2.2 Third Year B.Tech. in Civil Engineering

Sem. V & VI

Academic Scheme and Syllabus

Year 2015-16

Scheme for Third Year B.Tech. in Civil Engineering (Semester - V) Year 2015-16

Sr. No.	Course	Code	Course Plan for Each Week (Hrs)				Evaluation (Marks)							Total
			Lectures	Laboratory	Tutorial	Credits	Test 1	Test 2	End Semester		End Semester Weightage (%)	Practical*	Term Work#	
									Marks	Duration (Hrs)				
1	Structural Analysis-II	CE301	4	--	2	5	20	20	100	3	60	25	25	150
2	Geotechnical Engineering-I	CE302	4	2	--	5	20	20	100	3	60	25	25	150
3	Building Design and Drawing	CE303	3	4	--	5	20	20	100	4	60	50	25	175
4	Hydraulic Engineering-I	CE304	4	2	--	5	20	20	100	3	60	--	25	125
5	Transportation Engineering-I	CE305	4	--	2	5	20	20	100	3	60	--	25	125
6	Entrepreneurship & Management	CE306	3	--	2	4	20	20	100	3	60	--	25	125
Total			**22**	**8**	**6**	**29**	**120**	**120**	**--**	**--**	**360**	**100**	**150**	**850**

NOTE Test 1, Test 2 and end semester weightage marks will be added and shown as the theory marks in the mark sheet.Duration of Test 1, Test 2 is of 1 hour.

* Evaluation based on practical (if possible) / objective type test / Sketching / Mini Project.

\# Distribution of Term Work marks: Journal work = 10 Marks, Attendance =10, Quiz = 05 Marks.

For passing, Student must secure minimum 40% marks in each Course with all heads of passing taken together and minimum 35% marks in the end semester examination

Scheme for Third Year B.Tech. in Civil Engineering, (Semester - VI) Year 2015-16

Sr. No.	Course	Code	Course Plan for Each Week (Hrs)				Evaluation (Marks)							Total
			Lectures	Laboratory	Tutorial	Credits	Test 1	Test 2	End Semester		End Semester Weightage (%)	Practical*	Term Work#	
									Marks	Duration (Hrs)				
1	Geotechnical Engineering-II	CE351	4	2	--	5	20	20	100	3	60	25	25	150
2	Design and Drawing of Steel Structures	CE352	4	--	2	5	20	20	100	4	60	25	25	150
3	Hydraulic Engineering -II	CE353	4	2	--	5	20	20	100	3	60	25	25	150
4	Transportation Engineering-II	CE354	4	2	--	5	20	20	100	3	60	25	25	150
5	Environmental Engineering-I	CE355	3	2	--	4	20	20	100	3	60	--	25	125
6	Theory of Reinforced & Prestressed Concrete	CE356	4	--	2	5	20	20	100	3	60	--	25	125
Total			**23**	**8**	**4**	**29**	**120**	**120**	**--**	**--**	**360**	**100**	**150**	**850**

NOTE Test 1, Test 2 and end semester weightage marks will be added and shown as the theory marks in the mark sheet.Duration of Test 1, Test 2 is of 1 hour.

* Evaluation based on practical (if possible) / objective type test / Sketching / Mini Project.

\# Distribution of Term Work marks: Journal work = 10 Marks, Attendance =10, Quiz = 05 Marks.

For passing, Student must secure minimum 40% marks in each subject with all heads of passing taken together and minimum 35% marks in the end semester examination

Class:-T. Y. B. Tech. (Civil)	**Semester V**		
CODE: CE301	**Course:-Structural Analysis - II**		
Prerequisites	**BT104, BT204, BTC253, BTC203 BTC252, BTC228**		
Period per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	Practical	---	25
	Laboratory Work (Journal)	---	25
	TOTAL	**---**	**150**

*60% Weightage for end semester

Course Objectives:

The main objectives of the course are

- To introduce the students to the methods of analysis of indeterminate structures.
- To introduce the students to the plastic analysis of steel structures.
- To prepare the base for the students to study other advanced structural engineering subjects at a later stage.

Course Outcomes:

At the end of the course the students shall be able to

- Find absolute and relative deflections caused by loads, temperature changes and settlement of supports and to identify and determine the type and degree of indeterminacy in structures.
- Analyse indeterminate structures using force methods.
- Analyse indeterminate structures using displacement methods.
- Find shape factor, determine collapse load for beams.

Course Content

Module No	**Details**	**Hrs**
1	General Types of structures occurring in practice and their classification. Stable and unstable structure, statically and kinematical determinacy and indeterminacy of structure. Symmetric structure, symmetrical and anti-symmetrical loads, distinction between linear and non-linear behavior of material and geometric non-linearity.	06
2	Deflection of statically determinate structures: Review of general theorems based on virtual work and energy methods, introduction to the concept of complimentary energy, absolute and relative deflections caused by loads, temperature changes and settlement of supports, application to beams, pin jointed frames and rigid jointed frames.	06
3	Analysis of indeterminate structures by flexibility method: Flexibility coefficients and their use in formulation of compatibility equations. Theorem of three moments, Application of above methods to propped cantilevers, fixed beams, continuous beams. Simple pin jointed frames including effect of lack of fit for members. Simple rigid jointed frames with static indeterminacy up to 3Application of flexibility method to two hinged parabolic arches.	09

4	Analysis of indeterminate structures byCastiglione's theorem of least work application of the theorem to propped cantilevers, fixed beams, continuous beams. Simple rigid jointed frames with static indeterminacy up to 3.	05
5	Analysis of indeterminate structures by stiffness method: Stiffness coefficients for prismatic members and their use for formulation of equilibrium equations, direct stiffness method, Application of the above methods to indeterminate beams including the effect of settlement of supports and simple rigid jointed frames with kinematic indeterminacy up to 3, rigid jointed frames with inclined member but having only one translational degree of freedom in addition to rotational degree of freedom.	08
6	Slope deflection method, Moment distribution method. , Application of these methods to indeterminate beams including the effect of settlement of supports and simple rigid jointed frames with inclined member but having only one translational degree of freedom in addition to rotational degree of freedom.	06
7	Introduction to plastic analysis of steel structures: Behavior of ductile material. Idealized stress strain diagram for plastic analysis. Concept of plastic theory of bending, plastic hinge and plastic moment carrying capacity, shape factor, determination of collapse load for single and multiple span beams.	08

Term work:-
At least 20 (twenty) solved problems based on the above syllabus as per the module weightage shall be submitted as term work.

Text Books:-

1. Reddy C.S.(1999), "Basic Structural Analysis", Tata McGraw hill, ISBN 0070702764, 779 pages
2. Junnarkar S.B. (2013), "Structural Analysis, Vol. II" Charotar Publishers ISBN 9380358703, 986 pages
3. Pandit and Gupta (1999), "Structural Analysis Vol. I and Vol. II", Tata McGraw hill, ISBN 0074634933
4. L. S. Negi, and R. S. Jangid (1997), "Theory and Problems in Structural Analysis ", Tata McGraw - Hill Education, ISBN 0074623044, 828 pages
5. ISBN 0138534080, 352
6. Baker & Heyman (1980), "Plastic Design of Steel frames", Cambridge University Press, ISBN 0521297788, 238 pages

Reference Books:-

1. G. Pandit and S. Gupta (2008), "Matrix Method in Structural Analysis", Tata McGraw hill, ISBN 0070667358, 612 pages
2. Dr. B.N. Thadani And Dr. J. P.Desai (1964), "Modern Methods in Structural Analysis", Asia Publishing House,
3. C. K. Wang (2010), "Intermediate Structural Analysis", Tata McGraw hill. ISBN 0070702497
4. James M. Gere, William Weaver (2014), "Analysis of Framed Structure", José Francisco Anunciação, ISBN 0442234856, 547 pages
5. D.S. Prakash Rao (1996)," Structural Analysis: A Unified Approach", Orient Blackswan ISBN 8173710279, 672 pages
6. Dr. A. S. Meghre, and S. K. Deshmukh (2003), "Matrix Methods of Structural Analysis", Charotar Publishing House, ISBN 8185594088, 552 pages

7. Alexander Chajes (1982), "Structural Analysis", Longman Higher Education,

Sr. No.	Examination	Module
1	T – I	1 , 2 and part of 3
2	T – II	Remaining part of 3, 4 and part of module 5
3	Final exam	1 to 7

Class:-T. Y. B. Tech. (Civil)	**Semester V**		
CODE: CE302	**Course:- Geotechnical Engineering – I**		
Prerequisites	**BTC203, BTC252, BTC205, BTC254, BTC229, BTC277**		
Period per week (each of 60 minutes)	Lecture	04	
	Practical	02	
	Tutorial	-	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 x 02
	End Semester*	03	100
	Practical	---	25
	Laboratory Work (Journal)	---	25
	TOTAL	**---**	**150**

*60% Weightage for end semester

Course Objectives:

All construction that takes place, ultimately transfers the load to the ground, geotechnical engineering plays a crucial role in all civil engineering projects. The failure to carry out adequate geotechnical study often has had dramatic and expensive consequences on construction projects.

1. Introduce the subject of soil mechanics, rock mechanics and basic definitions of terms related to Geotechnical Engineering and the relationship between them
2. Classify soils, estimate soil permeability, perform seepage analysis, draw flow nets, differentiate between compaction and consolidation of soils and discuss causes of instability of soil slopes.
3. Calculate effective stresses and principal stresses
4. Introduce methods of soil investigation.

Course Outcomes:

The course will enable the students to

1. Explain the basic principles of soil mechanics,
2. Identify and quantify various engineering properties of soil either in the field, in the laboratory or both.
3. Analyze soil behavior under the application of loads.
4. Design a soil investigation programme needed before commencement of construction

Course Content

Module No	**Details**	**Hrs**
1.	**Introduction** Definitions: soils, soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering, comparison between soil & rock. Basic definitions and relationships between them. Soil as a three phase system. Determination of various soil properties such as moisture content by oven dry method, sand bath method, etc. specific gravity by density bottle method, pycnometer method, unit weight by core cutter method and sand replacement method.	08

2.	**Plasticity Characteristics And Classification 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, shrinkage limit Use of consistency limits. Introduction of soil classification: particle size classification, textural classification, unified soil classification, Indian standard soil classification system. Field identification of soils, general characteristics of soils in different groups	08
3.	**Permeability Of Soils And Seepage Analysis** Introduction to hydraulic head, Darcy's law, validity of Darcy's law. Determination of coefficient of permeability, Laboratory methods: constant head method, falling head method, Field methods: pumping-in test, pumping-out test.Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets, use of flow nets.	08
4.	**Effective Stress Principle And Compaction Of Soils** Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuation of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition. Compaction of soils - Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in the field, compaction specification and field control.	06
5.	**Consolidation of soils** Introduction, comparison between compaction & consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, consolidation test results, basic definitions, Terzaghi's theory of consolidation, final settlement of soil deposits, consolidation settlement: one-dimensional method, secondary consolidation	06
6.	**Shear strength** Principal planes parallel to the coordinate axes, Mohr's circle, important characteristics of Mohr's circle, Mohr-Coulomb theory, types of shear tests, direct shear test, merits of direct shear test , tri-axial compression tests, test behaviour of UU, CU and CD tests, relation between major and minor principal stresses, unconfined compression test, vane shear test.	06
7.	**Stability of slopes and Soil exploration** Introduction to slope stability, different factors of safety, types of slope failures, analysis of finite and infinite slopes, wedge failure, Swedish circle method, friction circle method, stability numbers and charts, applicability of different methods, software for slope stability. Soil exploration - Introduction, methods of investigation, soil samplers and sampling, number and disposition of trial pits and borings, penetrometer tests, borehole logs, geophysical methods.	06

Practical Examination:-
Practical examination will be based on the experiments conducted.

List of Practicals:- (at least ten to be performed)

1 Field density using core cutter method
2 Field density using sand replacement method
3 Natural moisture content using oven drying method
4 Field identification of fine-grained soils
5 Specific gravity of soil grains
6 Grain size distribution by sieve analysis
7 Grain size distribution by hydrometer analysis
8 Consistency limits - liquid limit
9 Consistency limits - plastic limit
10 Consistency limits - shrinkage limit
11 Permeability tests using constant test method
12 Permeability tests using falling head method
13 Compaction test: standard proctor test.
14 Compaction test: modified proctor test
15 Relative density

Term work:

Report on experiments performed as detailed above and assignments including problems based on the above syllabus shall be submitted as term work.

Recommended Books:

1. Alam Singh (2012); "Soil Engineering in Theory and Practice (Vol. -1)", CBS Publishers & Distributors, New Delhi. ISBN-13: 979-8123902769. 325p.
2. V. N. S. Murthy (2002) "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press. ISBN-13: 9780824708733. 1056p.
3. Taylor. D. W (2013); "Fundamentals of Soil Engineering", Literary Licensing, LLC. ISBN-13: 978-1258766924. 714p.
4. Robert D. Holtz (2011) "An Introduction to Geotechnical Engineering" Pearson. ISBN-13: 978-0132496346. 853p.
5. Craig, R. F. (2004); "Soil Mechanics", CRC Press. ISBN-13: 978-0415327022. 464p.
6. Lambe T. W. & Whitman R. V (2008); "Soil Mechanic", John Wiley & Sons. ISBN-13: 9788126517794. 572p.
7. K. Terzaghi (1996); "Soil Mechanics in Engineering Practice", John Wiley & Sons. ISBN-13: 9780471086581. 549p.
8. Relevant Indian Standard Specifications & Codes, BSI Publications, New Delhi.

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3, 4
3	Final Examination	1 to 7

Class:-T. Y. B. Tech. (Civil)	**Semester V**		
CODE: CE303	**Course:- Building Design and Drawing**		
Prerequisites	**BTC203, BTC252, BTC205, BTC254, BTC229, BTC277**		
Period per week (each of 60 minutes)	Lecture	3	
	Practical	4	
	Tutorial	-	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20X02
	End Semester*	04	100
	Practical	-	25
	Laboratory Work (Journal)	-	50
	TOTAL		**175**

* 60% Weightage for end semester

Course Objectives:

Students will learn to:

1. Interpret various types of building drawings.
2. Comprehend building rules, regulation and bylaws, Building codes.
3. Acquire the knowledge of the principles of planning of residential and public (non-residential) buildings, sun path diagram & its importance.
4. Prepare and analyze plans of various types of residential building considering the functional requirements.
5. Prepare submission drawings, working drawings, detailed drawings for the planned buildings.

Course Outcomes:

The students will be able to

1. Understand & interpret the drawings.
2. Transform their ideas to create plans and designs for various types of building.
3. Convert design parameters, process details into 2D and 3D views.
4. Supervise various construction processes and execute civil engineering structures such as buildings, roads, railways, dams, bridges.

Course Content

Module No.	**Details**	**Hrs.**
1	**Planning approach** Basic areas in residential buildings-Process of planning-family requirement & analysis-conceptual plan outlines-princiles and techniques for functional planning-planning for service & landscaping-concept of art & creativity-role of architect & engineer-structural system & functional classification of buildings-residential building forms.	8
2	**Building Regulations** Building byelaws-provisions in developed developing urban areas-Introduction of Building code (NBC 2005)-plan approval process-understanding certification methods (TERI, LEEDS) for green buildings.	4
3	**Planning for Residential Buildings** Plan preparation for residential units-structure, space forms and analysis-activity space-elements of human scale-size & dimensions decisions-furniture layouts.	8

4	**Planning of Public (non-residential) Buildings** Approach for activity analysis for public buildings, hostels,school,offices,primary health care centers-Space norms,basic areas,functional setting areas	8
5	**Archiectural Composition** Mass composition-princiles of elevation development-techniques-impacts of colour & structure	2
6	**Town Planning** Concept of built environment –ancient planning in india-objectives & principles-origin & growth of town-satellite town-ribbon development-surves-master plan-road system-zoning-green belt-slums-replanning existing towns	5
7	**Building Drawing** Key plan-site plan& working drawings-elements of perspective drawings-foundation & plumbing layouts.	5

Practical Examination (Sketching & Lab work):-
Practical examination will be based on the entire syllabus. The examination shall consist of drawing sketches and oral based on the syllabus.

Term Work:
Term work shall comprise of

- A_3 Ssize practice sheet which includes, lines, their thicknesses and application in building drawing and line plan for any type of building.
- For each type of structure (Load Bearing structure & R.C.C. structure) two A_1 size drawing sheets must be prepared.
    1. One drawing sheet will have include ground floor plan,elevation section,site plan, construction notes,door-windows schedule,area statement.
    2. Second drawing sheet will have include foundation plan showing diagonal check sections of foundation, roof/terrace plan , roof section of terrace showing water proof details, section of door-window, sectional view of staircase, column schedule.
    3. Drawing sheets for residential building must be hand drawn.
    4. Drawing for public building must be completed by AutoCad software.
    5. For each type of public building, one report must be submitted.
- A_1 size drawing sheet for perspective view of above mention structures.

Recommended Books:

1. M.G. Shah, C.M. Kale, S.Y. Patil (2011); "Building Drawing with an Integrated Approach to Built Environment" McGraw Hill Education (India) Private Limited; ISBN-13: 978-0071077873. 408p.
2. V.B. Sikka (2013); "A Course in Civil Engineering Drawing" S.K. Kataria & Sons; ISBN-13: 978-9350142721. 550 p.
3. Dr.N.Kumara Swamy & A.Kameshwara Rao (2012); "Building Planning & Drawing" Charotar Publishing House. ISBN-13: 978-9380358581. 434 p
4. Rangwala (2013); "Town Planning" Charotar Publishing House Pvt. Ltd. ISBN-13: 978-9380358680. 344 p

Sr. No.	Examination	Module
1	T – I	1 , 2
2	T – II	3, 4
3	Final Examination	1 to 7

Class:-T. Y. B. Tech. (Civil)	**Semester V**		
CODE: CE304	**Course:- Hydraulic Engineering – I**		
Prerequisites	**BTC229, BTC277**		
Period per week (each of 60 minutes)	Lecture	04	
	Practical	02	
	Tutorial	--	
Scheme of Evaluation		**Hours**	**Marks**
	In Semester	01	20 x 02
	End Semester*	03	100
	Practical	---	---
	Termwork	---	25
	TOTAL	**---**	**125**

*60% Weightage for end semester

Course Objectives:

1. To describe the types of flow and pipe flow system.
2. To discuss the concept of fluid dynamics and its applications.
3. To exemplify the fundamentals of impulse momentum principle
4. To explain the working of various hydraulic machines such as hydraulic turbines, centrifugal pumps, hydraulic rams, hydraulic press, accumulator, intensifier, crane and lift.

Course Outcomes:

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

1. Use the fundamentals of pipe flow, losses in pipe and analysis of pipe network in various conditions.
2. Differentiate between types of flow.
3. Implement the dynamics and impulse momentum principle to hydraulic machines.
4. Design the components of hydraulic turbines and centrifugal pump.

Course Content

Module No	**Details**	**Hrs**
1.	**Flow through Pipes:** Darcy-Weisbach's equation, major and minor losses, Hydraulic gradient and total energy line, Pipes in series and parallel, Power transmission through pipes and nozzles. Siphon pipe. Water hammer in pipes and its control measures, Analysis of pipe network: Hardy cross method, three reservoir problem.	08
2	**Dynamics of Fluid flow:** Momentum and moment of momentum principle, its application, forces on pipe bends, sprinklers	06
3	**Impact of Jets and jet propulsions:** Jet striking flat plates, stationary and moving normal, inclined plates, curved vanes, series of plates and vanes mounted on wheel. Jet propulsion of ships.	08
4	**Hydraulic Turbines:** General layout of Hydroelectric power plant, Heads and efficiencies of turbines, Classification, working of Impulse turbine, Pelton wheel, Reaction turbine, Francis turbine, Kaplan turbine, draft tube theory, specific speed, unit quantities, cavitation, characteristic curves.	08

5	**Centrifugal Pumps:** Work done, Head and efficiency, priming, minimum starting speed, pumps in series and parallel, multistage pumps, specific speed, model testing, characteristic curves, cavitation.	08
6	**Hydraulic Machinery:** Hydraulic Ram, press, accumulator, intensifier, crane and lift.	04
7	**Laminar Flow:** Reynold's experiment, Critical velocity, Steady laminar flow through circular pipes, annulus, Parallel plates, stationery and moving, kinetic energy correction factor, momentum correction factor.	06

List of experiments: (preferably Eight to be performed)

1. Losses in pipes
2. Laminar flow through pipe
3. Reynold's experiment
4. Impact of jet, Flat plate, inclined plate, curved vanes
5. Performance of Pelton turbine
6. Performance of Francis Turbine
7. Performance of Kaplan Turbine
8. Performance of Centrifugal pumps
9. Pumps in series and parallel
10. Performance of Hydraulic Ram.

Term work:

Report on experiments performed as detailed above and assignments including problems based on the above syllabus shall be submitted as term work.
The distribution of term work marks will be as follows:

Reports of experiments performed and assignments : 15 marks
Attendance Quiz : 10 marks

Recommended Books:

1. Dr. P.N. Nodi (2009); "Hydraulics and Fluid Mechanics" Standard Book House ISBN-13: 978-8189401269. 250p
2. Dr. Jain A.K (2010); "Fluid Mechanics" Khanna Publishers. ISBN-13: 978-8174091949
3. K Subramanya (2008); "Flow in Open Channels" 978-0070086951. 576p
4. Subramanaya K (2010); "Fluid mechanics & hydraulic Machines". McGraw Hill Education (India) Private Limited. ISBN-13: 978-0070699809
5. Nagarathnam S. (1984); "Fluid Mechanics:" Khanna Publishers.637p.

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:-T. Y. B. Tech. (Civil)	**Semester V**		
CODE: CE305	**Course:-Transportation Engineering - I**		
Prerequisites	**BTC204, BTC253, BTC230, BTC278**		
Period per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	Practical	---	---
	Laboratory Work (Journal)	---	25
	TOTAL	**---**	**125**

*60% Weightage for end semester

Course Objectives:

1. To illustrate modes of transportation, advantage and disadvantage.
2. To discuss and Compute orientation of Runway & taxiway, its geometric design elements, drainage, Gate and Gate positions, marking and lighting on taxiway, aircraft parking system, Terminal area & airport layout.
3. To summarize cross section of permanent way and track components, and Compute number of sleepers, fish plate, fish bolt, geometric elements of railway, Points and crossing.
4. To explain railway stations and yards, layout of track, position of signals, train movement. Methods of construction, material selection, maintenance of tracks.

Course Outcomes:

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

1. To Analyze and Design orientation of Runway & taxiway, its geometric design, drainage, Gate and Gate positions and able to prepare project report for new airport construction.
2. To acquire the knowledge of cross section of permanent way, function of each component and Geometric Design of Railway track including turnout signals.
3. To execute construction and maintenance of stations, yards and railway tracks.

Course Content

Module No	**Detatails**	**Hrs**
01	Introduction: Role of transportation in Society, objectives of transportation system, different types of modes, planning & coordination of different modes for Indian conditions.	04
02	Airport Engineering	12

	i Aircraft component parts and its function, aircraft characteristics and their influence on airport planning. ii Airport planning: topographical and geographical features, existing airport in vicinity, air traffic characteristics, development of new airports, factors affecting airport site selection. iii Airport obstruction: zoning laws, classification of obstructions, imaginary surfaces, approach zones, turning zones. iv Airport layout: runway orientation, wind rose diagrams, basic runway length, corrections for runway length, airport classification, geometric design, airport capacity, runway configuration, taxiway design, geometric standards, exit taxiways, holding aprons, location of terminal buildings, aircraft hangers and parking. v Airport marking and lighting marking and lighting of runways, taxiway, approach and other areas. Terminal area & airport layout: terminal area, planning of terminal buildings, apron: size of gate position, number of gate position, aircraft parking system, hanger, general planning considerations and blast considerations.	
03	i Air traffic control: Air traffic control aids, en-route aids, landing aids. ii Airport drainage: requirement of airport drainage, design data, surface drainage design. iiiAirport airside capacity and delay: runway capacity and delays, practical hourly capacity, practical annual capacity, computation of runway system, runway gate capacity, taxiway capacity.Air traffic forecasting in aviation: forecasting methods, forecasting requirement and applications.	04
04	Railway Engineering i Merits of rail transportation, railway gauges and problems due to non uniformity of gauges. ii Cross section of permanent way and track components, sleeper – functions and types, sleeper density, ballast functions and different ballast materials. iii Rails: coning of wheels and tilting of rails, rail cross sections, wear and creep of rails, rail fastenings. Merits of rail transportation, railway gauges and problems due to non uniformity of gauges.	09
05	i Geometrics: gradients, transition curves, widening of gauge on curves, cant and cant deficiency. ii Points and crossing: design of turnouts, description of track junctions, different types of track junctions. iii Yards: details of different types of railway yards and their functions.	09
06	i Signalling and interlocking: classification of signals, interlocking of signals and points, control of train movement. ii Construction and maintenance of railway track, methods of construction, material requirements, maintenance of tracks and traffic operations. iii Modernization of track and railway station for high speed trains special measures for high speed track.	06
7	Introduction of water transportation system, harbors and docks, port facilities.	04

Term work:

Report on minimum 10 assignments including problems based on the above syllabus shall be submitted as term work.

The distribution of term work marks will be as follows:

Reports of experiments performed and assignments : 15 marks

Attendance/ Quiz : 10 marks

Recommended Books:

1. Saxena S C and Arora S P (2010); "A text book of Railway Engineering", Dhanpat Rai and Sons, New Delhi. ISBN-13: 978-8189928834.
2. Khanna & Arora (1999); "Airport Planning and Design" Nemchand Bros, Roorkee. ISBN-13: 978-8185240688. 390p
3. Agarwal M. M (1984); "Indian Railway Track: Design, Construction, Maintenance and Modernisation", Suchdeva press New Delhi.
4. Bindra S P (2012); "Docks and Harbour Engineering", Dhanpat Rai and Sons. ISBN-13: 978-8189928858.
5. R Shrinivas (2013); "Harbour, Dock and Tunnel Engineering" Charotar Publishing House. ISBN-13: 978-9380358741. 422p.
6. Sehgal S E, Bhanot K L (1980); "A Text Book on Highway Engineering and Airports", S. Chand & Co.544p
7. Horonjeff and Mckelrey (1994); "Planning and Design of Airport", McGraw-Hill Professional. ISBN-13: 978-0070453456. 848p.
8. Quinn A D (1991); "Design & Construction of Ports and Marine Structures", McGraw-Hill Inc., US. ISBN-13: 978-0070510647. 608p.
9. Rao G V (1992); "Airport Engineering", Tata McGraw-Hill Publishing Company ISBN-13: 9780074603178. 165p.

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:-T. Y. B. Tech. (Civil)	**Semester V**		
CODE: CE306	**Course:- Entrepreneurship and Management**		
Prerequisites	**BTC204, BTC253, BTC230, BTC278**		
Period per week (each of 60 minutes)	Lecture	03	
	Practical	-	
	Tutorial	02	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	Practical	---	---
	Laboratory Work (Journal)	---	25
	TOTAL	**---**	**125**

*60% Weightage for end semester

ENTREPRENEURSHIP AND MANAGEMENT

An engineer applies mathematics, science, and systems-integrative approaches to conceive, design, build, and operate useful objects or processes; whereas an entrepreneur assumes the tasks of organisation and management as well as the risks of new-project creation or new-venture startup. In today's advanced world, there's a need of engineers as entrepreneurs.

Course Objectives:

1. To understand contemporary leadership, entrepreneurship and management concepts, principles and theories, individual, group and organizational leadership principles.
2. To understand the role of human behavior and motivation in performance
3. To study the nature of entrepreneurial work - risks, rewards, challenges.
4. To experience situations and assignments where leadership, entrepreneurial and managerial thinking is needed for success.
5. To instill a creative, risk-taking attitude on challenges.
6. To gain working understanding of fundamental business framework
7. To complete a new product "launch" project, including definition and design, strategic planning, business plan, funding analysis.

Course Outcomes:

The course will enable the students:

1. To understand their personality type and leadership style.
2. To assess human behavior and motivation in performance.
3. To carry out a team project that will make them understand the product concept developmentincluding definition and design, strategic planning, business plan, funding analysis, selection, and "launch".

Course Content

Module No	**Details**	**Hrs**
1.	Definitions of entrepreneurship, concept and characteristics of entrepreneur and entrepreneurship, an ideal entrepreneur, qualities of an entrepreneur, aspects of entrepreneurship, environment for entrepreneurship	04

2.	The entrepreneurial culture : elements of culture, business culture and culture of society, entrepreneurial culture, cultural change, socio-economic origins of entrepreneurship, barriers to entrepreneurship, factors affecting entrepreneurship	05
3.	Classification depending on type of business, technology, motivation, growth, stages of development. Entrepreneurial traits and motivation: initiative, entrepreneurial skills, entrepreneurship: sources of supply & motivation, Growth of entrepreneurs, entrepreneurial functions	07
4.	Project development Project: stages of project, project development cycle, life cycle of project, ISO certification & its importance, search for an idea, preliminary screening, project identification, project Formulation, SWOT analysis, project report. Project appraisal: market, technical, financial, economical, social, ecological, organizational. Tools of analysis: time value of money, compounding & discounting, break-even analysis, payback period, net present value, social cost-benefit analysis Sources & types of finance	06
5.	Present scenario of Indian industry and entrepreneurs, government policies promoting entrepreneurship, institutions in aid of entrepreneurs, finance for entrepreneurs, sources and types of finance, small scale industries related to civil engineering, steps for starting a small scale industry, safety rules & regulations for construction industries, selection of type of own organization, ownership types: sole proprietorship, partnership, private company, public limited company	05
6.	Project accounting: generally accepted accounting principles, book keeping, double entry system and ledger, preparation of income statement and balance sheet	04
7.	Management: concept of management, objectives, basic functions of management, emergence of management thought, brief description of contributions by Fredrick Taylor, Henry Fayol, Elton Mayo and Gilbreth, Principles of organization, forms of organization: line, line & staff, functional and matrix	05

Term work:

Report on minimum 10 assignments including problems based on the above syllabus shall be submitted as term work.
The distribution of term work marks will be as follows:
Reports of experiments performed and assignments : 15 marks
Attendance/ Quiz : 10 marks

Recommended Books:

1. Prasanna Chandra (1986); "Projects: Preparation, Appraisal, Budgeting & Implementation", Tata Mc Graw Hill. 543p.
2. Vasant Desai (2011); "Dynamics of Entrepreneurial Development & Management", Himalaya Publishing House. ISBN-13: 978-9350244548.
3. Koontz, O'Donell & Weirich (1980); "Management", McGraw Hill. ISBN-13: 9780070353770. 895p.
4. R. Hisrich & M. P. Peters (2013); "Entrepreneurship", Tata Mc Graw Hill. ISBN-

13: 9780071326315. 587p.
5. Entrepreneurship Development, Colombo plan Staff College for Technical Education, Tata Mc Graw Hill
6. Prasanna Chandra (2010); "Finance Sense", Tata McGraw-Hill Education. ISBN-13: 9780070680203. 516p.

Sr. No.	Examination	Module
1	T – I	1,2
2	T – II	3,4
3	Final Examination	1 to 7

Third Year B.Tech. in Civil Engineering

Sem. VI

Academic Scheme and Syllabus

Year 2015-16

Class:-T. Y. B. Tech. (Civil)	**Semester VI**		
CODE: CE351	**Course:- Geotechnical Engineering - II**		
Prerequisites	**CE302**		
Period per week (each of 60 minutes)	Lecture	04	
	Practical	02	
	Tutorial	-	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	Practical	---	25
	Laboratory Work (Journal)	---	25
	TOTAL	**---**	**150**

*60% Weightage for end semester

The students are exposed to apply the theory learnt in Geotechnical Engineering-I to the practical applications. They are introduced to the topics of design of retaining walls, bearing capacity of shallow foundations, pile foundations, etc. They are required to perform the practicals to determine the relevant parameters required to be used in the above applications.

Course Objectives:

1. Description of various earth pressure theories, design and analysis of stability of various types of earth retaining structures
2. Estimation of bearing capacity of shallow foundations by various theories.
3. Assessment of the need for pile foundations and determination of their load carrying capacity.
4. Explaination of basic design principles of flexible retaining system, open cuts and reinforced soil.

Course Outcomes:

1. Based on the understanding of soil properties and characteristics studied in GE-I, the students will be able to predict soil behavior under the application of loads and come up with appropriate solutions to foundation design queries.
2. The students will also be able to analyze the stability of natural slopes and if found unsafe, recommend the use of and design the suitable retaining structures or reinforced earth walls.

Course Content

Module No	**Details**	**Hrs**
1.	**Lateral earth pressure theories** Introduction: applications of earth pressure theories, different types of earth pressures - at rest, active and passive pressures. Rankine's earth pressure theory, active earth pressure and passive earth pressure for horizontal and inclined backfill including the direction of failure planes for cohesionless and cohesive soils.Coulomb's wedge theory: Coulomb's active pressure in cohesionless soils, expression for active pressure, Coulomb's passive earth pressure.Rebhann's construction for active pressure, Culmann's graphical solutions for active pressure.	10
2.	**Earth retaining structures**	06

	Rigid and flexible retaining structures, stability analysis of retaining walls, cantilever retaining walls, deflection, bending moment and earth pressure diagrams for cantilever sheet piles, computation of embedment depth, construction details, drainage and wall joints.	
3.	**Bearing capacity of shallow foundations** Definitions of ultimate bearing capacity, gross, net and safe pressures, allowable bearing pressure, types of shallow foundations, modes of failures. Bearing capacity theories - concept behind derivation of equation, general bearing capacity equation, bearing capacity equations for square and circular footings, factors influencing bearing capacity, performance of footings in different soils, Vesic's chart, ultimate bearing capacity in case of local shear failure. IS code recommendations. Plate load test in detail with reference to IS 1888 and its applications and estimation of settlements.	10
4.	**Axially loaded pile foundations** Introduction to pile foundations, necessity of pile foundation, classification of piles, construction methods of bored piles, concrete bored piles, driven cast in-situ piles. Pile capacity based on static analysis, piles in sand, piles in clay, dynamic methods and their limitations, in-situ penetration tests and pile load test as per IS 2911 specifications, negative skin friction. Pile groups, ultimate capacity of groups, settlement of pile groups in sand and in clays as per IS 2911 and critical depth method.	10
5.	**Underground conduits** Classes of underground conduits, load on a ditch conduit, settlement ratio, ditch condition and projection condition, imperfect ditch conduit.	04
6.	**Flexible Retaining Structures** Introduction to sheet pile walls, earth pressure diagrams for cantilever sheet pile walls in granular and cohesive soils	04
7.	**Reinforced earth** The mechanism, reinforcement (elements), reinforcement-soil interaction, applications, reinforced soil embankments/walls.	04

Practical Examination:-
Practical examination will be based on the experiments conducted.

List of practicals:(At least five to be performed)
1. Consolidation test
2. Triaxial test (UU)
3. Direct shear test
4. Unconfined compression strength test
5. California bearing ratio test
6. Vane shear Test
7. Determination of free swell index

Term work:-
Report on experiments performed as detailed above shall be submitted as term work

Recommended Books:-

1. Alam Singh (2012); "Soil Engineering in Theory and Practice (Vol. -1)", CBS Publishers & Distributors, New Delhi. ISBN-13: 979-8123902769. 325p.
2. V. N. S. Murthy (2002) "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press. ISBN-13: 9780824708733. 1056p.
3. K. Terzaghi (1996); "Soil Mechanics in Engineering Practice", John Wiley & Sons. ISBN-13: 9780471086581. 549p.
4. R. B. Peck (1953); "Foundation Engineering", John Wiley & Sons. 410p.
5. A. Kaniraj, Shenbaga R. Kaniraj (1988) "Design aids in Soil Mechanics and Foundation Engineering" Tata McGraw Hill, New Delhi. ISBN-13: 9780074517147. 698p.
6. N. V. Nayak (1982) "Foundation Design Manual", Dhanpat Rai Publications, New Delhi
7. Relevant Indian Standard Specifications & Codes, BIS Publications, New Delhi.

Sr. No.	Examination	Module
1	T – I	1, 2
2	T – II	3, 5
3	Final Examination	1 to 7

Class:-T. Y. B. Tech. (Civil)	**Semester VI**		
CODE: CE352	**Course:-Design & Drawing of Steel Structures**		
Prerequisites	**BTC203, BTC252, BTC228, CE301**		
Period per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	04	100
	Practical	---	25
	Laboratory Work (Journal)	---	25
	TOTAL	**---**	**150**

*60% Weightage for end semester

Course Objectives:

- To introduce behavior and design of simple steel structures according to limit state design concept.
- To have the basic knowledge about the design and failure mode of steel structural members.

Course Outcome:

The course will enable the students to:

1) Design simple structural elements using IS-800-2007:
   a) Tension members
   b) Compression members
   c) Flexural members
   d) Slab base & Gusseted Base
   e) Bolted and Welded connections
2) Design simple structural systems using IS-800-2007 & IS-875-1987
   a)truss (subjected to wind load)
   b)G+3 steel building

Course Content

Module No	**Details**	**Hrs**
1	Introduction to types of steel, mechanical properties of steel, advantages of steel as structural material, design philosophies of Working Stress Method (WSM) and Limit State Method (LSM) Limit state method, limit state of strength and serviceability (deflection, vibration, durability, fatigue, fire), characteristics and design loads, Classification of cross section- plastic, compact, semi-compact and slender, limiting width to thickness ratio.Introduction to bolted and welded connections by LSM,	09
2	Design of tension members with welded / bolted end connections using single and double angle sections by LSM, design strength due to- yielding of gross section, rupture of critical section and block shear.	05
3	Design of compression members with welded / bolted end connections using single and double angle by LSM, design strength, effective length of compression members. Design of columns with single and built-up sections, design of lacing and batten	10

	plates with bolted and welded connections using LSM, column buckling curves, effective length, slenderness ratio, limiting values of effective slenderness ratio, buckling class of various cross sections.	
4	Design of slab base and gusseted base using bolted and welded connection by LSM, Effective area of a base plate.	06
5	Design of members subjected to bending by LSM, design strength in bending, effective length, laterally supported and unsupported beams.Design of single and built-up rolled steel sections using bolted and welded connections, shear lag effect. Design for shear, web buckling and web crippling, concept of web stiffners and different types of web stiffners. Introduction to plate girders.	08
6	Beam to beam and beam to column connections, design of framed, un-stiffened and stiffened seat connections.	04
7	Truss: Determinate truss, imposed load on sloping roof, wind load on sloping roof and vertical cladding including effect of permeability and wind drag, analysis of pin jointed trusses under various loading cases, computation of forces in members, design and detailing of connections and supports, wind bracing for roof system, supported on columns.	06

Term work:

The Term work shall consist of a Design report and detailed drawings on two projects as indicated below:

i. Roofing system including details of supports.
ii. Flooring system including Columns.

The drawing should be drawn in pencil only on minimum of A- 1 (imperial) size drawing sheets. Solution of at least 20 problems with neat sketches wherever necessary shall be submitted as term work.

Text Books:-

1. Dr Ramachandra (2010), “Design Of Steel Structures Vol. II”, Scientific Publishers-Jodhpur, ISBN 8172336446
2. N. Subramanian (2008), “Design Of Steel Structures”, Oxford, ISBN 0195676815, 864 pages
3. Pasala Dayaratnam (2014), “Design Of Steel Structures”, S. Chand Publishing, ISBN 8121923204, 868 pages
4. S. S. Bhavikatti (2009), “ Design of Steel Structures by Limit state mrthod as per IS 800:2007”, I K International Pvt. Ltd, 414 pages
5. Duggal S K (2010), “Limit State Design of Steel Structures”, Tata McGrwaHill
6. Shiyekar M R (2010), “Limit State Design of Steel Structures”, PHI Learning
7. SaiRam K S (2010), “ Design of Steel Structures”, PHI Learning

Reference Books:-

1. Anand S. Arya, J.L. Ajmani (1977), “Design of Steel Structures”, Nem Chand & Bros., India, ISBN 0861861671, 888 pages
2. B. C. Punmia, Ashok Kumar Jain (2006), “Comprehensive Design of Steel Structures”, Laxmi Publications, ISBN 8170080932, 1156 pages
3. Edwin H. Gaylord, Charles N. Gaylord, James E. Stallmeyer (1991), “Design Of Steel Structures”, Tata McGraw-Hill, ISBN 0070230544, 792 pages

4. T. J. Mac Ginley (1998), "Design Of Steel Structures", Spon Press ISBN 0419179305, 496 pages
5. William T. Segui (1996), "LRFD Steel Design", PWS Pub Co., ISBN 0534954782, 563 pages
6. James K. Nelson Jr., Jack C. McCormac (2002), "Structural Steel Design: LRFD Method", Prentice Hall, ISBN 0130479594, 713 pages
7. Charles G. Salmon, John E. Johnson, Faris A. Malhas (2008), "Steel Structures: Design and Behavior", Prentice Hall, ISBN 0131885561, 888 pages
8. Satinder Singh, Ic Syal (2007), "Design Of Steel Structures", Standard Publishers Distributors, ISBN 8186308646, 780 pages

Sr. No.	Examination	Module
1	T – I	1 , 2
2	T – II	3. 4
3	Final exam	1 to 7

Class:-T. Y. B. Tech. (Civil)	**Semester VI**		
CODE: CE353	**Course:-Hydraulic Engineering- II**		
Prerequisites	**BTC229, BTC277, CE304**		
Period per week (each of 60 minutes)	Lecture	04	
	Practical	02	
	Tutorial	-	
Scheme of Evaluation		**Hours**	**Marks**
	In Semester	01	20 x 02
	End Semester*	03	100
	Practical (MCQ)	---	25
	Term Work	---	25
	TOTAL	**---**	**150**

*60% Weightage for end semester

Course Objectives:

1. To describe the laminar flow, turbulent flow in pipe and boundary layer theory.
2. To discuss the development of drag and lift forces acting on submerged bodies, airfoils, circular and cylindrical body.
3. To summarize the uniform and non uniform flow applied to open channel flow.
4. To explain dimensional analysis techniques.

Course Outcomes:

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

1. Carry out estimation of boundary layer thickness, drag forces acting on flat and curved surfaces along with the principle behind boundary layer separation.
2. Design hydraulically efficient open channels.
3. Appraise GVF and RVF in the formation of hydraulic jump in open channels.
4. Solve the forces exerted by flowing fluid on stationery bodies, lift forces on airfoils as well as circular cylinder.
5. Test the dimensional homogeneity in hydraulic engineering.

Course Content

Module No	**Details**	**Hrs**
1	**Turbulent Flow through pipes:** Causes of turbulence, instability, mechanism of turbulence, Reynold's stresses, semi-empirical theories of turbulence, Prandtl's mixing length theory, Universal velocity distribution equation, Resistance equation, and Moody's diagram.	08
2	**Boundary Layer Theory:** Development of boundary layer over flat plate and curved surfaces, laminar and turbulent boundary layer, boundary layer thickness, displacement thickness, momentum thickness, energy thickness, drag forces on flat plate due to boundary layer, boundary layer separation and control.	08
3	**Flow around submerged bodies:** Force exerted by flowing fluid on stationary body, drag and lift, terminal velocity of body, development of lift on a circular cylinder, development of lift on an airfoil.	06
4	**Uniform Flow through open Channels:** Classification, Uniform flow, Chezy's and Manning's equation, Prismatic and non-	08

	prismatic channels, hydraulically efficient channels, pressure distribution in open channels.	
5	**Applications of Bernoulli's Theorem:** Open channels, Broad crested weir, Venturiflume, Ogee weir.	04
6	**Nonuniform flow through open channels:** Specific energy and specific force diagrams, applications of specific energy, momentum principle to open channels, Gradually varied flow, hydraulic jump, waves and surges.	06
7	**Dimensional analysis:** Dimensional homogeneity, Buckingham's Π theorem, Rayleigh's method, Dimensionless groups, similitude, model studies, distorted and undistorted models.	08

Practical Examination:-
Practical examination will be based on the experiments conducted.

List of experiments: (preferably six to be performed)
1. Chezy's roughness factor
2. Specific energy
3. Hydraulic Jump
4. Boundary layer
5. Calibration of Broad crested weir
6. Calibration of Venturiflume
7. Calibration of Ogee weir

Termwork:-
Report on experiments performed as detailed above, assignments including 10 problems shall be submitted as term work
The distribution of term work marks will be as follows:
Reports of experiments performed and assignments : 15 marks
Attendance/Quiz : 10 marks

Recommended Books:

1. Dr. P.N. Nodi (2009); "Hydraulics and Fluid Mechanics" Standard Book House ISBN-13: 978-8189401269. 250p
2. Dr. Jain A.K (2010); "Fluid Mechanics" Khanna Publishers. ISBN-13: 978-8174091949.
3. K Subramanya (2008); "Flow in Open Channels" 978-0070086951. 576p
4. Subramanaya K (2010); "Fluid mechanics & hydraulic Machines". McGraw Hill Education (India) Private Limited. ISBN-13: 978-0070699809.
5. Nagarathnam S. (1984); "Fluid Mechanics:" Khanna Publishers.637p.
6. B.C.Pumnia.(2009); "Irrigation and Water Power Engineering", Standard Publishers. ISBN-13: 9788131807637. 964p
7. S.K.Garg (2009); "Irrigation Engineering and Hydraulic Structures", Khanna Publishers. ISBN-13: 9788174090478. 1594p

Sr. No.	Examination	Module
1	T-1	Module 1 and 2
2	T-2	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:-T. Y. B. Tech. (Civil)	**Semester VI**		
CODE: CE354	**Course:-Transportation Engineering - II**		
Prerequisites	**CE305**		
Period per week (each of 60 minutes)	Lecture	04	
	Practical	02	
	Tutorial	-	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	Practical	---	25
	Laboratory Work (Journal)	---	25
	TOTAL	**---**	**150**

*60% Weightage for end semester

Course Objectives:

1. To Summarize brief History of roads in India, and classification of roads as per different plan.
2. To discuss geometric elements of Roads, Design and construction of Flexible as well as Rigid Pavements & its strengthening as per IRC guide lines.
3. To classify subgrade soil by various methods and Laboratory procedure for computing various properties.
4. To appraise various parameters for design of bridges.

Course Outcomes:

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

1. To analyze and Design Geometric elements of different road types and able to Estimate length of different roads.
2. To implement the knowledge gained for Design of Flexible Pavements, Rigid Pavements and Bridges as per IRC guide line.
3. To execute construction and maintenance of Flexible and Rigid Pavements.

Course Content

Module No	**Details**	**Hrs**
01	**Highway Planing** i Classification of roads, brief history of road developments in India, present status of roads in India ii Highway alignment, basic requirement of ideal alignment, factors governing highway alignment iii Highway location survey, map study, reconnaissance, topographic surveys,	04

	highway alignment in hilly area, drawing and report preparation	
02	**1. Geometric Design of Highway:** i Terrain classification, vehicular characteristics, highway cross section elements, salient dimensions, clearances, width of carriage way, shoulders, medians, width of road way, right of way, camber and its profile. ii Design speed, sight distance, perception time, break reaction time, analysis of safe sight distance, analysis of overtaking sight distance, intersection sight distance. iii Horizontal curves: design of superelevation and its provisions, minimum radius of horizontal curves, widening of pavement, transition curves. ivGradients: different types, maximum, minimum, ruling and exceptional, grade compensation in curves, vertical curves: design factors, comfort and sight distance. Summit curve, valley curve. v Introduction of geometric design software. **2. Pavement Materials:** i Subgrade materials: desirable properties, modulus of elasticity, modulus of subgrade reaction, classification of subgrade soils, importance of CBR. ii Subbase material: desirable properties, different tests on aggregate, requirement of aggregate for different types of pavements. iii Bituminous materials: types of bituminous material, test on bituminous material, desirable properties, grade of bitumen.	12
03	**Pavement Design:** i Types of pavements, different method of pavement design, comparison of flexible and rigid pavements, design wheel load, equivalent single wheel load, equivalent wheel load factor. ii Flexible pavement design: GI method, IRC approach, Burmister's layers theory, introduction to AASHTO method. iii Stress in Rigid Pavements, critical load position, stress due to load, stress due to temperature variation, combine loading and temperature stress. iv Introduction to pavement design software, relationship between number of cumulative axle, strain value and elastic modulus of materials.	08
04	**Highway Construction:** i Modern equipment for road construction, construction of different types of roads: water bound macadam (WBM) road, different types of bituminous pavements, cement concrete pavement. ii Constructions of stabilized roads: different method of soil stabilization, use of geo-textile and geogrid in highway subgrade.	05
05	**1. Highway Maintenance and Rehabilitation** i Pavement failure: flexible pavement failure, rigid pavement failure, maintenance of different types of pavements. ii Evaluation of pavements: structural evaluation of pavements, functional evaluation of pavement. iiiStrengthening of existing pavement: objective of strengthening, types of overlay, different types of overlay, design of overlay using Benkeleman beam method. iv Highway drainage, necessacity, surface drainage, subsurface drainage.	06
06	**Traffic Engineering and Control** iTraffic study and surveys: speed studies, presentation of data, journey time and delay studies, use of various methods, merits and demerits. iiVehicular volume count: types, various available methods, planning of traffic count.	08

	iiiO- D survey, need and uses, various available methods. ivParking survey, need and types, traffic sign and marking, signals, miscellaneous traffic control aids, traffic regulations, traffic signals. vIntersection types: at grade and grade separation, factors influencing design.	
07	**Bridge Engineering** Bridge engineering: importance, investigations, site selection, collection of data, determination of flood discharge, waterway, afflux, economic span, scour depthPier, abutment, Bearing	04

List of Experiments:- (At least six to be performed)

1. Impact test on aggregates
2. Abrasion test on aggregates
3. Crushing test on aggregates
4. Shape test on aggregates
5. Penetration test on bitumen
6. Ductility test on bitumen
7. Softening point test on bitumen
8. Viscosity test on bitumen

Term Work:

A report on traffic volume and speed studies, report of experiments performed and at least 10 assignments (including numerical problems and layout sketches) shall be submitted as term work.

The distribution of term work marks will be as follows:

Reports of experiments performed and assignments : 15 marks
Attendance/Quiz : 10 marks

Recommended Books:

1. Yoder, E. J., John (1975); "Principles of Pavement Design" Wiley & Sons, Inc., New York. ISBN -13: 9780471977803. 711p.
2. Khanna & Justo (1971); "Highway Engineering", New Chand & Brothers, Roorkee.678p.
3. Dr. L. R. Kadiyali and Dr. N. B. Lal (2005); "Principles and Practices of Highway Engineering", Khanna Publication, New Delhi. ISBN-13: 9788174091659. 835p.
4. L.R. Kadiyali (1983) "Traffic engineering and Transport Planning", Khanna publishers Delhi.860p.
5. Raju N. K (1988)"Design of Bridges:"Oxford & IDH.ISBN-13: 9788120417410
6. Guide lines for the Design of Flexible Pavements, IRC:37 -2001, IRC:37-2012,
7. Guide lines for the Design of Flexible Pavements for Low Volume Rural Roads, IRC: SP: 72-2007.
8. Concrete Roads: HMSO, Road Research Laboratory, London.

Sr. No.	Examination	Module
1	T – I	Module 1 and 2
2	T – II	Module 3 and 4
3	Final Examination	Module 1 to 7

Class:-T. Y. B. Tech. (Civil)	**Semester VI**		
CODE: CE355	**Course:-Environmental Engineering - I**		
Prerequisites	**BT106, BT156, BT206, BT256, CE302**		
Period per week (each of 60 minutes)	Lecture	03	
	Practical	02	
	Tutorial	-	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	Practical	---	---
	Laboratory Work (Journal)	---	25
	TOTAL	**---**	**125**

*60% Weightage for end semester

Course Objectives:

The students will learn to

1. Prepare a general layout of a water supply scheme and discuss the components of the water treatment plant on the basis of topography and source
2. Design various units of water treatment system
3. Understand and deliberate on ecological system and importance of natural resources to the nation
4. Apply fundamental knowledge about air pollution, land pollution, water pollution and noise pollution

Course Outcomes:

The course will enable the students to

1. Analyse and interpret the data leading to pollution by performing practicals
2. Demonstrate their capability for designing water supply scheme for rural and urban areas.
3. Design all water treatment units such as flocculator, sedimentation tank, filtration, ion exchange units
4. Evaluate and understand various eco-friendly technologies to facilitate conservation and regeneration of the natural resources.

Course Content

Module No	**Details**	**Hrs**
1.	Ecology: Basic principles, food chain, food webs and ecological pyramids, tropic structure gross production to total community, respiration ratio(p/r), biochemical cycles, limiting factors-Liebig's law, extended ecological regulation, important ecosystems such as the seas, estuaries & sea shores, streams & rivers, lakes & ponds	04
2.	Environmental Pollution: Definition, different types of pollutions such as water pollution, air pollution, noise pollution, thermal pollution, soil pollution, marine pollution, nuclear hazards in brief. i. Water Pollution: Water pollutants: oxygen demanding wastes, pathogens, nutrients, salts	06

	thermal pollution, heavy metals, pesticides, volatile organic compounds. Surface water quality, water quality in lakes, rivers and ground water. ii Noise Pollution: Basic concepts, measurement, standards, effects on human health, and various control methods.	
3.	Water Engineering – Quality and Quantity of Water i. Water supply systems: need for planned water supply schemes, components of water supply system and determination of their design capacities, distribution system of water, types of intake structure. ii. Quality of water: wholesomeness and palatability, physical, chemical, bacteriological standards.	06
4	Water Engineering – Treatment of Water supplies i. Treatment of water; impurities in water-processes for their removal-typical flow –sheets.	03
5.	Water Engineering – Basic treatment of water supplies i. Sedimentation: factors affecting efficiency, design values of various parameters, tube settlers. ii. Coagulation and flocculation: mechanisms, common coagulations, rapid mixing and flocculating devices, G and GT values, Jar test, coagulant aids- polyelectrolyte etc. iii. Filtration: classification, slow and rapid sand filters, dual media filters, sand, gravel and under-drainage system, mode of action, cleaning, limitations, operational difficulties, performance, basic design consideration, pressure filters: construction and operation. iv. Disinfection: chlorination, chemistry of chlorination, kinetics of disinfection, chlorine demand, free and combined chlorine, break point chlorination, superchlorination, dechlorination , chlorine residual, use of iodine, ozone, ultraviolet rays and chlorine dioxide as disinfectants, well water disinfection	12
6.	Advanced treatment of water supplies i. Water softening: lime soda and base exchange methods, principle reactions, design considerations, sludge disposal. ii. Miscellaneous treatments: removal of iron and manganese, taste, odour and colour, principles and methods, de-fluoridation, reverse osmosis.	04
7.	Municipal solid waste management: i. Solid Waste: Sources, types, composition, physical and biological properties of solid wastes ,sources and types of hazardous and infectious wastes in municipal solid wastes ii. Solid waste generation and collection, storage, handling transportation, processing. iii. Treatment and disposal methods: iv. Material separation & recycle, physico-chemical and biological stabilization and solidification thermal methods, land disposal, site remediation, leachate and its control v. Hazardous wastes: vi. Definition, identification, mutagenesis, carcinogesis, toxicity testing, human studies, lot of evidence categories for potential carcinogens.	08
List of experiments:- 1. Determination of pH in water.		

2. Determination of Hardness of water.
3. Determination of Turbidity of water.
4. Determination of Optimum dose of coagulant by using Jar Test Apparatus.
5. Determination of Residual chlorine from water
6. Determination of Most probable number
7. Solid waste: Determination of pH
8. Solid waste: Determination of moisture content
9. Solid Waste : Organic content of solid waste
10. Measurement of Noise Level

Term Work:

Report of experiments performed and assignments (including numerical problems and layout sketches) shall be submitted as term work.

The distribution of term work marks will be as follows:

Reports of experiments performed and assignments : 15 marks
Attendance/Quiz : 10 marks

Recommended Books:-

1. S.K.Hussain (1976); "Water Supply and Sanitary Engineering", Oxford & IBH Publication, New Delhi. ISBN-13- 9788120401341. 884p.
2. E.W.Steel (1947); "Water Supply & Sewage", McGraw Hill, New York. ASIN: B001SL037A
3. T.J.McGhee (1991); "Water Supply & Sewage" McGraw Hill, New York. ISBN-13-9780071008235. 602p.
4. Nathanson J.A (2014) "Basic Environmental Technology: Water Supply, Waste Management and Pollution Control". Prentice Hall. ISBN-13: 978-0132840149. 456p.
5. J.W. Clark, W.Veisman, M.J.Hammer (2008); "Water Supply and Pollution Control" Prentice Hall. ISBN-13: 978-0132337175. 864p.
6. Gilbert Masters (2013); "Introduction to Environmental Engineering and Science" Pearson Education. ISBN 13 9781292025759. 700p.
7. S.K. Garg (2010); "Water Supply Engineering", Khanna Publications. ISBN 13: 978-8174091208. 300p.
8. Vesilind (2013);' "Introduction to Environmental Engineering", PWS Publishing Company. ISBN 13: 9780534378127.
9. Peavy, Rowe, Tchobanoglous (2013); "Environmental Engineering", Tata Mc Graw Hill. ISBN-13: 978-9351340263. 736p.
10. Eugene P. Odum (); "Fundamentals of Ecology", Nataraj Publications. ISBN-13: 978-0534420666. 624p.
11. Tchobanoglous. Theissen &Vigil (); "Integrated Solid Waste Management" Tata Mc Graw Hill Publication. ISBN-13: 978-0070632370. 992p.
12. Manual on Water Supply and Treatment, (latest Ed.): Ministry of & Housing. New Delhi
13. Manual on municipal Solid waste Management: Ministry of Urban Development, New Delhi
14. Relevant Indian Standard Specifications, BIS Publications
15. CPHEEO Manual on Water Supply & Treatment
    CPHEEO Manual on Sewage & Treatment

Sr. No.	Examination	Module
1	T – I	1, 2,3
2	T – II	4 and 5
3	Final Examination	1 to 7

Class:-T. Y. B. Tech. (Civil)	**Semester VI**		
CODE: CE356	**Course:-Theory of Reinforced and Prestressed Concrete**		
Prerequisites	**BTC230, BTC278, CE301**		
Period per week (each of 60 minutes)	Lecture	04	
	Practical	-	
	Tutorial	02	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	Practical	---	--
	Laboratory Work (Journal)	---	25
	TOTAL	**---**	**125**

*60% Weightage for end semester

Course Objectives:
1. To impart understanding for design of basic RCC structures (beams, columns & slabs) with the help of knowledge of structural analysis.
2. To understand the concept of Prestressed Concrete along with analysis and its design

Course Outcomes:
1. Designing basic structural members like beam, column and slab by Working stress Method
2. Realizing the importance of Prestressed reinforced concrete its application, advantages and disadvantages as compared to that of RCC .

Course Content

Module No	**Details**	**Hrs**
1.	Concept of reinforced concrete, working stress method of design for reinforced concrete, permissible stresses as per IS-456-2000, stress strain curve of concrete and steel, characteristics of concrete and steel reinforcement.	02
2.	Analysis and design of singly reinforced and doubly reinforced rectangular, Tee, Ell-beams for flexure by WSM, balanced, under reinforced and over reinforced sections. Design for shear and bond by WSM.	13
3.	Design of one way and two way slab by WSM Analysis and Design of rectangular and circular columns subjected to axial and bending by WSM.	10
4.	Prestressed Concrete: Basic principles of prestressed concrete, materials used and their properties, methods and systems of pre stressing,	06
5.	Losses in pre stress, analysis of various types of sections subjected to prestress and external loads.	05
6.	General design principles: Concepts of centre of compression, kern of a section, efficiency of the section, pressure line and safe cable zone, principal tension in prestressed concrete members.	09
7.	Simple Design of prestressed concrete beams (no end block design)	03

Term work

Solution of at least 20 problems with neat sketches wherever necessary shall be submitted as term work.

Text Books:-

1. S N Sinha (2002),"Reinforced Concrete Design, Second Revised Edition", Tata McGraw-Hill Education, ISBN 0070473323, 708 pages
2. Dr. H. J .Shah (2008), "Reinforced Concrete, Volume 2", Charotar Publishing House Pvt. Limited, ISBN 8185594732, 536 pages
3. A.K. Goel & I. C. Syal (2007)," Reinforced Concrete Structures", S. Chand Publishing ISBN 8121923530, 826 pages
4. N. Krishna Raju (2006)," Prestressed concrete" Tata McGraw-Hill Education, ISBN: 0070634440, 363 pages
5. P. Dayaratnam,(2011)," Design of Reinforced Concrete Structures", Oxford &Ibh-Pubs Company-New Delhi, ISBN 8120414195
6. Sinha N C, Roy S K (2007), "Fundamentals of Reinforced Concrete", S. Chand Publishing
7. Pillai & Menon (2009), "Reinforced Concrete Design", Tata McGraw-Hill Education

Reference Books:-

1. Warner. R. F. Rangan B. C. & Hall A. S (1977)," Reinforced Concrete", Pitman, ISBN 0858968219
2. T. Y. B. TECH. Lin, A. P. Burns (1981)," Design of Prestressed Concrete Structures ", John Wiley & Sons, ISBN 0471018988, 656 pages.

Sr. No.	Examination	Module
1	T – I	1,2
2	T – II	3,4
3	Final Examination	1 to 7