R.K. Bansal, "Strength of Materials", Laxmi Publications, New Delhi, 2015.
2. R.K. Rajput, "Strength of Materials", S. Chand Publications, New Delhi, 2014.

Course Outcomes:

At the end of the course, the students will able to

CO1: Determine the strength characteristics such as tensile, compressive, torsion, impact, and hardness strength of construction materials.

CO2: Evaluate bending properties for wood and steel.

CO3: Evaluate deflection character of RC beams.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M		H		M						H	H	L
CO2	H	M		H		M						H	H	L
CO3	H	M		H		M						H	H	L

Surveying

Semester III **Hours of Instruction / week: 3T**
21BEVC01 **No. of Credits: 3**

Course Learning Objective:

CLO1: To impart knowledge on measuring horizontal, vertical and angular measurements using surveying methods and its applications in Civil Engineering projects using chain, compass, theodolite, total station and GPS instruments.

UNIT I INTRODUCTION TO SURVEYING 9

Definition - Classifications - Basic Principles - Equipment and accessories for ranging and chaining – Methods of ranging - well conditioned triangles – Errors in linear measurement and their corrections - Obstacles - Traversing – Plotting – applications - enlarging the reducing the figures – Areas enclosed by straight line irregular figures - digital planimetre.

UNIT II LEVELLING 9

Levels and staves, Spirit level, sensitiveness - Benchmarks - Temporary and permanent adjustments methods - Differential, fly, check, profile and block levelling - Booking, reduction, Arithmetic checks, correction for curvature and refraction, Reciprocal levelling. Intervisibility of stations - Errors in levelling. Longitudinal and cross sections, plotting, calculation of areas and volumes - Contouring, characteristics and uses of contours, plotting, Earthwork volume capacity of reservoirs.

UNIT III THEODOLITE SURVEY 7

Transit Theodolite - vernier, micrometer and micro-optic theodolite - description and uses - Fundamental lines of Transit theodolites, Temporary and Permanent adjustments, Horizontal angles, reiteration and repetition, vertical angles - Methods of traversing conditions for closure, closing error and distribution, Gale's Traverse table - plotting by Coordinates - Omitted Measurements, Gross errors.

UNIT IV CURVES 11

Elements of simple and compound curves – Method of setting out – Elements of Reverse curve - Transition curve – length of curve – Vertical curves.

UNIT V ADVANCED INSTRUMENTS 9

Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories – Advantages and Applications, Errors in Total Station Survey; Global Positioning Systems - Segments, GPS measurements.

Total Hours: 45

Textbooks :

1. Dr. B.C. Punmia, Ashok Kumar Jain, Ashok K. Jain, Arun K. Jain, Surveying (Volume –I and II), Lakshmi Publications, 17th Edition, 2016
2. N.N. Basak, Surveying & Levelling, Tata McGraw-Hill Education, 2nd Edition, 2014
3. N. Madhu, R. Sathiskumar and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2nd Edition, 2017.
4. Manoj K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011.
5. S.S Bhavikatti, Surveying and Levelling, Vol. I and II, I.K. International, 2nd Edition, 2016

Reference Books:

1. A. Bannisterand & S. Raymond "Surveying", 7th ed., Dorling Kindersley India Pvt Ltd, New Delhi, 2009.
2. S.K. Duggal, Surveying, Vol – I and II, McGraw Hill Education (India) Private Limited, 4th Edition, 2013.
3. A.M. Chandra, Higher Surveying. New Age International (P) Ltd, New Delhi, 2002.
4. S.K. Roy, "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2004.
5. K.R. Arora, "Surveying Vol I & II", Standard Book house, 10th Edition 2008.

Course Outcomes:

At the end of the Course, the student will be able to

CO1: Identify and apply various surveying instruments for linear and angular measurements.

CO2: Compute various components of curve

CO3: Discuss about the functions and applications of total station and GPS

CO- PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M		L								H	M	
CO2	H	M		L								H	M	
CO3	H	L		L	H							H	M	

Survey Practicals

Semester III **Hours of Instruction / week: 3P**

21BEVC02 **No. of Credits: 1.5**

Course Learning Objective

CLO1: To impart knowledge on practical applications in measurements of land, using Chain, Theodolite, Tacheometry, Total Station and GPS instruments.

List of Experiments:

1. Determination of Area of polygon Using Chain Survey and Cross Staff Survey
2. Fly Levelling
3. Profile Levelling
4. Longitudinal and Cross Sectioning
5. Height of the object when the base is accessible/ inaccessible
6. Tangential Tachometric Surveying
7. Setting out of curves by long chord method
8. Setting out of curves by One Theodolite method
9. Determine the area of the given location using Total station
10. Use of GPS to determine latitude and longitude and locate the place
11. Contouring

Total Hours: 45

Reference Books:

1. Department of Civil Engineering, "Survey Laboratory Manual", School of Engineering, Avinashilingam Institute, Coimbatore

Course Outcomes:

At the end of the Course, the students will be able to:

CO1: Execute various measurements of land using chain and theodolite

CO2: Compute measurements of field using total station and GPS

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H		H	H				M			H	H	
CO2	H	H		H	H				M			H	H	

Introduction to Geographic Information System

Semester IV **Hours of Instruction / week: 3T**
21BESV01 **No. of Credits: 3**

Course Learning Objectives:

CLO1: To introduce the fundamentals and components of Geographic Information System.

CLO2: To provide details of spatial data structures and input, management and output processes.

UNIT I INTRODUCTION TO GIS BASIC CONCEPTS 9

Definition and history, Components of GIS, Recent trends and applications of GIS; Data structure and formats, Spatial data models – Raster and vector, Data base design- editing and topology creation in GIS, Linkage between spatial and non-spatial data, Data input in GIS. Rectification, Transformation Methods; Root Mean Square (RMS) Error.

UNIT II DATA TYPES AND DATA MODELS 9

Data Types; Spatial Data; Non-Spatial Data, Data Input; Existing GIS Data, Metadata; Conversion of Existing Data, Creating New Data, Data Models; Vector Data Model; Raster Data Model; Integration and Comparison of Vector and Raster Data Models.

UNIT III SPATIAL DATA EDITING 9

Types of Digitizing Errors, Causes for Digitizing Errors; Topological Editing and Non-topological Editing; Other Editing Operations; Editing Using Topological Rules. Attribute Data and Data Exploration: Attribute Data in GIS, Attribute Data Entry, Manipulation of Fields and Attribute Data, Data Exploration; Attribute Data Query, Raster Data Query, Map - Based Data Manipulation.

UNIT IV SPATIAL ANALYSIS 9

Spatial Data: Definition, Analysis, Processes & Steps, Software and Tools, Geo database Model, Role of Databases in GIS, Creating, Editing and Managing, Classification scheme of Vector - Based and Raster - Based GIS Operation Raster - Based Techniques: Methods of reclassification overlay analysis, Digital Terrain Analysis and Modelling - TIN and DEM, Surface representation and analysis, Slope and Aspect, Geographic Visualization Data Classification, Map Comparison.

UNIT V GEO STATISTICAL ANALYSIS TECHNIQUES 9

Introduction to Spatial Interpolation: Control Points, Global Method - Trend surface analysis, regression model, local methods - Thiessen polygons, density estimation, Inverse Distance weighted Interpolation, Kriging - Ordinary Kriging and Universal Kriging, GIS and decision support system, Introduction to AHP, basic principal of AHP. Principal and components of multiple criteria decision making

Total Hours:45

Textbooks :

1. Kang-tsung Chang (2007), 'Introduction to Geographic Information Systems' Tata MCGraw Hill, New Delhi.
2. C.P.Lo and Albert K.W. Yeung (2006) "Concepts and Techniques of Geographic information Systems" Prentice Hall of India, New Delhi.
3. Burrough, Peter A. and Rachael McDonnell, (1998), 'Principles of Geographical Information Systems' Oxford University press, New York.
4. D.J. Magwire, M.F. Goodchild, and D.M. Rhind, (2005), 'Geographical Information Systems: Principles and Applications', Longman Group, U.K.
5. P.A. Burrough, 1986, Geographical Information System for land Resources System, Oxford Univ. Press, UK.

Reference Books :

1. S. Fotheringham, P. Rogerson (ed.), 1994. Spatial analysis and GIS. Taylor and Francis, London, UK.
2. Laurini, Robert and Dierk Thompson, 1992, Fundamentals of Spatial Information Systems, Academics Press, ISBN 0-12-438380-7.
3. D.J. Magwire, M.F. Goodchild, and D.M. Rhind, 1991.Geographical information System, Longman, London, UK
4. M.A. Siddiqui, 2006, Introduction to Geographical Information System, Sharda Pustak Bhavan, Allahabad.
5. M.A. Siddiqui, 2011, Concepts and Techniques of Geoinformatics, Sharda Pustak Bhavan, Allahabad.

Course Outcomes:

At the end of the course the student will be able to

CO1: Explain and analyze the basic concepts, components and data models of GIS.

CO2: Process spatial and attribute data and prepare thematic maps.

CO3: Apply the knowledge of spatial statistical techniques to real time problems.

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	M	M	M	M					H		H	
CO2	H	M	M	M	H	M					H		H	
CO3	H	M	M	M	H	M					H		H	

Strength of Materials

(Prerequisite: Mechanics of Solids)

Semester IV **Hours of Instruction / week: 3T+1Tu**

21BEVC03 **No. of Credits: 4**

Course Learning Objectives:

CLO1: To provide knowledge on deformation of solids such as bars, beams and thin cylinders and plane truss to different types of static loads

CLO2: To study the behavior of shafts and springs due to torsion

CLO3: To provide knowledge on analyzing complex state of stress

UNIT I TORSION 12

Elastic theory of Torsion –Solid and hollow circular shafts - Combined bending moment and torsion of shafts- strain energy due to torsion- Modulus of rupture- Power transmitted to shaft Closed and open coiled helical springs- Leaf springs.

UNIT II SHEAR CENTRE AND CURVED BEAMS 12

Introduction to non-circular sections-Shear center for thin walled beam of mono- symmetric open sections- Shear flow in thin walled beams of open sections.

Curved Beams: Curved beams-Stresses due to bending by Wrinkler back theory- Rectangular, trapezoidal and circular solid section-Crane hook problem.

UNIT III COLUMNS AND THICK CYLINDERS 12

Rankine - Gordon formula for eccentrically loaded columns – Eccentrically loaded short columns – middle third rule – core section. Direct and bending stresses for eccentrically loaded short column and other structural components such as retaining walls, dams, chimneys, etc. Effect of lateral force and selfweight. Resultant stress diagrams due to axial loads, uni-axial, and bi-axial bending.Concept of core of section for solid and hollow rectangular and circular sections.Euler's theory of long columns – critical loads for prismatic columns with different end conditions. Thick cylinders – Compound cylinders.

UNIT IV UNSYMMETRICAL BENDING OF STRAIGHT BEAMS 12

Symmetrical and Unsymmetrical Bending-Bending Stresses in Beams Subjected to Unsymmetrical Bending- Change in Direction of Neutral Axis and Increase in Stress Compared to Symmetrical Bending.

UNIT V PLANE TRUSSES 12

Plane trusses- Analysis of trusses - Method of joints – Method of sections- Tension Co-efficient Method

Total Hours: 60

Textbooks:

1. R.K. Bansal, “Strength of Materials”, Laxmi Publications, New Delhi, 2015.
2. R.K. Rajput, “Strength of Materials”, S. Chand Publications, New Delhi, 2014.
3. Egor P Popov, “Engineering Mechanics of Solids”, 2nd edition, PHI Learning Pvt. Ltd, New Delhi, 2012.

Reference Books:

1. William A. Nash, “Theory and Problems of Strength of Materials”, Schaum’s Outline Series, Tata McGraw Hill Publishing company, 2007.
2. B.C. Punmia, "Theory of Structures" (SMTS) Vol 1&II, Laxmi Publishing Pvt Ltd, New Delhi 2004.
3. S.S. Rattan, "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.

Course Outcomes:

At the end of the course, Students will be able to

CO1: Analyze shafts, thin walled and curved beams

CO2: Analyse columns for different end support conditions and loading thick cylinders for external loads and plane truss for joint loads

CO3: Analyse straight beams for unsymmetrical bending

CO- PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H		M								H	H	H
CO2	H	H		M								H	H	H
CO3	H	H		M								H	H	H

Applied Hydraulics and Hydraulic Machinery
(Prerequisite: Mechanics of Fluids)

Semester IV **Hours of Instruction / week: 3T+1Tu**
21BEVC04 **No. of Credits: 4**

Course Learning Objective:

CLO1: To provide exposure on the applications of hydraulic engineering by studying the performance of hydraulic devices and machineries

UNIT I FLOW MEASUREMENT 12

Velocity measurement, Pitot tube, Current meter, Discharge measurement, Orifices, mouthpieces, notches and weir, Rectangular, triangular, Cippoletti weir, submerged weir, Time of emptying reservoirs through orifices, mouthpieces and notches.

UNIT II FLOW THROUGH PIPES 12

Energy losses in pipes, Darcy Weisbach's formula, flow through pipes in series flow through parallel pipes, flow through branched pipes, equivalent pipe - Water hammer in pipes, Laminar flowthrough circular pipes, Hagen Poiseuilles' equation, turbulent flow through circular pipes, Velocity distribution.

UNIT III FLOW IN OPEN CHANNELS 12

Types of flow in channels, velocity distribution, Chezy's formula, Manning's formula; Most economical channel section; Computation of specific energy and critical depth; hydraulic jump and backwater curves. IMPACT OF JETS: Applications of momentum equation, Force exerted by fluid jet on stationary and moving curved vanes

UNIT IV TURBINES 12

General layout of a Hydroelectric power plant, Classification of turbines, Specific speed and characteristic curves, Draft tube and cavitation.

UNIT V PUMPS 12

Classification of pumps, Centrifugal pumps, multistage pumps, minimum speed to start the pump, specific speed and characteristic curves, reciprocating pumps, negative slip, Indicator diagram, functions of air vessels. Hydraulic Devices: Hydraulic press, hydraulic accumulator, hydraulic intensifier and hydraulic ram, hydraulic jacks

Total Hours: 60

Textbooks:

1. R.K. Rajput, A textbook of Fluid Mechanics and Hydraulic Machines. S Chand and Company Ltd., New Delhi, 2004.
2. R.K. Bansal, "Fluid Mechanics and Hydraulic Machines", 9th Revised edition, Laxmi Publications, New Delhi, 2011.
3. S.K. Garg, "Irrigation Engineering & Hydraulic Structures", 23rd edition, Khanna Publishers, New Delhi, 2009.

Reference Books:

1. Yunus A. Cengel, John M. Cimbal, Fluid Mechanic Fundamentals and Applications. Tata McGraw, Hill Publishing Company Limited, New Delhi,2006.
2. A.K. Mohanty, Fluid Mechanics. Second Edition. Prentice Hall of India Private Limited, New Delhi, 2007.
3. V.T. Chow, "Open Channel Hydraulics", Blackburn Press, Caldwell United States, 2009.
4. Modi & Seth, "Hydraulics & Fluid Mechanics including Hydraulic Machines" Standard Publications, New Delhi, 2002.

Course Outcomes:

At the end of the course, the students will able to

CO1: Determine flow measurements in hydraulic devices and open channels

CO2: Identify an effective section for flow in different cross sections

CO3: Evaluate the performance of pumps and turbines

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	H	H								H	H	
CO2	H	H	H	H								H		
CO3	H			H								H	H	

Mechanics of Soils

Semester IV **Hours of Instruction / week: 3T**
21BEVC05 **No. of Credits: 3**

Course Learning Objectives:

CLO1: To impart knowledge on engineering behaviour and performance of soils
CLO2: To gain knowledge on assessing compaction and strength properties of soils.

UNIT I BASIC PROPERTIES OF SOILS 9

Soil formation – Grain size distribution – Atterberg's limits – Soil classification system – their significance – Field identification – Simple tests. Soil problems in Engineering – Physical properties of soil – Phase relations – Index properties of soil – Theory of compaction, determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.

UNIT II SOIL WATER 9

Permeability of Soil, Introduction to hydraulic head, Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant head method, falling head method. Effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

UNIT III STRESS DISTRIBUTION AND CONSOLIDATION 9

Stress distribution in soil media, Bousinesq's Analysis, Westergaard's Analysis, Intensity of vertical stress using influence chart. Consolidation, measurement of compressibility, e-log, P-curves, Terzaghi's one dimensional theory, determination of coefficient of consolidation.

UNIT IV SHEAR STRENGTH 9

Shear Strength, Principle planes parallel to the coordinate axes, Mohr's circle, important characteristics of Mohr's circle, Mohr, Coulomb theory, types of shear test: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests, relation between major and minor principal stresses, unconfined compression test, vane shear test.

UNIT V SLOPE STABILITY 9

Stability of Slopes, Introduction, different factors of safety, types of slope failures, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

Total Hours: 45

Textbooks:

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2009
2. Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", Wiley Eastern Ltd,New Delhi (India), 2007.
3. Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2011.

Reference Books:

1. Punmia, B.C. Ashok Kumar Jain, Arun Kumar Jain ―Soil Mechanics and Foundations‖, Laxmi Publications Pvt. Ltd., New Delhi, 2005.
2. McCarthy D, ―Essentials of Soil Mechanics and Foundations Pearson New International, Seventh Edition 2013.
3. Das, B.M. "Principles of Foundation Engineering" (Eigth edition), Thompson Asia Pvt. Ltd., Singapore, 2013.
4. Palanikumar. M, "Soil Mechanics", Prentice Hall of India Pvt. Ltd, Leaning Private Limited, Delhi, 2013.
5. Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2nd Edition, Pearson Education, 2013

Course Outcomes:

At the end of the course, the students will be able to

CO1: Discuss about soil classifications and determine index properties of soil

CO2: Analyse soil water behaviour and stress distribution in soils due to compaction and consolidation

CO3: Determine the shear strength of soils and stability of slopes

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H		H								H	H	H
CO2	H	H		H								H	H	H
CO3	H	H		H								H	H	H

Hydraulics and Hydraulic Machinery Practicals

(Prerequisite: Mechanics of Fluids)

Semester IV **Hours of Instruction / week: 3P**

21BEVC06 **No. of Credits: 1.5**

Course Learning Objective:

CLO1: To impart knowledge on characteristics of fluids namely flow through pipes, pumps and Turbines

List of experiments:

1. Determination of Coefficient of discharge of a mouthpiece.
2. Determination of Coefficient of discharge of an orifice.
3. Determination of Coefficient of discharge of a rectangular notch and V-notch.
4. Determination of Coefficient of discharge of a Venturimeter.
5. Determination of Coefficient of discharge of an Orifice meter.
6. Determination of pressure loss in pipe flow.
7. Verification of Bernoulli's theorem.
8. Determination of Metacentric Height
9. Determination of velocity in pitot tube
10. Performance of Pelton Turbine and Francis Turbine, Operating characteristics.
11. Study on Performance Characteristics of centrifugal pump.
12. Study on Performance Characteristics of reciprocating pump.
13. Study on Performance Characteristics of Jet and gear pump.

Total Hours: 45

Reference Books:

1. R.K. Rajput, A textbook of Fluid Mechanics and Hydraulic Machines. S Chand and Company Ltd., New Delhi, 2004.
2. R.K. Bansal, "Fluid Mechanics and Hydraulic Machines", 9th Revised edition, Laxmi Publications, New Delhi, 2011.

Course Outcomes:

At the end of the course, the students will be able to

CO1: Demonstrate and measure discharge in open and closed pipes.

CO2: Demonstrate and perform experiment to find characteristic curves of various pumps and turbines

CO –PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	L									H	L	L	
CO2	H	L									H	L	L	

Soil Mechanics Practicals

Semester IV **Hours of Instruction / week: 3P**
21BEVC07 **No. of Credits: 1.5**

Course Learning Objective:

CLO1: To provide hands-on experience to determine properties of soils and interpret results as per the guidelines of BIS of soils

List of Experiments:

1. Moisture content in soil.
2. Specific gravity and relative density test for sand.
3. Sieve analysis for coarse grained soil.
4. Hydrometer analysis for fine grained soil.
5. Consistency limits.
6. Field density tests (Sand replacement method and core cutter method).
7. Permeability tests – Constant Head method and variable Head method.
8. Direct Shear test.
9. Unconfined compression test for Soil.
10. Vane Shear Test for Cohesive Soil.
11. Standard Proctor's Compaction Test.
12. Consolidation Test.
13. Differential free swell tests.
14. Swell Pressure Test.
15. Triaxial Compression Test (Demonstration only).

Total Period: 45

Reference Books:

1. Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2011.
2. Saibaba Reddy, E. Ramasastri, K. "Measurement of Engineering Properties of Soils" New age International (P) Limited Publishers, New Delhi, 2002.

Course Outcome:

At the end of the course, students will be able to

CO1: Determine and analyse engineering properties of soil and classify them

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H	M	H				H				H		H

Structural Analysis

(Prerequisite: Strength of Materials)

Semester V **Hours of Instruction / week: 3T+1Tu**

21BEVC08 **No. of Credits: 4**

Course Learning Objectives:

CLO1: To aquire the knowledge on behavior of structural elements before and after application of loads.

CLO2: To provide knowledge to analyse determinate and indeterminate structures using different methods.

UNIT I STATIC ANALYSIS 12

Propped cantilever and fixed beams-fixed end moments and reactions, Application of slope deflection method to the analysis of statically indeterminate beams and rigid jointed plane frames, Effects of settlement of supports for beams only (Examples on structures having Kinematic indeterminacy not exceeding three). Application of Moment distribution methods to the analysis of continuous beams and rigid jointed plane frames, effects of settlement of supports. Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

UNIT II MOVING LOADS AND INFLUENCE LINES 12

Moving loads, Absolute maximum shear force and bending moment in simply supported beams, Determination of equivalent UDL, influence lines for shear force, bending moment and reactions in statically determinate beams and influence lines for forces in members of statically determinate plane trusses, Reversal of forces in members of plane trusses. Influence lines for shear force, bending moment and reactions in statically indeterminate beams by Muller-Breslau's Principle, Application of Muller Breslau Principle to beams with degree of static indeterminacy not exceeding one.

UNIT III ANALYSIS OF ARCHES 12

Analysis of three hinged arches of parabolic and circular profiles, Analysis of two hinged symmetric parabolic and circular arches. Settlement and temperature effects, Influence lines for bending moment, normal thrust and radial shear at sections of an arch.

UNIT IV FLEXIBILITY MATRIX METHOD 12

Equilibrium and compatibility – Determinate vs. Indeterminate structures – Indeterminacy – Primary structure – Compatibility conditions – Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).

UNIT V STIFFNESS MATRIX METHOD 12

Element and global stiffness matrices – Analysis of continuous beams – Co-ordinate transformations

– Rotation matrix – Transformations of stiffness matrices, load vectors and displacements vectors – Analysis of pin-jointed plane frames and rigid frames (with redundancy limited to two)

Total Hours: 60

Textbooks:

1. Guptha.S.P and Pandit.G.S., Theory of Structures,Vol.I&II.Tata McGraw Hill, New Delhi.,2012.
2. Rajasekaran.S and Sankarasubramanian.G, Computational Structural Mechanics. Prentice Hall of India, New Delhi.,2012
3. Vaidyanathan, R and Perumal, P., Comprehensive Structural Analysis,‖ Volume I and II, Laxmi Publications Pvt. Ltd., Chennai, Fourth edition 2008.
4. S.S.Bhavikatti, - Structural Analysis‖ – Vol.I& II, Vikas Publishing Pvt Ltd., New Delhi, Fourth Edition 2013.

Reference Books:

1. Punmi. B.C., Jain, Ashok Kumar and Jain, Arun Kumar., ―Theory of Structures, Laxmi Publications, New Delhi, 2014.
2. Reddy.C.S,Basic Structural Analysis. Tata Mc,Graw Hill, New Delhi., 2012
3. Junnarkar and Shah , Mechanics of Structures Vol.II. Charotar Publishing House, Anand.,2012
4. Wang.C.K , Intermediate Structural Analysis. Tata Mc-Graw Hill, New Delhi.,2010.

Course Outcomes:

At the end of the course, the students will able to analyse

CO1: Statically indeterminate fixed beams, rigid and pin jointed plane frames using slope deflection, moment distribution and matrix methods and draw bending moment and shear force diagram.

CO2: Statically determinate and indeterminate beams and arches for bending and deflection.

CO3: Statically determinate plane frames and pin jointed beams for moving loads.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H		H								H	H	
CO2	H	H		H								H	H	
CO3	H	H		H								H	H	

Foundation Engineering

(Prerequisite: Mechanics of Soils)

Semester V **Hours of Instruction / week: 3T+1Tu**
21BEVC09 **No. of Credits: 4**

Course Learning Objectives:

CLO1: To impart knowledge on sub soil investigation and design of shallow & deep foundation.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 12

Scope and objectives – Methods of exploration – augering and boring – Wash boring and rotary drilling – Depth of boring – Spacing of bore hole – Sampling techniques – Representative and undisturbed sampling – methods - Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetration tests (SPT and SCPT) - Bore log report – Data interpretation – strength parameters and Liquefaction potential - Selection of foundation based on soil condition.

UNIT II SHALLOW FOUNDATION 12

Introduction – Location and depth of foundation – Codal provisions – bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – factors affecting bearing capacity – problems – Bearing capacity by in-situ tests (SPT, SCPT and plate load) Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.

UNIT III FOOTINGS AND RAFT FOUNDATION 12

Types of footings – Contact pressure distribution: Isolated footing – Combined footings – Types and proportioning – Mat foundation – Types and applications – Proportioning – Floating foundation – Seismic force consideration – Codal Provision.

UNIT IV PILE FOUNDATION 12

Types of piles and their function – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – static formula – dynamic formulae (Engineering news and Hileys) – Capacity from in-situ tests (SPT and SCPT) – Negative skin friction – uplift capacity- Group capacity by different methods (Feld's rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only) – Under reamed piles – Capacity under compression and uplift.

UNIT V EARTH PRESSURE AND RETAINING WALLS 12

Plastic equilibrium in soils – active and passive states – Rankine's theory – cohesionless and cohesive soil – Coulomb's wedge theory – Condition for critical failure plane – Earth pressure on

retaining walls of simple configurations – Culmann Graphical method – pressure on the wall due to line load – Stability analysis of retaining walls.

Total Hours: 60

Textbooks:

1. Das B.M. “Principles of Foundation Engineering”, 5th edition, Thompson Asia Pvt.Ltd.,Singapore, 2003.
2. Kaniraj, S.R. “Design aids in Soil Mechanics and Foundation Engineering”, Tata McGraw Hill Publishing company Ltd., New Delhi, 2002.
3. Punmia, B.C. "Soil Mechanics and Foundations”, Laxmi Publications Pvt.Ltd., NewDelhi,2005
4. Venkatramaiah, C. “Geotechnical Engineering”, New Age International Publishers, New Delhi, 2007 (Reprint).

Reference Books:

1. Arora K.R. “Soil Mechanics and Foundation Engineering”, Standard Publishers and Distributors, New Delhi, 2005.
2. Gopal Ranjan and Rao A.S.R. “Basic and Applied soil mechanics”, New Age International Pvt. Ltd, New Delhi, 2005
3. Purushothama Raj. P., “Soil Mechanics and Foundation Engineering”, 2nd Edition, Pearson Education, 2013
4. Varghese, P.C., “Foundation Engineering”, Prentice Hall of India Private Limited, New Delhi, 2005. Standards, New Delhi, 1997

Codal Provisions:

1. IS 6403 : 1981 (Reaffirmed 1997) “Breaking capacity of shallow foundation”, Bureau of Indian Standards, New Delhi, 1998
2. IS8009 (Part1):1976 (Reaffirmed 1998) “Shallow foundations subjected to symmetrical static vertical loads”, Bureau of Indian Standards, New Delhi, 1999
3. IS8009 (Part2):1980 (Reaffirmed 1995) “Deep foundations subjected to symmetrical static vertical loading”, Bureau of Indian Standards, New Delhi, 1992
4. IS2911 (Part1):1979 (Reaffirmed 1997) “Concrete Piles” Bureau of Indian Standards, New Delhi, 1994
5. IS2911 (Part2):1979 (Reaffirmed 1997) “Timber Piles”, Bureau of Indian Standards, NewDelhi,2007.
6. IS2911 (Part 3):1979 (Reaffirmed 1997) “Under Reamed Piles”, Bureau of Indian Standards, New Delhi, 1998

7. IS2911 (Part 4):1979 (Reaffirmed 1997) “Load Test on Piles”, Bureau of Indian Murthy, V.N.S., “Soil Mechanics and Foundation Engineering”, CBS Publishers and Distributers Ltd., New Delhi, 2007.

Course Outcomes:

At the end of the course, the students will be able to

CO1: Explore soil investigation and demonstrate field tests needed for safe design of foundation.

CO2: Analyse and design various types of shallow and deep foundation

CO3: Analyse retaining walls for its stability.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M		M					M		H	H	M	L
CO2	H	M	H	H								H	M	L
CO3	H	H		H								H	M	L

Computer Aided Design in RC Elements

(Relevant IS Code books to be used)

Semester V **Hours of Instruction / week: 3T+1Tu**
21BEVC10 **No. of Credits: 4**

Course Learning Objective:

CLO1: To introduce the philosophies related to design and design basic structural elements such as slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice with computer design concepts.

UNIT I REINFORCED CONCRETE MATERIALS AND DESIGN CONCEPTS 12

Materials: Stress strain curve for concrete – Standard concrete mixes for RCC works – types of Reinforcements – plain and deformed bars – Stress – strain curve for reinforcing steel.

Design concepts: Design philosophies – Characteristic load and strength – permissible stresses – partial safety factors – limit state of collapse– limit state of Serviceability – Durability limit state – deflection and cracking – modification factors. Basic design concepts – working stress and limit state methods.

Design Software: Various aspects of Programming for RC Elements.

UNIT II LIMIT STATE DESIGN OF BEAMS 12

Design of singly and doubly reinforced rectangular and flanged sections by limit state method with are code specifications – Analysis and design of singly and doubly reinforced rectangular and flanged beams. Design of sections subjected to the combined action of bending moment, transverse shear and torsion.

Program for Design of Beam Sections: Defining Variables-flow chart & Description of Program.

UNIT III LIMIT STATE DESIGN OF SLABS 12

Behaviour of one way & two-way slabs – Design of one way slab – span / effective length ratio – two way slab – Analysis, design and detailing of rectangular slabs subjected to uniformly distributed load. Design of lintel and lintel cum sunshade – Design of staircase.

Program for Design of Slab Sections: Defining Variables-flow chart & Description of Program

UNIT IV LIMIT STATE DESIGN OF COLUMNS 12

Types of columns – Effective length of columns - Design of rectangular and circular columns for axial load – Codal Provisions for the analysis of columns subjected to axial load and uniaxial bending – Design of short columns subjected to axial load and uniaxial / biaxial bending moment using interaction charts.

Program for Design of Column Sections: Defining Variables-flow chart & Description of Program

UNIT V LIMIT STATE DESIGN OF FOOTINGS 12

Design of wall footings, Design of isolated, square and rectangular footings, Combined rectangular and trapezoidal footings, Detailing.

Total Hours:60

Textbooks:

1. Unnikrishna Pillai and Devados Menon (2011). Reinforced Concrete Design, Tata McGraw Hill Publishing Co, New Delhi.
2. Ashok K Jain (2012). Reinforced Concrete Limit State Design. New Chand Bros, Roorkee.
3. Varghese,P.C (2011). Limit State Design of R.C. Structures. Prentice Hall of India.
4. Krishna Raju, N and Pranesh, R.N., ―Reinforced Concrete Design – IS 456 – 2000 Principles and Practice‖, New Age International Publishers, New Delhi, 2003.
5. Subramanian, N, ―Design of Reinforced Concrete Structures, Oxford University Press, New Delhi,2014.
6. Sinha, N.C., and Roy, S.K (2013).Fundamentals of Reinforced Concrete. S.Chand and Company, New Delhi.

Reference Books:

1. Sinha, S.N (2012). Reinforced Concrete Design. Tata McGraw-Hill Publishing Co, Ltd., New Delhi.
2. MacGregorJ.G (2011). Reinforced Concrete Mechanics and Design. Prentice Hall, New Jersey
3. MallickS.K., and Gupta,A.P(2012).Reinforced Concrete. Oxford& IBH Publishing Co., New Delhi.
4. IS: 456-2000 Indian Standard Code of Practice for Reinforced Concrete, Bureau of Indian Standards, New Delhi.
5. SP 16-1980 Design Aids for reinforced Concrete, Bureau of Indian Standards, New Delhi.
6. SP 34-1987, Hand Book on Concrete Reinforcement and Detailing, Bureau of Indian Standards, New Delhi.

Course Outcomes:

At the end of the course, the student will be able to

CO1: Discuss the design concepts involved in RC materials

CO2: Design RC beams and slabs by manual and computer programming method

CO3: Design RC columns and footing.

CO- PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H			H				H				H	H	L
CO2	H	M	H	H				H				H	H	L
CO3	H	M	H	H				H				H	H	L

Environmental Engineering I

Semester V **Hours of Instruction/Week: 3T**
21BEVC11 **No. of Credits: 3**

Course Learning Objectives:

CLO1: To make the students to conversant with principles of water supply system, treatment units and distribution.

UNIT I PLANNING FOR WATER SUPPLY SYSTEM 9

Public water supply system - Planning - Objectives - Design period - Population forecasting – Water demand - Sources of water and their characteristics - Surface and Groundwater - Impounding Reservoir Well hydraulics - Development and selection of source - Water quality – Characterization and standards - Impact of climate change.

UNIT II CONVEYANCE SYSTEM 9

Water supply - intake structures - Functions and drawings - Pipes and conduits for water - Pipe materials - Hydraulics of flow in pipes - Transmission main design - Laying, jointing and testing of pipes - Drawings appurtenances - Types and capacity of pumps - Selection of pumps and pipe materials.

UNIT III WATER TREATMENT 9

Objectives - Unit operations and processes - Principles, functions, design and drawing of Chemical feeding, Flash mixers, flocculators, sedimentation tanks and sand filters – Disinfection - Residue Management - Construction and Operation & Maintenance aspects of Water Treatment Plants.

UNIT IV ADVANCED WATER TREATMENT 9

Principles and functions of Aeration - Iron and manganese removal, Defluoridation and Demineralization - Water softening - Desalination - Membrane Systems - Recent advances.

UNIT V WATER DISTRIBUTION AND SUPPLY TO BUILDINGS 9

Requirements of water distribution - Components - Service reservoirs - Functions and drawings - Network design - Economics - Computer applications - Analysis of distribution networks - Appurtenances - operation and maintenance - Leak detection, Methods. Principles of design of water supply in buildings - House service connection - Fixtures and fittings - Systems of plumbing and drawings of types of plumbing.

Total Hours:45

Textbooks:

1. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 2010.
2. Modi, P.N., Water Supply Engineering, Vol.I Standard Book House, New Delhi, 2010.
3. Punmia, B.C., Ashok Jain and Arun Jain, Water Supply Engineering, Laxmi Publications(P) Ltd., New Delhi,2014.

Reference Books:

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. Syed R. Qasim and Edward M. Motley Guang Zhu, Water Works Engineering Planning, Design and Operation, Prentice Hall of India Learning Private Limited, New Delhi, 2009.

Course Outcomes:

At the end of the course, the students will able to

CO1: Discuss about source of water and its water characteristics and materials used for conveyance system.

CO2: Select and Design various components of the water supply system including conveyance, primary and advanced water treatment units.

CO3: Identify, design and analyse water distribution system.

CO – PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	H					H	M	H				H		H
CO2	H	H	H			H	M	H				H		H
CO3	H	H	H	H		H	M	H				H		

Construction Technology Testing Practicals

Semester V **Hours of Instruction/Week: 3P**
21BEVC12 **No. of Credits: 1.5**

Course Learning Objective:

CLO1: To provide exposure to students on various basic construction techniques in constructing building components in the field.

List of Experiments:

1. Prepare and develop a centre line plan and foundation plan for a given line sketch of a building.
2. Setting out spread footing foundation in the field for a given line plan of a building.
3. Setting the layout of columns and footing foundation in the field for a given line plan of a building (Framed structure).
4. Arrangement of bricks using different types of bonds.
5. Arrangement of bricks using English Bond for one brick thick wall, one and half brick thick wall for Tee junction and for right angled corner junction.
6. Arrangement of bricks using English Bond for one brick thick square pillars.
7. Formwork, Cutting, hooking, cranking and arrangement of reinforcement for a Beam b Lintel and sunshade c Column and footing
8. Setting out of stairs case, doors and windows
9. Design of plumbing layout
10. Checking out of levels and plumbs

Total hours:45

Reference Books:

1. Varghese,P.C (2011). Limit State Design of R.C. Structures. Prentice Hall of India.
2. Krishna Raju, N and Pranesh, R.N., ―Reinforced Concrete Design – IS 456 – 2000 Principles and Practice‖, New Age International Publishers, New Delhi, 2003.
3. Subramanian, N, ―Design of Reinforced Concrete Structures, Oxford University Press, New Delhi,2014.

Course Outcomes:

At the end of the course, the students will able to

CO1: Prepare centre line plan, foundation plan, and plumbing layout for a building.
CO2: Demonstrate different types of brick bonds and bar bending schedule.
CO3: Demonstrate the levels of building components using plumbs.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H				H			H			H	H	
CO2	H	H				H			H			H	H	
CO3	H	H				H			H			H	H	

Computer Aided Modeling Practicals

Semester V **Hours of Instruction/Week: 3P**
21BEVC13 **No. of Credits: 1.5**

Course Learning Objective:

CLO1: Objective of building drawing and drafting course is to introduce students the basic terminology, component and element of building drawing. This course is designed to familiarize the students with the fundamentals of building drawing and drafting skill. Emphasis is placed on drafting floor plan, elevation, section and details of building.

List of Experiments:

1. Introduction to Structural system, Anatomy and Elements of building, scale of building drawing
2. Symbols and conventional signs used for building drawing
3. Prepare residential building drawing including location plan, site plan, floor plan, elevation, cross section and detail drawing -satisfying the principles of planning and by-laws using AutoCAD
4. Prepare public building drawing using AutoCAD
5. Prepare 3D model of a residential building using REVIT Architecture

Total Hours:45

References:

1. "Metrix Architectural construction drafting and design fundamentals", Willian J. Hornung.
2. John Molnar "Building construction drafting and design"
3. Brian W. Boughton."Building and Civil engineering construction"
4. John D. Bies. "Architectural drafting: Structure and Environment "Thomas, Marvin L." Architectural.

Course Outcomes:

At the end of the course, the students will be able to

CO1: Draft the plan, elevation and sectional view of different types of buildings using Auto CAD.

CO2: Prepare 3D model of building using REVIT Architect.

CO – PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H				H			H				H	H	
CO2	H				H			H				H	H	

Design of Steel Structures

Semester VI **Hours of Instruction / week: 3T+1Tu**
21BEVC18 **No. of Credits: 4**

Course Learning Objectives:
CLO1: To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections.
CLO2: To provide the students the tools necessary for designing structural systems such as roof trusses and gantry girders as per provisions of current code (IS 800-2007) of practice.

UNIT I INTRODUCTION TO STRUCTURAL STEEL AND DESIGN OF CONNECTIONS **12**

General -Types of Steel -Properties of structural steel - I.S. rolled sections - Concept of Limit State Design - Design of Simple and eccentric Bolted and welded connections - Types of failure and efficiency of joint – prying action – Introduction to HSFG bolts

UNIT II TENSION AND COMPRESSIONMEMBERS **12**

Behaviour and Design of simple and built-up members subjected to tension - Shear lag effect- Design of lug angles - tension splice - Behaviour of short and long columns - Euler's column theory-Design of simple and built-up compression members with lacings and battens - Design of column bases – slab base and gusseted base.

UNIT III BEAMS **12**

Design of laterally supported and unsupported beams – Design of built – up beams – Design of plate girders.

UNIT IV INDUSTRIAL STRUCTURES **12**

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

UNIT V PLASTIC ANALYSIS AND DESIGN **12**

Introduction to plastic analysis - Theorems of plastic Analysis - Design of continuous beams and portal frames using plastic design approach

Total Hours: 60

Textbooks:

1. Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013
2. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.
3. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2014

Reference Books:

1. Shiyekar. M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition, 2013.
2. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800–2007, IK International Publishing House Pvt. Ltd., 2009
3. Shah.V.L. and Veena Gore, "Limit State Design of Steel Structures", IS 800–2007 Structures Publications, 2009.

Codal provisions:

1. IS800 :2007, General Construction In Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007
2. SP 6(1)-1964 Handbook for Structural Engineers-Structural Steel Sections
3. IS 875: 1987 Code of Practice for Design loads: Part-1 Dead load, Part-II Imposed load & Part-III Wind load

Course Outcomes:

At the end of the Course, The student will be able to

CO1: Compile design concepts of steel sections and connections

CO2: Design the tension and compression members, built up beams

CO3: Design Plate & gantry girders, elements of roof truss and joints and apply the principles of plastic design in steel beams

CO- PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H											H	H	
CO2	H		H	L				H				H	H	
CO3	H		H	L				H				H		H

Environmental Engineering II

(Prerequisite: Environmental Engineering - I)

Semester VI **Hours of Instruction / week: 3T**
21BEVC15 **No. of Credits: 3**

Course Learning Objective:

CLO1: To educate the students to know knowledge about principles and design of Sewage Collection, Conveyance, treatment and disposal of effluent.

UNIT I PLANNING FOR SEWERAGE SYSTEMS 9

Sources of waste water generation – Effects – Estimation of sanitary sewage flow – Estimation of storm runoff – Factors affecting - Characteristics and composition of sewage and their significance – Effluent standards – Legislation requirements.

UNIT II SEWER DESIGN 9

Sewerage – Hydraulics of flow in sewers – Objectives – Design period - Design of sanitary and storm sewers – Small bore systems - Computer applications – Laying, joining & testing of sewers – appurtenances – Pumps – selection of pumps and pipe Drainage - Plumbing System for Buildings – One pipe and two pipe system.

UNIT III PRIMARY TREATMENT OF SEWAGE 9

Objective – Selection of treatment processes – Principles, Functions, Design and Drawing of Units- Onsite sanitation - Septic tank with dispersion - Grey water harvesting – Primary treatment –Principles, functions design and drawing of screen, grit chambers and primary sedimentation tanks – Construction, operation and Maintenance aspects.

UNIT IV SECONDARY TREATMENT OF SEWAGE 9

Objective – Selection of Treatment Methods – Principles, Functions, Design and Drawing of Units - Activated Sludge Process and Trickling filter – Oxidation ditches, UASB – Waste Stabilization Ponds – Reclamation and Reuse of sewage - sewage recycle in residential complex – Recent Advances in Sewage Treatment – Construction and Operation & Maintenance of Sewage Treatment Plants.

UNIT V DISPOSAL OF SEWAGE AND SLUDGE MANAGEMENT 9

Standards for disposal - methods – dilution – self-purifications of surface water bodies – oxygen sag curve – land disposal – sludge characterization – thickening – sludge digestion – biogas recovery – sludge conditioning and dewatering – disposal – advances in sludge treatment and disposal.

Total Period: 45

Textbooks:

1. P.N. Modi, Water Supply Engineering, Vol. I Standard Book House, New Delhi, 2010.
2. Metcalf & Eddy, "Wastewater Engineering" – Treatment and Reuse, Tata McGraw Hill Company, New Delhi, 2003.

Reference Books:

1. G L Karia & Christian R A, "Wastewater Treatment", Prentice Hall of India, New Delhi, 2013.
2. S.K.Garg, "Environmental Engineering", Vol.I and II, Khanna Publishers, New Delhi, 2005.
3. B.C.Punmia, Ashok K Jain and Arun K Jain, "Water Supply Engineering", Laxmi Publications Pvt. Ltd., New Delhi, 2013.
4. Government of India, Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, New Delhi, 2003.

Course Outcomes:

At the end of the course, the students will able to

CO1: Identify generation and conveyance of waste water and analyse the characteristics of sewage

CO2: Select and Design various components of sewerage system including sewer, primary and secondary treatment units.

CO3: Explain various disposal methods of sewage and sludge management.

CO -PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H		H		M	M	H				H		H
CO2	H	M	H	H		M	M	H				H	M	H
CO3	H	M		H		M	H	H				H		H

Highway Engineering

Semester VI **Hours of Instruction / week: 3T**
21BEVC16 **No. of Credits: 3**

Course Learning Objective:
CLO1: To impart knowledge on basics of highway engineering with respect to the development, planning, design, construction and maintenance.

UNIT I HIGHWAY PLANNING AND ALIGNMENT 9

History of road development in India, Classification of highways, Institutions for Highway planning, design and implementation at different levels, factors influencing highway alignment - Engineering surveys for alignment, objectives, conventional and modern Methods

UNIT II GEOMETRIC DESIGN OF HIGHWAYS INCLUDING HILL ROADS 9

Typical cross sections of Urban and Rural roads, Lateral and vertical clearance at underpasses, Cross sectional elements, Horizontal curves, super elevation, transition curves, widening of curves, Sight distances, Vertical curves, gradients, hairpin bends, IRC standards

UNIT III DESIGN OF FLEXIBLE AND RIGID PAVEMENTS 9

Design principles, pavement components and their role, Design practices for flexible and rigid pavements, (IRC methods only).

UNIT IV HIGHWAY CONSTRUCTION MATERIALS, EQUIPMENT AND PRACTICE 9

Highway construction materials, properties, testing methods, Construction practice including modern methods, concrete road constructions (problem not included), Highway drainage, Special considerations for hilly roads.

UNIT V EVALUATION AND MAINTENANCE OF PAVEMENTS 9

Pavement distress in flexible and rigid pavement, Pavement evaluation, roughness, present serviceability index, skid resistance, structural evaluation, evaluation by deflection measurements, Strengthening of pavements, Types of maintenance, IRC standards.

Total Period: 45

Textbooks:

1. K.Khanna and C.E.G.Justo, Highway Engineering, Khanna Publishers, Roorkee, 2015.
2. L.R.Kadiyali, Principles and Practice of Highway Engineering. Khanna Technical Publications, Delhi,1997.
3. Indian Road Congress (IRC), Guidelines and Special Publications of Planning and Design.
4. W.R.Blunden and J.A Black, the Land Use Transport Systems. Pergamon Press, 1994.

Reference Books:

1. V.N.Vazirani, and S.P.Chandola, Transportation Engineering. Vol.1. Khanna Publishers NewvDelhi, 1999.
2. H.Clarkson Oglesby and R.Gary Hicks, Highway Engineering. John Wileysons,1992
3. N.L.Arora, Transportation Engineering. New India Publishing Home, 1996.
4. S.K.Sharma, Principles, Practices and Design of Highway Engineering, S.Chand and Company Ltd., 1995.

Course Outcomes:

At the end of the course, the students will be able to

CO1: Discuss the classification of highways and its implementation in geometric design standards for streets and highways and various desirable properties of highway materials

CO2: Design flexible and rigid pavements

CO3: Identify and use appropriate maintenance methods to control pavement failure.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02
CO1	H	M										H	M	M
CO2	H		H	H								H	H	
CO3	H	M										H	M	

Water Resources and Irrigation Engineering

Semester VI **Hours of Instruction / week: 3T**
21BEVC17 **No. of Credits: 3**

Course Learning Objectives:

CLO1: The student is exposed to different phases in water resources management
CLO2: To impart awareness on national water policy
CLO3: To impart knowledge on reservoir planning management and economic analysis including Irrigation and Irrigation management practices.

UNIT I WATER RESOURCES 9

Water resources survey – Water resources of India and Tamilnadu – Description of water resources planning – Estimation of water requirements for irrigation and drinking - Single and multipurpose reservoir – Multi objective - Fixation of Storage capacity -Strategies for reservoir operation - Design flood - levees and flood walls.

UNIT II WATER RESOURCE MANAGEMENT 9

Economics of water resources planning; – National Water Policy – Consumptive and non-consumptive water use - Water quality – Scope and aims of master plan - Concept of basin as a unit for development - Water budget - Conjunctive use of surface and ground water.

UNIT III IRRIGATION ENGINEERING 9

Need – Merits and Demerits – Duty, Delta and Base period – Irrigation efficiency – Crops and Seasons - Crop water Requirement – Estimation of Consumptive use of water.

UNIT IV CANAL IRRIGATION 9

Types of Impounding structures: Gravity dam – Diversion Head works - Canal drop – Cross drainage works – Canal regulations – Canal outlets – Canal lining - Kennady's and Lacey's Regime theory.

UNIT V IRRIGATION METHODS AND MANAGEMENT 9

Lift irrigation – Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub-Surface and Micro Irrigation - Merits and demerits – Irrigation scheduling – Water distribution – Participatory irrigation management with case studies.

Total Hours: 45

Textbooks:

1. S.K.Garg, "Irrigation Engineering and Design of Structures", New Age International Publishers, New Delhi, 1997.

Reference Books:

1. A.Mohana Krishnan, "A few Novel and Interesting Innovative Irrigation Structures: Conceived, Designed and Executed in the Plan Projects in Tamil Nadu", Publ. No. 44 and Water Resources Development & Management Publ.No.43, IMTI Thuvakudy, Trichy, 2011.
2. H.M.Raghunath, "Irrigation Engineering", Wiley India Pvt. Ltd., New Delhi, 2011.
3. R.K.Sharma, "Irrigation Engineering and Hydraulic Structures", Oxford and IBH Publishing Co., New Delhi, 2002.
4. Satya Narayana Murthy Challa, "Water Resources Engineering: Principles and Practice", New Age International Publishers, New Delhi, 2002.

Course Outcomes:

At the end of the course**,** the students will able to

CO1: Plan and manage water resources

CO2: Identify and apply different irrigation methods

CO3: Design components of water distribution and irrigation structures

CO - PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**
CO1	H			M								H		
CO2	H			M								H		
CO3	H		H	M								H	M	

Computer Aided Structural Engineering Practicals

(Prerequisite: Computer Aided Design of RC Elements & Computer Aided Modelling Practicals)

Semester VI **Hours of Instruction / week: 3P**

21BEVC18 **No. of Credits: 1.5**

Course Learning Objectives:

CLO1: The students will be able to understand the concepts of analysis and design of R C structural members of a building and also get familiar with the software.

List of Experiments:

1. Analysis and design of cantilever, simply supported beam, fixed beams, continuous beams for different loading conditions.
2. Analysis and design of R.C. continuous and cantilever beams, one way and two way slab, column
3. Analysis and design of foundation and staircase
4. Analysis and design of R.C.C residential building of G+1 storey
5. Analysis and design of simple pin joined frame

All the above experiments can be done using software package for experiments.

Total Hours:45

Reference Books:

1. Unnikrishna Pillai and Devados Menon (2011). Reinforced Concrete Design, Tata McGrawHill Publishing Co, New Delhi.
2. Ashok K Jain (2012). Reinforced Concrete Limit State Design. New Chand Bros, Roorkee.
3. Varghese P.C., ―Limit State Design of Reinforced Concrete‖, Prentice hall of India Pvt. Ltd., 2004.
4. Krishna Raju, N and Pranesh, R.N., ―Reinforced Concrete Design – IS 456 – 2000 Principles and Practice‖, New Age International Publishers, New Delhi, 2003.
5. Subramanian, N, ―Design of Reinforced Concrete Structures, Oxford University Press, New Delhi,2014.
6. Sinha, N.C., and Roy, S.K (2013).Fundamentals of Reinforced Concrete. S.Chand and Company, New Delhi.

Course Outcomes:

The student will be able to

CO1: Analyse and design of different types of RC beams with different loading conditions

CO2: Analyse and design structural components of a building using software.

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H							H	L	H				
CO2	H							M	L	M				

Environmental Engineering Practicals

(Prerequisite: Environmental Engineering I & II)

Semester VI **Hours of Instruction / week: 3P**

21BEVC19 **No. of Credits: 1.5**

Course Learning Objective:

CLO1: To provide knowledge to analyse water and sewage quality as per the guidelines of BIS.

List of Experiments

1. Determination of Conductivity
2. Determination of Turbidity
3. Determination of Total Solids
   a)Dissolved solids
   b)Suspended solids
4. Determination of Optimum coagulant
5. Estimation of Sulphates
6. Estimation of Chlorides
7. Available chlorine in Bleaching powder
8. Estimation of BOD
9. Estimation of COD
10. Estimation of Nitrates
11. Estimation of Iron
12. Estimation of Fluorides

Total Period: 45

Reference Books:

1. Standards Methods for the Examination of Water and Wastewater, 17th Edition, WPCF, APHA and AWWA, USA, 1989.

Course Outcomes:

At the end of the course, students will be able to

CO1: Analyse and interpret the characteristics of water and sewage samples.

CO- PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	H		H			M	H	H			H		H

Construction Management

Semester VII **Hours of Instruction / week: 3T**
21BEVC21 **No. of Credits: 3**

Course Learning Objective

CLO1: To impart knowledge on principles and functions, of construction management and planning, scheduling and execution of construction projects and maintaining accounts.

UNIT I CONSTRUCTION PLANNING 9

Basic concepts in the development of construction plans - Choice of technology and construction method - Defining work tasks - Work breakdown structure – Definition - Precedence relationships among activities - Estimating activity duration - Estimating resource requirements for work activities: Material, Human resources and Equipment

UNIT II TENDERING AND CONTRACTING 9

TTT Act 2000 –Tender notices – types, procedures, documents – EMD - security deposit - scrutiny and acceptance of tender - Drafting model tenders, E-tendering - Digital signature certificates – Encrypting – Decrypting – Reverse auctions.

Contract – Types of contracts – Formation of contract – Contract conditions – Contract for labour, material, design, construction – Drafting of contract documents based on IBRD /MORTH Standard bidding documents – Construction contracts – Contract problems.

UNIT III CONSTRUCTION SCHEDULING 9

Forms of scheduling: bar charts-milestone charts - network analysis CPM Network construction: Activities and events, Fulkerson's rule for numbering events - logic and interdependence in network-time computations, floats, critical path PERT Network: Time estimates, beta distribution, expected time, standard deviation, variance, probability of achieving desired time targets for projects Resource allocation: Resource aggregation diagrams as per early start and late start - resource smoothing - levelling of resources according to constraints - minimum project duration subject to resource constraints. Time cost optimization**:** Direct and indirect cost related to time - activity crashing - normal and crashed duration and corresponding cost - cost slope - crashing of network to optimize cost and duration of a project - time and motion studies

UNIT IV COST CONTROL MONITORING AND ACCOUNTING 9

The cost control problem - The project Budget - Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows - Schedule control - Schedule and Budget updates - Relating cost and schedule information.

UNIT V QUALITY CONTROL AND SAFETY DURING CONSTRUCTION 9

Quality and safety Concerns in Construction - Organizing for Quality and Safety - Work and Material Specifications - Total Quality Control - Quality control by statistical methods - Statistical Quality control with Sampling by Attributes - Statistical Quality control by Sampling and Variables - Safety.

Total Hours: 45

Textbooks:

1. K.K.Chitkara, "Construction Project Management Planning, Scheduling and Controlling", Tata McGraw-Hill Publishing Company Ltd., 2014.
2. Subramanian, "Construction Management", Anuradha Publications, 2007.
3. B.C.Punmia and K.K.Khandelval, "Project Planning and Control with PERT and CPM", Laxmi Publications, 1993

Reference Books:

1. Kumar Neeraj Jha, "Construction Project Management: Theory and Practices", Pearson Publications, 2015.
2. Sidney M. Levy, "Project Management in Construction", Tata McGraw Hill Company Ltd., 2013.
3. R.L.Peurifoy, "Construction Planning Equipment and Method", Tata McGraw Hill Publication, New Delhi, 2010.
4. S.C.Sharma, "Construction Engineering and Management", Khanna Publishers, 2008

Course Outcomes:

At the end of the course**,** the students will be able to

CO1: Prepare contract, tender document and schedule of construction projects and plan & estimate the resource requirements.

CO2: Analyze cost control monitoring and accounting.

CO3: Execute quality control and safety during execution of building construction.

CO - PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M		M							H	H	M	
CO2	H	H		H							H	H	M	
CO3	H	H		M								H	M	

Estimation and Quantity Surveying

Semester VII **Hours of Instruction / week: 3T**
21BEVC22 **No. of Credits: 3**

Course Learning Objectives:

CLO1: To impart knowledge on estimating the quantities of item of works involved buildings, water supply and sanitary works, road works and irrigation works

CLO2: To impart knowledge on rate analysis, valuation of properties and preparation of reports for estimation of various items.

UNIT I QUANTITY ESTIMATION **9**

Methods of estimates – Types of estimates – Approximate estimates – Detailed estimate. Units of measurements - Bill of entry - Measurement Book entry-Estimation of quantities for buildings - Load bearing and framed structures – Single room – Single and double storey buildings.

UNIT II ESTIMATE OF OTHER STRUCTURES **9**

Estimating of septic tank, soak pit , sanitary and water supply installations, water supply pipe line, sewer line, tube well, open well, estimate of bituminous and cement concrete roads, estimate of retaining walls, culverts, estimating of irrigation works, aqueduct, syphon, fall.

UNIT III RATE ANALYSIS AND COSTING **9**

Standard Data – Observed Data – Schedule of rates – Market rates - Standard Data for Man Hours and Machineries for common civil works – Rate Analysis for all Building works, canals, and Roads – Cost Estimates (additional practice in classroom using Computer software's) - (Analysis of rates for the item of work asked, the data regarding labour, rates of material and rates of labour to be given in the Examination Question Paper)

UNIT IV SPECIFICATION AND REPORT PREPARATION **9**

Data, Schedule of rates, Analysis of rates, Specifications, sources, Detailed and general specifications, Arbitration and legal requirements. Principles for report preparation, report on estimate of residential building, Culvert, Roads, Water supply and sanitary installations, Tube wells, Open wells.

UNIT V VALUATION **9**

Definitions – Various types of valuations – Valuation methods - Necessity – Capitalised value – Depreciation – Escalation – Valuation of land – Buildings – Calculation of Standard rent Mortgage – Lease

Total Hours: 45

Textbooks:

1. Dutta, "Estimating and Costing in Civil Engineering‖,", UBS Publishers & Distributors Pvt. Ltd, 2015
2. D.D.Kohli, and R.C.Kohli,,A Text Book of Estimating and Costing (Civil). S.Chand & Company Ltd. PWD Data Book.,2004.

Reference Books:

1. M.Chakraborti, "Estimation, Costing, Specification and Valuation in Civil Engineering (including Computer estimation)", 2015.
2. G.S.Birdie, "Text book of Estimation and Costing (Civil Engineering)", Dhanpat Rai & Sons, 2000.
3. S.C.Rangwala, "Estimating, Costing and Valuation", 17th Edition, Charotar, Gujarat, 2015.

Course Outcomes:

At the end of the course, the students will be able to

CO1: Prepare quantity estimation, cost estimation for a building and other structures

CO2: Prepare report on specifications for buildings, culverts, roads, water supply and sanitary installation, tube wells and open wells.

CO3: Evaluate value of building and land.

CO - PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M		M	M						H	H	H	
CO2	H	M		M	M						H	H	H	
CO3	H	H		M								H		

Concrete and Highway Practicals

Semester VII **Hours of Instruction / week: 3P**

21BEVC23 **No. of Credits: 1.5**

Course Learning Objectives:

CLO1: To learn procedures of testing Construction materials

CLO2: To impart hands-on experience on testing the properties of concrete and highway materials by inferences.

List of Experiments

I. TESTS ON CEMENT

1. Normal Consistency
2. Initial and Final Setting Time
3. Fineness

II. TESTS ON AGGREGATES

1. Specific Gravity
2. Gradation of Aggregate
3. Crushing Strength
4. Abrasion Value
5. Impact Value
6. Water Absorption
7. Flakiness and Elongation Indices

III. TESTS ON FRESH CONCRETE

1. Slump cone test
2. Compaction factor
3. Vee bee consistometer test
4. Flow table

IV. TESTS ON HARDENED CONCRETE

1. Compressive strength - Cube & Cylinder
2. Flexure test
3. Modulus of Elasticity.

V. TESTS ON BITUMEN

1. Penetration
2. Softening Point

Total Period: 45

Codal Provision:

1. IS: 456 – 2000, Indian Standard code of practice for Plain and Reinforced concrete.

Course Outcomes:

At the end of the course**,** the students will able to

CO1: Evaluate and interpret quality of constituents of hardened and fresh concrete as per IS Code.

CO2: Evaluate quality of bitumen for pavement construction materials as per IS Code.

CO- PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	H	H	M	H				H				H	H	M
CO2	H	H	M	H				H				H	H	M

Construction Software Practicals

Semester VII **Hours of Instruction / week: 3P**
21BEVC24 **No. of Credits: 1.5**

Course Learning Objective

CLO1: This course gives an exposure to students in utilizing the sophisticated Project Management software programs, estimation software and other package program.

Introduction:

Project Management software -Projection Estimation, Project Planning, Project scheduling, Network analysis, Project time reduction and optimization, Resource levelling, Project time, cost and finance management, Earned value analysis, visualization software, exposure to BIM Modelling.

List of experiments:

1. Introduction to MS Project and Primavera.
2. Scheduling of small construction project using Primavera scheduling systems including reports and tracking.
3. Scheduling of small construction project using tools like MS project scheduling systems including reports and tracking
4. Assigning Resources and linking tasks .
5. Completion time and critical path.
6. Quantity takeoff, Preparation and delivery of the bid or proposal of an engineering construction project.
7. Design of a simple equipment information system for a construction project.
8. Simulation models for project risk analysis.
9. Virtual progress tracking of small construction project using Navis works
10. Introduction to Building information Modelling (BIM)–Demo

Total Periods: 45

Textbooks

1. PERT and CPM – BC Punmia and KK Khandelwal
2. PERT and CPM – LS Srinath.
3. A management guide to PERT/CPM by Wiest Levy, PHI Publications

References Books:

1. Srinath.L.S., "PERT and CPM Principals and applications" Affiliated East-West Press Pvt.Ltd., New Delhi.
2. Srivastava, U.K., "Construction Planning and Management", Galgotia Publications Pvt.Ltd.,New Delhi.
3. S V Deodhar and SC Sharma, " Construction engineering and Management", KhannaPublishing House.

Course Outcomes:

At the end of the course, the students will able to

CO1: Prepare the proposal for a construction project and store, retrieve information about theequipment

CO2: Track the activities and schedule a construction project using MS Project & Primavera.

CO3: Develop a simulation model for analyzing the project risk.

CO-PO Mapping:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	H	M		M	M							H	H	
CO2	H	M		M	M							H	H	
CO3	H	H		M								H		