B.Tech. (Civil Engineering)

Scheme and Syllabus

Batch 2022 and Onwards

Department of Civil Engineering

Semester 1st										
Sr. No.	**Category**	**Subject Code**	**Course Title**	**Contact Hours**			**Maximum Marks**		**Total Marks**	**Credits**
				L	**T**	**P**	**Internal**	**External**		
1	Certificate Course-I	BTCE101C	Introduction to Civil Engineering	3	0	0	40	60	100	3
Semester 2nd										
Sr. No.	**Category**	**Subject Code**	**Course Title**	**Contact Hours**			**Maximum Marks**		**Total Marks**	**Credits**
				L	**T**	**P**	**Internal**	**External**		
1	Certificate Course-II	BTCE201C	Building Materials	3	0	0	40	60	100	3

Semester 3rd									Total Credits=24	
Sr. No.	**Category**	**Subject Code**	**Course Title**	**Contact Hours**			**Maximum Marks**		**Total Marks**	**Credits**
				L	**T**	**P**	**Internal**	**External**		
1	Core Subject	BTCE301C	Irrigation Engineering	3	0	0	40	60	100	3
2	Core Subject	BTCE302C	Fluid Mechanics	3	1	0	40	60	100	4
3	Core Subject	BTCE303C	Solid Mechanics	3	1	0	40	60	100	4
4	Core Subject	BTCE304C	Surveying	3	0	0	40	60	100	3
5	Core Subject	BTCE305C	Fluid Mechanics Lab	0	0	2	30	20	50	1
6	Core Subject	BTCE306C	Solid Mechanics Lab	0	0	2	30	20	50	1
7	Core Subject	BTCE307C	Surveying Lab	0	0	4	30	20	50	2
8	Core Subject	BTCE308C	Computer Aided Structural Drawing Lab-I	0	0	2	30	20	50	1
9	Training/ Project	BTCE309C	Workshop Training*	0	0	2	60	40	100	2
10	Diploma Course	BTCE310C	Engineering Geology	3	0	0	40	60	100	3
Total				**15**	**2**	**12**	**380**	**420**	**800**	**24**
*Training will be imparted in the institution at the end of 2nd semester for 4 week duration.										

Shaheed Bhagat Singh State University, Ferozepur

B.Tech. (Civil Engineering) Scheme and Syllabus Batch 2022 and Onwards

Semester 4th									Total Credits=24
Sr. No.	Category	Subject Code	Course Title	Contact Hours			Maximum Marks		Total Marks	Credits
				L	T	P	Internal	External		
1	Core Subject	BTCE401C	Structural Analysis	3	1	0	40	60	100	4
2	Core Subject	BTCE402C	Transportation Engineering-I	3	0	0	40	60	100	3
3	Core Subject	BTCE403C	Environmental Engineering-I	3	1	0	40	60	100	4
4	Core Subject	BTCE404C	Design of Concrete Structures-I	3	1	0	40	60	100	4
5	Core Subject	BTCE405C	Transportation Engineering Lab	0	0	2	30	20	50	1
6	Core Subject	BTCE406C	Structural Engineering Lab	0	0	2	30	20	50	1
7	Core Subject	BTCE407C	Environmental Engineering Lab	0	0	2	30	20	50	1
8	Open Elective Course	xxxx	Open Elective Subject is chosen from the list of Open Electives offered by other departments of university.	3	0	0	40	60	100	3
9	Diploma Course	BTCE408C	Construction Machinery and Works Management)	3	0	0	40	60	100	3
Total				**18**	**3**	**6**	**330**	**420**	**750**	**24**
Survey camp will be conducted after fourth semester for which viva will be conducted along with end semester examination of fifth semester.										

Shaheed Bhagat Singh State University, Ferozepur

B.Tech. (Civil Engineering) Scheme and Syllabus Batch 2022 and Onwards

Semester 5th									Total Credits=21	
Sr. No.	**Category**	**Subject Code**	**Course Title**	**Contact Hours**			**Maximum Marks**		**Total Marks**	**Credits**
				L	**T**	**P**	**Internal**	**External**		
1	Core Subject	BTCE501C	Design of Concrete Structures -II	3	0	0	40	60	100	3
2	Core Subject	BTCE502C	Transportation Engineering-II	3	0	0	40	60	100	3
3	Core Subject	BTCE503C	Geotechnical Engineering	3	0	0	40	60	100	3
4	Core Subject	BTCE504C	Concrete Technology Lab	0	0	2	30	20	50	1
5	Core Subject	BTCE505C	Geotechnical Engineering Lab	0	0	2	30	20	50	1
6	Core Subject	BTCE506C	Survey Camp	-	-	-	30	20	50	1
7	Departmental Elective (Select any one)	BTCE511C	Environmental Engineering-II	3	0	0	40	60	100	3
		BTCE512C	Repair & Rehabilitation of Structures							
		BTCE513C	Environment Impact Assessment and Life Cycle Assessment							
8	Open Elective Course	xxxx	Open Elective Subject is chosen from the list of Open Electives offered by other departments of university.	3	0	0	40	60	100	3
9	Advanced Diploma Course	BTCE507C	Earthquake Engineering	3	0	0	40	60	100	3
Total				**18**	**0**	**4**	**330**	**420**	**750**	**21**

Shaheed Bhagat Singh State University, Ferozepur

B.Tech. (Civil Engineering) Scheme and Syllabus Batch 2022 and Onwards

Semester 6th									Total Credits=21	
Sr. No.	**Category**	**Subject Code**	**Course Title**	**Contact Hours**			**Maximum Marks**		**Total Marks**	**Credits**
				L	**T**	**P**	**Internal**	**External**		
1	Core Subject	BTCE601C	Foundation Engineering	3	1	0	40	60	100	4
2	Core Subject	BTCE602C	Estimation & Costing	3	1	0	40	60	100	4
3	Core Subject	BTCE603C	Computer Aided Structural Drawing Lab-II	0	0	2	30	20	50	1
4	Departmental Elective (Select any one)	BTCE611C	Ground Improvement Techniques	3	0	0	40	60	100	3
		BTCE612C	Disaster Management							
		BTCE613C	Solid & Hazardous Waste Management							
5	Open Elective Course	xxxx	Open Elective Subject is chosen from the list of Open Electives offered by other departments of university.	3	0	0	40	60	100	3
6	Humanities & Management	xxxx		3	0	0	40	60	100	3
7	Advanced Diploma Course	BTCE604C	Air & Noise Pollution	3	0	0	40	60	100	3
Total				**18**	**2**	**2**	**270**	**380**	**650**	**21**

Semester 7th									**Total Credits=21**	
Sr. No.	**Category**	**Subject Code**	**Course Title**	**Contact Hours**			**Maximum Marks**		**Total Marks**	**Credits**
				L	**T**	**P**	**Internal**	**External**		
1	Core Subject	BTCE701C	Hydrology & Dams	3	1	0	40	60	100	4
2	Core Subject	BTCE702C	Design of Steel Structures	3	1	0	40	60	100	4
3	Departmental Elective (Select any one)	BTCE711C	Rural Water Supply and Onsite Sanitation Systems	3	0	0	40	60	100	3
		BTCE712C	Traffic Engineering							
		BTCE713C	Bridge Engineering							
4	Open Elective Course	xxxx	Open Elective Subject is chosen from the list of Open Electives offered by other departments of university.	3	0	0	40	60	100	3
5	Humanities & Management	xxxx		3	0	0	40	60	100	3
6	Core Subject	BTCE703C	Project	0	0	8	40	60	100	4
Total				**15**	**2**	**8**	**240**	**360**	**600**	**21**

Semester 8th(a)									Total Credits=14	
Sr. No.	**Category**	**Subject Code**	**Course Title**	**Contact Hours**			**Maximum Marks**		**Total Marks**	**Credits**
				L	**T**	**P**	**Internal**	**External**		
1	Core Subject	BTCE801C	Smart City	2	0	0	40	60	100	2
2	Departmental Elective (Select any one)	BTCE811C	Maintenance of Building Structures	3	0	0	40	60	100	3
		BTCE812C	Intelligent Transport System							
3	Departmental Elective (Select any one)	BTCE813C	Construction Engineering Materials	3	0	0	40	60	100	3
		BTCE814C	Pre-stressed Concrete							
4	Departmental Elective (Select any one)	BTCE815C	Soil Reinforcing Techniques	3	0	0	40	60	100	3
		BTCE816C	Groundwater Engineering							
5	Open Elective Course	xxxx	Open Elective Subject is chosen from the list of Open Electives offered by other departments of university.	3	0	0	40	60	100	3
Total				**14**	**0**	**0**	**200**	**300**	**500**	**14**

OR

Semester 8th(b)							Total Credits=14	
Sr. No.	**Category**	**Subject Code**	**Course Title**	**Evaluation Internal**		**External**	**Total Marks**	**Credits**
				Institutional	**Industrial**			
1	Training (One Semester)	BTCE802C	Software Training	50	50	100	200	14
			Industrial Training	100	100	100	300	
Total				**150**	**150**	**200**	**500**	**14**

Shaheed Bhagat Singh State University, Ferozepur

B.Tech. (Civil Engineering) Scheme and Syllabus Batch 2022 and Onwards

List of open electives offered by Department of Civil Engineering to other departments

Sr.No.	Subject Code	Course Tile	Contact Hours			Maximum Marks		Total Marks	Credits
			L	T	P	Internal	External		
1	BTCE901C	Rock Mechanics and Engineering Geology	3	0	0	40	60	100	3
2	BTCE902C	Disaster Management	3	0	0	40	60	100	3
3	BTCE903C	Remote Sensing & GIS	3	0	0	40	60	100	3
4	BTCE904C	Construction Engineering & Management	3	0	0	40	60	100	3
5	BTCE905C	Concrete Technology	3	0	0	40	60	100	3
6	BTCE906C	Metro system and Engineering	3	0	0	40	60	100	3
7	BTCE907C	Traffic Management	3	0	0	40	60	100	3
8	BTCE908C	Road Safety	3	0	0	40	60	100	3
9	BTCE909C	Environmental Impact Assessment	3	0	0	40	60	100	3
10	BTCE910C	Air & Noise Pollution	3	0	0	40	60	100	3

Semester 1st

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Certificate Course-I	BTCE101C	Introduction to Civil Engineering	L	T	P	3
				3	0	0	3
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Introduced to an overview of Civil Engineering profession and the ethical responsibilities of engineering practice.

UNIT-I

Structural Engineering: Introduction to various basic aspects associated with analysis and design of various structural systems, Introduction to buildings, Bridges and other infrastructure projects.

UNIT-II

Geotechnical Engineering: Soil as construction material, Problems in plain and hilly areas, Earth retaining structures, Introduction to foundations for different types of structures, Embankments.

UNIT-III

Transportation Engineering: Modes of Transportation Engineering, Transportation Systems – Their suitability and utility, Transportation problems and roles of traffic engineers, Introduction to types of pavements, Pavement materials – conventional and new materials.

UNIT-IV

Environmental Engineering: Introduction and importance of water and wastewater engineering.

UNIT-V

Surveying: Introduction and importance of surveying in Civil Engineering.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Illustrate the fundamental aspects of Civil Engineering.
2. Make choice of career decisions.
3. Apply concepts of ethics in professional practice.

Books Recommended:

1. Saikia, M. D., Das, B.M. and Das, M.M. “Elements of Civil Engineering”, PHI Learning Private Limited, New Delhi.
2. Arora, M.K. and Badjatiya, R.C. “GeomaticsEngg”, Nem Chand and Bros., Roorkee.
3. Penn, M. R. and Parker, P. J. “Introduction to Infrastructure: An Introduction to Civil and Environmental Engineering”, John Wiley & Sons.
4. Arora, K. R. “Soil Mechanics and Foundation Engineering” Standard Publishers Distributors, Delhi.
5. Justo, C. E. G., Khanna, S.K. and Veeraragaban, A. “Highway Engineering”, Nem Chand and Bors.,Roorkee.

Semester 2nd

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Certificate Course-II	BTCE201C	Building Materials	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Develop knowledge of material science and behaviour of various building materials used in construction.
2. Identify the construction materials required for the assigned work.
3. Provide procedural knowledge of the simple testing methods of brick, cement, lime and concrete etc.
4. Understanding of damp proofing course, finishing, plastering and pointing.

UNIT-I

Bricks: General terms, Classification of bricks, Composition of good brick earth, Harmful ingredients in brick earth, Qualities of good bricks, Tests for bricks.

Timber: Definition, Classification of trees, Structure of a tree, Seasoning of timber, Defects in timber, Market forms of timber.

UNIT-II

Lime: Introduction, Definitions: Calcination, Hydraulicity, Setting, Slacking, Sources of lime, Classification of limes and their uses, Tests for lime stones.

Cement: Different types of cement, Constituents of cement, Manufacturing of Portland cement, Hydration of cement, Tests for cement, Uses of different types of cement.

UNIT-III

Concrete: Introduction, Constituents of concrete, Batching of materials, Manufacturing process of cement concrete, Workability and factors affecting it, Methods to determine workability, Segregation and bleeding of concrete, Strength of concrete and factors affecting it, Tests for concrete.

UNIT-IV

Damp Proofing: Causes and bad effects of dampness, Preventive measures for dampness in buildings.

Plastering and Pointing: Objectives, Methods of plastering, Materials and types, Defects in plastering, Special material for plastered surface, Distempering, White washing and colour washing.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Understand the concept of various methods of manufacture of bricks.
2. Obtain differentiate the fine aggregates and coarse aggregates under various views.
3. Explain various types of cements and their applications in construction. Various field and laboratory tests on cement.
4. Explain the methods of plastering, materials and its types.
5. Understanding the concept of dampness in buildings.

Books Recommended :

1. Shetty, M.S. “Concrete Technology”, S. Chand Publication.
2. Bindra, S.P. andArora, S.P. “Building Construction”, DhanpatRai Publication.
3. Duggal, S.K. “Building Materials”, New Age International Publishers.
4. Rangwala, ‘Engineering Materials’, Charotar Publication House.
5. Punmia, B.C. “Building construction”, Laxmi Publication.
6. Singh,P. “Civil Engineering Materials”, S K Kataria and Sons

Semester 3rd

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE301C	Irrigation Engineering	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Take up the basic concepts of irrigation and construction of various hydraulic structures.
2. Introduce students to basic concepts of water, plants, their interactions, as well as irrigation and drainage systems design, planning and management.
3. The structures involved the elementary hydraulic design of different structures and the concepts of maintenance shall also form part.
4. Develop analytical skills relevant to the areas mentioned above, particularly the design of irrigation and drainage projects.

UNIT-I

Introduction: Importance of irrigation engineering, Purposes of irrigation, Objectives of irrigation,Benefits of irrigation, Advantages of various techniques of irrigation: Furrow irrigation, Border strip irrigation, Basin irrigation, Sprinkler irrigation, Drip irrigation.

Methods of Irrigation: Advantages and disadvantages of irrigation, Water requirements of crops,Factors affecting water requirement, Consumptive use of water, Water depth or delta, Duty of water,Relation between delta, duty and base period, Soil crop relation-ship and soil fertility.

UNIT-II

Canal Irrigation: Classifications of canals, Canal alignment, Inundation canals, Bandhara irrigation, Advantages and disadvantages, Silt theories-Kennedy's theory and Lacey's theory, Drawbacks in Kennedy's andLacey's theories, Comparison of Lacey's and Kennedy's theories, Design of unlined canals based on Kennedy's and Lacey's theories, Suspended and bed loads.

Lined Canals: Types of lining, Selection of type of lining, Economics of lining, Maintenance of lined canals, Silt removal, Strengthening of channel banks, Measurement of discharge in channels, Design of lined canals, Methods of providing drainage behind lining.

UNIT-III

Losses in Canals, Water Logging and Drainage: Losses in canals- evaporation and seepage, Water logging, Causes and ill effects of water logging- anti water logging measures, Drainage of land, Classification of drains – surface and subsurface drains, Design considerations for surface drains, Advantages and maintenance of tile drains.

River Training Works: Objectives, classification of river-training works, Design of guide banks,Groynes or spurs – Their design and classification ISI, Recommendations of approach embankments and afflux embankments, Pitched islands, Natural cut-offs, artificial cut-offs and their design considerations.

UNIT-IV

Tube Well Irrigation: Types of tubewells – strainer type, cavity type and slotted type, Type of strainers, Aquifer, Porosity, Uniformity coefficient, Specific yield and specific retention, Coefficients of permeability, Transmissibility and storage, Yield or discharge of a tube well, Assumptions, Theim's and Dupuit's formulae, Interference of tubewells with canal or adjoining tubewells, Optimum capacity, Causes of failure of tubewells, Duty and delta of a tube well, Rehabilitation of tube well.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Concepts of irrigation and different hydraulic structures.
2. Estimate the quantity of water required by crops.
3. Plan and design irrigation projects.

4. Design channels and other irrigation structures required for irrigation, drainage, soil conservation, flood control and other water-management projects.

Books Recommended :

1. Sharma, S.K. "Principles and practice of Irrigation Engg",
2. Punmia, B.C.and LalPande, B.B. "Irrigation and Water Power Engg",Laxmi Publications (P) Ltd.
3. Singh,B."Fundamentals of Irrigation Engg.",Nem Chand & Bros.
4. Gupta & Gupta,V. "Irrigation Engg. & Hydraulic Structure",Nem Chand and Brothers
5. Garg,S. K."Irrigation Engg. & Hydraulic Structure",Khanna Publishers

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE302C	Fluid Mechanics	L	T	P	4
				3	1	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Make the students learn the basic concepts of fluid mechanics and gain knowledge about the methods of solving real life problems involving fluids.
2. Introduce fundamentals of stagnant, flowing fluid and flow through different conduits.

UNIT-I

Basic Concepts and Definitions: Distinction between a fluid and a solid, Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity, Variation of viscosity with temperature, Newton law of viscosity, Surface tension, Capillarity, Bulk modulus of elasticity, Compressibility.

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

UNIT-II

Fluid Kinematics: Classification of fluid flow: Steady and unsteady flow, Uniform and non-uniform flow, Laminar and turbulent flow, Rotational and irrotational flow, Compressible and incompressible flow, Ideal and real fluid flow; One, Two and Three dimensional flows, Stream line, Path line, Streak line and stream tube, Stream function, Velocity potential function, One, Two and Three -dimensional continuity equations in Cartesian coordinates.

Fluid Dynamics: Surface and body forces, Equations of motion - Euler's equation, Bernoulli's equation – derivation, Energy Principle, Practical applications of Bernoulli's equation : Venturimeter, Orifice meter and pitot tube, Momentum principle, Forces exerted by fluid flow on pipe bend, Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number, Buckingham's π-Theorem.

UNIT-III

Laminar Flow and Turbulent Flow: Laminar flow through: circular pipes, parallel plates, Stoke's law, Reynolds experiment, Transition from laminar to turbulent flow, Prandtl's mixing length theory, Universal velocity distribution equation, Resistance to flow of fluid in smooth and rough pipes, Moody's diagram, Flow through Pipes: Loss of head through pipes, Darcy-Wiesbach equation, Minor losses, Total energy equation, Hydraulic gradient line, Pipes in series, Equivalent pipes, Pipes in parallel.

Boundary Layer Analysis: Assumption and concept of boundary layer theory, Boundary-layer thickness, Displacement, Momentum and energy thickness, Laminar and turbulent boundary layers on a flat plate, Laminar sublayer, Smooth and rough boundaries, Local and average friction coefficients, Separation and control.

UNIT-IV

Open Channel Flow: Introduction, Comparison between open channel flow and pipe flow, geometrical parameters of a channel, Uniform Characteristics of uniform flow, Chezy's formula, Manning's formula, Most economical section of channel, Specific energy, Specific energy curve, Critical flow, Discharge curve, Specific force, Specific depth and Critical depth, Channel Transitions, Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular channel, Length and height of jump, Location of jump: Types, applications and location of hydraulic jump, Energy dissipation and other uses.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Understand the basic terms used in fluid mechanics and its broad principles.
2. Estimate the forces induced on a plane/ submerged bodies.

3. Apply the continuity, momentum and energy principles and design the pipelines used for water supply or sewage under different situation.
4. Calculate drag force exerted by fluid on the body of varying shapes and able to minimize them.
5. Design and addressing problems in open channel (lined/ unlined) of different shapes and size optimally as per site condition.

Books Recommended :

1. Bansal, R.K., "Fluid Mechanics & Hydraulic Machines",Laxmi Publication (P)Ltd.
2. Modi, P.N. and Seth, S.M., "Hydraulic and Fluid Mechanic",Standard Book House.
3. Garde, R.J. and Mirajgaoker, A.G., "Engineering Fluid Mechanics",Vedams (P) Ltd (New Delhi, India).
4. Douglas, J.F., Gasiorek, J.M., Swaffield, J.P. and Pitman, "Fluid Mechanics",Prentice Hall.
5. Subraminayam, S., "Flow in Open Channels", Tata McGraw Hill.
6. Streeter, V.L. and Benjamin, W.E., "Fluid Mechanics", McGraw-Hill.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE303C	Solid Mechanics	L	T	P	4
				3	1	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Introduce to continuum mechanics and material modeling of engineering materials based on first energy principles, deformation and strain, momentum balance, stress and stress states, elasticity and elasticity bounds, plasticity and yield design.
2. Develop the ability of the student to analyze the engineering objects subjected to different types of forces using the basic principles of statics.
3. Involve analytical methods for determining the strength, stiffness (deformation characteristics), and stability of the various members in a structural system.

UNIT-I

Simple Stresses and Strains: Concept of stress and strain, St. Venant‘s principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke‘s law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson‘s ratio and volumetric strain – Elastic modulii and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience Gradual, Sudden, Impact and shock loadings – simple applications.

Compound Stresses and Strains: Two dimensional system, Stress at a point on a plane, Principal stresses and principal planes, Mohr circle of stress, Ellipse of stress and their applications. Two dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain, Relationship between elastic constants.

UNIT-II

Shear Force and Bending Moment Diagrams: Shear force diagrams (SFD) and Bending moment diagrams (BMD). SFD and BMD for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum SF and BM and the point of contra flexure under concentrated loads, Uniformly distributed loads over the whole span or part of span, Combination of concentrated loads (two or three) and uniformly distributed loads, Uniformly varying loads, Application of moments.

Flexural Stresses-Theory of Simple Bending: Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

UNIT-III

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

Slope and deflection: Relationship between moment, slope and deflection, Double Integration method, Macaulay‘s method, Use of these methods to calculate slope and deflection for determinant beams.

UNIT-IV

Torsion: Derivation of torsion equation and its assumptions, Applications of the equation for hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stresses and maximum shear stresses under combined loading of bending and torsion, Analysis of closely-coiled-helical springs.

Thin Cylinders and Spheres: Derivation of formulae and calculations of hoop stress, Longitudinal stress in a cylinder and sphere subjected to internal pressures.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Describe the concepts and principles, understand the theory of elasticity including strain / displacement and Hooke’s law relationships, and perform calculations, relative to the strength and stability of structures and

mechanical components.
2. Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures, analyze solid mechanics problems using classical methods and energy methods.
3. Analyze various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress, locate the shear centre of thin wall beams.
4. Calculate the deflection at any point on a beam subjected to a combination of loads, solve for stresses and deflections of beams under unsymmetrical loading, apply various failure criteria for general stress states at points and solve torsion problems in bars and thin walled members.

Books Recommended :

1. Ramamrutham, S. And Narayaan, R., Strength of Materials, Dhanpat Rai Publishers.
2. Bansal, R. K., Strength of Materials: Mechanics of Solids, S. Chand.
3. Timoshenko, S. and Young, D. H., ―Elements of Strength of Materials, DVNC, New York, USA.
4. Kazmi, S. M. A., ―Solid Mechanics‖ TMH, Delhi, India.
5. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall.
6. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd edition New York, NY: McGraw Hill, 1979
7. R. Subramanian, " Strength of Materials", Oxford University Press, New Delhi.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE304C	Surveying	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Gain the practical knowledge on calculation of an area, volume of an irregular and regular land surface using chains and tapes.
2. Operate different types of instruments in surveying. Perform levelling and contouring of ground surfaces.
3. Apply knowledge of mathematics in surveying field to calculate areas and volumes for different projects.
4. Utilize total station and other modern survey instruments.

UNIT-I

Introduction to Surveying: Principles of surveying, Different types of surveys, Topographical map, Scale of map. Survey stations, Survey lines- ranging, direct & indirect ranging, Bearing and its measurement with prismatic compass, Calculation of angles from bearings, Local Attraction.

Levelling: Principles of levelling- booking and reducing levels, Differential, Reciprocal levelling, Profile levelling and cross sectioning, Auto level.

Contouring: Characteristics, methods and uses

Plane Table surveying: Temporary adjustment of plane table, Methods of plane tabling, Two and three point problem.

UNIT-II

Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Balancing of Traverse, Omitted Measurements.

Tachometry: Definition, determination of tachometer constants and reduced level from tachometric observations.

Triangulation: Baseline- Choices, Extension of base lines, Corrections, Trigonometric levelling.

UNIT-III

Curves: Elements of simple and compound curves, Method of setting out Transition curve, Length of curve, Elements of transition curve.

UNIT-IV

Modern Field Survey Systems: Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with DGPS, Introduction to Photogrammetry, Remote sensing and GIS.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Understand the concept, various methods and techniques of surveying.
2. Compute angles, distances and levels for given area.
3. Apply the concept of tachometry survey in difficult and hilly terrain.
4. Select appropriate instruments for data collection and survey purpose.
5. Analyze and retrieve the information from remotely sensed data and interpret the data for survey.
6. Understand the concepts related to GIS and GPS and analyze the geographical data.

Books Recommended :

1. Duggal, S.K., Surveying Vol I & II, Tata McGraw Hill
2. Punmia, B.C., Jain, Ashok Kumar and Jain, Arun Kumar, Surveying Vol. I, II & III, Laxmi Publications
3. Agor, R., Surveying, Khanna Publishers
4. Bhavikatti, S.S. Surveying & Levelling Volume I & II
5. Kochher, C. L., Surveying, Dhanpat Rai Publishers Co.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Core Subject	BTCE305C	Fluid Mechanics Lab	0	0	2	1
Internal Marks: 30, External Marks: 20, Total Marks: 50							

Course Objectives: The practical work should enable the students to:

1. Determine the various parameters related to fluid flow in Pipe and in open channels.
2. Examine the properties of fluids and to conduct experiments involving both in incompressible and compressible flow.
3. Investigating the fundamentals of fluid statics as well as kinematics & Kinetics of fluid flow to enhance the hands-on experience of our students.
4. conduct experiments on open channel flow, centrifugal pumps and groundwater flow.

List of Experiments:

1. To study of pressure measuring devices as peizometer, U-tube manometer, and pressure gauges.
2. To verify Bernoulli's Theorem
3. To determine the Meta centric height of a Floating Body under different condition.
4. To determine the coefficient of discharge of a Venturimeter.
5. To determine the coefficient of discharge of a Orifice Meter.
6. To determine the coefficient of friction of different diameter pipes.
7. To estimate the minor losses as energy loss in pipe bend, sudden contraction or enlargement in pipe.
8. To determine the coefficient of discharge on rectangular and V-notches.
9. To determine the various element of a hydraulic jump.

Course Outcomes: Upon completion of this practical work the student shall be able to:

1. Select appropriate pressure measuring device under different condition of flow.
2. Determine the stability of a floating body.
3. Understand and apply Bernoulli's theorem practically.
4. Find discharge of fluid through pipe, orifices and in open channel.
5. Estimate the major and minor losses in pipe.
6. Estimate the various elements and energy losses in hydraulic jump.

Manuals Recommended :

1. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
2. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
3. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
4. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE306C	Solid Mechanics Lab	L	T	P	1
				0	0	2	
Internal Marks: 30, External Marks: 20, Total Marks: 50							

Course Objectives: The practical work should enable the students to:

1. Deal with an experimental determination and evaluation of material behaviour in order to explain the deformation and fracture behaviour of structural materials.
2. Determine the mechanical and structural properties of materials from the laboratory.
3. Test the materials under accurately known forces or loads.
4. Study the material behaviour by careful observations and measurements.

List of Experiments:

1. To determine Impact Strength of Mild Steel.
2. To determine the spring constant / stiffness of the given spring.
3. To determine Brinell and Vicker's Hardness numbers of mild steel.
4. To determine the Rockwell Hardness number of metals.
5. To determine the Fatigue Strength of mild steel.
6. To determine Torsional Strength of mild steel and cast iron.
7. To determine Tensile Strength of mild steel.
8. Determination of shear forces in beams.
9. Determination of bending moments in beams.
10. Measurement of deflections in statically determinate beams.

Course Outcomes: Upon completion of this practical work the student shall be able to:

1. Operate the laboratory equipment, interpret the laboratory data including conversion of measurements into engineering values.
2. Find the deviation of material properties (strength and stiffness) from the engineering values
3. Observe various modes of failure in compression, tension, and shear.
4. Observe various types of material behavior under similar loading conditions.
5. Observe material behavior under repeated loading.

Manuals Recommended :

1. Experimental methods in Structural Mechanics by C.B. Kukreja and V.V. Sastry, Standard Publishers Distributors, Delhi.
2. Laboratory Manual of Testing Materials - William Kendrick Hall
3. Analysis of Structures, Volume – I, by V. N. Vazirani & Ratwani

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE307C	Surveying Lab	L	T	P	2
				0	0	4	
Internal Marks: 30, External Marks: 20, Total Marks: 50							

Course Objectives: The practical work should enable the students to:

1. Impart the practical knowledge in the field, it is essential to introduce in curriculum. Drawing of Plans and Maps and determining the area are pre requisites before taking up any Civil Engineering works.

List of Experiments:

1. Measurement of distance, ranging a line.
2. Measurement of bearing and angles with compass, adjustment of traverse by graphical method.
3. Different methods of levelling, height of instrument, rise & fall methods.
4. Measurement of horizontal and vertical angle by theodolite.
5. Determination of tachometric constants and determination of reduced levels by tachometric observations.
6. Plane table survey, different methods of plotting, three point problem.
7. Setting out of circular curves in the field using different methods.
8. Plotting of traverse using the Total Station and DGPS.

Course Outcomes: Upon completion of this practical work the student shall be able to:

1. Assess horizontal & vertical angles by Theodolite.
2. Survey the area using different methods of plane tabling and compass survey and to adjust the compass traverse graphically.
3. Compute the reduce levels using various methods of levelling.
4. Predict the location of any point horizontally and vertically using Tachometry.
5. Setting out curves in the field.
6. Use electronic survey instruments.

Manuals Recommended :

1. Duggal, S.K., Surveying Vol I & II, Tata McGraw Hill.
2. Punmia, B.C., Jain, Ashok Kumar and Jain, Arun Kumar, Surveying Vol. I, II & III, Laxmi Publications.
3. Agor, R., Surveying, Khanna Publishers.
4. Bhavikatti, S.S. Surveying & Levelling Volume I & II.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE308C	Computer Aided Structural Drawing Lab-I	L	T	P	1
				0	0	2	
Internal Marks: 30, External Marks: 20, Total Marks: 50							

Course Objectives: The practical work should enable the students to:

1. Develop structural designs.
2. Understand design procedures and ways- The student learn to interpret drawings, and to produce designs using Civil Engineering software.

Laboratory Drawing Works:

1. Basic Structural Drawings of concrete & steel elements such as plan, Elevation, side plans of beams, columns, slabs, Connections, Tension Members, Compression Members, steel Beams, Foundations, Roof Trusses, etc.

Course Outcomes: Upon completion of this practical work the student shall be able to:

1. Design and draw working structural drawings of various concrete structures and their members.
2. Understand and interoperate design aids and handbooks.
3. Use of relevant Indian Standard specifications applicable to Reinforced concrete structures

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Diploma Course	BTCE310C	Engineering Geology	3	0	0	3
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Know the principal objective of the engineering geologist is the protection of life and property against damage caused by various geological conditions.
2. Provide geological and geotechnical recommendations, analysis, and design associated with human development and various types of structures.

UNIT-I

General Geology: Scope of geology in Civil Engineering, The Earth - its structure and environment - Standard geological time scale, Unit & fossils, Physiographic, Stratigraphic and tectonic divisions of India - Geomorphologic (surface) processes - Weathering - types, Weathered products, Fluvial processes, Glacial Deposits, Wind action, and their significance in Civil Engineering.

UNIT-II

Mineralogy and Petrology: Physical properties of minerals – classification - study of important rock forming minerals – Quartz family, Feldspar family, Mica family, Calcite, Iron oxide minerals, Clay minerals and their behaviour and significance in the field of Civil Engineering. Classification of rock - mode of formation - distinction between Igneous, Sedimentary and Metamorphic rocks. Characteristic of rocks. Study of important rocks: Granite, Syenite, Diorite, Gabbro, Pegmatite, Dolerite, Basalt, Sand stone, Limestone, Shale, Quartzite, Marble, Slate.

UNIT-III

Structural Geology and Geophysical Methods: Attitude of beds - out crops, Study of structures such as Folds, Faults, Joints, Unconformities, In-lier and out-lier - their brief classification and their bearing on engineering construction. Principles of geophysical methods, Electrical resistivity method, Seismic method and its applications in civil engineering.

UNIT-IV

Geology and Construction: Role of geology in site investigation, Geotechnical classification of rock, Geological considerations in open excavation, Tunnels and Dam site, Reservoir site, Buildings, Road cuttings, Landslides and land subsidence its causes, Classification and preventive measures, Groundwater- types of aquifers, Properties of geological formations affecting groundwater and its role as a geological hazard.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Provide the students with basic knowledge and understanding in the most central part of engineering geology, rock and soil.
2. Give an overview & an understanding of the engineering properties of rock and soil materials, debris generation and distribution, engineering geological investigations, slope stability, geological factors affecting the stability of a facility on and in the soil, engineering, stability and protection of underground facilities, etc.
3. Develop the ability to perform basic engineering geological assessments and analyses, and to understand the relevance of engineering geology in complex projects in and on solid rock.

Books Recommended :

1. Arora. D.S., "A Text Book of Geology", Mohindra Capital Publishers, 1988.
2. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria& Sons
3. A Text Book of Engineering Geology, N. ChennaKesavulu, 2nd Edition (2009), Macmillan Publishers India. Reddy D.," Engineering Geology for Civil Engineers", Oxford & IBH , 1995
4. Blyth, F.G.M., "A Geology for Engineers", Arnold, Londo, 2003.
5. Bell. F.G, "Fundamentals of Engineering Geology" Butterworth, 1983.

Semester 4th

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE401C	Structural Analysis	L	T	P	4
				3	1	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Provide students with a solid background on principles of structural analysis by exposing them to the theories and concepts of analyzing the civil engineering structures.
2. Cover the analysis of statically determinate structures.

UNIT-I

Slope & Deflection of Beams & Frames: Review of Double Integration Method and Macaulay's Method, Moment Area Method, Conjugate Beam Method, Strain Energy / Real Work Method, Virtual Work / Unit Load Method, Castigliano's Method& Maxwell's Reciprocal Theorem, Problems related to beams and frames.

Analysis of Trusses: Introduction, determination of forces in member of trusses by method of joints, method of sections, Tension Coefficient Method, Deflection of Joints of plane frames by Castigliano's first theorem and unit load method, Effect of Lack of Fit & Temperature Change.

UNIT-II

Simple Cable & Arch Structures: Introduction, shape of a loaded cable, cable carrying point loads and UDL, cables with ends at different level, Analysis of three hinged (Parabolic and Circular) Arches for Horizontal Thrust, Bending Moment, Normal Thrust and Radial Shear.

Suspension Bridges & Rolling Loads: Introduction, Analysis of suspension bridges with two hinged and three hinged stiffening girders, Introduction to rolling loads and influence lines.

UNIT-III

Fixed & Continuous Beams: Introduction, Analysis of fixed beams by moment-area theorem and strain energy method, fixed end moments due to different types of loadings, sinking and rotation of supports,Clapeyron's Theorem of Three Moments, Numerical problems.

Approximate Methods of Structural Analysis: Introduction, Vertical and lateral load analysis of multi-storey frames, Portal, Cantilever and Substitute-frame methods and their comparison.

UNIT-IV

Slope-Deflection Method: Introduction, slope-deflection equations, Numerical problems related to beams & frames.

Moment-Distribution Method: Introduction, absolute and relative stiffness of members, stiffness and carry-over factors, distribution factors.

Rotation Contribution Method: Introduction, basic concept, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loadings and yielding of supports.

Influence Lines for Statically Indeterminate Structures: Muller-Breslau principle, Influence lines for reactions, shear force and bending moment for statically determine &indeterminate beams.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Possess the skills to solve statically determinate problems of structural analysis dealing with different loads.
2. Apply their knowledge of structural analysis to address structural design problems.

Books Recommended :

1. Reddy, C.S. "Basic Structural Analysis".
2. Vazirani and Ratwani "Analysis of Structures", Vol. - I, -II.
3. Wang, C.K. "Intermediate Structural Analysis".
4. Punmia, B.C. "Theory of Structures".

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE402C	Transportation Engineering-I	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Acquaint the students about highway planning and development in India.
2. Cover selection of highway alignment, design of geometric elements of highways, carry out traffic studies and implement traffic regulation and control measures and intersection design.
3. Characteristic the properties of road construction materials and design of flexible and rigid pavements as per IRC guidelines shall also be covered in this course.

UNIT-I

Highway Development and Planning: Classification of roads, road development in India, current road projects in India, highway alignment and project preparation.

Geometric Design of Highways: Highway cross section elements, sight distance, design of horizontal alignment, design of vertical alignment.

UNIT-II

Traffic Characteristics & Studies: Road user characteristics, driver characteristics, vehicular characteristics. Volume studies, speed studies, O-D survey, parking study.

Traffic Safety and Control Measures: Traffic signs, markings, islands, signals, cause and type of accidents, use of intelligent transport system.

UNIT-III

Pavement Materials: Materials used in highway construction- soils, stone aggregates, bituminous binders, desirable properties, tests, requirements for different types of pavements.

Paving Mixes: Marshall method of bituminous mix design, Super pave and Concrete mix design for rigid pavements.

UNIT-IV

Design of Flexible Pavements: Pavement types, factors affecting design and performance of pavements, flexible pavements- components and functions, stresses in flexible pavements, design of flexible pavements as per IRC.

Design of Rigid Pavements: components and functions, stresses in rigid pavements, design of cement concrete pavements as per IRC.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Learn about essentials of highway planning and features of highway development in India.
2. Learn how to do selection of highway alignment and design the geometric elements of highways.
3. Learn how to carry out traffic studies and implement traffic regulation and control measures and intersection design.
4. Know about characteristic properties of road construction materials and design the flexible and rigid pavements as per IRC guidelines.

Books Recommended :

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A "Highway Engineering", Nem Chand & Bros., Roorkee.
2. Kadiyali, L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi.
3. ParthaChakraborty "Principles of Transportation Engineering", PHI Learning, New Delhi.
4. Sharma, S.K. "Principles, Practice & Design of Highway Engineering", S. Chand&CompanyLtd.,New Delhi.
5. Paul H. Wright and Karen K. Dixon, "Highway Engineering", Wiley Student Edition, USA.
6. C.A.O. Flaherty, "Highway Engineering", Vol. 2, Edward Arnold, London.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE403C	Environmental Engineering-I	L	T	P	4
				3	1	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Inculcate the basics of water demand, supply, source & future demand estimation.
2. Applicability of concepts of water quality & its examinations.
3. Inculcate the basic concepts of water treatment, its design and management.
4. Extensive knowledge of sources, conversion, distribution & maintenance of water supply system.
5. Modern low cost water treatment techniques for rural supply system.

UNIT-I

Introduction: Beneficial uses of water, water demand, per capita demand, variations in demand, water demand for fire fighting, population forecasting and water demand estimation.

Water sources and development: Surface and ground water sources; Selection and development of sources; intakes and transmission systems.

UNIT-II

Pumps and pumping stations: Types of pumps and their characteristics and efficiencies; Pump operating curves and selection of pumps; pumping stations.

Quality and Examination of Water: Impurities in water, sampling of water, physical, chemical and bacteriological water quality parameters, drinking water quality standards and criteria.

UNIT-III

Water treatment: Water treatment schemes; Basic principles of water treatment; Design of Plain sedimentation, coagulation and flocculation, filtration – slow, rapid and pressure; Disinfection units; Fundamentals of water softening, fluoridation and deflouridation, water desalination and demineralization, taste and odour removal, Design of water treatment plant.

UNIT-IV

Water Supply Systems: Pipes for transporting water and their design, water distribution systems and appurtenances; Water supply network design and design of balancing and service reservoirs; operation and maintenance of water supply systems.

Rural water supply: Principles, selection of source, rain water harvesting, quantitative requirements, low cost treatment techniques.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Design a system, component, or process to meet desired needs.
2. Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, welfare, and environmental factors.
3. Develop and conduct appropriate experimentation, analyze and interpret data for future demand & supply.

Books Recommended :

1. Punmia, B.C., Jain, A. and Jain, A. "Water Supply Engineering- Environmental Engg". (Vol. – I) Laxmi Publications, New Delhi.
2. Arcadio P., Sincero and Gregoria P. Sincero "Environmental Engg. - A design Approach" Prentice Hall of India, New Delhi
3. Garg S.K. "Water Supply Engineering" (Vol. – I) by Khanna Publishers, Delhi
4. Verma, S., Kanwar V., John, S. (2014), Water Supply Engineering, Vikas Publications, New Delhi.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE404C	Design of Concrete Structures-I	L	T	P	4
				3	1	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Learn the behaviour of structural concrete components and Ability to perform analysis and design of concrete members.

Note:

1. **IS 456, Indian Standard. Plain and Reinforced Concrete -Code of practice is permitted in examination.**
2. **Examiner requested to provide requisite data for Mix Design Problems; if any.**

UNIT-I

Concrete Mix Design: Introduction, Selection of mix proportions, Durability of concrete, Quality Control of concrete, Introduction of various mix proportion methods, Proportioning of concrete mixes by BIS method of mix design.

UNIT-II

RCC Design Philosophies: Introduction, Objectives & methods of analysis & Design, Properties of Concrete and Steel. Philosophies of Working Stress Methods (WSM) & Limit State Method (LSM) in RCC design. **Shear, Torsion & Bond (Only Theory/Concept):** Types of shear & torsion, importance in RCC Design Structures, IS Provisions for Shear & Torsion, Bond-types of bonds, Anchorage Bond, Development length & its determination.

UNIT-III

RCC Beams: Types of beams, Behaviour in Flexure-Singly reinforced beam, Doubly reinforced beam, Flanged beam, Cantilever beam, Neutral Axis, Neutral Axis Depth, Moment of Resistance, Design of beams- Singly reinforced beam, Doubly reinforced beam, Flanged beam, Cantilever beam.

UNIT-IV

RCC Slabs: Types of slab systems, Guidelines for Design, Design of One Way and Two Way Slab.

Columns: Classifications (According to Shape, Length and Loading Conditions), Assumptions, Behaviour and Design of Axially Loaded Columns.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Identify the different failure modes and determine their design strengths.
2. Select the most suitable section shape and size for beams according to specific design criteria.

Books Recommended :

1. Shetty, M.S. “Concrete Technology”, S. Chand & Co.
2. Neville, A.M. “Properties of Concrete”, Prentice Hall.
3. Gambhir, M.L. “Concrete Technology”, Tata McGraw Hill Publishers, New Delhi.
4. Pillai&Menon, “Reinforced Concrete Design”, Tata McGraw Hill Education.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE405C	Transportation Engineering Lab	L	T	P	1
				0	0	2	
Internal Marks: 30, External Marks: 20, Total Marks: 50							

Course Objectives: The course should enable the students to:

1. The main objective of this course is to give practical exposure of laboratory testing of different kinds of highway construction materials such as Soil, Aggregate and Bitumen to check their suitability for their use in road construction.
2. The knowledge of these tests is very essential for a civil engineer to choose appropriate construction material to exercise better quality control in a road construction project.

Tests on Sub-Grade Soil:

1. California Bearing Ratio Test

Tests on Road Aggregates:

1. Crushing Value Test
2. Los Angles Abrasion Value Test
3. Impact Value Test
4. Shape Test (Flakiness and Elongation Index)

Tests on Bituminous Materials:

1. Penetration Test
2. Ductility Test
3. Softening Point Test
4. Flash & Fire Point Test

Field Tests:

1. Study of Roughometer/Bump Indicator
2. Study of Benkelman Beam Method

Course Outcomes: Upon completion of this course the student shall be able to:

1. Learn the laboratory testing of different kinds of highway construction materials such as Soil, Aggregate and Bitumen.
2. Learn to check the suitability of highway construction material so as to exercise better quality control in a road construction project.

Books/Manual Recommended :

1. S.K. Khanna and C.E.G. Justo, “Highway Material & Pavement Testing”, Nem Chand and Brothers, Roorkee.
2. Ajay K. Duggal, Vijay P. Puri, “Laboratory Manual in Highway Engineering”, New Age Publications, New Delhi.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE406C	Structural Engineering Lab	L	T	P	1
				0	0	2	
Internal Marks: 30, External Marks: 20, Total Marks: 50							

Course Objectives: The course should enable the students to:

1. Introduce engineering students to the theory and experimental techniques of structural mechanics.
2. Experimentally illustrate, in a comprehensive way, the basic principles of structural analysis and their applications.
3. Familiarize them, through the laboratory exercises, with the model behavior and practical limitations of each set-up and to get opportunity to critically examine and developing various skills in them for structural analysis of theoretical concepts, data handling and decision making.

List of Experiments:

1. To study the behavior of different types of struts.
2. Deflection of a simply supported beam and verification of Clark-Maxwell's theorem.
3. To determine the Flexural Rigidity of a given beam.
4. To verify Moment- Area Theorems for slope and deflection of a given beam.
5. To determine the Carry over Factor (C.O.F.) for beams with rigid connections.
6. Experiment on three-hinged arch and influence line diagram for horizontal thrust.
7. Experiment on two-hinged arch.
8. To determine the deflection of a Pin-connected truss.
9. Forces in members of a redundant frame.
10. Experiment on curved beams.
11. Unsymmetrical bending of a cantilever beam.
12. Influence line diagrams for BM of a beam with one end hinged and the other fixed.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Effectively link the theory / analytical concepts.
2. Demonstrate the background of the theoretical aspects, with practice and application.
3. Generate and analyze data using experiments and develop observational skill by the exposure to equipment and machines.
4. Use computing tools in analyzing and presentation of the experimental data.

Books/Manual Recommended :

1. Experimental methods in Structural Mechanics by C.B. Kukreja and V.V. Sastry, Standard Publishers Distributors, Delhi.
2. Laboratory Manual of Testing Materials - William Kendrick Hall.
3. Laboratory Manual on Structural Mechanics by Harvinder Singh.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE407C	Environmental Engineering Lab	L	T	P	1
				0	0	2	
Internal Marks: 30, External Marks: 20, Total Marks: 50							

Course Objectives: The practical work should enable the students to:

1. Make the students understand the practical aspects of environmental engineering.

List of Experiments:

1. To measure the pH value of a water/waste water sample.
2. Determination of total solids, dissolved solids, suspended solids of a given water sample.
3. Determination of Hardness of a given water sample
4. To find acidity/alkalinity of a given water sample
5. To determine optimum Alum dose for Coagulation.
6. To find the turbidity of a given waste water/water sample
7. To measure D.O. of a given sample of water.
8. To find B.O.D. of a given waste water sample.
9. To determine the COD of a wastewater sample.
10. To determine the concentration of sulphates in water/wastewater sample.
11. To find chlorides in a given sample of water/waste water.
12. To find MPN for the bacteriological examination of water.

Course Outcomes: Upon completion of this practical work the student shall be able to:

1. Conduct experiments as per standard methods of sampling and analysis.
2. Demonstrate the expertise to characterize water and wastewater samples.
3. Understand the importance of laboratory analysis as a controlling factor in the treatment of water and wastewater.
4. Record the experimental observations and interpret the analysis results.

Manuals Recommended :

1. APHA (2017), Standard methods for the examination of water and wastewater.
2. Water & Waste Water Testing by Mathur, Nem Chand & Bros.
3. Manual on Sewage and Sewerage treatment by Central Public Health and Environmental Engineering Organisation (CPHEEO), GOI.
4. IS 10500: 2012, Code for Drinking Water by Bureau of Indian Standards (BIS), GOI.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Diploma Course	BTCE408C	Construction Machinery and Works Management	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Make the students learn the basics of construction management, evaluation of a construction project, selection of construction equipment, ascertain the economic viability and financial analysis of civil engineering projects.

UNIT-I

Basics of Construction: Unique features of construction, construction projects types and features, phases of a project, agencies involved and their methods of execution.

Brief Introduction of Construction Project Planning: Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules.

UNIT-II

Introduction: Need for project planning & management, time, activity & event, bar chart, Milestone chart, uses & draw backs.

PERT Technology: Construction of PERT network, time estimates, network analysis, forward pass & backward pass, slack, critical path, data reduction, suitability of PERT for research project.

UNIT-III

CPM Technology: Definitions, network construction, critical path, fundamental rules, determination of project schedule, activity time estimates, float types, their significance in project control.

Construction Methods Basics: Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls; Modular construction methods for repetitive works.)

UNIT-IV

Construction Equipment: Conventional construction methods VS Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment for Productivities.

Contracts Management Basics: Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to precede, rights and duties of various parties, notices to be given, Contract Duration and Price; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Understand of modern construction practices
2. Understand construction dynamics- various stakeholders, project objectives,
3. Plan, control and monitor construction projects with respect to time and cost
4. Learn how construction projects are administered with respect to contract structures and issues.

Books Recommended :

1.Varghese, P.C., “Building Construction”, Prentice Hall India, 2007.
2. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
3. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
4. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education
5. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications.
6. Srinath,L.N., “PERT and CPM Principles and Applications” East West Press Private Ltd. New Delhi.

Semester 5th

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE501C	Design of Concrete Structures-II	L	T	P	4
				3	1	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Impart understanding of various aspects of design of reinforced concrete.
2. Understand the codal recommendations for methods of design.
3. Understand the design of various compression members of the building structures.
4. Understand the design of foundations, beams, retaining walls, domes and water tanks.

Note: Indian Standards-IS 456, IS 3370 and Design Aid SP-16 are permitted in examination.

UNIT-I

Design of Foundations: Concept, Application, Types, Components of Footing, Design of Isolated Footing (Square, Rectangular), Combined Footing (Rectangular, Trapezoidal & Strap footing) and Raft Foundation. **Design of Stairs:** Introduction, Elements of Stairs-Tread, Rise, Flight, Landing, Types of Stairs, Design and Reinforcement detail of Stairs.

UNIT-II

Design of Columns: Classifications (According to Shape, Length and loading conditions), Assumptions, Guidelines as per Indian Standards, Behavior of Compression Members, Short Compression Members under Axial Load with Uni-axial and Bi-axial Bending, Design of Slender (Long) Columns.

UNIT-III

Design of Beams (Continuous and Curved): Definition, Behavior, Design of Continuous beams and Curved beams, Reinforcement detailing.

Design of Various Components of Framed Structures

Design of Retaining Walls: Classification, Elements-Stem, Base, Heel, Toe, Behavior and design of Cantilever and Counter fort type retaining wall.

UNIT-IV

Design of Domes: Types, Components, Design of Spherical and Conical Dome.

Water Tanks: Introduction, Types & uses of Underground water tanks, ground water tanks, Design of Circular and Rectangular water tanks resting on ground.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Design the components of footings i.e. isolated, combined and raft foundations.
2. Know about column's types, applications, behavior of columns along with their design.
3. Design the details of the concrete components i.e. beams (continuous and curved) and retaining walls.
4. Design the special structures like domes and water tanks.

Books Recommended :

1. Jain, A.K., "Reinforced Concrete-Limit State Design" Nem Chand & Bro.
2. Bhavikatti, S.S., "Advanced RCC Design" New Age International Private Limited.
3. Punmia, B.C.,"Design of Concrete Structures" Laxmi Publications.
4. Krishna, R.,"Pre-stressed Concrete"; TMH.
5. Subramanian, N., "Design of Reinforced Concrete Structures", Oxford University Press.
6. Pillai and Menon, "Reinforced Concrete Design", Tata McGraw Hill Education.
7. Varghese, P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India Pvt. Ltd.
8. Mallick and Rangasamy, "Reinforced Concrete", Oxford-IBH.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE502C	Transportation Engineering-II	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Impart basic knowledge of railway track components and their functions.
2. Introduce geometric design, points and crossings, track resistances, signalling and control system.
3. Learn advancement in railway stations, yards, modernization of railways and high speed trains.
4. Design the airport runway, taxiways and aprons.
5. Summarise the concepts of the terminal service facilities.

UNIT-I

Railway Engineering: Introduction to Railway Engineering, Organisation of Indian Railway, Important Statistics of Indian Railways.

Railway Gauges: Definition, Gauges on World Railways, Choice of Gauge, Uniformity of Gauge, Loading Gauge, Construction Gauge.

Railway Track: Track Specifications on Indian Railways, Rails, Sleepers, Ballast, Subgrade and formation, Track fixtures and fastenings, Coning of wheels, Tilting of rails, Adzing of sleepers, Rail joints, Creep of rails.

UNIT-II

Geometric Design of Railway Track: Alignment, Gradients, Horizontal curve, Super elevation, Equilibrium Cant, Cant deficiency, Transition curves.

Points and Crossings: Functions, Working of Turnout, Various types of Track Junctions and their layouts, Level-crossing.

UNIT-III

Railway Stations & Yards: Site Selection, Classification & Layout of Stations, Marshalling Yard, Locomotive Yard, Equipment at Railway Stations & Yards

Signalling and Interlocking: Objectives, Classification of Signals, Types of Signals in Stations and Yards, Automatic Signalling, Principal of Interlocking.

Modernization of Railway Tracks: High Speed Tracks, Improvement in existing track for high speed, Ballast less Track, MAGLEV, TACV Track

UNIT-IV

Airport Engineering: Introduction to Airport Engineering, Factors for Site Selection, Airport Classification, General Layout of an Airport. Obstructions and Zoning Laws, Imaginary Surfaces, Approach Zones and Turning Zones.

Runway Orientation and Design: Head Wind, Cross Wind, Wind Rose Diagram, Basic Runway Length, Corrections, Geometric Design Elements, Runway Configuration.

Taxiway and Aircraft Parking: Aircraft Parking System. Main Taxiway, Exit Taxiway, Separation Clearance, Holding Aprons.

Visual Aids: Marking and Lighting of Runway and Taxiway, Landing Direction Indicator, and Wind Direction Indicator, IFR/VFR.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Apply the knowledge of railway track components, materials and fixtures and fastenings.
2. Solve problems of railway track geometrics, train resistance, points and crossings, signalling and control system.
3. Carry out feasibility study of rail tracks.
4. Describe the different components of airport and aircrafts.
5. Analyse the requirements of an airport layout with respect to international regulations.

Books Recommended :

1. Chandra S., and Aggarwal, "Railway Engineering", M.M. Oxford University Press, New Delhi, 2007.
2. Saxena, S.C., and Arora, S.P., "A Text Book of Railway Engineering", DhanpatRai and Sons, Delhi, 1997.
3. J. S. Mundrey, "Railway Track Engineering", McGraw Hill Publishing Co., 2009
4. Khanna, S.K., Arora, M.G., and Jain, S.S., "Airport Planning and Design", Nem Chand & Bros. Roorkee, 1999.
5. Horenjeff, R. and McKelvey, F., "Planning and Design of Airports", McGraw Hill Company, New York, 1994.
6. Norman J. Ashford, SalehMumayiz, Paul H. Wright, "Airport Engineering: Planning, Design and Development of 21st Century", Wiley Publishers, 2011.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE503C	Geotechnical Engineering	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering. Also to become familiar broadly with geotechnical engineering problems such as flow of water through soil medium and terminologies associated with geotechnical engineering.
2. Know the basic engineering properties and the mechanical behaviour of different types of soil. This includes strength-deformation characteristics under shearing stresses. Also consolidation properties of clayey soils.
3. Determine the improvement in mechanical behaviour by densification of soil deposits using compaction.
4. Know how the properties of soils that can be measured in the laboratory.

UNIT-I

Soil Formation: Soil mechanics, Soil engineering, Geotechnical engineering. Scope of soil engineering. Basic definitions and relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: Moisture content, Unit weights, Degree of saturation, Void ratio, Porosity, Specific gravity and their relationships, Determination of various parameters such as: Moisture content by oven dry method, Specific gravity by density bottle method, Unit weight by core-cutter method, sand-replacement method.

Plasticity Characteristics of Soil: Introduction to definitions of: Plasticity of soil, Consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, Definitions of activity and sensitivity, Determination of: liquid limit, plastic limit and shrinkage limit, Use of consistency limits, Particle size classification, Textural classification, Indian standard soil classification system

UNIT-II

Compaction: Compaction, Concept of O.M.C. and Zero air void line, Standard and Modified proctor test, Factors affecting compaction, Effect of compaction on engineering soil properties, Field compaction methods their comparison of performance and relative suitability, Field control of compaction by proctor needle.

Permeability of Soil: Concept of effective stress principle, Critical hydraulic gradient and quick sand condition, Capillary phenomenon in soil, Darcy's law and its validity, Co-efficient of permeability and its determination by Constant head permeability test and Variable head permeability test, Average permeability of stratified soils, Factors affecting coefficient of permeability.

UNIT-III

Consolidation: Consolidation, Difference between compaction and consolidation, Concept of various consolidation characteristics, Primary and secondary consolidation, Terzaghi's theory for one-dimensional consolidation, Consolidation test, Determination of coefficient of consolidation from curve fitting methods, Normally consolidated and over consolidated clays, Importance of consolidation settlement in the design of structures, e-logσ curve.

UNIT-IV

Shear Strength: Mohr circle and its characteristics, Principal planes, Relation between major and minor principal stresses, Mohr-Coulomb theory, Types of shear tests: Direct shear test, Merits of direct shear test, Tri-axial compression tests, Test behavior of UU, CU and CD tests, Pore-pressure parameters, Computation of effective shear strength parameters. Unconfined compression test, Vane shear test.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Comprehend the various geotechnical field challenges and understand their fundamental, index and engineering properties and then use (apply) the soil as an engineering material.
2. Apply the various concepts of compaction of soils in the construction of highways and earthen dams as well as investigate and write the laboratory reports for soil design properties and parameters by applying the concept of permeability.

3. Able to apply the knowledge of consolidation, soil deformation parameters, and calculate settlement magnitude and rate of settlement.
4. Learn the shear strength parameter of soil.

Books Recommended :

1. Arora, K.R., "Soil Mech. & Foundation Engg", Standard Publishers Distributors.
2. Raj, P. P., "Geotechnical Engineering", Tata McGraw Hill.
3. Murthy,V.N.S., "Soil Mech. & Foundation Engg", CBS Publishers & Distributors.
4. Das, B.M., "Principle of Geotechnical Engineering", Cengage Publisher.
5. Ranjan, G. and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International Publishers.
6. Bowle, J. E., "Physical & Geotechnical Properties of Soil".

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE504C	Concrete Technology Lab	L	T	P	1
				0	0	2	
Internal Marks: 30, External Marks: 20, Total Marks: 50							

Course Objectives: The course should enable the students to:

1. Give practical exposure of laboratory testing of different kinds of building construction materials such as brick, cement, lime, aggregate, etc.
2. Check the suitability for different materials used in civil construction works.
3. Determine the engineering properties in terms of strength, strain, fatigue, stiffness, durability and workability.
4. The knowledge of these tests is very essential to choose appropriate construction material to exercise better quality control in a civil construction project.

List of Experiments:

1. To determine the specific gravity, soundness, consistency and setting time (initial & final setting time) of cement.
2. To determine the compressive strength of cement.
3. To determine the specific gravity, water absorption and moisture content of coarse aggregate & fine aggregate.
4. To determine the shape & size, efflorescence, water absorption and compressive strength of bricks.
5. To determine the workability of concrete by Slump Cone and Vee-Bee test method.
6. To determine the workability of concrete by Compaction Factor Method.
7. Design mixes of concrete by IS methods.
8. To determine the compressive Strength, flexural strength and split tensile strength of Concrete by IS methods.
9. To determine the compressive Strength of Concrete by Cube test & Cylinder test.
10. To determine the strength of hardened concrete by Rebound hammer.
11. To determine strength and quality of hardened concrete by Ultra Sonic Pulse Velocity test .

Course Outcomes:

1. Determine the consistency, setting time and fineness of cement.
2. Determine the grading, density & specific gravity of aggregates.
3. Determine the shape & size, compressive strength and water absorption of bricks.
4. Design concrete mixes as per BIS provisions.
5. Analyze the properties of concrete in fresh and hardened state.
6. Understand and apply nondestructive testing for evaluating concrete quality.

Books/Manual Recommended:

1. Gambhir, M.L., "Building and Construction Materials: Testing and Quality Control" TMH.
2. "Concrete Lab Manual" NITTTR, Chandigarh.
3. Shetty, M.S., "Concrete Technology, Theory and Practice" S. Chand & Company.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE505C	Geotechnical Engineering Lab	L	T	P	1
				0	0	2	
Internal Marks: 30, External Marks: 20, Total Marks: 50							

Course Objectives: The course should enable the students to:

1. Distinguish various soil properties and its behavior.
2. Carry out firm foundation in testing various types of soils and their properties.
3. Experience with the measurement of geotechnical laboratory parameters.
4. Excel in experiment research and to succeed with real time projects.
5. Ability to design and conduct experiments as well as analyze and interpret data.

List of Experiments:

1. Determination of natural moisture content by oven drying method.
2. Determination of field dry unit weight using core cutter method.
3. Determination of field dry unit weight using sand replacement method.
4. Determination of specific gravity of Soils.
5. Grain size distribution analysis by sieve analysis.
6. Determination of void ratio and porosity.
7. Determination of liquid limit by Casagrande's apparatus.
8. Determination of plastic limit.
9. Determination of shrinkage limit.
10. Determination of coefficient of permeability using Constant-head test method.
11. Determination of coefficient of permeability using Falling-head method.
12. Compaction of soil by standard proctor test.
13. Compaction of soil by modified proctor test.
14. Determination of relative density of soil.
15. Consolidation Test.
16. Unconfined Compression Strength Test.
17. Direct Shear Test.
18. Triaxial Test (UU)

Course Outcomes: Upon completion of this course the student shall be able to:

1. Analyze soil behavior and its mechanism.
2. Find role of basic properties of soil in simple and complex applications.
3. Develop a proficiency in handling experimental data.
4. Report the results of a laboratory experiment at a professional standard.
5. Recommend extensive research in geotechnical properties.

Recommended Books / Manuals:

1. Prakash, S. and Jain, P.K, "Soil Testing Engineering, Manual", Nem Chand & Brother.
2. Craig, R.F., "Soil Mechanics", Chapman & Hall.
3. Taylor, "Fundamentals of Soil Engineering", John Wiley & Sons.
4. Holtz,R.D. and Kovacs, W.D., "An Introduction to Geotechnical Engineering", Prentice Hall.
5. Das, B.M., "Principles of Geotechnical Engineering", CengageLearning.
6. Das, B.M., "Learning Principles of Foundation Engineering", Cengage Learning.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE511C	Environmental Engineering-II	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Understand characteristics of wastewater and its determination.
2. Study wastewater generation and design periods for wastewater treatment units.
3. Expose the students to understand components of sewer lines.
4. Develop analytical skills and design of wastewater treatment units.

UNIT-I

Introduction: Terms & definitions, types of sewage, system of sewerage, choice of sewerage system and suitability to Indian conditions.

Sewerage Systems: Generation and estimation of community sewage, flow variations, storm water flow, types of sewers. Design of sewers and storm water sewers, construction & maintenance of sewers, sewer appurtenances, sewage pumping and pumping stations.

UNIT-II

House Drainage: Principles of house drainage, traps, sanitary fittings, systems of plumbing, drainage lay out for residences.

Characteristics of Sewage: Composition of domestic and industrial sewage, sampling, physical, chemical and microbiological analysis of sewage, biological decomposition of sewage, BOD and BOD kinetics, effluent disposal limits.

UNIT-III

Treatment of Sewage: Introduction to unit operations and processes – Primary treatment: screening (theory), grit chamber (theory and design), floatation units, sedimentation tanks (theory and design), Secondary treatment units: ASP (theory and design), Sequencing batch reactors (theory and design), Trickling filters (theory and design) Anaerobic systems; Anaerobic filters (theory), UASB (theory), Anaerobic lagoons (theory), Sludge handling and disposal; thickening, stabilization, dewatering, drying and disposal.

UNIT-IV

Low Cost Sanitation Systems: Imhoff tanks (theory and design), septic tank (theory and design), soakage pit/soil absorption systems; stabilization ponds (theory and design); oxidation ponds (theory and design); and constructed wetland systems.

Wastewater Treatment Plants and Advanced Wastewater Treatment: Treatment Plants; site selection, operation and maintenance aspects, advanced wastewater treatment for nutrient removal, disinfection for sewage.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Understand assessment procedure and significance of physical, chemical and biological characteristics of wastewater.
2. Explain the process of self-purification of the sources of disposal and determine the degree of treatment of sewage based on the source of disposal of wastewater.
3. Evaluate the quantity estimation for sewage generation.
4. Describe and design various parameters of collection and conveyance of wastewater.
5. Design of wastewater treatment units.

Books Recommended :

1. Punmia, B.C. and Jain, A., "Waste Water Engg. (Environmental Engg.-II)'' Laxmi Publications.
2. Garg, S.K., "Environmental Engineering (Vol. II)" Khanna Publishers, Delhi.
3. Peavy, H. S., Rowe, D. R. and Tchobanoglous, G., "Environmental Engg."McGraw Hill, International Edition.
4. Metcalf and Eddy,"Wastewater Engineering Treatment, Disposal, Refuse",T.M.H. Edition, New Delhi, 1995.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE512C	Repair & Rehabilitation of Structures	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Understand the cause of deterioration of concrete structures.
2. Able to assess the damage for different types of structure.
3. Summarize the principles of repair and rehabilitation of structures.
4. Recognize the ideal material for different repair and retrofitting techniques.

UNIT-I

Maintenance and Repair Strategies: Definitions: Maintenance, Repair and rehabilitation. Facets of maintenance, Importance of maintenance and Daily, weekly, monthly, yearly Routine Maintenance, Various aspects of inspection, Stages of inspection, Assessment procedure for evaluating a damaged structure, Causes of deterioration.

UNIT-II

Materials for Repair: Special concretes and mortar, Concrete chemicals, special elements for accelerated strength gain, Expansive cement, Polymer concrete, Sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete.

Strength and durability of concrete: Quality assurance for concrete: Strength, Durability and Thermal properties, Cracks: Different types, Causes, Effects due to climate, Temperature, Sustained elevated temperature, Corrosion – Effects of cover thickness.

UNIT-III

Techniques for Repair and Protection Methods: Non-destructive testing techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques: Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, Cathodic protection.

Demolition techniques: Engineered demolition methods and Case studies.

UNIT-IV

Repair, Rehabilitation and Retrofitting of Structures: Evaluation of root causes, Under pinning & shoring some simple systems of rehabilitation of structures; Guniting, Shortcreting, Non-destructive testing system; Use of external plates, Carbon fibre wrapping and carbon composites in repairs. Strengthening of structural elements, Repair of structures distressed due to corrosion, fire, leakage, earthquake.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Understand design and construction errors.
2. Understand special concretes and mortar, concrete chemicals etc..
3. Understand maintenance, repair and rehabilitation.
4. Understand various techniques of repair.

Books Recommended :

1. Panchdari, A.C., “Maintenance of Buildings”, New Age International (P) Limited Publishers.
2. Gambhir, M.L., “Concrete Technology”, McGraw Hill, 2013.
3. Ravishankar, K. and Krishnamoorthy, T.S., “ Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures”, Allied Publishers, 2004.
4. Chudley, R., “Building Finishes, Fittings and Domestic Services”, Longman Technical Services.
5. Szechy, G., SCD., “Foundation Failures”, Concrete Publications Limited, 14 Dartmouth Street, London.
6. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
7. Ransom, W.H., “Building Failures: Diagnosis and Avoidance”, New Age Publications (P) Ltd.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE513C	Environment Impact Assessment and Life Cycle Assessment	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:
1. Learn the purpose and role of EIA in the decision-making process.
2. Provide knowledge on the strengths of EIA in regard to environmental management.

UNIT-I

Evolution of EIA Concepts: Methodologies – Screening- Scoping- Base line studies- Mitigation – Matrices - Check List.

UNIT-II

Elements of Life Cycle Assessment: Life Cycle Costing, Eco Labelling, Design for the Environment, Environmental Audit- Life cycle Assessment, International Environmental Standards

UNIT-III

Assessment of Impacts: Air, Water, Soil, Noise, Biological, Green energy and green process management in Pharmaceutical, Construction, Textiles, Petroleum Refineries, Iron and Steel.

UNIT-IV

Documentation of EIA: Environmental management Plan- Post Project monitoring Environmental Management System EMS – case studies in EIA.

Course Outcomes: Upon completion of this course the student shall be able to:
1. Identify the negative impacts and propose the provision of infrastructure or mitigation measures.
2. Develop current EIA methods, assessment methods, environmental monitoring systems and legislation.
3. Assess process of environmental impact modelling and prediction as a design tool.
4. Interact with experts of other fields to assess the impact.

Books Recommended :

1. Ramaswami, A., Milford J.B. and Small M. J., "Integrated Environmental Modeling - Pollutant Transport, Fate and Risk in the Environment", John Wiley & Sons.
2. Burrough, P.A. and McDonnell, R.A, "Principles of Geographical Information Systems", Oxford University Press 1998.
3. Snape, J.B., Dunn I.J., Ingham, J. and Prenosil, J.E., "Dynamics of Environmental Bioprocesses Modeling and Simulation", VCH, Weinheim 1995.
4. Chapra, S.C., "Surface Water Quality Modeling", McGraw-Hill Inc. 1997

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Advanced Diploma Course	BTCE507C	Earthquake Engineering	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Provide a coherent development to the students for the courses in sector of earthquake engineering.
2. Present the foundations of many basic engineering concepts related earthquake engineering.
3. Give an experience in the implementation of engineering concepts which are applied in field of earthquake engineering.
4. Involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.

UNIT-I

Introduction to Earthquakes: Causes of Earthquakes, Basic Terminology, Magnitude, Intensity, Peak ground motion parameters, Seismic Zoning Map of India, Seismograms and Accelerogram. Past earthquakes and Lessons learnt.

UNIT-II

Introduction to Dynamics: Theory of Vibrations, Sources of Vibrations, Types of Vibrations, Degree of Freedom, spring action and damping, Single Degree of Freedom (SDOF) Systems – Formulation of equations of motion –Undamped and damped free vibration –Damping –Response to harmonic excitation –Concept of response spectrum. Multi-Degree of Freedom (MDOF) Systems: -Formulation of equations of motion –Free vibration –Determination of natural frequencies of vibration and mode shapes –Orthogonal properties of normal modes –Mode superposition method of obtaining response.

UNIT-III

Lateral Force Analysis: Lateral Strength, stiffness, ductility and structural configuration, Floor Diaphragm action, Moment resisting frames, shear walls.

Codal Design Provisions: Review of the latest Indian seismic code IS:1893 (Part-I) provisions for buildings – Earthquake design philosophy.

UNIT-IV

Codal Detailing Provisions: Review of the latest Indian Seismic codes IS: 4326 and IS: 13920 provisions for ductile detailing of R.C buildings –Beam, column and joints, Design of Shear walls as per IS: 13920 –Detailing of reinforcements.

Course Outcomes: The course will enable the student to:

1. Gain an experience in the implementation of Earthquake Engineering on engineering concepts which are applied in field Structural Engineering.
2. Get a diverse knowledge of earthquake engineering practices applied to real life problems.
3. Understand the theoretical and practical aspects of earthquake engineering along with the planning and design aspects.
4. Apply various codal provisions related to seismic design of buildings.

Books Recommended:

1. Aggarwal, P. and Shrikhande, M., "Earthquake Resistant Design of Structure" Learning, PHI.
2. Chopra, A.K., "Dynamics of Structures: Theory and application of earthquake engineering" Prentice Hall.
3. Clough, R.W. and Penzien, J., "Dynamics of structures" McGraw-Hill Education.
4. David, J. and Dowrick, "Earthquake Resistant Design" Willey India Pvt. Ltd.

5. Krishna, J., Chandrasekaran, A.R. and Chandra, B., "Elements of Earthquake Engg" South Asian Publishers.
6. IS 12893-2016 Indian Standard Criteria for Earthquake Resistant Design of structures.
7. IS: 4326-1993 Indian Standard for Earthquake Resistant Design and Construction of Buildings.
8. IS:13920: 2016 Ductile Design and Detailing of Reinforced Concrete Structures subjected to Seismic Forces- Code of Practice.

Semester 6th

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE601C	Foundation Engineering	L	T	P	4
				3	1	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. To Gain Knowledge about Soil Investigation Methods, Stress Distribution in Soil and Techniques for determining Soil Properties.
2. Impart understanding about the concept of Lateral Earth Pressure, it's theories and applications in the analysis and design of Retaining Structures
3. To impart Knowledge on Shallow Foundations, Bearing Capacity, Settlement Analysis and Design Principles based on IS Code Recommendation.
4. To provide Knowledge on Pile Foundation, Caissons and well foundations focusing on their Types, Load Carrying Capacity Settlement & Stability analysis for various Soil Conditions.

UNIT-I

Soil Investigation: Soil Investigation for new and existing structures. Depth of exploration for different structures, spacing of bore Holes, Methods of soil exploration and relative merits and demerits. Types of soil sample. Design features of sampler affecting sample disturbance, Essential features and application of various types of samplers, Geophysical exploration by seismic and electrical resistivity methods, Standard Penetration Test and Plate load test, Bore hole log.

Stresses in Soil: Boussinesq's equation for a point load, uniformly loaded circular and rectangular area, pressure distribution diagrams, Isobars, New mark's chart and its construction, Approximate method of load distribution, Comparison of Boussinesq's & Westergaard analysis for a point load.

UNIT-II

Earth Pressure: Terms and symbols used for a retaining wall, Movement of wall and the lateral earth pressure, Earth pressure at rest, Rankine states of plastic equilibrium, Coefficient of active and passive earth pressures for horizontal backfills, Rankine's theory both for active and passive earth pressure for Cohesion-less and cohesive soil, Coulomb's method for cohesion less backfill, Merits and demerits of Ranking and Coulomb's theories, Culmann's graphical construction (without surcharge load).

UNIT-III

Shallow Foundation: Type of shallow foundations, Factors affecting choice of foundation, Factors affecting the depth of foundation. Definition of ultimate bearing capacity, safe bearing capacity and allowable bearing capacity, Terzaghi's analysis. Types of failures, Factors affecting bearing capacity, Skempton's equation, B.I.S. recommendations for shape, depth, inclination factors and water table corrections, Causes of settlement of structures, Immediate and consolidation settlement, calculation of settlement by plate load Test and Static Cone penetration test data, Allowable settlement of various structures according to I.S. Code, Introduction of rafts and floating foundation.

UNIT-IV

Pile Foundations: Types, Necessity and uses of piles, Classification of piles, Types of pile driving hammers & their comparison, Determination of load carrying capacity of driven piles by dynamic formulae, Cyclic Pile Load Test, Determination of point resistance and frictional resistance of a single pile by Static formulas in sand and clay, Spacing of piles in a group, Group action of piles, Calculation of settlement of friction pile group in clay, Settlement of pile groups in sand, Negative skin friction.

Caissons and Wells: Major areas of use of caissons, advantages and disadvantages of open box and pneumatic caissons, Essential part of a pneumatic caisson, Components of a well foundation, Calculation of allowable bearing pressure, Conditions for stability of a well, Forces acting on a well foundation, Computation of scour depth.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Understand the method of surface and subsoil exploration and to prepare investigation report.
2. Estimate the stresses in soils and bearing capacity of soil for shallow foundation.
3. Analyse the bearing capacity, settlement and design of shallow foundation based on soil condition and IS Code recommendations.
4. Apply the concepts of deep foundation and solve problems related with pile foundation.

Books Recommended:

1. Arora, K.R., "Soil Mech. & Foundation Engg," Standard Publishers Distributors.
2. Murthy, V.N.S., "Soil Mech. & Foundation Engg."
3. Ranjan, Gopal and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age International.
4. Budhu, Muni., "Soil Mech. & Foundations", Wiley, John Wiley & Sons.
5. Gulhati and Datta., "Geotechnical Engineering", Tata McGraw Hill Education.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE602C	Estimation & Costing	L	T	P	4
				3	1	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Provide the ability to estimate the quantities of item of works involved in buildings, water supply & sanitary works, road works and irrigation works etc.
2. Equip the student with the ability to do rate analysis, valuation of properties and preparation of reports for estimation of various items.
3. Understand the technical specifications for various works to be performed for a project.
4. Impact the cost of a structure and also able to understand how competitive bidding works.
5. How to submit a competitive bid proposal.

UNIT-I

Estimating: Different types of estimates, Methods of estimating and scheduling quantities for the following works: Building, Culverts, Bridges, Irrigation works, Steel structures, Road works, Canal works, Sanitary and water supply works, Roofs, R.C.C. work, Cost sensitive index.

Analysis of Rates: Schedule of rates (As per CSR Punjab-2016), Analysis of rates: Earth work, Brick masonry, Stone masonry, Cement concrete, RCC work, Iron work, Plastering, Flooring, White washing, Painting, Wood work, Road work.

UNIT-II

Specifications: Detailed specifications of the following: Earth work in foundation, Lean concrete in foundation, Cement concrete, RCC, Brick work, Plastering, Painting, C.C. floor, Mosaic floor, White washing, Distempering, Varnishing, Painting, Doors and windows, DPC, Centering and shuttering, Cement mortar, Brick ballast and Sand.

UNIT-III

Valuation: Gross income, Net income, Outgoing, Scrap value, Salvage value, Obsolescence, annuity, Capitalized value, Year's purchase, Sinking fund, Depreciation, Book value, Valuation of building, Determination of depreciation, Method of valuation, Life of various items of works, Different types of lease, Fixation of rates, Plinth area required for residential & commercial building, Arbitration, Introduction to Acts pertaining to-Minimum wages, Workman's compensation.

UNIT-IV

Accounts Procedures: Regular and work charged establishment, Pay bill, ACR, Classifications of works, Contract, Tender, Tender notice, Earnest money, Security money, Arranging contract, Power of accepting tender, Daily labour, Muster roll, Classification of contracts, Penalty, Measurement book, Account procedures of stores, Stock accounting, Introduction to forms and bills, Advance payment, Hand receipt, Refund of security money, Cash book, Imprest, Deposit works, Temporary advances, Treasury challan, Inventory, Administrative approval, Competent authority, Building bye laws.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Understand the preparation of an abstract estimate for a residential building, roads, irrigation projects, bridges, etc.
2. Analyse the units for various quantities of items of work & also evaluate the rates for various items of work
3. Design and prepare bar bending schedule for reinforcement works.
4. Evaluate the valuation of buildings & preparation of standard specifications for different items.

Books Recommended :

1. Estimating & Costing in Civil Engineering: Theory & Practice by B.N. Dutta, UBS Publishers Distributors Ltd.
2. Estimation and Costing in Civil Engineering, by Birdie, G.S., Dhanpat Rai Publishing Co. Ltd, New Delhi, 2011.
3. Estimation, Costing, Specifications and Valuation in Civil Engineering, Chakraborti M, National Halftone Co. Calcutta
4. Estimating and Costing for Building & Civil Engineering Works by P.L. Bhasin.
5. Standard Schedule of rates and standard data book by Public Works Department.
6. National building code of India.
7. I.S. 1200 (Parts I to XXV – 1974/method of measurement of building and Civil Engineering works – B.I.S.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE603C	Computer Aided Structural Drawing Lab-II	L	T	P	1
				0	0	2	
Internal Marks: 30, External Marks: 20, Total Marks: 50							

Course Objectives: The course should enable the students to:
1. Develop structural designs.
2. Understand design procedures and ways to interpret drawings, and to produce designs using Civil Engineering software's.

Laboratory Drawing Works:
1. Advanced Structural Drawings of concrete elements.
2. Advanced Structural Drawings of steel elements.
3. Hydraulic Structures: Canal sections, Guide Bank, Weir/Barrage, Head/ Cross regulators, Canal falls, Cross Drainage works. 4. Structural drawings of R.C.C. building (Single & multi storey).

Course Outcomes:
Upon successful completion of this course, student will be able to:
1. Use the software packers for drafting and modelling.
2. Design and draw working structural drawings of various concrete, steel, hydraulic structures and their components & members.
3. Understand and interoperate design aids and handbooks.
4. Use of relevant Indian Standard specifications applicable to reinforced concrete, steel, hydraulic and other structures.

Books Recommended :

1. Engineering graphics with Auto CAD - R.B. Choudary, Anuradha Publishes.
2. Computer Aided Drafting & Modeling Lab by K. Venugopal, Raja, Scitech Publications.
3. Computer Aided Design Laboratory by M.N. Shesha Prakash, G.S. Suresh, Laxmi Publication

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE611C	Ground Improvement Techniques	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. To understand the formation, distribution and alteration of soils, along with various geo-technical compaction methods & their applications in the field.
2. To explore drainage and pre-compression methods including dewatering techniques, consolidation properties and advanced soil compression methods.
3. To understand principles , design and application of grouting & injection methods focusing on Grout types, equipment and quality control.
4. To explore various soil stabilization methods , techniques with a focus on quality control and use of admixtures, geo-synthetics and other advanced materials.

UNIT-I

General : Formation of rock, soils and soil profiles, soil distribution in India and other countries - marine, black cotton soils (expansive)., lateritic, alluvial, desert soils peat etc., factors affecting the alteration of ground after formation – natural and man-made – reclaimed soils – methods of Geotechnical processes.

Compaction Methods: moisture density relations – compactive efforts – field methods – surface compaction, deep compactions- vibro compaction methods, vibro-probes, stone columns, sand compaction, stone column piles, selection of methods – quality control – specifications for compaction process for solving field problems.

UNIT-II

Drainage Methods: seepage, ground water seepage control – filter requirements methods of dewatering – well point methods of discharge computations – design of steps for dewatering – design of well screens selection of pumps and accessories – deep bored wells. Pre-compression methods: compressibility and consolidation properties of soils estimation of rate of consolidation settlements – accelerating methods monitoring compressions – design of vertical drains – consolidation by electro osmosis and vacuum compression methods.

UNIT-III

Grouting and Injection Methods: principles, design methods, selection of methods and requirements. Aspects of grouts, types of grouts and chemical applications, seepage control, solidification and stabilization – equipment and accessories used – quality control – specifications for achieving satisfactory results.

UNIT-IV

Stabilization Methods: Mechanical, cement, lime, chemical methods of stabilization of soils – use of admixtures – polymers – geosynthesis –reinforcements thermal slurry trenches, void filling –
prewetting –improving rock stability methods – exercise quality control to achieve desired results.

Course Outcomes: Upon completion of the course the students shall be able to:

1. Learn soil formation, types, and factors affecting soil changes, geotechnical processes, and surface & deep compaction techniques, selection criteria, and quality control for field applications.
2. Apply drainage, dewatering, seepage control, well design, pump selection, and pre-compression to manage soil settlement using vertical drains, electro-osmosis, and vacuum compression.
3. Use drainage, dewatering, and pre-compression methods to control seepage and soil settlement with pumps, wells, and advanced techniques like vertical drains and vacuum compression.
4. Apply soil stabilization methods using mechanical, chemical, cement, lime, admixtures, polymers, geosynthetics, and techniques like thermal trenches and rewetting with quality control for field stability.

Books Recommended:

1. Bowles, J., "Foundation Design & Analysis", McGraw-Hill Edition.
2. Raj, Purushottam,. "Ground Improvement Techniques", Laxmi Publications
3. Fang, F.S., "Handbook of Foundation Engg". CBS Publications, 1985.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE612C	Disaster Management	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Understand the concepts, types and impact of natural & man-made disasters, along with hazard and vulnerability profiles for effective disaster prevention and mitigation strategies.
2. Analyze the multifaceted impacts of disasters on society, environment and economy, considering demographic factors, hazard patterns and the influence of climate change & urbanization.
3. Understand the disaster management cycle, Risk reduction strategies and the role of stakeholders in implementing policies and programs for effective disaster risk reduction in India.
4. Explore the relationship between disasters, environment and development, focusing on vulnerability factors, sustainable recovery & environmentally responsible reconstruction practices.

UNIT-I

Introduction: Concepts and definitions -disaster, hazard, vulnerability, risks-severity, frequency and details, capacity, impact, prevention, mitigation, Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT-II

Disaster Impacts: Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-III

Disaster Risk Reduction (DRR): Disaster management cycle –its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT-IV

Disasters, Environment and Development: Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmentally friendly recovery; reconstruction and development.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Identify various types of disaster, their causes, effects & mitigation measures.
2. Analyse the impacts of disasters on various sectors and influence of climate change, demographic factors and urbanization on disaster trends.
3. Understanding the use of emergency management system to tackle the problems
4. Analyse disaster vulnerability based on various impacts of development activities and apply sustainable practices for the construction and development.

Books Recommended:

1. C.B.R.I, lyengar., by, "Natural Hazards in the Urban Habitat", Tata McGraw Hill Pulisher.
2. Ingleton, Jon., "Natural Disaster Management", Published by Tudor Rose, Leicester 92.
3. Singh, B.K., "Handbook of disaster management: Techniques & Guidelines", Rajat Publications.
4. Singh, R.B., "Disaster Management", Rawat Publications.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE613C	Solid & Hazardous Waste Management	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Understand the problems of municipal waste, biomedical waste, hazardous waste, E-waste, industrial waste etc.
2. Knowledge of legal, institutional and financial aspects of management of solid wastes.
3. Become aware of Environment and health impacts of solid waste mismanagement
4. Understand engineering, financial and technical options for waste management.

UNIT-I

Sources and Composition of Solid Waste: Solid Waste Introduction, Sources of solid waste, types & classification of solid waste, Composition of solid waste & its determination, Types of materials recovered from MSW.

Properties of Municipal Solid Wastes: Physical properties of Municipal Solid Waste, Chemical properties of Municipal Solid Waste, Biological properties of Municipal Solid Waste, Transformation of Municipal Solid Waste.

UNIT-II

Solid Waste Generation and Collection: Quantities of Solid Waste, Measurements and methods to measure solid waste quantities, Solid waste generation and collection, Factors affecting solid waste generation rate, Quantities of materials recovered from MSW.

Handling, Separation and Storage of Solid Waste: Handling and separation of solid waste At site, Material separation by pick in, screens, float and separator magnets and electromechanical separator and other latest devices for material separation, Waste handling and separation at Commercial and industrial facilities, Storage of solid waste at the sources.

UNIT-III

Processing of Solid Waste: Processing of solid waste at residence e.g. Storage, conveying, compacting, Shredding, pulping, granulating etc., Processing of solid waste (Size & volume reduction)

Disposal & Treatment of Solid Waste: Combustion and energy recovery of municipal solid waste, effects of combustion, Sanitary landfill: Classification, planning, landfill processes, landfill design, landfill operation & bioreactors, Compositing, Incineration, Pyrolysis & gasification, Landfill leachate & gas management.

UNIT-IV

Solid Waste Management: Solid waste (management and handling) rules, hazardous waste (management and handling) rules, biomedical waste handling rules, Fly ash management & handling rules, recycled plastics usage rules, e-waste management rules, batteries (management and handling) rules, solid waste management in rural area, Recent advances in solid waste management.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Do sampling and characterization of solid waste.
2. Analysis of hazardous waste constituents including QA/QC issues
3. Apply steps in solid waste management like waste reduction at source, collection techniques, recycling, transport, optimization of solid waste.
4. Analyse treatment & disposal techniques and economics of the onsite and offsite waste management.

Books Recommended :

1. Environmental Engineering (Vol. II) by S.K. Garg, Khanna Publishers, New Delhi.
2. Vesilind P.A., Worrell W. And Reinhart D.R., "Solid Waste Engineering", Thomson Books.
3. Bhide A.D. and Sundaresan B.B., "Solid Waste Management, Collection, Processing and Disposal", Nagpur.
4. Tchobanoglous G., Theisen H. And Vigil S.A., "Integrated Solid Waste Management", McGraw-Hill.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Advanced Diploma Course	BTCE604C	Air & Noise Pollution	3	0	0	3
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Understanding of basic concepts of air pollution & noise pollution.
2. Study of air & noise pollution, identification of the parameters, conditions, mechanisms.
3. Study of sampling types and methods for ambient air and stack.
4. Study of macro and micro meteorology for understanding the dispersion of pollutants.
5. Study of pollution control methods, mechanism and devices.

UNIT-I

Air Pollution: Composition and structure of atmosphere, global implications of air Pollution, Classification of air pollutants: Particulates, hydrocarbon, Carbon monoxide, Oxides of sulphur, Oxides of nitrogen and photo chemical oxidants. Indoor air pollution, Effects of air pollutants on humans, animals, property and plants.

Air Pollution Chemistry: Meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion.

UNIT-II

Air Sampling & Measurement: Ambient air quality and standards, air sampling and measurements; ambient air sampling, Collection of gaseous air pollutants, collection of particulate air pollutants, stack sampling, Control devices for particulate contaminants: gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP).

UNIT-III

Control of Gaseous Contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydro carbons, automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications.

UNIT-IV

Noise Pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psycho-acoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infra-sound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure, Noise indices

Course Outcomes: The course will enable the student to:

1. Explain basic principles on various aspects of atmospheric chemistry.
2. Identify the major sources, effects and monitoring of air and noise pollutants.
3. Understand the key transformations and meteorological influence on air and noise.
4. Relate and analyse the pollution regulation on its scientific basis.

Books Recommended:

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. S.K. Garg, “Environmental Engineering (Vol. II)” , Khanna Publishers, Delhi
3. K. Kant and R. Kant, “Air Pollution and Control Engineering”, Khanna Publishers House.
4. C.S. Rao, “Environmental Pollution Control Engineering”, Wiley Eastern Ltd., New Delhi
5. P.E. Cunniff, “Environmental Noise Pollution”, McGraw Hill.

Semester 7th

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE701C	Hydrology & Dams	L	T	P	4
				3	1	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Understand about different components of the hydrological cycle and enable them to estimate runoff, infiltration, evaporation, ground water flow and peak floods.
2. Understand the design principles of embankment dams and gravity dams.

UNIT-I

Precipitation: Importance of hydrological data in water resources planning. The hydrologic cycle. Mechanics of precipitation, types and causes, measurement by rain gauges, Gauge networks, hyetograph, averaging depth of precipitation over the basin, mass-rainfall curves, intensity duration frequency curves and depth area-duration curves, relevant numerical problems.

UNIT-II

Interception, Evapotranspiration and Infiltration: Factors affecting interception, evaporation from free water surfaces and from land surfaces, transpiration, Evapotranspiration. Infiltration Factors affecting infiltration, rate, Infiltration capacity and its determination, relevant numerical problems.

UNIT-III

Runoff: Factors affecting runoff, run-off hydrograph, unit hydrograph theory, S-curve hydrograph, Synder's synthetic unit hydrograph, relevant numerical problems.

Peak Flows: Estimation of Peak flow-rational formula, use of unit hydrograph, frequency analysis, Gumbel's method, design flood and its hydrograph, relevant numerical problems.

UNIT-IV

Gravity Dams: Non Overflow Section: Forces acting, Stability factors, stresses on the faces of dam, Design of profile by the method of zoning, elementary profile of a dam.

Arch and Buttress Dams: Classification of arch dam- constant radius, constant angle and variable radius, Cylinder theory, Expression relating central angle and Cross-Sectional area of arch. Types of buttress dams, Advantages of buttress dams.

Earth Dams: Components of earth dams and their functions, Phreatic line determination by analytical and graphical methods.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Compute mean precipitation, infiltration rate and runoff from a catchment area
2. Construct unit hydrograph and S-hydrograph, and compute peak flood flow and design flood for hydraulic structures.
3. Estimate seepage through embankment dam using seepage theory and work out factor of safety of gravity dam for different forces acting on it.
4. Learn the designing hydraulic structures like dams.

Books Recommended :

1. J. Nemec, 'Engineering Hydrology', Prentice Hall.
2. Stanley Buttler, John. Wiley 'Engineering Hydrology',.
3. TODD, 'Ground Water Hydrology', John Wiley.
4. Creager Justin & Hinds, 'Engineering for Dams', Vol. -II, -III, John Wiley.
5. S.K. Garg, 'Hydrology', Khanna Publishers.
6. H.M. Raghunath, 'Hydrology Principles, Analysis and Design', New Age Int. Publishers.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE702C	Design of Steel Structures	L	T	P	4
				3	1	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Grasp the knowledge about design essential components, flange curtailment techniques, and diverse stiffener applications in plate girders.
2. Understand the classification and design principles of various beam-column connections, focusing on the detailed design of shear-resistant connections.
3. Understand various column base configurations, including slab bases along with the distinct principles governing the design of grillage footings.
4. Understanding of plastic hinge behaviour, collapse load determination for basic beams and frames, and the practical application of plastic analysis in design.

UNIT-I

Connections: Terminology, Types of connection, Modes of failure, Design of bolted and welded connections for axial and eccentric loads.

Tension Members: Introduction, Modes of failure, IS Specifications, Design of members subjected to axial tension using bolts and welds.

Compression Members: Introduction, buckling, effective length, slenderness, effects of end supports, Design of axially loaded members, built-up columns, laced and battened columns including the design of lacing and battens using bolts and welds.

UNIT-II

Beam-Column Connections: Types of beam-column connections, Design of shear resistant connections - Design of bracket connections, seat connections and framed connections.

UNIT-III

Design of Plate Girders: Elements of a plate girder, design of plate girder, curtailment of flanges, various type of stiffeners.

Column Bases and Footings: Types, slab base, gusseted base, bases for eccentrically loaded columns, Grillage footing.

UNIT-IV

Industrial Buildings: Types, elements of industrial buildings/sheds, structural planning, analysis and design of trussed roof/bents, crane/gantry girders, column brackets, transverse and longitudinal bracings.

UNIT-V

Roof Truss: Introduction, types of trusses, design of steel roof truss.

Plastic Analysis: Introduction to Plastic analysis; plastic hinge mechanism, collapse load, analysis of simple beams and frames.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Design structural connections like bolts & welds and structural members, including tension and compression elements.
2. Apply the knowledge for analysis &design of beam column connections and various components of a plate girder.
3. Design the column bases and footings for a steel structure under various loading conditions.
4. Analyse the loads and design various elements of industrial buildings.
5. Implement the basic knowledge of plastic analysis of simple steel elements and to design the steel roof truss.

BIS Codes of practice and Design Handbooks:

1. IS 800: 2007 (General construction in steel-Code of practice) *
2. IS 875-2015 Part -3 [Design loads (other than earthquake) for buildings and structures — code of practice- wind loads] *
3. SP: 6(1) (Handbook for structural engineers-Structural steel sections) *

The codes marked with * are permitted in examination.

Books Recommended:

1. Duggal. S.K."Limit State Design of Steel Structures" TMH.
2. Chandra. Ram."Design of steel structures (Vol. 1& 2)"
3. Punmia. BC."Design of steel structures"
4. Vazirani & Ratwani. "Design of Steel Structures"
5. Wiley. C.W.,John and Sons. "Planning of Industrial Structures, Dunham"

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Department Elective	BTCE711C	Rural Water Supply and Onsite Sanitation Systems	3	0	0	3
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Learn about water supply in rural areas
2. Learn about environmental sanitation methods in rural areas
3. Comprehend the global picture of water/sanitation/hygiene and health.
4. Understanding the principles of operation of a range of appropriate water and sanitation technologies, and to be able to critically evaluate them with respect to multiple criteria.

UNIT-I

Sanitation in Rural Area: Concept of environmental and scope of sanitation in rural areas, Magnitude of problem of water supply and sanitation – population to be covered and difficulties National policy, Various approaches for planning of water supply systems in rural areas, Selection and development of preferred sources of water, springs, wells and infiltration galleries, collection of raw water from surface source.

UNIT-II

Water Treatment for Rural Areas: Specific problem in rural water supply and treatment e.g. iron, manganese, fluorides etc., Low cost treatment, appropriate technology for water supply and sanitation, Compact system of treatment of surface and ground waters such as MB settlers, slow and sand filter, chlorine diffusion cartridge etc.

UNIT-III

Waste Water Treatment & Distribution: Planning of distribution system in rural areas, Water supply during fairs, festivals and emergencies, Treatment and disposal of wastewater/sewage, various method of collection and disposal of night soil.

UNIT-IV

Onsite Sanitation System for Rural Areas: On site sanitation system and Disposal of solids waste: Simple wastewater treatment system for rural areas and small communities such as stabilization ponds, septic tanks, soakage pits, surface drains, onsite sanitation systems etc., composting, land filling, Biogas plants.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Knowledge about water supply scheme in rural areas.
2. Knowledge about environmental sanitation methods and design in rural areas.

Books Recommended:

1. Rijswijk (the Haque), Wagner, E.G. and Lanoik, J.N.' "Water Supply for Rural Areas and Small communities," Geneva: W.H.O.1959.
2. Manual of water supply and treatment, 3rd edition, CPHEEO, GOI, New Delhi.
3. Warren Viessman Jr. & Mark J. Hammer' "Water Supply and Pollution Control" by, 7th Edition 2005,Pearson Education.
4. Metcalf & Eddy, "Wastewater Engineering; Treatment, Disposal, Reuse" by Tata McGraw- Hill.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE 712C	Traffic Engineering	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Understand the traffic flow parameters and measures related to traffic control and management.
2. Analyze the feasibility of different control devices for traffic management.
3. Create the solution of the problem related to traffic congestion and safety.
4. Outline the causes of road accidents and procedure to assess the road safety audit.

UNIT-I

Fundamentals of Traffic Management: Principles of Traffic management, Highway capacity and Level of service, Mixed Traffic flow, PCU concept and its limitations, Traffic stream parameters, Interrupted and Uninterrupted flow.

UNIT-II

Traffic Regulation and Control: Road Signs and markings, Channelization; At-grade and Grade separated Intersections, Traffic Rotary, Design principles of traffic signals.

Traffic Management techniques: Regulatory measures for Traffic management, Travel Demand Management, Role of ITS in traffic management.

UNIT-III

Road accidents: Causes of road accidents, Vehicle design factors & Driver characteristics influencing road safety,

Road condition, Parking and its influence on traffic safety.

Road safety measures: Accident data collection methods, Representation of accident data, Collision and condition diagram, Methods to Identify and Prioritize Black spots, Road safety, 3 E measures.

UNIT-IV

Road safety audits: Key elements in Road safety audit, Road safety audit procedure and investigations, Role of ITS in Road safety.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Apply the methods to identify the black spots and propose the solutions to improve road safety.
2. Assess the need of modernization in traffic management and road safety.

Books Recommended :

1. Fred L. Mannering, Scott S. Washburn. Principles of Highway Engineering and Traffic Analysis.7th Edition, Wiley,2019.
2. Kadiyali, L. R., “Traffic Engineering and Transport Planning”, Khanna Publishers.
3. ChakrobortyPartha and Animesh Das, “Principles of Transportation Engineering”, Prentice hall
4. O’Flaherty C A, “Transport Planning and Traffic Engineering”, Butterworth Heinemann, Elsevier, Burlington,MA.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE713C	Bridge Engineering	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Understand about the planning and construction of bridges, which is one of the most important components of the transportation infrastructure.
2. Understand about different types of bridges, their choice, site selection, loads, with special emphasis on RCC and steel bridges.
3. Understand about components of sub-structure and super-structure of the bridges along with construction and maintenance aspects of bridges.

UNIT-I

Introduction: Definition and components of a bridge, Classification of bridges, Choice of a bridge type, Investigation for bridges, Selection of bridge site, design discharge for river bridge, linear waterway, economical span, vertical clearance, scour depth, afflux.

Standard Specifications for Road Bridges: IRC Bridge Codes, Width of carriageway, Dead load, I.R.C. standard live loads, Impact effect, Wind load, Longitudinal forces, Centrifugal forces, Horizontal forces due to water current, Buoyancy effect, Earth pressure, Deformation stresses, Erection stresses, Temperature effects and Seismic forces.

UNIT-II

Reinforced Concrete Bridges: Types of RCC bridges; Culverts - Box Culvert, Pipe Culvert, Solid slab bridge, T-beam girder bridges, Hollow girder bridges, Balanced cantilever bridges, Continuous girder bridges, Rigid frame bridges, Arch bridges, Pre-stressed concrete bridges.

Steel Bridges: Types of Steel bridges; Beam bridges, Plate girder bridges, Box girder bridges, Truss bridges, Arch bridges, Cantilever bridges, Cable stayed bridges, Suspension bridges.

UNIT-III

Sub-structure and Foundation: Piers and abutments, materials for piers and abutments, Types of foundations; Shallow, Pile, and Well foundations. Relative merits of piles and well foundations, Pneumatic Caissons, Box Caissons.

Bearings: Importance of Bearings, Different types of bearings, Expansion Bearings, Fixed Bearings, Elastomeric Bearings.

UNIT-IV

Joints & Appurtenances: Expansion joints, Wearing Course, Approach Slab, Footpath, Handrails. **Construction and Maintenance of Bridges:** Methods of construction of concrete and steel bridges. Formwork and false work for concrete bridges, Causes of Bridge failures, Inspection and maintenance, Bridge Management System.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Plan the construction of bridges, which is one of the most important components of the transportation infrastructure.
2. Familiar about different types of bridges, their choice, site selection, loads, with special emphasis on RCC and steel bridges.
3. Construct the components of sub-structure and super-structure of the bridges.

Books Recommended :

1. Johnson, Victor, 'Essentials of Bridge Engineering', Oxford University Press.
2. C.H. Khadilkar, 'A Text book of Bridge Construction', Allied Publishers.
3. S.C. Rangwala, 'Bridge Engineering', Charotar Publishing House Pvt. Ltd.
4. V.K. Raina, 'Concrete Bridges Handbook, Shroff Publishers and Distributors.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE703C	Project	L	T	P	4
				0	0	8	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Use knowledge of various disciplines gained during entire study in a civil project of his choice.
2. Demonstrate the personal abilities and skills required to produce and present an extended piece of work.
3. Engage in personal inquiry, action and reflection on specific topics and issues.
4. Focus on, and demonstrate an understanding of, the areas of interaction.
5. Reflect on learning and share knowledge, views and opinions.

Project Work: Students are required to work on practical projects based on sustainability, design, testing and use of recycled materials in the field of Civil Engineering. The students have to work for 8 hrs per week with his / her supervisor(s).

Course Outcomes: Upon completion of this course the student shall be able to:

1. Identify, describe & analyze the steps followed to achieve the chosen area(s) of interaction or stated goal.
2. Analyze & choose techniques relevant to the project's goal.
3. Respond thoughtfully to ideas and inspiration by using modern tools & techniques.
4. Fully worked-out design proposal-including consideration of site planning, structure, services, and any other aspect/specific to the project.
5. Assess the achieved results in terms of the initial goal and the focus on the chosen area(s) of interaction with future meets.

Semester 8th(a)

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Core Subject	BTCE801C	Smart City	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Obtain basic knowledge of smart cities
2. Learn how to analyze and compare existing smart community projects.

UNIT-I

Introduction: Definition and concept of smart city, Difference between: Intelligent city, Digital city, and E-city, Objectives, principles, stages in to smart city planning, Smart city planning schemes. Complexities of Smart cities, Smart cities in India.

UNIT-II

Smart Planning: Structure plan, detailed smart city planning scheme and action plan, Estimating future needs, planning standards for different land use allocation for commerce, industries, public amenities, open areas etc.,

UNIT-III

Smart Infrastructure: Adaptive capabilities; smart infrastructures of energy, mobility, health and sustainability and their growing interdependencies. Cyber security, Safety, and Privacy.

UNIT-IV

ICT for Smart City: Internet of Things, Block chain, Artificial Intelligence, Alternate Reality, Virtual Reality, Future of Smart cities, Smart City Informatics.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Acquaint knowledge on smart cities planning and development.
2. Develop work break down structure, scheduling and project management of smart cities.
3. Work out the most energy efficient technique.

Books Recommended:

1. Jo Beall (1997); "A city for all: valuing differences and working with diversity"; Zed books limited, London (ISBN: 1-85649-477-2)
2. UN-Habitat; "Inclusive and sustainable urban planning: a guide for municipalities"; Volume 3: Urban Development Planning (2007); United Nations Human Settlements Programme (ISBN: 978-92-1-132024-4)
3. Arup Mitra; "Insights into inclusive growth, employment and wellbeing in India"; Springer (2013), New Delhi (ISBN: 978-81-322-0655-2)
4. William J. V. Neill (2004); "Urban Planning and cultural identity"; Routledge London (ISBN: 0-415-19747-3)

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE811C	Maintenance of Building Structures	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Diversified skills needed to maintain and renovate commercial and residential properties.
2. Learn the skills of the maintenance management.
3. Learn the defects, Investigation & Inspection etc.
4. Learn various repair steps for different elements of building.

UNIT-I

Maintenance of Buildings: Introduction, Importance of maintenance, Types of Maintenance - Daily, Weekly, Monthly, Annually, General importance – Painting and home electricity system.
Repair Strategies: Causes of distress in structures Construction and design failures, Condition assessment and distress-diagnostic techniques, Inspection and evaluating damaged structure.

UNIT-II

Durability and Serviceability of Concrete: 1. Quality assurance for concrete construction based on concrete properties like: (a) strength (b) Permeability (c) Thermal properties (d) cracking 2. Effects due to: (a) climate (b) temperature (c) chemicals (d) corrosion 3. Design and construction errors 4. Effects of cover and cracks.

UNIT-III

Materials for Repair: Special concretes and mortar, concrete chemicals, construction chemicals, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete, Rust eliminators and polymers coating for rebar, foamed concrete, dry pack, vacuum concrete, asphalt sheeting.
Techniques for Repairs: Guniting, grouting and Shotcrete, Epoxy injection, Jacketing, shoring and underpinning. Methods of corrosion protection: (a) corrosion inhibitors (b) corrosion resistant steels (c) coating and cathodic protection.

UNIT-IV

Repair: Repair of – stone, brick and block masonry (Cracks, dampness, efflorescence, joint separation, etc.), Flooring, Roofs (sloping, flat, pitched, etc.), Concrete members due to Steel Corrosion, Lack of Bond & shear, tension, torsion, compression failure. Estimation of Repair.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Assess the health condition of structures.
2. Inspect and evaluate damage structures.
3. Implement the techniques for repairing of concrete structures.
4. Test to assess the conditions of properties of existing concrete structures.

Books Recommended:

1. Panchdari. A.C."Maintenance of Buildings", New Age International (P) Limited Publishers.
2. Gahlot. P.S."Building Repair and Maintenance Management", CBS Publishers and Distributors Pvt. Ltd.
3. Gupta. B.L."Maintenance & Repair of Civil Structures", Standard Publications.
4. Ransom. W.H."Building Failures: Diagnosis and Avoidance", New Age Publications (P) Ltd.
5. Housing Defects Reference Manual, 'The Building Research Establishment E. & F.N. Spon'.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE 812C	Intelligent Transport System	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:
1. Understand the concept of Intelligent Transportation system.
2. Analyse ITS's relevance with Smart growth and energy based planning.
3. Conceptualise the urban transportation systems using different models.

UNIT-I

Overview of Intelligent Transportation Systems: Introduction to ITS, its history and future, Framework for analysing ITS relationships- Information technology, GPS.

UNIT-II

Advanced Transportation Planning Process and Problems: Terminology of Transportation Planning, Functional Components, Brief Overview of Models used in Transportation Planning, Environmental concerns, Smart growth and sustainable alternatives, Energy based planning, Global Positioning Systems.

Transportation System Impacts: Travel Facilities, Origin and Destination, Transit Surveys, Decision making Process, Transportation Demand Management (TDM), Use of GIS in Transport planning.

UNIT-III

Land Use Transportation System: Urban system components, Urban Spatial Structure, Location Theory, Land use planning, Land use Models, Land use transport models – (Lowry and Garin), Lowry Models, Transit Oriented Development(TOD).

UNIT-IV

Urban Public Transportation: Urban Growth and Public Transport needs, Transit mode characteristics, transit characteristics, Fleet size and capacity estimation, Smart cities based Transit Planning.

Road Safety: Highway safety using ITS.

Course Outcomes: Upon completion of this course the student shall be able to:
1. Explore methodology for smart city based Transit planning.
2. Suggest road safety using ITS.

Books Recommended :
1. Joseph M. Sussman, "Perspectives on Intelligent Transportation systems".
2. Kadyali, "Traffic Engineering and Transport planning", Khanna publishers.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE813C	Construction Engineering Materials	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Understand about various construction materials, and understand their relevant characteristics.
2. Suitability of various materials for different construction purposes.
3. Understand about natural, artificial, and processed materials available for various purposes of construction activities.

UNIT-I

Construction Materials: Classifications of Construction Materials. Consideration of physical, Mechanical, thermo-physical Properties, characteristics behaviour under stress, Selection criteria for construction materials, green building materials.

Materials for making Mortar and concrete: Lime manufacture, properties, hardening of lime, types of lime, lime concrete uses. Cement, pozzolanic material, aggregates, water, admixtures - characteristics, properties and uses .Types of mortars, special mortars, their properties and applications. Ceramic Materials: Classification, Refractories, glass, glass wool, mechanical, thermal and electrical properties, fire resistance materials, Uses and application.

UNIT-II

Polymers in Civil Engineering: Rubber and plastics, properties, effect of temperature on mechanical properties, Uses and application, Polymers, fibres and composites, Fibre reinforced plastic. Architectural use and aesthetics of composites. Adhesives and sealants. Structural elastomeric bearings and resilient seating. Moisture barriers, Polymer foams and polymers in Building Physics. Polymer concrete composites.

UNIT-III

Metals: Types of structural steels, special steel, alloy steel, stainless steel, light gauge steel, Corrosion of concrete and reinforcing steel in various environments. Electro-chemical process and measures of protection during construction. Ferro-cement, composition and properties.

UNIT-IV

Modified Materials: Modified bitumen using plastic or polymers, Modified cement concrete using various industrial ashes, soil stabilised using slag, polymers - their properties, advantages and applications as per Indian conditions.

Special concretes: Concretes, Behaviour of concretes - Properties and Advantages of High Strength and High Performance Concrete – Properties and Applications of Fibre Reinforced Concrete, Self- compacting concrete, Alternate Materials to concrete on high performance & high Strength concrete.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Know about the composition, microstructure, and engineering behavior of various materials used in civil engineering applications.
2. Introduce various modifications possibilities in construction materials.
3. Explain special concrete properties.

Books Recommended :

1. Rangawala S.C. , “Engineering Materials” Chortor Publications 1991.
2. S.K. Duggal, “ Building Materials”, New Age International Publications 2006.
3. Bruntley L.R, “ Building Materials Technology Structural Performance & Environmental Impact” McGraw Hill Inc 1995.
4. R Chudley. “ Construction Technology”, Vol I - IV Longman Group Construction Ltd. 1973.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE814C	Pre-stressed Concrete	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Understand materials and systems for pre-stressed concrete, including high-strength concrete, and pre-tensioning/post-tensioning systems.
2. Gain knowledge about stresses and the behaviour of pre-stressed concrete under various loads.
3. Understand the structural capacity of pre-stressed concrete sections under flexure, shear, and torsion.

UNIT-I

Materials for Pre-stressed Concrete and Pre-stressing Systems: High strength concrete and high tensile steel, tensioning devices, pre-tensioning systems, post tensioning systems.

UNIT-II

Analysis of Pre-stress and Bending Stresses: Analysis of pre-stress, resultant stresses at a sector, pressure line or thrust line and internal resisting couple, concept of load balancing, losses of pre- stress, deflection of beams.

UNIT-III

Strength of Pre-Stressed Concrete Sections in Flexure, Shear and Torsion: Types of flexural failure, strain compatibility method, IS: 1343 code procedure, design for limit state of shear and torsion.

UNIT-IV

Design of Pre-Stressed Concrete Beams and Slabs: Transfer of pre-stress in pre tensioned and post tensioned members, design of anchorage zone reinforcement, End zone, design of simple beams, cable profiles.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Know about the general mechanical behaviour of pre-stressed concrete.
2. Design pre-stressed concrete flexural members.
3. Design for vertical and horizontal shear in pre-stressed concrete.

BIS Codes of practice

1.* IS 1343 2012, Code of Practice for Pre-stressed Concrete
2. * IS 456-2000, Code of practice for design of reinforced concrete
Note: The codes marked with * are permitted in examination.

Books Recommended:

1. Raju Krishna. N.“Prestressed concrete”, Tata McGraw Hill.
2. Lin Y. T, &Burns H. Ned.“Design of Prestressed Concrete Structures”, John Wiley & Sons.
3. Dayaratnam. P. “Prestressed Concrete”, Oxford & IBH.
4. Rajagopalan. N. “Prestressed Concrete”.
5. Code of Practice for Prestressed Concrete (IS 1343: 2012).

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
1.	Departmental Elective	BTCE815C	Soil Reinforcing Techniques	L	T	P	3
				3	0	0	
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Understand the necessity and scope of geo-synthetics in ground improvement.
2. Gain comprehensive understanding about different types of geo-synthetic products their functions, application and suitability.
3. Learn the analysis and design of reinforced soil walls.

UNIT-I

Reinforced Earth Retaining Wall: Principles, concepts and mechanism of reinforced earth – design consideration of reinforced earth retaining wall.

UNIT-II

Geo-membrane: Physical, mechanical, chemical, biological, thermal and identification properties.

Designing with Geo-membranes: Liquid containment liners, covers for reservoirs, canal liners, landfill liners, caps & closures, underground storage tanks etc.

UNIT-III

Geo-textile: Physical, mechanical, hydraulic, endurance and degradation properties, designing with geo-textiles, geo-textile functions and mechanisms, designing for separation, designing for reinforcement, designing for stabilization, designing for filtration, designing for drainage, designing for multi functions.

UNIT-IV

Geo-grid: Physical, mechanical, endurance and environmental properties, designing for geo-grid reinforcement

Geo-nets: Physical, mechanical, hydraulic, endurance and environmental properties, designing for geo-net drainage

Geo-composites: Geo-composites for separation, reinforcement, filtration, drainage, liquid, vapour barriers.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Competence in identification of ideal geo-synthetic function and ability to select the ideal product to serve the function.
2. Analyse and design the application of geo-synthetics.
3. Apply construction practices and evaluation of post construction improvement.

Books Recommended :

1. Hausman, M. R. (1990). " Engineering Principles of Ground Modification" McGraw-Hills
2. Moseley, M.P. (1193), "Ground Improvement" Chapman and Hall.
3. Koener, R.M. (2012), "Designing with Geo-synthetics, Vol.1 & 2, Xlibriss Corporation.
4. Rao, G.V. and Raju, G.V.S.S. (1995) "Engineering with Geo-synthetics", TMH.
5. Purushothama Raj, P. (2014). "Ground Improvement Techniques". Laxmi Publishers.

Sr. No.	Category	Subject Code	Course Title	Contact Hours			Credits
				L	T	P	
1.	Departmental Elective	BTCE816C	Groundwater Engineering	3	0	0	3
Internal Marks: 40, External Marks: 60, Total Marks: 100							

Course Objectives: The course should enable the students to:

1. Comprehending groundwater occurrence, movement, and storage.
2. Learning about well hydraulics, well design, and groundwater contamination and protection.
3. Gain expertise in aquifer characterization, and the implementation of sustainable groundwater management practices.

UNIT-I

Introduction: Groundwater in Hydrologic Cycle, Occurrence of groundwater, Hydrogeology, Hydrometeorology, Groundwater Systems, Planning and Management of Groundwater, Groundwater Sustainability, Groundwater protection: Concerns and Acts Groundwater Properties- Vertical distribution of subsurface, characteristics and classification of aquifers, Determination of specific yield and permeability.

UNIT-II

Groundwater Hydraulics: Groundwater movement: Darcy's law and its limitations, Dupuit–Forchheimer Theory of Free-Surface Flow, Stream lines and Flow net analysis, Discharge and draw down for various condition of groundwater flow, Groundwater tracers, continuity equation, equation of motion in ground water.

Well hydraulics: steady/unsteady, uniform/radial flow to a well in a confined/unconfined/leaky aquifer, Well flow near aquifer boundaries/for special conditions, Evaluation of well loss parameters, Partial penetration of wells, Interference of wells, Collector wells and Infiltration galleries.

Water Wells: design, Construction; completion, development, protection and rehabilitation of wells.

UNIT-III

Groundwater Quality: Groundwater constituents and contaminants, Water quality standards, Groundwater solubility, Disequilibrium and Saturation Index, sources of groundwater contamination, Mass Transport of Dissolved Contaminants. Groundwater Management: Basin management, investigations, conjunctive use, modelling, artificial recharge; Saline water intrusion.

UNIT-IV

Impact of Climate change: Climate change impact on hydrological cycle, Climate change impact on Groundwater, impact on groundwater quality, climate change simulation, impact on availability of water in aquifer area, Recent advances in solid waste management.

Course Outcomes: Upon completion of this course the student shall be able to:

1. Define the discharge in well for different aquifers.
2. Apply the principles and dynamics of groundwater flow.
3. Examine the reasons of groundwater depletion and fluctuations
4. Appraise the principles of well hydraulics and methods of well construction.

Books Recommended :

1. Todd, D. K. and Mays, L. W., "Groundwater Hydrology" by John Wiley & Sons, Inc.
2. Mays, L. W., "Ground and Surface Water Hydrology" by John Wiley & Sons, Inc.
3. Bear J., "Hydraulics of Groundwater", McGraw-Hill, New York, 1979.
4. Bouwer H., "Groundwater Hydrology", McGraw-Hill, New York, 1978.
5. Driscoll, "Groundwater and Wells", Johnson Filtration Systems, Inc., 1986.

Semester 8th(b)

Semester 8th(b)								**Total Credits=14**
Sr. No.	**Category**	**Subject Code**	**Course Title**	**Evaluation Internal**		**External**	**Total Marks**	**Credits**
				Institutional	**Industrial**			
1	Training (One Semester)	BTCE 802C	Software# Training	50	50	100	200	14
			Industrial Training	100	100	100	300	
Total				**150**	**150**	**200**	**500**	**14**

Course Objective of Training: The objective of the six month industrial & software training is to expose the final year civil engineering students to the competency, knowledge and skills needed to succeed at the workplace. By undergoing industrial training, they will be able to relate the theory that they learnt and applied them practically. Industrial & Software Training is essential for students to develop the practical skills that they will need to be effective professional engineers.

#List of Software for Training to be learnt during Training Period.
Any software that enhances professional capability in civil engineering practice a partial indicative list is mentioned below:

GT STRUDAL	AUTOCAD CIVIL 3D
PRIMA VERA	MX ROAD
GEOTECH	GEOMATIC
ArcGIS	STAAD PRO
GEO	HDM-4
Ansys	PLAXIS
Abacus 13	Any other relevant software