

Sardar Patel College of Engineering Andheri (West), Mumbai 400 058
Year: 2018-19

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CIVIL ENGINEERING

T.Y. B.Tech. In Civil Engineering

Sem. V & VI

Course Content

Year 2018-19

Semester V	T. Y. B. Tech. (Civil)		
CODE: PC-BTC501	Course:- Geotechnical Engineering – I		
Prerequisites	BS-BTC305, BS-BTC356, PC-BTC 306		
Period per week (each of 60 minutes)	Lecture	03	
	Tutorial	-	
Evaluation system		Hours	Marks
	In Semester	01	20 x 02
	End Semester*	03	100
	TOTAL	---	100

*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.
3. Analyze soil behavior under the application of loads and estimate stability of slopes
4. Design a soil investigation programme needed before commencement of construction

Course Content

Module No	Details	Hrs
1.	<p>Introduction Importance of geotechnical engineering. Basic definitions of various soil parameters and relationships between them. Soil as a three phase system. Determination of various soil properties such as moisture content, specific gravity, unit weight of soil.</p>	08
2.	<p>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. Methods of determination and use of Atterberg limits. Basic clay mineralogy 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</p>	08
3.	<p>Permeability Of Soils And Seepage Analysis 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 of stratified soils, factors affecting permeability of soil. Seepage analysis- Introduction, flow lines and potential lines, characteristics of flow nets, graphical method to plot flow nets, use of flow nets.</p>	08
4.	<p>Effective Stress Principle And Compaction Of Soils Introduction, effective stress principle, 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, factors affecting compaction, laboratory determination of optimum moisture content and maximum dry density, compaction in the field.</p>	06
5.	<p>Consolidation of soils Introduction, comparison between compaction & consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, consolidation test results, Terzaghi's theory of consolidation, consolidation settlement</p>	06
6.	<p>Shear strength Mohr's circle, important characteristics of Mohr's circle, Mohr-Coulomb theory, shear strength of cohesive and cohesionless soils, 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.</p>	06
7.	<p>Stability of slopes and Soil exploration</p>	06

	<p>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.</p> <p>Soil exploration - Introduction, methods of investigation, methods of boring, soil samplers and sampling, number and disposition of trial pits and borings, penetrometer tests, borehole logs, introduction to geophysical methods.</p>	
<p>Recommended Books:</p> <ol style="list-style-type: none"> 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. 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: PC-BTC502	Course:-Structural Analysis - II		
Prerequisites	ES-BT104, ES-BTC302, ES-BTC351, PC-BTC402		
Period per week (each of 60 minutes)	Lecture (hrs)	03	
	Practical (hrs)	-	
	Tutorial (hrs)	01	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	In semester Evaluation	---	25
	TOTAL	---	125

*60% Weightage for end semester

Course Objectives:

The main objectives of the course are

- To introduce the students to the methods of finding absolute and relative deflections caused by loads, temperature changes and settlement of supports.
- 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	Deflection of statically determinate structures: Review of general theorems based on virtual work and energy methods, absolute and relative deflections caused by loads, temperature changes and settlement of supports, application to beams, pin jointed frames and rigid jointed frames, absolute and relative deflections caused by lack of fit in pin jointed frames. Self learning: Introduction to the concept of complimentary energy	05
2	Types of structures occurring in practice and their classification. Stable and unstable structure, statically and kinematical determinacy and indeterminacy of structure. Self learning: Symmetric structure, symmetrical and anti-symmetrical loads, distinction between linear and non-linear behavior of material and geometric non-linearity.	03
3	Analysis of indeterminate structures by flexibility method: Flexibility coefficients and their use in formulation of compatibility equations. Application of above methods to propped cantilevers, fixed beams, continuous	06

	beams. Simple pin jointed frames. Simple rigid jointed frames with static indeterminacy up to 3. Theorem of three moments and its applications to beams. Self learning: Simple pin jointed frames including effect of lack of fit for members.	
4	Analysis of indeterminate structures by flexibility method: Analysis of indeterminate structures by the theorem of least work. Application of the theorem to propped cantilevers, fixed beams, continuous beams. Self learning: Application of flexibility method to two hinged parabolic arches. Application of theorem of least work to simple rigid jointed frames with static indeterminacy up to 3 and pin jointed frames.	04
5	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. Self learning: Application of these methods to simple rigid jointed frames with inclined member but having only one translational degree of freedom in addition to rotational degree of freedom.	07
6	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.	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.	05

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

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: ES-BTC503	Course:- Development Engineering		
Prerequisites	PC-BTC303, PC-BTC 352, ES-BTC304, ES-BTC355		
Period per week (each of 60 minutes)	Lecture	2	
Evaluation system		Hours	Marks
	In Semester	01	20X02
	End Semester*	03	100
	TOTAL		100

* 60% Weightage for end semester

Course Objectives:

The main objectives of the course are:

1. To provide an overview to the students of the various fields within planning, such as community development, urban planning and sustainability, issues and challenges at rural level, rural development.
2. To enable students to develop professional capabilities through field and design work in real world problems in the field of planning and development of urban and rural areas.

Course Outcomes:

The required course for emphasis in development engineering will help students

1. To develop multi scaled perspective about decisions in the built environment,
2. To expose the students to the analysis and evaluation of real world problems aiming to bring desired change in the society.

Course content

Module No.	Details	Hrs.
1	Introduction to Development Engineering Introduction to development Engineering; need of development engineering; core disciplines and concept; major issues in development; urban development; rural development; socioeconomic development; scientific social research, formulation of research problem, field work and data collection, report drafting	06
2	Design of Sustainable Communities Concept and development of sustainable communities; Sustainable design principles, building regulations, codes and standards – ANSI, ASTM, ASHRAE, approval process; green buildings- green building techniques- energy solutions, site solutions, site solutions, exterior and interior solutions, Certification –BREEAM, GRIHA, NAHB, LEED, IGBC;	06
3	Town / City Planning Town Planning- history of town planning in India, characteristics of city/town, town planning at national, regional and local levels, planning standards, master plan, site layout and development, zoning and density control, green belt, slum redevelopment; Smart city planning- introduction to city planning, infrastructure elements of smart city planning, dimensions of smart cities – global standards and performance benchmark; smart solutions- e governance, waste management, water management, energy management, urban mobility, citizen services, other services such as tele medication and education, trade facilitation, skill development; GIS for	08

	planning	
4	Planning and Development of Rural Areas District administration, District Planning , introduction to various sectors of rural areas such as drinking water, waste water treatment, electricity, public transport, irrigation, sanitation and cooking energy; issues and challenges associated with these sectors; People's participation and role in development of rural areas ; various schemes and policies floated by state and central government - phases in the schemes; life cycle costing of these schemes.	08
5	Geoinformatics for Planning and Development Introduction to Geoinformatics; Advantages, benefits and limitations; Interdisciplinary applications; Data extraction; use of Geoinformatics for planning, mapping and preparation of layouts.	06
6	Development Aspects: Urban and Rural 1. Planning and designing of a model town / city and using AutoCad and/ or GIS. 2. Visit to a village or small town - The project will be carried out in groups. Problem faced by the villagers pertaining to various sectors or existing schemes; define the need, method, tools and techniques for development; deliver technology based solution.	08

Recommended Books:

1. Chand, M. and Puri, U.K.(1983), 'Regional Planning in India', Allied Publishers, New Delhi.
2. Kaiser, E. J., et.al. (1995), 'Urban Landuse Planning', 4th (ed) Urbana, University of Illinois Press.
3. Sundaram, K.V. 1985 'Geography & Planning', Concept Publishing Co., New Delhi.
4. Ayyar, C.P.V. (1987), 'Town Planning in Early South India', Mittal Publications, Delhi.
5. Reeder, L. Hoboken, NJ, (2010), 'Guide to green building rating systems', John Wiley & Sons, Inc., 2010.
6. Longley, P. A., Michael F. Goodchild, Maguire, D.J., Rhind, D. W. (2005), 'Geographic Information Systems and Science', Second Edition 2005: John Wiley & Sons, New York.
7. Desai, V. (2005), 'Rural Development of India', Himalaya publishing house, Mumbai.
8. Rau, S.K. (2001), 'Global Search for Rural Development', NIRD, Hyderabad.

References:

1. Institute of Town Planners, India, Ministry of Urban Affairs & Employment, Government of India, New Delhi, UDPFI Guidelines , 1996.
2. Miles R. Simon, 1970, 'Metropolitan Problems' Methuen Publications, Canada.
3. B.I.S., 1980, "National Building Code of India", ISI, New Delhi.
4. ANSI/ASHRAE/USGBC/IES Standard 189.1, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
5. ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings

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

CLASS:T.Y.B.Tech.(Civil)		Semester V	
CODE: PC-BTC504	Course:- Hydraulic Engineering – I		
Prerequisites	PC-BTC306, PC-BTC353		
Period per week (each of 60 minutes)	Lecture	03	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 x 02
	End Semester*	03	100
	TOTAL	---	100

*60% Weightage for end semester

Course Objectives:

1. To describe the types of flow and pipe flow system.
2. To learn about concepts of hydraulics in dynamic state 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 Ram, hydraulic press, accumulator, intensifier, crane and lift.

Course Outcomes:

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

1. Understand 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 hydraulic machines.
4. Design the components of hydraulic turbines and Centrifugal pumps.

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.	07
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.	06

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.	06
6	Hydraulic Machinery: Hydraulic Ram, press, accumulator, intensifier, crane and lift.	03
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

Text Books:

1. [Dr. P.N. Modi](#) (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.

Reference Book:

1. R. K. Rajput (2010): Fluid Mechanics and Hydraulic Machinery, S. Chand and Company.

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: PC-BTC505	Course:-Transportation Engineering - I		
Prerequisites	PC-BTC307, PC-BTC354, PC-BTC403,PC-BTC451		
Period per week (each of 60 minutes)	Lecture	03	
	Tutorial	01	
Evaluation system		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	In Semester Evaluation	--	25
	TOTAL	---	125

*60% Weightage for end semester

Course Objectives:

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

Course Outcomes:

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

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, points and switches, selection of materials and method of Construction.
3. Understand the planning processes of Harbours, Docks and Ports.

Course Content

Module No	Details	Hrs
01	Introduction: Role of transportation in Society, objectives of transportation system, planning & coordination of different modes of transportation systems for Indian conditions.	04

02	<p>Airport Engineering</p> <ul style="list-style-type: none"> 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 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. 	12
03	<ul style="list-style-type: none"> 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. iii Airport 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	<p>Railway Engineering</p> <ul style="list-style-type: none"> 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. 	10
05	<ul style="list-style-type: none"> i. Cross section of permanent way and track components, sleeper – functions and types, sleeper density, ballast functions and different ballast materials. ii. Geometric elements: gradients, transition curves, widening of gauge on curves, cant and cant deficiency. iii Points and crossing: design of turnouts, description of track junctions, different types of track junctions. iv. Yards: details of different types of railway yards and their functions. 	08

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, planning processes of harbors and docks, port facilities.	04

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.
3. Bindra S P (2012); “**Docks and Harbour Engineering**”, Dhanpat Rai and Sons. ISBN-13: 978-8189928858.
4. R Shrinivas (2013); “**Harbour, Dock and Tunnel Engineering**” Charotar Publishing House. ISBN-13: 978-9380358741.
5. Sehgal S E, Bhanot K L (1980); “**A Text Book on Highway Engineering and Airports**”, S. Chand & Co.
6. Horonjeff and Mckelrey (1994); “**Planning and Design of Airport**”, McGraw-Hill Professional. ISBN-13: 978-0070453456.
7. Quinn A D (1991); “**Design & Construction of Ports and Marine Structures**”, McGraw-Hill Inc., US. ISBN-13: 978-0070510647.
8. Rao G V (1992); “**Airport Engineering**”, Tata McGraw-Hill Publishing Company ISBN -13: 9780074603178.
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	SEMESTER – V		
CODE:HSM-BTC506	Course: Organizational Communication and Interpersonal Skills		
Prerequisites	HSM-BT107		
Period per week (each of 60 minutes)	Lecture	02	
	Tutorial	01	
Evaluation system		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	02	50
	TW/Practical	---	50
	TOTAL		100

*60% Weightage for end semester

COURSE OBJECTIVE:

1. To inculcate in students professional and ethical attitude, effective communication skills, team work, interpersonal Skills, and an ability to understand social responsibilities with multi- disciplinary approach.
2. To enable students to communicate in professional and social context with knowledge of business etiquettes.
3. To prepare students for successful career that meets the corporate, industrial and global requirement
4. To help students build an understanding of different organizational cultures, business practices, and social norms to communicate more effectively in domestic and cross-cultural business contexts.
5. To help student's to use a strategic communication model and critical thinking to identify objectives, analyze audiences, and choose the most effective structure and style for delivering strategically sound written and spoken messages.

COURSE OUTCOME:

Upon successful completion of this Course learners will be able to

1. Explain principles of effective group communication, so as to cultivate trust and understanding, develop open participation, and strengthen decision making in work groups and teams.
2. Analyse a company's communication processes or key messages and recommend changes that can help advance communication as an integral part of that organization's management strategy and possess entrepreneurial approach for lifelong learning
3. As a team, design and deliver a presentation that both informs and persuades, using an appropriate visual support strategy with leadership skills and adhering to a specified time limit.
4. Participate and succeed in campus placements and display corporate etiquettes
5. Have education necessary for understanding the impact of engineering solutions on society and demonstrate awareness of contemporary issues.

Course content

Module No.	Details	Hrs.
01	Organisational Behaviour: Introduction, Concept of OB, Organisational culture, Status patterns in organizations, Organisational conflicts: Causes, Consequences and Management, Techniques of Organisational Development.	05
02	Corporate Etiquettes and Manners: Introduction, Etiquettes and rules of behavior, Professional Conduct, Etiquette in Meetings, Dining Etiquettes, Netiquette.	05
03	Meetings & Documentations: Types of meetings, Notice, Agenda, Minutes of the meetings, Strategies for conducting effective meetings.	02
04	Report writing: Objectives of report writing, Language and style in a report, types of reports. Formats of reports: Memo, Letter, and Project report Survey based.	06
05	Presentation Skills: A Computer- aided presentation of the Project report. Technical Proposals: Objectives of technical proposals, Parts of proposals.	02
06	Interpersonal Skills: Emotional Intelligence, Leadership Skills, Goal Setting and Decision making, Stress Management, Assertiveness.	08
07	Career Skills: Group Discussions, Know thy Self (SWOT Analysis), Job Application letter, Writing Effective Resume', Interview Skills.	04

List of Assignments:

- Two assignments based on case studies on Organisational Behaviour
- Three assignments on report-writing (A Bound report to be submitted on topic given in partial fulfillment of the syllabus report writing, Report content will be graded and counted during presentation, a printed copy of the presentation and a soft copy in the form of CD to be attached with the report).
- Technical Proposal (Group activity, document of the proposals)
- Interpersonal Skills: Case Studies, Group Activity and assignments
- Two assignments on Career Skills (Cover Letter and Resume' Mock Interviews, Practical sessions)
- Etiquettes case study and role play.
- Practical sessions on Group Discussion topics

Recommended Books:

- Fred Luthans, "Organisational Behavior", Mc Graw Hill, edition.
- Lesikar and Petit, "Report Writing for Business", Mc Graw Hill, edition.
- Huckin and Isen, "Technical Writing and Professional Communication", Mc Graw Hill
- Wallace and Maters, "Personal Development for Life and Work", Thomson Learning, 12th edition.

5. Heta Murphy, "Effective Business Communication", Mc Graw Hill, edition.
6. R. C. Sharma and Krishna Mohan, "Business Correspondence and Report Writing"
7. B.N. Ghosh, "Managing Soft Skills for Personality Development", Tata McGraw Hill
Lehman, Dufrene, Sinha, "BCOM", Cengage Learning, 2nd edition
8. Bell Smith, "Management Communication" Wiley India Edition, 3rd edition,
9. Dr. K. Alex, "Soft Skills", S.Chand and Company.

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

SEMESTER- V	T. Y. B. Tech. (Civil)		
CODE: PC-BTC551	Course:- Geotechnical Engineering Lab – I		
Prerequisites	BS-BTC305, BS-BTC356, PC-BTC 306		
Period per week (each of 60 minutes)	Lecture	--	
	Laboratory	02	
	Tutorial	---	
Evaluation system		Hours	Marks
	In Semester Test	--	--
	End Semester Test*	--	--
	In Semester Evaluation	--	25
	TOTAL	---	25
Course Objectives:			
<ol style="list-style-type: none"> To introduce students to soil types based on grain size and plasticity characteristics To familiarize students with various soil properties. 			
Course Outcomes:			
Students will be able to			
<ol style="list-style-type: none"> Apply the knowledge of mechanics to soil so as to measure and quantify various soil properties. Demonstrate their capability to prepare soil testing reports showing values of properties tested. Draw a conclusion regarding soil type and engineering behaviour based on tests performed. 			

Assessment criteria for laboratory/Tutorial work. i.e. weightage for assessment shall be as follows:

- Attendance = 20%,
- Journal = 40%,
- MCQ/Oral/Test = 40%.

List of Experiments: (Minimum eight to be performed)

- Field density using core cutter method
- Field density using sand replacement method
- Natural moisture content using oven drying method
- Field identification of fine-grained soils
- Specific gravity of soil grains
- Grain size distribution by sieve analysis
- Grain size distribution by hydrometer analysis
- Consistency limits - liquid limit, plastic limit and shrinkage limit
- Permeability tests using constant test method
- Permeability tests using falling head method
- Compaction tests: standard proctor test and modified proctor test
- Relative density.

Recommended Books:

- Alam Singh (2012); "Soil Engineering in Theory and Practice (Vol. -1)", CBS Publishers & Distributors, New Delhi. ISBN-13: 979-8123902769. 325p.
- V. N. S. Murthy (2002) "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press. ISBN-13: 9780824708733. 1056p.
- Relevant Indian Standard Specifications & Codes, BSI Publications, New Delhi.

CLASS: T.Y.B.Tech.(Civil)		Semester V	
CODE: ES-BTC552	Course:- Development Engineering		
Prerequisites	PC-BTC303, PC-BTC 352, ES-BTC304, ES-BTC355		
	Laboratory	02 hours/batch	
		Hours	Marks
Evaluation system	In Semester Evaluation	--	50
	TOTAL	---	50

Course Objectives:

1. Apply the knowledge and concepts of town planning and smart city planning in developing a model town or smart city.
2. Apply the knowledge of subjects of engineering, understanding of the various government schemes and sectors / areas of rural development to identify the real problems faced by the rural areas and providing a technology based solution.

Course Outcomes:

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

1. Transform the town planning concepts and ideas to create town and smart city plans, design parameters, process detail in to 2D and 3D view using building design softwares.
2. Identifying a real world problem, especially for the rural areas, by carrying out visits and field work, spatially mapping the problem by using GIS software and satellite imageries, and providing a technology based solution.

Laboratory work

1. Planning and designing of a model town / city and using Auto Cad and/ or GIS - The project will be carried out in groups. Each group should have maximum five students. The students should submit the final report with the master plan of the model town/city.
2. Visit to a village or small town - The project will be carried out in groups. Each group should have minimum five and maximum ten students. The students should Identify the problem faced by the villagers pertaining to various sectors or existing schemes; define the need, method, tools and techniques for development; deliver technology based solution. The students should submit the final report based on the work.

Recommended Books:

1. Chand, M. and Puri, U.K.(1983), 'Regional Planning in India', Allied Publishers, New Delhi.
2. Kaiser, E. J., et.al. (1995), 'Urban Landuse Planning', 4th (ed) Urbana, University of Illinois Press.
3. Sundaram, K.V. 1985 'Geography & Planning', Concept Publishing Co., New Delhi.
4. Ayyar, C.P.V. (1987), 'Town Planning in Early South India', Mittal Publications, Delhi.

5. Reeder, L. Hoboken, NJ, (2010), 'Guide to green building rating systems', John Wiley & Sons, Inc., 2010.
6. Longley, P. A., Michael F. Goodchild, Maguire, D.J., Rhind, D. W. (2005), 'Geographic Information Systems and Science', Second Edition 2005: John Wiley & Sons, New York.
7. Desai, V. (2005), 'Rural Development of India', Himalaya publishing house, Mumbai.
8. Rau, S.K. (2001), 'Global Search for Rural Development', NIRD, Hyderabad.

References:

1. Institute of Town Planners, India, Ministry of Urban Affairs & Employment, Government of India, New Delhi, UDPFI Guidelines , 1996.
2. Miles R. Simon, 1970, 'Metropolitan Problems' Methuen Publications, Canada.
3. B.I.S., 1980, "National Building Code of India", ISI, New Delhi.
4. ANSI/ASHRAE/USGBC/IES Standard 189.1, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings
5. ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings

CLASS: T.Y.B.Tech.(Civil)		Semester V	
CODE: PC-BTC553	Course:- Hydraulic Engineering – I (Laboratory)		
Prerequisites	PC-BTC306, PC-BTC353		
	Practical/ Laboratory	02 Hours/ batch--	
Evaluation System		Hours	Marks
	In Semester evaluation	--	25
	TOTAL	---	25

Course Objectives:

1. To describe the types of flow and pipe flow system.
2. To discuss the concepts 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 Ram, 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 hydraulic machines.
4. Understand the components of hydraulic turbines and Centrifugal pumps.

List of experiments: (preferably six 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.

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

Reference Book:

R. K. Rajput (2010): Fluid Mechanics and Hydraulic Machinery, S. Chand and Company.

Value added courses

Class:- UG (Civil)	Choice based Open Elective (Interdisciplinary) Class: TY Civil Sem. V		
Course Code: VA-BTC526 (Credit/Audit Course)	Introduction to Offshore Engineering		Credits: 03
Period per week (each of 60 minutes)	Lecture (hrs)	03	
	Practical (hrs)	-	
	Tutorial (hrs)	-	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	In semester Evaluation	---	-
	TOTAL	---	100
Course Objectives: The objective of this course to make Civil and Mechanical Engineering students familiar with Offshore constructions.			
Course Outcomes: At the end of this course the students will be able to understand introduction of Offshore Engineering			
Course Content: <ul style="list-style-type: none"> • Offshore environment • Types of offshore structures • Wave theories - linear and nonlinear • Wave induced forces - on fixed and floating structures; • Stability of floating structures; • Submarine pipelines; • Offshore construction - installation, repairs, maintenance and operation. 			
References: <ol style="list-style-type: none"> 1. C.A. Brebbia and S. Walker, Dynamic analysis of Offshore Structures, Newnes Butterworth, London, 1979. 2. T. Sarapkaya and M. Isaacson, Mechanics of Wave Forces on Offshore Structures, Van Nostrand Reinhold, New York, 1981. 3. B.C. Gerwick, Offshore Construction, Buttersworth, 2000. S. Narasimhan, S Kathirolu and T Nagendrakumar, Harbor and Coastal Engineering, National Institute of Ocean Technology, Chennai, 2001. 4. Prof. M.C. Deo: Waves and Structures: https://www.civil.iitb.ac.in/~mcdeo/waves.html 5. SUBRATA K. CHAKRABARTI http://dl.kashti.ir/ENBOOKS/offshore%20engineering-2.pdf 			

SEMESTER-V	CLASS: TY Sem. V (Civil)			
CODE: VA-BTC527 Open Electives: (Credit/Audit course)	COURSE:Legal Aspects in Construction			
Period per week (Each of 60 minutes)	Lecture	03		
	Laboratory	--		
	Tutorial	02		
Scheme of evaluation		Duration (Hrs)	Marks	
	In Semester Tests	01	20 X 02	
	End Semester Exam*	04	100	
	In semester Scheme of evaluation	--	-	
	Total		100	
	Credits		03	

* 60% weightage for end semester exam

<p>Course Objective:</p> <ul style="list-style-type: none"> • To describe fundamentals of common law • To discuss the concept of bid cycle • To explain Indian contract act • To identify the concept contract administration • To summarize students with Laws applicable to construction activity • To interpret various acts in connection with construction activities • To summarize FIDIC contracts
<p>Course Outcome:students will be able to</p> <ul style="list-style-type: none"> • Use of law in general • Practice tendering process • Utilize Indian contract act and its provision with respect to construction • Implement contract administration • Use labor laws on construction site • Relate acts applicable to construction • Use International contract provisions

Course content

Module	Topics	No.of Lectures
1	Law and common man	04
2	Construction through contracts ;Types, critical comparison, bid cycle, tender and contract documents, contract conditions, study of contract documents of State PWD and CPWD	06
3	Indian Contract Act; Need, provisions, scope for modifications / improvement	06

4	Contract administration Deviations and extras, claims and their management, disputes and dispute resolution methods, Arbitration and Conciliation Act.	06
5	Laws applicable to construction activity need and broad provisions of : Industrial Disputes Act, Workmen's Compensation Act ,	06
6	Employer's Liability Act, Payment of wages Act, Contract Labour Act, Minimum Wages Act, Inter-state Migrant workmen act, BOCW Act and other acts introduced from time to time	06
7	FIDIC contracts; Contract administration;	06
<p>Term work:- Assignments consisting of minimum twenty problems covering entire syllabus shall be submitted as term work.</p> <p>Recommended Books:-</p> <ol style="list-style-type: none"> 1. Bajirao Shankarrao Patil (1986); "Legal Aspects of Building & Engineering Contracts" S.B. Patil. 471p. 2. G. T. Gajria, Kishore Gajria (2000); "Law Relating To Building & Engineering Contracts In India", Lexisnexis Butterworths India. ISBN 13: 9788187162162. 538p. 3. P. C. Markanda, Naresh Markanda (2013); "Law Related To Arbitration and Conciliation" Lexisnexis Butterworths India. ISBN 13: 9788180388132. 1570p. 4. Edward R. Fisk, Wayne D. Reynolds (2013); "Construction Project Administration" Pearson Education. ISBN 13: 9780133149258. 432p. 5. Indian Contract Act 1872 6. Arbitration Conciliation Act 1996.4. All Referred Bare Acts 7. CPWD Manual Volume I & II, A Handbook For Government Officials And Contractors 		

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

SEMESTER-V	CLASS: TY Sem. V (Civil)		
CODE: VA-BTC528 Open Electives: (Credit/Audit course)	COURSE: Computational Techniques		
Period per week (Each of 60 minutes)	Lecture	03	
	Laboratory	--	
	Tutorial	02	
Scheme of evaluation		Hours	Marks
	In Semester Tests	01	20 X 02
	End Semester Exam*	04	100
	In semester Scheme of evaluation	--	-
	Total		100

*60% weightage for end semester exam

<p>Course Objectives:</p> <ul style="list-style-type: none"> • To Describe Different methods of statistics. • To explain the knowledge of probability theory and application in construction Industry. • To identify about different methods of data collections and its analysis. • To outline the importance of Hypothesis testing and its application in Civil Engineering. • To Discuss Application of ANOVA. • To explain the application of linear programming problem and transportation problem in construction industry.
<p>Course Outcome:</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> • Practice different methods of statistics and its applications, different methods of data collection and presentation. • Carry out application of Binomial Distribution, Poissons distribution in civil engineering projects. • Implement the concept of linear Programming Problem and Transportation Problem in getting the optimum solution for civil engineering problem. • Test hypothesis, significance level, type – I and type – II error in hypothesis.

Course content:

Sr.No.	Description	Hrs
1	Review of basic statistics and probability	06
2	Probability Distributions: Theoretical, binomial, poisson, normal, exponential, hypergeometric, uniform	06
3	Sampling and Sampling Distributions: Probability and non-probability	06

	samples, sampling and non-sampling errors, sample size, sampling distributions : t, F and χ^2 distributions	
4	Hypothesis Testing: Type I and II error, testing of mean, proportion, tests for equality of mean and variances of two populations, confidence interval, χ^2 test for goodness of fit, ANOVA (one way classification), Non parametric tests : sign test, U test	06
5	Correlation and Regression: Karl Pearson's and Rank Correlation coefficient, simple linear regression: least squares method. Simulation: Random number generation. Monte Carlo method, applications	06
6	Management Decision Making: System approach, decision making under uncertainty and risk: decision tables and decision tree	06
7	Linear Programming: Graphical solution, simplex method, dual, sensitivity analysis, transportation and assignment problems	06

Recommended Books:

1. Shrivastava, Shenoy & Sharma (1989); "Quantitative Techniques for Managerial Decisions" New Age International. ISBN-13: 9788122401899. 941p.
2. Kothari C R (2004); "Research Methodology: Methods and Techniques", New Age International. ISBN-13: 978-8122415223. 401p.
3. Goode W J & Hatt P K (2006) "Methods in Social Research" Surjeet Publication. 386p.

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

SEMESTER-V	CLASS: TY Sem. V (Civil)		
CODE: VA-BTC528 Open Electives: (Credit/Audit course)	COURSE: Quantitative Techniques and Its applications in Civil Engineering		
Period per week (Each of 60 minutes)	Lecture	02	
	Laboratory	--	
	Tutorial	02	
Scheme of evaluation		Hours	Marks
	In Semester Tests	01	10X2
	Practical	-	-
	Laboratory work	-	-
	End Semester Exam*	03	50
	In semester Scheme of evaluation	--	25
	Total		75

*60% weightage for end semester exam.

Course Objectives:

- To discuss about different methods of data collections and its analysis.
- To discuss the importance of hypothesis testing, ANOVA and its applications in Civil Engineering
- To explain the application of linear programming problem and transportation problem in construction industry

Course Outcomes:

- Implement the concept of linear programming problem and transportation problem in getting the optimum solution for Civil engineering problem
- Understand the concept of hypothesis, significance level, type-I and Type-II error hypothesis.

Course content

1	Hypothesis Testing: Type-I and II error, testing of mean, proportion, test for equality of mean and variance of two populations, confidence interval, different test for goodness of fit ANOVA (one way classification), Non parametric tests: sign test, U test.	08
2	Correlation and Regression: Karl Pearson's and Rank correlation coefficient, simple linear regression: Least square method. Simulation: random number generation, Monte Carlo method, applications.	08
3	Linear Programming: Graphical Solution, Simplex method, dual, sensitivity analysis, transportation problem	08

Recommended Books:

1. Shrivastava, Shenoy & Sharma (1989); "Quantitative Techniques for Managerial Decisions" New Age International. ISBN-13:9788122401899.941p
2. Kothari C R (2004) "Research Methodology: Methods and Techniques", New Age International. ISBN-13:978-8122415223.401p
3. Goode W J & Hatt P K (2006) "Methods in Social Research" Surjeet Publication. 386p.

2.2 T.Y. B.Tech. In Civil Engineering (CBCS)
Sem. VI
Academic Evaluation Scheme and Course Content
Year 2018-19

Class:-T. Y. B. Tech.(Civil)		Semester VI	
CODE:PC- BTC601	Course:- Geotechnical Engineering - II		
Prerequisites	BS-BTC305, BS-BTC356, PC-BTC 306, PC-BTC501		
Period per week (each of 60 minutes)	Lecture	03	
	Tutorial	-	
Evaluation system		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	TOTAL	---	100

*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, and pile foundations.

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. Explanation of basic design principles of flexible retaining system, underground conduits and introduction to 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 be able to design a suitable retaining structure.

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 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	10

	active pressure, Culmann's graphical solutions for active pressure.	
2.	Earth retaining structures Rigid retaining structures, stability analysis of retaining walls, cantilever retaining walls, construction details, drainage and wall joints.	06
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, ultimate bearing capacity in case of local shear failure. IS 6403 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.	08
5.	Underground conduits and open cuts Classes of underground conduits, load on a ditch conduit, settlement ratio, ditch condition and projection condition, imperfect ditch conduit. Open cuts: Apparent earth pressure diagrams, average earth pressure diagrams in cohesive and cohesionless soils, estimation of strut loads in braced cuts	06
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
Recommended Books:-		
<ol style="list-style-type: none"> 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. 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
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Class:-T. Y. B. Tech. (Civil)	Semester VI		
CODE: PC-BTC602	Course:-Design & Drawing of Steel Structures		
Prerequisites	ES-BTC302, ES-BTC351, PC-BTC402, PC-BTC502		
Period per week (each of 60 minutes)	Lecture (hrs)	03	
	Practical (hrs)	-	
	Tutorial (hrs)	01	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	04	100
	In semester Evaluation	---	50
	TOTAL	---	150

*60% Weightage for end semester

<p>Course Objectives:</p> <ul style="list-style-type: none"> 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.
<p>Course Outcome:</p> <p>The course will enable the students to:</p> <ol style="list-style-type: none"> Design simple structural elements using IS-800-2007: <ol style="list-style-type: none"> Tension members Compression members Flexural members Slab base & Gusseted Base Bolted and Welded connections Design simple structural systems using IS-800-2007 & IS-875-1987 <ol style="list-style-type: none"> truss (subjected to wind load) 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.	06
2	Design of tension members with welded / bolted end connections using single	04

	and double angle sections by LSM, design strength due to- yielding of cross section, rupture of critical section and block shear.	
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 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.	07
4	Design of slab base and gusseted base using bolted and welded connection by LSM, Effective area of a base plate.	04
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 stiffeners and different types of web stiffeners. Introduction to plate girders.	07
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.	04

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 method 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:PC- BTC603	Course:-Hydraulic Engineering- II		
Prerequisites	PC-BTC306, PC-BTC353, PC-BTC504,PC-BTC553		
Period per week (each of 60 minutes)	Lecture	03	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 x 02
	End Semester*	03	100
	TOTAL	---	100

*60% Weightage for end semester

Course Objectives:

1. To describe the laminar flow and turbulent flow in pipes 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 over 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 stationary 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.	06
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.	06
3	Flow around submerged bodies: Force exerted by flowing fluid on stationary body, drag and lift, terminal	06

	velocity of body, development of lift on a circular cylinder, development of lift on an airfoil.	
4	Uniform Flow through open Channels: Classification, Uniform flow, Chezy's and Manning's equation, Prismatic and non-prismatic channels, hydraulically efficient channels, pressure distribution in open channels.	06
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.	06

Text Books:

1. [Dr. P.N. Modi](#) (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. B.C.Pumnia.(2009); "Irrigation and Water Power Engineering", Standard Publishers. ISBN-13: 9788131807637. 964p

Reference Book:

- 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: PC-BTC604	Course:-Transportation Engineering - II		
Prerequisites	PC-BTC307, PC-BTC354, PC-BTC403,PC-BTC451, PC-BTC505		
Period per week (each of 60 minutes)	Lecture	03	
Evaluation system		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	TOTAL	---	100

*60% Weightage for end semester

Course Objectives:

1. To Summarize brief History of roads in India, and classification of roads as per different plan, to discuss Highway planning and geometric design of Roads,
2. Classify subgrade soil by various methods and Laboratory procedure for computing various properties. Design and construction of Flexible as well as Rigid Pavements & its strengthening as per IRC guide lines.
3. To discuss basics of traffic engineering, various types of traffic survey and traffic control devices.
4. To appraise various parameters for planning of bridges.

Course Outcomes:

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

1. To analyze and Design of Geometric elements of different road types.
2. To implement the knowledge gained for Design & Construction of Flexible Pavements, Rigid Pavements and Bridges as per IRC guide line and Material Selection for its Construction.
3. To execute construction and maintenance of Flexible and Rigid Pavements.
4. To understand various types of traffic surveys and traffic control devices.

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, highway alignment in hilly area, drawing and report preparation	04
02	1. Geometric Design of Highway: i.Terrain classification, vehicular characteristics, highway cross section elements, salient dimensions, clearances, width of carriage way, shoulders,	12

	<p>medians, width of road way, right of way, camber and its profile.</p> <p>ii. Design speed, sight distance, perception time, break reaction time, analysis of safe sight distance, analysis of overtaking sight distance, intersection sight distance.</p> <p>iii. Horizontal curves: design of superelevation and its provisions, minimum radius of horizontal curves, widening of pavement, transition curves.</p> <p>iv. Gradients: different types, maximum, minimum, ruling and exceptional, grade compensation in curves, vertical curves: design factors, comfort and sight distance. Summit curve, valley curve.</p> <p>v. Introduction of geometric design software</p> <p>2. Pavement Materials:</p> <p>i Subgrade materials: desirable properties, modulus of elasticity, modulus of subgrade reaction, classification of subgrade soils, importance of CBR.</p> <p>ii Subbase material: desirable properties, different tests on aggregate, requirement of aggregate for different types of pavements.</p> <p>iii Bituminous materials: types of bituminous material, test on bituminous material, desirable properties, grade of bitumen.</p>	
03	<p>Pavement Design:</p> <p>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.</p> <p>ii Flexible pavement design: IRC approach, Burmister's layers theory, Triaxial method.</p> <p>iii Stress in Rigid Pavements, critical load position, stress due to load, stress due to temperature variation, combine loading and temperature stress.</p> <p>iv Introduction to pavement design software, relationship between number of cumulative axle, strain value and elastic modulus of materials.</p>	08
04	<p>Highway Construction:</p> <p>i Construction of different types of roads: water bound macadam (WBM) road, different types of bituminous pavements, cement concrete pavement.</p> <p>ii Constructions of stabilized roads: different method of soil stabilization, use of geo-textile and geogrid in highway subgrade.</p>	05
05	<p>1. Highway Maintenance and Rehabilitation</p> <p>i Pavement failure: flexible pavement failure, rigid pavement failure, maintenance of different types of pavements.</p> <p>ii Evaluation of pavements: structural evaluation of pavements, functional evaluation of pavement.</p> <p>iii Strengthening of existing pavement: objective of strengthening, types of overlay, different types of overlay, design of overlay using Benkeleman beam method.</p>	06

	ivHighway drainage, necessity, surface drainage, subsurface drainage.	
06	<p>Traffic Engineering</p> <p>iTraffic study and surveys: speed studies, presentation of data, journey time and delay studies, use of various methods, merits and demerits.</p> <p>iiVehicular volume count: types, various available methods, planning of traffic count.</p> <p>iiiO- D survey, need and uses, various available methods.</p> <p>ivParking survey, need and types, traffic sign and marking, signals, miscellaneous traffic control aids, traffic regulations, traffic signals.</p> <p>vIntersection types: at grade and grade separation, factors influencing design.</p>	08
07	<p>Bridge Engineering</p> <p>Bridge engineering: importance, investigations, site selection, collection of data, determination of flood discharge, waterway, afflux, economic span, scour depthPier, abutment, Bearing.</p>	04

Recommended Books:

1. Yoder, E. J., John (1975); **“Principles of Pavement Design”** Wiley & Sons, Inc., New York. ISBN -13: 9780471977803.
2. S. K. Khanna, C. E. G. Justo & A. Veeraragavan (2014); **“Highway Engineering”**, Xth Edition New Chand & Brothers, Roorkee.
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.
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 Rigid Pavements**, IRC:58:2002.
8. **Guide lines for Strengthening of Flexible Road Pavements using Benkelman Beam Deflection Technique.** IRC:81:1997.
9. 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: PC-BTC605	Course:-Environmental Engineering - I		
Prerequisites	BS-BT106, BS-156, BS-206, BS-256, PC-BTC304		
Period per week (each of 60 minutes)	Lecture	03	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	TOTAL	---	100

*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.
2. Demonstrate their capability for designing water supply scheme for rural and urban areas.
3. Design of 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
01	Ecology: Basic principles, food chain, food webs and ecological pyramids, trophic structure gross production to total community, respiration ratio(p/r), gross production to total community, respiration, biochemical cycles, Liebig's law of limiting factors, ecological regulation, important ecosystems such as the seas, estuaries & sea shores, streams, rivers, lakes & ponds; calculations for NPP and GPP.	06
02	Environmental Pollution II: i. Air: Definition, Sources, classification, Effects: global, On human, plants and materials, Mitigation Measures for particulate and gaseous pollutants ii. Soil: Definition, Sources, Effect: global, on human, plants and materials, Mitigation measures: Remediation measures iii. Noise: Definition; Classification of air pollutants, Calculation of sound levels; Leq, Ln and other sound or noise properties; Effect,	04

	Mitigation	
03	Environmental PollutionII: i. Water: Definition;Classification of pollutants, Surface water quality,water quality in lakes,rivers and ground water, Effects of water pollution, Remediation of water pollution ii. Thermal: Definition, Sources, Effect on receiving Bodies, Mitigation Measures: Cooling ponds	04
04	Water Engineering : Quality and Quantity 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
05	Water Engineering – Basic treatment of technologies i. Sedimentation: factors affecting efficiency, design values of various parameters, tube settlers. ii. Coagulation and flocculation: mechanisms, common coagulations iii. Rapid mixing and flocculating devices, G and GT values, Jar test, coagulant aids- polyelectrolyte etc. iv. 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. v. 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
06	Advanced water Treatments i. Water softening: Basis, lime soda and Base Exchange processes, principle reactions, design considerations, sludge disposal. ii. Miscellaneous treatments: removal of iron and manganese, taste, odour, colour,dechlorination, Iron and Manganese removal, principles technology	04
07	Municipal solid waste management: i. Solid Waste: Sources, types, composition, physical and biological properties of solid wastes ,sources and types of hazardous and municipal waste ii. Solid waste generation and collection, storage, handling transportation, processing and disposal iii. Treatment and disposal methods: Separation and recycle; physic chemical and biological stabilization and thermal methods, land disposal, leachate and its control iv. Hazardous wastes:Definition, identification, effects, toxicity testing	08

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.
16. 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: PC-BTC606	Course:-Theory of Reinforced and Prestressed Concrete		
Prerequisites	PC-BTC403, PC-BTC451, PC-BTC502		
Period per week (each of 60 minutes)	Lecture (hrs)	03	
	Practical (hrs)	-	
	Tutorial (hrs)	01	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	03	100
	In semester Evaluation	---	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, Self Learning: 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. Self Learning: Design for bond by WSM	09
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.	08
4.	Prestressed Concrete: Basic principles of prestressed concrete, materials used and their properties, Self Learning: Methods and systems of pre stressing,	03
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, Self Learning :Principal tension in prestressed concrete members.	06
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

CODE:PC- BTC651	Course:- Geotechnical Engineering Lab – II		
Prerequisites	BS-BTC305, BS-BTC356, PC-BTC 306, PC-BTC501		
Period per week (each of 60 minutes)	Lecture	--	
	Laboratory	02	
	Tutorial	---	
Evaluation system		Hours	Marks
	In Semester Test	--	--
	End Semester Test*	--	--
	In Semester Evaluation	--	25
	TOTAL	---	25

Course Objectives:

1. To familiarize students with various soil properties needed for foundation design
2. To quantify engineering properties of soil

Course Outcomes:

Students will be able to

1. Apply the knowledge of mechanics to soil so as to measure and quantify various soil properties required for geotechnical structures such as foundations and retaining walls
2. Demonstrate their capability to prepare soil testing reports showing values of properties tested.
3. Draw a conclusion regarding soil type and engineering behaviour based on tests performed.

Assessment criteria for laboratory/Tutorial work. i.e. weightage for assessment shall be as follows:

- (i) Attendance = 20%,
- (ii) Journal = 40%,
- (iii) MCQ/Oral/Test = 40%.

List of Experiments: (Minimum 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

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. Relevant Indian Standard Specifications & Codes, BSI Publications, New Delhi.

CLASS: T.Y.B.Tech.(Civil)		Semester VI	
CODE:PC- BTC652	Course:-Hydraulic Engineering- II (Laboratory)		
Prerequisites	PC-BTC306, PC-BTC353, PC-BTC504,PC-BTC553		
	Practical	02	
		Hours	Marks
Evaluation system	In Semester Evaluation	--	25
	TOTAL	---	25

Course Objectives:

1. To describe the laminar flow and turbulent flow in pipes 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.

Course Outcomes:

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

1. Understand boundary layer formation along with the principle behind boundary layer separation.
2. Evaluate GVF and RVF in the formation of hydraulic jump in open channels.

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

Text 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. B.C.Pumnia.(2009); "Irrigation and Water Power Engineering", Standard Publishers. ISBN-13: 9788131807637. 964p

Reference Book:

1. S.K.Garg (2009); "Irrigation Engineering and Hydraulic Structures", Khanna Publishers. ISBN-13: 9788174090478. 1594p

CLASS :T.Y.B.Tech.(Civil)		Semester VI	
CODE: PC-BTC653	Course:-Transportation Engineering - II (Laboratory)		
Prerequisites	PC-BTC307, PC-BTC354, PC-BTC403,, PC-BTC505		
	Practical	02	
Evaluation system		Hours	Marks
	In Semester Evaluation	--	25
	TOTAL	---	25

Course Objectives:

1. To understand the Laboratory procedure for computing various properties pavement layer materials.

Course Outcomes:

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

1. Understand the suitability of aggregate to be use for construction of Different layers of Pavements
2. Understand the suitability of binding material to be use for construction of BM and BC layer of flexible Pavements

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

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. Guide lines for the Design of Flexible Pavements, IRC:37 -2001,IRC:37-2012,
5. Guide lines for the Design of Flexible Pavements for Low Volume Rural Roads, IRC: SP: 72-2007.
6. Concrete Roads: HMSO, Road Research Laboratory, London.

CLASS: T.Y.B.Tech.(Civil)		Semester VI	
CODE:PC- BTC654	Course:- Environmental Engineering – I(Laboratory)		
Prerequisites	BS-BT 106,BS-BTC156, BS-BT 206,BS-BTC256 PC-BTC-504		
	Practical	02	
		Hours	Marks
Evaluation system	In Semester Evaluation	--	25
	TOTAL	---	25

Course Objectives:

The students will learn to

1. To find various parameters of water
2. To analyse and interpret the usability of water for potable purposes
3. To find basic parameters related to solid waste
4. To analyse and interpret the treatment technologies to be used for waste reuse or disposal

Course Outcomes:

The course will enable the students to

1. Analyse and interpret the data related to water parameters.
2. Analyse and interpret the data related to solid waste.

Experiment No.	Details
	Experiments related to water treatment
1	Determination of Turbidity
2	Determination of Hardness
3	Determination of Alkalinity
4	Determination of Acidity
5	Determination of Solids
6	Determination of Chlorides
7	Determination of Optimum dose of alum (Jar Test)
8	Determination of Most Probable Number (MPN)
9	Determination of residual chlorine
	Experiments related to solid waste management
10	Determination of moisture content of Solid Waste Sample
11	Determination of pH of Solid Waste Sample
12	Determination of organic matter content of Solid Waste Sample
	Experiments related to Noise Levels
13	To find Ln, Leq and noise climate

Reports of experiment performed shall be submitted as part of practical work along with assignments related to experimental work. The marks will be allotted as follows

Recommended Books:-

- [1] Eaton, A. D., Clesceri, L. S., Greenberg, A. E., Franson, M. A. H., American Public Health Association., American Water Works Association., & Water Environment Federation.(2000). *Standard methods for the examination of water and wastewater*. Washington, DC: American Public Health Association.
- [2] Relevant Indian standards

Value Added Courses

SEMESTER-V	CLASS: TY Sem. VI (Civil)		
CODE: VA-BTC626 Open Electives: (Credit/Audit course)	COURSE: Geographical Information Systems (GIS and Its Applications)		
Period per week (Each of 60 minutes)	Lecture	03	
	Laboratory	--	
	Tutorial	-	
Scheme of evaluation		Duration (Hrs)	Marks
	In Semester Tests	01	20 X 02
	End Semester Exam*	03	100
	In semester Scheme of evaluation	--	-
	Total		100

*60% weightage for end semester examination

With the rapid development of industry and information technology, users / researchers/ in all fields begin to discuss some new ideas connected with Geographic Information Systems (GIS). This course will provide a valuable opportunity for the students of all the fields to learn the theories and technologies in Geoinformatics, their applications to their related fields.

Course Objectives:

The students will learn:

1. About various softwares and their utility for geographical information systems (GIS), Digital elevation modeling, etc.
2. Demonstrate and use state-of-the-art computer softwares in conjunction with the fundamentals of civil and site design.

Course Outcome:

At the end of this course he students will be able to

1. Demonstrate an appropriate mastery of fundamental knowledge and software of GIS, DEM, and other technological processes inherent to their specific field of study.
2. Apply fundamental knowledge along with GIS technology and skills to conduct small projects.

Course Content

Module No	Topics	No. of Lectures
1	Introduction to GIS: Definition, sources of data, types of data, concept of space and time in GIS, spatial information theory, history of GIS, elements of GIS, objectives of GIS, hardware and software requirements of GIS, application of GIS	4
2	Data models of spatial information: Layers and coverage, conceptual models of spatial information,	4

	representation of spatial data models in computer: raster and vector models, comparative overview between raster and vector models	
3	Data models of non-spatial information: Database management systems, hierarchical structure, network structure, relational structure	4
4	Digitizing, Editing and Structuring of map data: Digitizing: manual, semi-automatic and automatic, editing: error detection and correction, tolerances, topology creation, attribute map generation	4
5	Digital Elevation Model: Need of DEM, Various structures of DEM: line, TIN, grid.	4
6	Integration of GIS, GPS & RS: Integrated systems, its advantages, development of integrated systems.	4
7	Applications: Forest resource management, agriculture and soil management, water resource management, land use and land suitability, disaster management	8

Text Books:-

1. Geographic Information Systems and Science, Second Edition 2005: Longley, Paul A., Michael F. Goodchild, David J. Maguire, David W. Rhind, John Wiley & Sons, New York.
2. Modeling Our World: The ESRI Guide to Geodatabase Design: Zeiler, M. 1999. ESRI Press, Redlands, California
3. GIS, Spatial Analysis and Modeling: Maguire, D., M. Batty, and M. Goodchild. 2005, ESRI Press.
4. Introduction to geographic Information Systems: Kang-tsung Chang, Tata McGraw Hill.
5. Advanced Surveying (Total Station, GIS and Remote Sensing) First Edition 2007: SatheshGopi, R. Sathikumar, N. Madhu,

Class:- UG	Choice based Open Elective (Interdisciplinary)		
	Class: TY Civil Sem. VI		
Course Code: VA-BTC627	Analysis of Offshore Structures	Credits: 03	
Period per week (each of 60 minutes) (Credit/Audit course)	Lecture (hrs)	03	
	Practical (hrs)	-	
	Tutorial (hrs)	-	
Scheme of Evaluation		Hours	Marks
	In Semester	01	20 X 02
	End Semester*	04	100
	In semester Evaluation	---	-
	TOTAL	---	100

*60% Weightage for end semester

Course Objectives:

1. The objective of this course are to understand wave and ocean structure interaction under various types of Hydrodynamic and aerodynamic loading.

Course Outcomes:

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

1. Wave generation process
2. Design aspects of ocean and coastal structure.
3. Short and long term statistics of wind, wave
4. Different types of offshore structures
5. Codes of Practices for design of ocean structures.

Course Content

- Wave Mechanics: Wave generation process, small and finite amplitude wave theories.
- Types of offshore structures
- Wave loads regular and random, loads due to wind, tides and currents. Operational environment.
- Wind forces: Wave forces on vertical, inclined cylinders, structures – current forces and use of Morison equation.
- Short and long term statistics of wind;
- Static and dynamic analysis of fixed structures.
- Codes of Practices (latest versions) such as API R-2A, bureau Veritas

Reference Books:-

1. Brebbia C.A. and Walker (1978): Dynamic Analysis of offshore structures", Newness butterworth, London, 1978.
2. Sarpakaya T. and Isaacson M.(1981): Mechanics of Wave Forces on Offshore Structures", Van Nostrand Rainhold, NewYork, 1981.
3. Hallam M.G., Heaf N.J. and Wootton, L.R. (1978): "Dynamics of Marine Structures", CIRIA Publications, Underwater Engg. Group, London, 1978.
4. Graff W.J. (1981): "Introduction to Offshore Structures", Gulf Publishing Co., Houston, Texas, 1981.
5. Clough R.W. and Penzien J. (1992): "Dynamics of Structures", IInd Edition, McGraw hill, 1992.
6. Simiu E. and Scanlan R.H. (1978): wind effects on Structures", Wiley, New York, 1978.
7. Codes of Practices (latest versions) such as API R-2A, bureau Veritas etc.

SEMESTER-VI	CLASS: TY Civil Sem. VI		
CODE: VA-BTC628	COURSE: Finite Element Analysis		
Pre-requisites	PC-BTC402, PC-BTC502		
Period per week (Each of 60 minutes) (Credit/Audit course)	Lecture	03	
	Laboratory	--	
	Tutorial	-	
Scheme of evaluation		Duration (Hrs)	Marks
	In Semester Tests	01	20 X 02
	End Semester Exam*	03	100
	Termwork	--	-
	Seminar	--	--
	Total		

*60% weightage for end semester exam

Course Objectives:

- To understand mathematical modelling and numerical formulation of engineering problems
- To learn about concepts of elements and their properties
- To understand finite element methods and its application for solution of structural mechanics problems.
- To understand finite element methods and its application for solution of non-linear and dynamics problems.

Course Outcomes:

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

- Formulate the numerical models for engineering problems.
- Use appropriate element for solution of problem by finite element modelling.
- Solve non-linear and dynamics problems using finite element approach

Course content:

Sr.No.	Description	No. of Lectures
1	Introduction: Mathematical Modelling of Engineering Problems, Types of governing equations, Solution methodologies, numerical modelling, approximate method of analysis – method of point collocation, method of collocation by sub region, method of least squares, Galerkin's method, Rayleigh-Ritz method.	03
2	Finite Element Method: General Steps in FEM, Direct approach, variational approach, energy approach and weighted residual approach	06
3	Finite Elements and Interpolation Functions: Interpolation functions, one two and three dimensional elements – linear, quadratic, Cubic and Lagrangian Interpolation function, Isoparametric elements, Serendipity elements	06
4	One Dimensional Finite Elements: Linear spring, Truss element, Space truss, Beam Element. Application to analysis of beams, trusses, plane frames and grids	06
5	Two Dimensional Finite Elements: Two dimensional stress analysis, CST element for plane stress and plane strain, triangular elements for axi-symmetric analysis, rectangular	05

	elements, isoparametric formulation	
6	Introduction to Non-Linear Analysis: Geometric Non-Linearity-Geometric Stiffness of an Axial Element.Stability of Bar- Spring System. General Formulation of Geometrically Non Linear Problem. Geometric Stiffness of Beam-Column and Triangular Elements. Non-Linear Material Behavior.Non-Linear Spring- Elasto Plastic Analysis by FEM- ElastoPlasticAnalysis of a truss- Two Dimensional Element Formulations- GeneralFormulation of a physically Non-Linear Problem.	05
7	Introduction to Dynamic Analysis by FEM: Formulation of Inertial Properties- Lumped Mass vs Consistent MassMatrices –Condensation and Assembly of Mass Matrices- Formulationof Damping Properties- Free Vibration, Steady – State and TransientResponse Analysis for Simple Problems.	05

Text Books:-

1. Rajshekar S. (2008), “Finite Element Analysis”, Wheeler publishing, ISBN 8121923149, 630 pages
2. Krishnamoorthy C.S, (1994), “Finite Element Analysis”, Tata McGraw Hill, ISBN 0074622102, 710pages
3. William B. Bickford, (1990),”First Course in The Finite Element Method”, ISBN 0256079730, 649 pages

Reference Books:-

1. O. C. Zienkiewicz,K. Morgan (2000), “Finite Elements and Approximation”, Dover publications, ISBN 0486453014, 352 Pages
2. J.N. Reddy, (2008), “Non linear Finite Element Analysis”, Oxford University Press, ISBN 0195692039,
3. Cook R.D., Malkus D.S. and Plesha,(2001), “Concepts and Applications of Finite Element Analysis”, John Wiley & Sons (Asia) PvtLtd.ISBN0471356050, 736 pages.
4. Weaver W and Johnston P.R., “Finite Element for Structural Analysis”, Prentice Hall

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

SEMESTER-VI	CLASS: TY Civil Sem. VI		
CODE: VA-BTC629	COURSE: Photogrammetry & GPS		
Period per week (Each of 60 minutes) (Credit/Audit course)	Lecture	03	
	Laboratory	--	
	Tutorial	-	
Scheme of evaluation		Duration (Hrs)	Marks
	In Semester Tests	01	20 X 02
	End Semester Exam*	03	100
	Termwork	--	-
	Seminar	--	--
	Total		100

SEMESTER-VI	CLASS: TY Civil Sem. VI		
CODE: MC-BT03	COURSE: Environmental Studies		
Period per week (Each of 60 minutes) (Mandatory/Credit/Audit course)	Lecture	02/Week	
	Laboratory	--	
	Tutorial	-	
Scheme of evaluation		Duration (Hrs)	Marks
	In Semester Tests	01	20 X 02
	End Semester Exam*	03	100
	Termwork	--	-
	Seminar	--	--
	Total		100

Course Objective:

1. Creating the awareness about environmental problems
2. Imparting basic knowledge about the environment and its allied problems.
3. Creating awareness about environment protection and environment improvement.
4. Acquiring skills to help the concerned individuals in identifying and solving environmental problems

Course Outcomes:

The student will be able to

1. Define and explain basic concepts of sustainability and ecology
2. Analyze impact and suggest control measures related to Environmental Pollution
3. Create awareness about mitigation and rules related to environmental causes

Course Content

Module No	Details	Hrs
01	Introduction to Environmental Studies and sustainability: History of Environmental Studies: Aqueducts of Greece; Harappa Civilization Air Pollution Episodes: Meuse Valley; Donora Pennsylvania; London smog; Bhopal Gas Tragedy.	02
02	Ecology and Sustainability: i. Ecology: Definitions: Ecosystem; Ecology; Biome; Biodiversity; Productivity; Respiration, Concept of primary and secondary productivity ii. Concept and Definition of Sustainable Development.	05

	iii. Social, Economic and Environmental aspects of sustainable development. iv. Control measures: 3R (Reuse, Recovery, Recycle), v. Sustainable Structures (Green building)	
03	Environmental Pollution: i. Air: Definition, Sources, classification, Effects: global, On human, plants and materials, Mitigation Measures for particulate and gaseous pollutants ii. Soil: Definition, Sources, Effect: Global, on human, plants and materials, Mitigation measures: Remediation measures iii. Noise: Definition; Classification of air pollutants; Effect, Mitigation iv. Water: Definition; Classification of pollutants, Surface water quality, water quality in lakes, rivers and ground water, Effects of water pollution, Remediation of water pollution v. Thermal: Definition, Sources, Effect on receiving Bodies, Mitigation Measures: Cooling ponds	09
04	Treatment of Water and Wastewater in short i. Flowsheet to treat Surface and Ground Water treatment; Function of units. ii. Flowsheet of wastewater treatment; function of units	02
05	Acts and Laws related to environment i. Water Act, 1974 ii. Air Act 1981 iii. EPA, 1986 iv. Hazardous Wastes (Management and Handling) Rules, 1989	05

Text Books

1. Gilbert Masters and Wendell Ella, Introduction to Environmental Engineering and Science, Pearson Edition:2013

Reference Books

1. Raman Siva Kumar Introduction to Environmental Science and Engineering Mc Graw Hill Second Edition:2015
2. **Mackenzie Davis and David Cornwell Introduction to Environmental Engineering, 5e publishing, Indian Edition: 2014**
3. **V.M. Domkundwar, Environmental Engineering; Dhanpat Rai and Co. Publishing Edition:2014**
4. Benny Joseph, Environmental Studies by Benny Joseph, Tata McGraw Hill.
5. R. Rajagopalan, Environmental Studies by R. Rajagopalan, Oxford University Press.
6. Anandita Basak Environmental Studies by. Anandita Basak, Pearson Education.