Course Structure
for Degree Programme
B. Tech. in Civil Engineering

with effect from AY 2018-19

Dr. Babasaheb Ambedkar Technological University Lonere

402 103 , Dist- Raigad, Maharashtra, INDIA

Program Objectives

Goal of the Civil engineering with a specialization in Structural Engineering (SE) at Dr. Babasaheb Ambedkar technological University, Lonere (BATU) is to provide students with preparation to become worthy of professional careers in the field and to be motivated for lifelong learning. All prescribed courses have definite objectives and outcomes. Program objectives are expected qualities of engineers as under:

a) **Preparation:** To prepare students to excel in various educational programmes or to succeed in industry / technical profession through further education/training;

b) **Core Competence:** To provide students with a solid foundation in mathematical, scientific fundamentals required to solve Structural problems;

c) **Breadth:** To train students with a breadth of scientific knowledge to comprehend, analyze, design & create novel products and solutions for real life problems;

d) **Professionalism:** To inculcate in students professional/ethical attitude, effective team work skills, multidisciplinary approach and to relate engineering issues to a broader context;

e) **Learning Environment:** To provide students with academic environment of excellence, leadership, ethical guidelines and life-long learning needed for a long / productive career.

In addition to above DBATU graduate is expected to be

1. Taking pride in their profession and have commitment to highest standards of ethical practices and related technical disciplines;
2. Able to design structural system that is safe, economical and efficient;
3. Capable of using modern tools efficiently in all aspects of professional practices;
4. Dealing successfully with real life civil engineering problems and achieve practical solutions based on a sound science and engineering knowledge;
5. Shall be engage in continuous research, development and exchange of knowledge for professional development;
6. Be honest in their control and performing their duties and promote effective use of resources through open, honest and impartial services to the public;
7. Act in such a manner which will uphold the honour, integrity, or dignity of the engineering profession, and avoid knowingly engaging in business or professional practices of a fraudulent, dishonest or unethical nature;
8. Recognize that the lives, safety, health and welfare of the general public are dependent upon engineering, decision and practices;
9. Continue their professional development throughout their careers and provide opportunities for the professional development;

Course Structure Evaluation Scheme

Sr. No	Particulars of Evaluation	MSE	CA		ESE		Total
			CA_1	CA_2	Internal	External	
01	Theory courses	20	10	10	---	60	100
02	Audit courses	---	50	50	---	---	100
03	Studio Courses (Product Design Engg)	---	30	30	40	---	100
03	Laboratory (Practical) courses	---	15	15	10	10	50
04	Seminar / Min Project/ Project Stage 1	---	30		20	---	50
05	Field Training	---	---	---	50	---	50
06	Project Stage II	---	---	---	50	50	100

Semester- V

Sr. No	Subject Code	Subject	Contact Hours			Credit
			L	T	P	
		Theory				
01	BTCVC 501	Design of Steel Structures	2	2	-	4
02	BTCVC 502	Structural Mechanics-II	2	1	-	3
03	BTCVC 503	Soil Mechanics	3	1	✓	4
04	BTCVC 504	Environmental Engineering	2	-	✓	2
05	BTCVC 505	Transportation Engineering	2	-	✓	2
06	CV E2	**Elective II**	3	-	-	3
07	BTHM3507	Essence of Indian Traditional Knowledge	1	-	-	AU
		Practical / Drawing and/or Design				
08	BTCVL508	Soil Mechanics Laboratory	-	-	2	1
09	BTCVL509	Environmental Engineering Laboratory	-	-	2	1
10	BTCVL510	Transportation Engineering Laboratory	-	-	2	1
11	BTCVL511	Seminar on Topic of Field Visit to works related to Building Services	-	-	1	AU
		Sub-Total	**15**	**4**	**7**	
		Total	**26**			**21**
	BTCVE506A BTCVE506B BTCVE506C BTCVE506D	**Elective II** Materials, Testing & Evaluation Computer Aided Drawing Development Engineering Business Communication & Presentation Skills	3	-		3

BTCVC 501 Design of Steel Structures

Teaching Scheme: (2 Lectures + 2 Tutorial) hours/week

Course Contents

Module 1: Introduction and Connections **(8 Lectures)**

Introduction, advantages & disadvantages of steel structures, permissible stresses, factor of safety, methods of design, types of connections, various types of standard rolled sections, types of loads and load combinations

Types: Riveted, Bolted, Welded; Analysis of axially & eccentrically loaded connections (subjected to bending & torsion), Permissible

Stresses, Design of connections, failure of joints

Module 2: Axially Loaded Members **(6 Lectures)**

Tension members: Common sections, net effective area, load capacity, connection using weld / bolts, design of tension splice

Compression members: Common sections used, effective length and slenderness ratio, permissible stresses, load carrying capacity, connection using weld / bolt

Module 3: Beams **(6 Lectures)**

Laterally supported & unsupported beams, design of simple beams, built up beams using flange plates, curtailment of flange plates, web buckling & web crippling, secondary and main beam arrangement, beam to beam connections

Module 4: Industrial Roofing **(6 Lectures)**

Gantry girder: Forces acting on a gantry girder, commonly used sections, design of gantry girder as laterally unsupported beam, connection details

Roof trusses: Components of an industrial shed, types of trusses, load calculations and combinations, design of purlins, design of truss members, design of hinge & roller supports

Module 5: Columns and Column Bases **(8 Lectures)**

Simple and built up section, lacing, battening, column subjected to axial force and bending moment, column splices.

Column bases: Analysis and design of: Slab base, gusseted base and moment resisting bases, grillage foundation, design of anchor bolt

Module 6: (4 Lectures)

Introduction to: Plastic Analysis, Hinge Formation, Collapse Mechanism, Recent approaches in Steel Structure design based on Plastic Analysis Method and Limit State Approach, Introduction to Provisions in IS 800-2007

Note: Contents in Module 1 to part of 6 shall be taught with help of relevant text or reference books based on elastic design concept, IS 800: 1984. Use of IS 800: 1984 and 2007, IS 875 (All Parts), IS: Handbook No.1 for Steel Section and Steel Table is permitted for theory examination.

Text Books

- Duggal S. K., "Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Gambhir, "Fundamentals of Structural Steel Design", Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Negi L. S., "Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Chandra Ram, "Design of Steel Structures", Vol. I & Vol. II, Standard Book House, New Delhi
- Dayaratnam P., "Design of Steel Structures", Wheeler Publishing, New Delhi
- Subramanian N., "Steel Structures: Design and Practice" Oxford Univ. Press, Delhi
- Vazirani V.N. and Ratwani M.M., "Design and Analysis of Steel Structures", ISBN NO: 978-81-7409-295-3
- Sai Ram K. S., "Design of Steel Structures", Pearson Education, 2nd Edition

Reference Books

- Arya A. S. and Ajamani J.L., "Design of Steel Structures", Nemchand and Brothers, Roorkee
- Vazirani & Ratwani, "Design of Steel Structures", Standard Book House, New Delhi
- Duggal S. K., "Limit State Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Publications of Bureau of Indian Standards, New Delhi, IS 800:1984, 2007, IS 875 (Part I to V)
- Gaylord E.H. and Gaylord C.N., "Design of Steel Structures" McGraw Hill, New York
- Lothers J.E., "Design in Structural Steel" Vol.-I, Prentice Hall New Jersy
- Salmon and Johnson, "Steel Structures: Design and Behaviour", Harper and Row, New York
- Steel Designers Manual.

Course Outcomes: On completion of the course, the students will be able to:

CO1: Identify and compute the design loads and the stresses developed in the steel member.

CO2: Analyze and design the various connections and identify the potential failure modes.

CO3: Analyze and design various tension, compression and flexural members.

CO4: Understand provisions in relevant BIS Codes.

BTCVC 502 Structural Mechanics-II

Teaching Scheme: (2 Lectures + 1 Tutorial) hours/week

Course Contents

Application of All methods shall be restricted to beams, Frames and /or pin jointed frames or trusses of Degree of Indeterminacy up to three

Module 1: Analysis of trusses **(6 Lectures)**

Analysis of determinate and indeterminate pin jointed trusses by energy method, effects of settlement and pre-strains

Module 2: Moving Loads and Influence Lines **(6 Lectures)**

Introduction to moving loads, concept of equivalent UDL, absolute maximum bending moment and shear force, concept of influence lines, influence lines for reaction, shear force, bending and deflection of determinate beams, influence line diagram (ILD) for forces in determinate frames and trusses, analysis for different types of moving loads, single concentrated load, several concentrated loads, uniformly distributed load shorter and longer than span, application of Muller Breslau principle for determinate structures to construct ILD

Module 3: Cables, Suspension Bridges and Arches **(6 Lectures)**

Analysis of forces in cables, suspension bridges with three hinged and two hinged stiffening girders, theory of arches, Eddy's theorem, circular , parabolic and geometric arches, concept of radial shear force and axial thrust, analysis of three hinged and two hinged arches, effect of yielding of supports, rib shortening and temperature changes. ILD for 3 hinged arches and suspension bridges

Module 4: Analysis of Indeterminate Structures by direct Flexibility Method **(6 Lectures)**

Fundamental concepts of flexibility method of analysis, flexibility coefficients and their use in formulation of compatibility equations, application of above methods to propped cantilevers, fixed beams, continuous beams, simple pin jointed frames including effect of lack of members, rigid jointed frames.

Module 5: Analysis of Indeterminate Structures by direct Stiffness Method **(6 Lectures)**

Fundamental concepts of stiffness method of analysis, stiffness coefficients for prismatic members and their use for formulation of equilibrium equation, applications of the above methods to indeterminate beams and simple rigid jointed frames, rigid jointed frames with inclined member but having only one translational DoF in addition to rotational DoF's, including the effect of settlement of supports, pin jointed frames.

Module 6: Finite Element Method (Contents to conceptual level) **(6 Lectures)**

Introduction to analysis by discretization such as finite difference method, Finite element method: types of elements-1D, 2D, 3D, Plane Strain and Plane Stress Problem, isoperimetric and axisymmetric, convergence criteria, Pascal's triangle, direct stiffness method, principle of minimum potential energy. Shape functions, concept of local and global stiffness matrix

Text Books

- Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill
- Pandit G. S. and Gupta S. P., "Structural Analysis - a Matrix Approach", Tata McGraw Hill, N.Delhi, 1986
- Chandrupatla T. R., Belegundu A. D., "Introduction to Finite Elements in Engineering, Prentice Hall, N. Delhi, 1996
- Thadani B. N. and Desai J. P., "Structural Analysis"
- Punmia B.C., "Structural Analysis", Laxmi Publications

- Wang C.K., "Statically Indeterminate Structures", McGraw Hill
- Vazirani V.N., Ratwani M.M and Duggal S.K., "Analysis of Structures - Vol. II" Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-205-6
- Sadhu Singh, "Theory and Solved Problems in Adv. Strength of Materials", Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-212-7

Reference Books

- Norris C. H. and Wilbur J. B., "Elementary Structural Analysis", McGraw Hill
- Beaufait, F. W., "Basic Concepts of Structural Analysis", Prentice Hall, N.J.
- Kinney J. S., "Indeterminate Structural Analysis", Oxford and IBH
- Krishnamurthy, C.S., "Finite Element Analysis – Theory and Programing", Tata McGraw Hill, N. Delhi 1994
- Hibbler R. C., "Structural Analysis", Pearson Publications
- Kanchi M. B., "Matrix Methods of Structural Analysis", Wiley Eastern Ltd., N. Delhi
- Wang C. K., "Matrix Methods of Structural Analysis", International Text-book, Scranton, Pennsylvania, 1970
- Gere J.M., Weaver W., "Analysis of Framed Structures", D. Van Nostrand Company, Inc., Princeton, N. Jersey

Course Outcomes: On completion of the course, the students will be able to:

CO1: Have a basic understanding of matrix method of analysis and will be able to analyze the determinant structure.

CO2: Have a basic understanding of the principles and concepts related to finite difference and finite element methods

CO3: Have a basic understanding of concept of influence line

BTCVC 503 Soil Mechanics

Teaching Scheme: (3 Lectures + 1 Tutorial) hours/week

Course Contents

Module 1: Introduction **(2 Lectures)**

Definition of soil and soil engineering, Application areas of soil mechanics, Three Phase system, Soil moisture, Soil minerals Soil structure, Terzaghi's effective stress concept, Effective and neutral pressure

Module 2: Soil Consistency **(10 Lectures)**

Index properties of soil: Different unit weights of soil, and their determination, unit weight of solids, unit weights of soil mass, method for determination of field density viz. sand replacement and core cutter, Specific Gravity determination methods void ratio and porosity, degree of saturation, Inter relation between weight volume state, density indexes, Atterberg's limits and their significance, Soil Classification: Soil classification based on particle size and consistency, I.S. classification system

Module 3: Flow of Water Through Soil: Permeability **(6 Lectures)**

Head, gradient and potential, Darcy's law, Factors affecting permeability, Field and Laboratory methods of determining permeability, Seepage pressure, quick sand condition, Derivation of Laplace equation, Flow net: characteristics& application, construction of flow net, piping phenomenon, Permeability through stratified soil, Discharge and seepage velocity.

Module 4: Shear Strength **(8 Lectures)**

Concept of shear, Coulomb's theory and failure envelope, Principle stress, stress analysis (Total stress approach and effective stress approach), representation of stresses on Mohr's circle for different types of soil such as cohesive and cohesionless, saturated and partly saturated soil etc, Application of shear stress parameters in the field, Different types of shear tests: Unconsolidated undrained, Consolidated undrained and consolidated drained choice of the type of test, box shear test, triaxial compression test with pore pressure and volume change measurement, Unconfined compression test, vane shear test

Module 5: Compressibility of Soils (8 Lectures)

Compaction Theory of compaction, factors influencing compaction, compacted density, Laboratory Standard and modified

compaction test, Method and measurement of field compaction, Field compaction control

Consolidation

Compressibility: Definition, compressibility of laterally confined soil, compression of sand and clay, e-p and e-log p curve, compression index. Consolidation: Terzaghi's theory of one dimensional consolidation, consolidation test, determination of coefficient of consolidation, degree of consolidation, relevance of one dimensional consolidation to field condition, time factor

Module 6: Earth Pressure Theories **(5 Lectures)**

Earth pressure at rest, active and passive conditions, Elementary idea about Rankin's and Coulomb's earth pressure. Graphical methods for active earth pressure.

Text Books

- Kasamalkar B. J., "Geotechnical Engineering", Pune Vidyarthi Griha Prakashan Pune
- Murthy V.N.S., "Soil Mechanics & Foundation Engineering", U.B.S. Pub. And Distri. N. Delhi Punmia B.S., "Soil Mechanics & Foundation Engineering", Laxmi Publications
- Arora K. R., "Soil Mechanics" Standard Publishers, N. Delhi
- Gopal R Rao "Basic Soil Mechanics "

Reference Books

- Alam Singh, "Text book of soil mechanics in theory and practice", Asian Pub. House, Mumbai
- Taylor D.W., "Fundamentals of Soil mechanics"
- Terzaghi and Peak "Soil mechanics" John Willey and Sons, New-York
- Scott R. F., "Principal of soil mechanics"
- Lambe T.W, "Soil Testing" by Willey Eastern Ltd., New Delhi

Course Outcomes: On completion of the course, the students will be able to:

CO1: Understand different soil properties and behavior

CO2: Understand stresses in soil and permeability and seepage aspects.

CO3: Develop ability to take up soil design of various foundations.

BTCVC 504 Environmental Engineering

Teaching Scheme: (2 Lectures) hours/week

Course Contents

Module 1: Introduction **(4 Lectures)**

Environment and its components, importance of water, role of environmental engineer, sources of water, water demand: Design flow, design period, design population, factors affecting water consumption, variation in demand, and design capacity for water supply components, quality of water: Physical, chemical, biological characteristics, Indian standard for quality of potable water

Module 2: Treatment of Water **(6 Lectures)**

Conveyance of raw water: Canals and pipelines, hydraulics of conduits, laying and jointing of pipelines, testing of pipe lines, designing of rising main, type of valves, types of pumps, intake structure, types of intake structures, necessity of water treatment processes

Types of Treatments:

Aeration: Necessity, methods, removal of taste and odour, design of aeration fountain

Sedimentation: Suspended Solids, settling velocity, types of sedimentation tanks, surface loading, detention time, inlet and outlet arrangements

Coagulation: Necessity, coagulant dosage, choice of coagulants, optimum pH

Rapid Mixing: Necessity, gravitational, mechanical, pneumatic devices

Slow Mixing and Flocculation: Design of flocculation chamber, mean velocity gradient, design of clari-flocculator, plate settler

and tube settler

Filtration: Theory of filtration, filter materials, types of filters, components, working and cleaning of filters

Disinfection: Theory of disinfection, factors affecting, efficiency of disinfection, types of disinfectants, break point chlorination, bleaching powder estimation

Water softening methods: Lime-soda, ion exchange method, demineralization

Module 3: System of Water Supply **(4 Lectures)**

Continuous and intermittent system, type of distribution systems, layouts, methods of supply: gravity, pumping and combination, hydraulic analysis of distribution system

Module 4: Treatment of Waste Water **(6 Lectures)**

Sources of wastewater flows, components of wastewater flows, wastewater constituents, characteristic of municipal waste water, necessity of treatment of waste water, sewerage systems, concept of sewage, sullage, storm water, introduction of preliminary treatment, primary treatment, secondary treatment, tertiary or advanced treatment fundamentals of anaerobic treatment, sewage and industrial waste of common origin, types, collection and recycling and reuse of waste

Module 5: Treatment of Solid Waste **(3 Lectures)**

Types, sources, characteristics, ill-effects of improper solid waste management, collection, processing techniques, methods of treatment of solid waste-composting, incineration, pyrolysis and sanitary land filling. biodegradable, non-degradable segregation of solid waste, concept of hazardous waste management, e-waste disposal

Module 6: Air Pollution **(3 Lectures)**

Definition, sources of air pollution, types air pollutants, atmospheric stability, mixing heights, plume types and meteorological parameters, effects of air pollution, control measures of air pollution

Text Books

- Rao and Rao,"Air Pollution ", Tata McGraw Hill Publications, New Delhi, 1990
- Garg S. K., "Water Supply Engineering", Khanna Publishers, New Delhi
- Birdi J. S. and Birdi G. S., "Water Supply & Sanitary Engineering", Dhanpat Rai Pub. Company, 8th edition, New Delhi

Reference Books

- Peavy and Rowe, "Environmental Engineering", McGraw Hill Publications
- Stern, "Environmental Engineering", Vol. I to IV, McGraw Hill Publications
- Sharma and Kaur, "Environmental Chemistry", Goyal Publisher
- Government Of India Publication, "Water Supply and Treatment Manual"
- Fair and Geyr, "Environmental Engineering", McGraw Hill Publications
- Steel and McGhee, "Environmental Engineering", McGraw Hill Publications
- Viessman& Hammer, "Water Supply & Pollution Control", Harper Collins Collage Publishers
- Publications by reouted organizations such as WHO, NEERI, MERI, MPCB, CWPRS, etc.

Course Outcomes: On completion of the course, the students will be able to:

CO1: Apply the water treatment concept and methods.

CO2: Prepare basic process designs of water and wastewater treatment plants.

CO3: Apply the wastewater treatment concept and methods.

CO4: Apply the solid waste management concepts.

BTCVC 505 Transportation Engineering

Teaching Scheme: (2 Lectures) hours/week

Course Contents

Module 1: Introduction **(4 Lectures)**

Importance of various modes of transportation, Highway Engineering, Road Classification, Developments in Road Construction, Highway Planning, Alignment and Surveys,

Module 2: **(6 Lectures)**

Geometric Design- Cross section elements, Sight distances, Horizontal alignment, Vertical alignment, Intersections, Construction of Pavements, Construction and Maintenance of Drainage, Road Arboriculture

Module 3: **(4 Lectures)**

Highway Materials: Soil – relevant properties, Various tests, Aggregates – strength, hardness, toughness, soundness, durability, shape, specific gravity, water absorption, Bituminous materials – Bitumen, Tar, and Asphalt – various properties, Design of Bituminous paving mixes-Marshall stability test

Module 4: Traffic Engineering **(6 Lectures)**

Traffic Characteristics, Speed, Journey Time and Delays, Vehicle Volume Counts, Origin and Destination Studies, Analysis and Interpretation of Survey Data, Traffic Operations, Design of Signals and Rotary intersections, Parking Space Design, Highway Lighting, Planning and Administration, Road Markings, Signs

Road Accidents and Safety: Classification, Causes, Mitigation and Control Measures, Aspects of Safety in Usage of Roads, Type and Design of anti-crash barriers, Introduction to Intelligent Transport Systems (ITS).

Module 5: Pavement Design **(6 Lectures)**

Basic Principles, Methods for different Types of Pavements, Design of flexible pavement using IRC: 37- 2012, Design of rigid pavement using IRC: 58-2011

Module 6: Other modes of Transport **(4 Lectures)**

Introduction to Railways, Airways, Waterways, Pipeline Transportation, Classification, Requirements, Comparative Studies

Text Books

- Khanna and Justo, “Highway Engineering”, Nemchand& Bros., Roorkee
- Khanna S.K., “Highway Engineering”,
- Arora N. L., “Transportation Engineering”
- Bindra and Arora, “Highway Engineering”, Standard Publishers
- Vazirani V.N. and Chandola S.P., “Transportation Engineering”, VolI Khanna Publishers, N. Delhi
- Vazirani V.N. and Chandola S.P., “Transportation Engineering”, Vol II Khanna Publishers, N. Delhi ISBN NO: N/A
- Shahani P.B, “Road Techniques” Khanna Publishers, N. Delhi ISBN NO: 978-81-7409-197-1 PRICE 149/-
- Kadiyali L.R, “Traffic Engineering and Transport Planning”, Khanna Publishers, N. Delhi, ISBN NO:978-81-7409-220-X

Reference Books

- Garber, N.J. and Hoel, L.A., “Traffic and Highway Engineering”, West Publishing Company, New York
- Jones, J.H., “Geometric Design of Modern Highways’, E & FN SPON Ltd., London.
- Khistry, C.J., “Transportation Engineering – An Introduction’, Prentice Hall of India Ltd.
- Agor R., “Surface Transportation (Railways and Highways)”,Khanna Publishers, N. Delhi ISBN NO: 978-81-7409-273-1

Course Outcomes: On completion of the course, the students will be able to:

Comprehend various types of transportation systems and their history of the development Comprehend to various types of pavements

Design the pavements by considering various aspects associated with traffic safety measures.

BTCVL 508 Soil Mechanics Laboratory

Practical: 2 hours / week

Term work shall consist of performance of at least seven experiments from the following mentioned list of experiments.

1) Specific gravity determination of coarse and fine grained soil
2) Particle size distribution-Mechanical sieve analysis, wet sieve analysis
3) Determination of Attergerg's consistency limit
4) Permeability- Determination of coefficient of permeability
5) Field density determination
6) Direct shear box test
7) Procter compaction test
8) Tri-axial test
9) Unconfined compression test
10) One dimensional consolidation test

Course Outcomes: On completion of the course, the students will able to:

CO1: Determine different engineering properties of soil.

CO2: Identify and classify soils based on standard geotechnical engineering practices.

CO3: Perform Laboratory oratory compaction and in-place density tests.

CO4: Perform and interpret direct shear tests and estimate shear strength parameters.

BTCVL 509 Environmental Engineering Laboratory

Practical: 2 hours / Week

Practical Work consists of performance of at least six experiments from the List (A) below:

(A) Determination of:

1) pH and Alkalinity
2) Hardness
3) Chlorides
4) Chlorine demand and residual chlorine
5) Turbidity and optimum dose of alum
6) MPN
7) Sulphates
8) Fluorides and Iron
9) Total Solids, Dissolved Solids & Suspended Solids
10) Sludge Volume Index (SVI)
11) Dissolved Oxygen
12) BOD and COD

B) Site Visit to Water Treatment Plant:

A report based on the visit to water treatment plant shall be submitted.

Course Outcomes: On completion of the course, the students will be able to:

CO1: Quantify the pollutant concentration in water, wastewater and ambient air.

CO2: Recommend the degree of treatment required for the water and wastewater.

CO3: Analyze the survival conditions for the microorganism and its growth rate.

BTCVL 510 Transportation Engineering Laboratory

Practical: 2 hours / week

Practical Work consists of all experiments from (a) and at least six performances among the list (b) below and detailed reporting in form of journal and Project Reports. Practical examination shall be based on above

a) Tests on Aggregates

1) Shape Test
2) Specific Gravity and Water Absorption Test
3) Stripping Value Test
4) Soundness Test
5) CBR Test on Soil and Aggregates

b) Test on Bituminous Materials

5) Penetration Test
6) Softening Point Test
7) Flash and Fire Point Test
8) Ductility Test
9) Viscosity Test
10) Specific Gravity Test
11) Demonstration of Marshall Test
12) Pavement design exercise based on flexible pavement consisting of bituminous concrete.
13) Visit to Road construction site for studying different construction equipment's.

Course Outcomes: On completion of the course, the students will be able to:

Perform tests on various road construction materials.

Perform CBR tests on local soils to determine subgrade properties needed for roadways.

BTCVL 511 Seminar on Topic of Field Visit to works related to Building Services

Student shall visit to ongoing construction sites in field to witness and collect necessary information from works of execution of building services such as electrification, plumbing, air-conditioning, acoustics, etc. It is desirable to collect basic information on components, tools and plants, construction equipment, safety precautions, etc. Intention of the work is to introduce the student to the chronological order of execution of works and generate data on vocabulary of terms in field.

BTCVE 506 A Materials, Testing & Evaluation

Course Objectives:

1. To provide an overview to the students about various types of civil engineering materials used in constructions along with their properties.
2. To enable students to know details of various tests to be performed on civil engineering materials to evaluate their quality to know their suitability for use in construction.

Teaching Scheme: (3 Lectures) hours / Week

Course Contents

Module1: **(8 Lectures)**

Basic Properties of Materials: importance of materials in civil engineering construction, types of materials such as ceramics, concrete, composites, optical /electronics materials, glass, metals, nano-materials ,polymers and plastics, wood and other materials. some basic properties of materials such as temperature, energy, specific heat, thermal conductivity, coefficient of thermal expansion ,mechanical properties of metals ,stress, strain modulus of elasticity, ,stress-strain behavior, elastic and plastic deformations, elastic properties of materials, tensile properties, ductility, resilience and toughness ,compressive, shear and torsional deformation, hardness. Variability

of material properties.

Module2: **(8 Lectures)**

Civil Engineering Materials: introduction to cement and concrete, uses of cement, strength of cement and concrete ,sand, coarse aggregates, mortar and grouts, masonry mortars, rendering, cementitious grouts, RCC, clay bricks ,calcium silicate bricks, concrete blocks., rubbles, steel , steel grades, mechanical properties of steel, different applications, floor and roofing tiles, slates, timber, strength of timber ,Engineered wood products, metals, glass for glazing, glass fibres, glass wool, bituminous materials, binder properties, binder mixtures, asphalt mixture.

Module3: **(4 Lectures)**

Composite Materials: RCC, FRC, steel/concrete composite bridge decks, fibre reinforced plastics structural insulated panels.

Module4: **(4 Lectures)**

Comparison of Different Materials, Introduction, comparison of strengths of various materials, comparison for environmental impact, health and safety.

Module 5: **(6 Lectures)**

New Techniques in Constructions—Introduction,3D printing, photo catalytic admixture, self-healing concrete, zero cement concrete ,hemp lime, wood-glass epoxy composites, bamboo.

Module 6: **(6 Lectures)**

Material Testing ,Machines And Equipment Requirements---Necessity of material testing, various testing methods, destructive tests, classification of destructive tests---static, impact and cyclic testing, non-destructive testing—its classification ,visual inspection, penetration test, magnetic detection, ultrasonic test, radiography test and spark test. Types of testing machines, UTM and CTM, force and displacement controlled machines, loading frames. Hardness testing machines, fracture tests.

Recommended Books:

- S.V. Deodhar. (1990),Civil Engineering Materials', Allied Publishers, N. Delhi.
- S.C Rangwala. (1983),Civil Engineering Materials', Dhanpat Rai and Sons, N. Delhi.

References:

- B.I.S., 1980, "National Building Code of India', ISI, New Delhi.

Course Outcomes: The required course for emphasis in development engineering will help students

1. To develop skill among students to construct strong and durable structures by applying knowledge of material science.
2. To make the students aware of quality assurance and control in their real life as a professional.

BTCVE 506 C Development Engineering

Course Objectives:

The main objectives of the course are:

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

Teaching Scheme: (3 Lectures) hours / Week

Course Contents

Module1: **(6 Lectures)**

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

Module2: **(6 Lectures)**

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;

Module3: **(6 Lectures)**

Town / City Planning: Town Planning- history of town planning 111 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 planning

Module4: **(6 Lectures)**

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.

Module5: **(6 Lectures)**

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.

Module6: **(6 Lectures)**

Development aspects: Urban and Rural: Planning and designing of a model town / city and using AutoCad and/ or GIS. 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.

Recommended Books:

- Chand, M. and Puri, U.K.(1983),'Regional Planning in India', Allied Publishers, N. Delhi.
- Kaiser, E. J ., et.al. (1995), 'Urban Land use Planning', (ed) Urbana, University of Illinois Press.
- Sundaram, K.V. 1985 'Geography & Planning', Concept Publishing Co., New Delhi.
- Ayyar, C.P.V. (1987), 'Town Planning in Early South India', Mittal Publications, Delhi.
- Reeder, L. Hoboken, NJ, 'Guide to green building rating systems', John Wiley &Sons, Inc., 2010.
- 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.
- Desai, V. (2005), 'Rural Development of India', Himalaya publishing house, Mumbai.
- Rau, S.K. (200 I), 'Global Search for Rural Development', NIRD, Hyderabad

References:

- Institute of Town Planners, India, Ministry of Urban Affairs & Employment, Government of India, New Delhi, UDPFI Guidelines, 1996.
- Miles R. Simon, 1970, 'Metropolitan Problems' Methuen Publications, Canada.
- B.I.S., 1980, "National Building Code of India', ISI, New Delhi.
- ANSI/ASHRAE/USGBC/IES Standard 189.1, Standard for the Design of High-Performance Green Buildings Except Low - Rise Residential Buildings
- ASHRAE Standard 90. 1, Energy Standard for Buildings Except Low-Rise Residential Buildings

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.

BTCVE 506 D Business Communication & Presentation Skills

Teaching Scheme: (3 Lectures) hours / Week

Course Contents

Module 1: Language for Technical Purpose and Presentation Tools

Technical vocabulary, Sentence structures, Computer Aids, Graphical presentations **(03 Lectures)**

Module 2: Formal Written Communication

Drafting Letters, e-Mails, Memos, Notices, Circulars, Schedules. **(03 Lectures)**

Module 3: Project Proposals and Reports

Abstract, Aims, Background & significance, Design & methods, writing a sample proposal, Project Report: Types of reports, Planning a report, Collection & organization of information, Structure & style, Proofreading etc. **(06 Lectures)**

Module 4: Leadership Skill and Team Building, Working.

Leadership Skills**:** Leadership quality and styles, Emotional intelligence, Diplomacy and Tact and effective communication, Case studies. Need of team, Effective teams, Group development **(06 Lectures)**

Module 5: Business Meetings

Understanding role of meetings, planning meetings, developing meeting agendas, scheduling meetings, Taking notes and publishing minutes **(06 Lectures)**

Module 6: Presentation Skills

Use of presentation tools, Presentation, nonverbal techniques, handling questions **(04 Lectures)**

References:

- S. Hariharan, et.al. Soft Skills; MJP Publishers, 2010.
- John Seely, Oxford Guide to Effective Writing and Speaking; Oxford University Press, 2009.
- Thomas N. Huckin and Leslie A. Olsen, Technical Writing and Professional Communication for Nonnative Speakers of English; Tata McGraw Hills, International Edition, 1991.
- Ann Masters & Harold R. W., Personal Development for Life & Work,10e,Cengage, Learning India Private Limited,2011.

Semester- VI

$:Students should register for the CVF 705 in Semester VI to undergo training during vacation after semester VI and appear at examination in Semester VII. Result shall appear in Grade-sheet of Semester VII

Sr. No.	Subject Code	Subject Title	Contact hours			Credit
			L	T	P	
01	BTCVC601	Design of Concrete Structures I	3	1	-	3
02	BTCVC602	Foundation Engineering	2	1	-	3
03	BTCVC603	Concrete Technology	2	-	✓	2
04	BTCVC604	Project Management	2	1	-	2
05	CVE3	**Elective III**	3	-	-	3
06	BTCVC606	Building Planning and Design	2	-	✓	2
Practical / Drawing and/or Design						
07	BTCVL607	Concrete Technology Laboratory	-	-	2	1
08	BTCVL608	Building Planning, Design and Drawing Laboratory	-	-	4	2
09	BTCVL609	Community Project (Mini Project)	-	-	2	1
10	BTCVL610	Seminar on Topic of Field Visit Road Construction	-	-	1	AU
11	BTCVL611	Industrial Training$	-	-	2	--
		Sub-Total	**14**	**3**	**11**	
		Total	**28**			**19**
Elective III						
	BTCVE605A BTCVE605B BTCVE605C BTCVE605D BTCVE605E	Waste Water Treatment Operations Research Geographic Data Analysis and Applications Advanced Engineering Geology Advanced Soil Mechanics				

BTCVC 601 Design of Concrete Structures - I

Teaching Scheme: (2 Lectures + 1 Tutorial) hours/week

Course Contents

Module 1: **(5 Lectures)**

Basic Aspects of Structural Design, Introduction to Design Philosophies, Stress Strain behaviour of Materials, Permissible stresses, Comparison of Different Philosophies, Estimation of Loads

Working Stress Method

Module 2: **(5 Lectures)**

Stress block parameters, Balanced, under reinforced and over reinforced section: Modes of failure, properties of singly and doubly reinforced rectangular section beams, Analysis and Design of Singly and Doubly Reinforced Beams

One Way and Two Way Slab: Behavior of slabs, types, support conditions, analysis and design with various conditions

Module 3: **(4 Lectures)**

Analysis and Design of Axially and Eccentrically Loaded Columns, Isolated Column Footings, Staircases, Design of dog-legged and open well stair case, effective span and load distribution

Limit State Method

Module 4: Introduction to Limit State Approach **(5 Lectures)**

Introduction to Limit State Approach, Types and Classification of Limit States, Characteristics Strength and Characteristics Load, Load Factor, Partial Safety Factors

Module 5: Limit State of Collapse (Flexure) **(7 Lectures)**

Limit State of Collapse (Flexure): Analysis and Design of Singly and Doubly Reinforced Rectangular Beam Sections, properties of Flanged (L and T) sections, Analysis and Design of Flanged Beams

Module 6: Limit States of Collapse (Shear and Bond) **(7 Lectures)**

Limit States of Collapse (Shear and Bond): Shear Failure, Types of Shear Reinforcement, Design of Shear Reinforcement, Bond – Types, Factors Affecting, Resistance, Check for Development Length, detailing of reinforcement

Text Books

- IS: 456-2000, IS: 456-1978, Bureau of Indian Standards, New Delhi
- Karve and Shah, "Limit State Theory & Design", Structures Publications, Pune
- Jain A.K., "Reinforced Concrete Design (Limit State)", Nemchand Brothers, Roorkee
- Sinha and Roy, "Fundamentals of Reinforced"
- Sinha S.N., "Reinforced Concrete Design, Vol. I, II", Tata Mc-Graw Hill
- Varghese P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi
- Mehra H. and V.N. Vazirani, "Limit State Design of Reinforced Concrete Structures", Khanna Publishers, N. Delhi, ISBN No: 978-81-7409-162-9
- Vazirani V.N. and Ratwani M.M., "Design of Reinforced Concrete Structures", Khanna Publishers, N. Delhi, ISBN No: 978-81-7409-232-8

Reference Books

- Punmia B.C., "Reinforced Concrete Design, Vol. I, II", Laxmi Publications
- Relevant Publications by Bureau of Indian Standards, New Delhi

Course Outcomes: On completion of the course, the students will be able to:

Comprehend to the various design philosophies used for design of reinforced concrete.

Analyze and design the reinforced concrete slab using limit state and working state method.

Analyze and design the reinforced concrete beam using limit state and working state method.

Analyze and design the reinforced concrete column using limit state and working state method.

BTCVC 602 Foundation Engineering

Teaching Scheme: (3 Lectures + 1 Tutorial) hours/week

Course Contents

Module 1: **(6 Lectures)**

Introduction, General requirements to be satisfied for satisfactory performance of foundations, Soil exploration: Necessity, Planning, Exploration Methods, Soil Sampling Disturbed and undisturbed, Rock Drilling and Sampling, Core Barrels, Core Boxes, Core Recovery, Field Tests for Bearing Capacity evaluation, Test Procedure & Limitations

Module 2: **(7Lectures)**

Bearing Capacity Analysis - Failure Modes, Terzaghi's Analysis,Specialization of Terzaghi's Equations, Skempton Values for Nc, Meyerhof's Analysis,I.S. Code Method of Bearing Capacity Evaluation, Effect of Water Table, Eccentricity of load, Safe Bearing Capacity and Allowable Bearing Pressure, Settlement Analysis: Immediate Settlement - Consolidation Settlement, Differential Settlement, Tolerable Settlement, Angular distortion

Module 3: **(5Lectures)**

Foundations for Difficult Soils - Guidelines for Weak and Compressible Soils, Expansive soil, Parameters of Expansive Soils, Collapsible Soils and Corrosive Soils, Causes of Moisture changes in Soils, Effects of Swelling on Buildings, Preventative Measures for Expansive Soils, Modification of Expansive Soils, Design of Foundation on Swelling Soils, Ground Improvement Methods: for general considerations, for Cohesive Soils, for Cohesionless Soils,

Module 4: **(5 Lectures)**

Shallow Foundations: Assumptions & Limitations of Rigid Design Analysis, Safe Bearing Pressure, Settlement of Footings, Design of Isolated, Combined, Strap Footing (Rigid analysis), Raft Foundation (Elastic Analysis), I. S. Code of Practice for Design of Raft Foundation

Module 5: **(7 Lectures)**

Deep foundations: Pile Foundation: Classification, Pile Driving, Load Carrying Capacity of Piles, Single Pile Capacity, Dynamic Formulae, Static Formulae, Pile Load Tests, Penetration Tests, Negative skin Friction, Under Reamed Piles, Group Action of Piles,

Caissons Foundations: Box, Pneumatic, Open Caissons, Forces, Grip Length, Well Sinking, Practical Difficulties And Remedial Measures

Sheet Piles: Classification, Design of Cantilever Sheet Pile in Cohesionless and Cohesive soils. Design of Anchored Sheet Pile by Free Earth Support Method, Cellular Cofferdams: Types, Cell Fill Stability Considerations

Module 6: **(6 Lectures)**

Slope Stability: Different Definitions of Factors of Safety, Types of Slope Failures, Stability of an Infinite Slope of Cohesionless Soils, Stability Analysis of an Infinite Slope of Cohesive Soils, Stability of Finite Slopes- Slip Circle Method, Semi Graphical and Graphical Methods, Friction Circle Method, Stability Number: Concept and its use

Text Books

- Kasamalkar, B.J., "Foundation Engineering", Pittsburgh vintage Grand Prix
- Murthy V.N.S., "Soil Mechanics and Foundation Engineering", CRC Press 2002
- Arora K.R., "Soil Mechanics and Foundation Engineering", Standard publication 2009
- Punmia B. C., "Soil Mechanics And Foundation Engineering", Laxmi publication 16th 2017
- Nayak N.V., "Foundation Design Manual", Dhanpat Rai And Sons
- Brahma S.P., "Foundation Engineering", Tata McGraw-Hill 5th Edition
- Braja Das, "Principles of Geotechnical Engineering", Engage Learning 9th edition
- Bowles J.E., "Foundation analysis & Design", McGraw-Hill Higher Education 5th edition

References Books

- Teng W.C., "Foundation Design", Prentice-Hall Inc
- Tomlinson M.J., "Foundation Design & Construction", Prentice-Hall; 7th edition
- Lee, "Sheet Piles" Concrete Publication,1961
- Relevant Publications by Bureau of Indian Standards, New Delhi
- IS 6403:1981, IS 1904:1986, IS 4091:1979

Course Outcomes: On completion of the course, the students will be able to:

To predict soil behavior under the application of loads and come up with appropriate solutions to foundation design queries. Analyze the stability of slope by theoretical and graphical methods.

Analyze the results of in-situ tests and transform measurements and associated uncertainties into relevant design parameters. Synthesize the concepts of allowable stress design, appropriate factors of safety, margin of safety, and reliability.

BTCVC 603 Concrete Technology

Teaching Scheme: (2 Lectures) hours/week

Course Contents

Module 1 (4 Lectures)

Materials for Concrete: Cement, Manufacturing Process, Physical Properties, Hydration of Cement, hydration products, Chemical Compounds in Cement, Types of Cement, Aggregates: Classification of aggregates, Physical Properties, Bulking of Sand, Mechanical Properties, Water: Specifications of Water to be used For Concrete

Module 2 (4 Lectures)

Properties of Fresh Concrete -Types of Batching, Mixing, Transportation, Placing Including Pumping and Compaction Techniques for Good Quality Concrete, Workability, Factors affecting workability, Methods of Measuring Workability, Segregation and Bleeding, setting time, Curing of Concrete, Types of curing, Temperature Effects on Fresh Concrete

Module 3 (3 Lectures)

Admixtures In Concrete: Types, Plasticizers and Super-plasticizers and their Effects On Workability, Air Entraining Agents, Accelerators, Retarders, Pozzolanic Admixtures, Green concrete, Bonding Admixtures, Damp-Proofing Admixtures, Construction Chemicals

Module 4 (4 Lectures)

Desired Properties of Concrete, Strength, Durability & Im-permeability, Characteristic Strength, Compressive, Tensile and Flexure of Concrete, **Bond Strength,** Tests on Concrete, Modulus of Elasticity, Effect of W/C Ratio and admixtures on Strength, **Types of concrete,** High Strength and High Performance Concrete

Module 5 (4 Lectures)

Creep and Shrinkage of Concrete, Significance, Types of Shrinkage and Their Control, Factors Affecting Creep. Durability of Concrete: Minimum & Maximum Cement Content, Strength & Durability Relationship, Exposure to Different Conditions, Factors Contributing to Cracks in Concrete, Sulphate Attack, Alkali Aggregate Reaction (AAR),factors affecting on AAR, Deteriorating effects of AAR, Chloride Attack, Corrosion of Steel (Chloride Induced)

Module 6 (6 Lectures)

Concrete Mix Design, Nominal Mix Concrete, Factors Governing Mix Design, Methods Of Expressing Proportions, Trial Mixes, Acceptance Criteria, Factors Causing Variations, Field Control, Statistical Quality Control, Quality Measurement in Concrete Construction., Non-destructive Testing of Concrete

Text Books

- Gambhir M. L. “Concrete Technology”, Tata Mc-Graw Hill 2015 15th edition
- Shetty M. S. “Concrete Technology”, S. Chand 2005.
- Krishnaswamy, “Concrete Technology”, Dhanapat Rai and Sons

Reference Books

- Orchard, “Concrete Technology”, Applied Science Publishers
- Neville A. M., “Concrete Technology”, Pearson Education
- Neville A. M., “Properties of Concrete”, Pearson Education
- Relevant Publications by Bureau of Indian Standards, New Delhi
- IS:10262(2009), IS:456 (2009), IS 4926 (2003)

Course Outcomes: On completion of the course, the students will be able to:

CO1: Understand the various types and properties of ingredients of concrete.

CO2: Understand effect of admixtures on the behavior of the fresh and hardened concrete.

CO3: Formulate concrete design mix for various grades of concrete.

BTCVC 604 Project Management

Teaching Scheme: (2 Lectures +1 Tutorial) hours/week

Course Contents

Module 1: **(6 Lectures)**

Introduction, Steps in Project Management, fundamentals of material, machinery and manpower management in Project, Bar Chart, Mile stone chart, Development of network, Fulkerson's Rule, Introduction to CPM, Time estimates, floats, critical path

Module 2: **(4 Lectures)**

Network Compression, Least Cost and Optimum Duration, Resource Allocation, Updating Calculations for Updated Network

Module 3: **(4 Lectures)**

Introduction to PERT, concept of probability, normal and beta distribution, central limit theorem, time estimates, critical path, slack, probability of project completion

Module 4: **(5 Lectures)**

Introduction to engineering economics, importance, demand and supply, types of costs, types of interests, value of money – time and equivalence, tangible and intangible factors, introduction to inflation, cash – flow diagram, economic comparisons – discontinuing methods, non-discontinuing criteria

Module 5: **(5 Lectures)**

Linear break even analysis – problems, quality control – concept, statistical methods – control charts

Module 6: **(5 Lectures)**

Total quality management– philosophy of Juran, Deming, importance, Quality Circle implementation, introduction to ISO 9000 series and 14000 series, Introduction to Computer Aided Project Management

Text Books

- Roy Pilcher, "Project Cost Control in Construction",Sheridon House Inc.(Feb1988)
- Gupta R.C. "Statistical Quality Control", khanna publishers 9th edition
- Layland Blank and Torquin, "Engineering Economics",Mc-Graw-Hill Edition
- Naik B. M. "Project Management",Stosius Inc./Advent Book division
- Khanna O.P., "Work Study",Dhanpatrai publication
- Srinath L. S. "CPM PERT", Affiliated East-West Press (Pvt) ltd

Reference Books

- Antill and Woodhead, "C.P.M. in Construction Practice", Wiley-Interscience 4th edition 1990
- Taylor. G.A., "Management and Engineering Economics", Mc-Graw Hill 4th edition
- Roy Pilcher, "Principles of Construction Management" Mc-Graw Hill Higher Education 2rd revision

Course Outcomes: On completion of the course, the students will be able to:

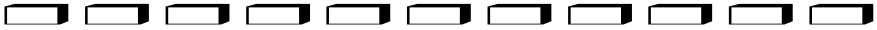
Understand various steps in project Management, different types of charts.

Construct network by using CPM and PERT method.

Determine the optimum duration of project with the help of various time estimates.

Know the concept of engineering economics, economic comparisons, and linear break even analysis problems.

Understand the concept of total quality Management including Juran and Deming's philosophy.



BTCVC 606 Building Planning and Design

Teaching Scheme: 2 Lectures hours/week

Course Contents

Planning of Buildings

Module 1: **(6 Lectures)**

Principles of building planning, significance sun diagram, wind diagram, orientation, factors affecting, and criteria under Indian condition, concept of green building: aspect at planning level, construction stage and operational level.

Module 2: **(6 Lectures)**

Building planning byelaws & regulations as per SP-7, National Building Code of India group 1 to 5, planning of residential building: bungalows, row bungalows, apartments and twin bungalows, procedure of building permission, significance of commencement, plinth completion or occupancy certificate

Module3: **(6 Lectures)**

Traditional constructions using stone, brick, timber, bamboo, mud, lime, etc. low cost housing-materials & methods (conceptual introduction only), maintenance, repairs, rehabilitation

Building Services

Module 4: Plumbing Systems **(10Lectures)**

Various materials for system like stoneware, GI, AC, CI, PVC, HDPE and various types of traps, fittings, chambers, need of septic tank, concept of plumbing & drainage plan, introduction to rainwater harvesting, concept of rain water gutters, rainwater outlet & down tank systems

Electrification: wiring types, requirements & location of various points, and concept of earthing

Fire resistance in building: Fire protection precautions, confining of fire, fire hazards, characteristics of fire resisting materials, building materials and their resistance to fire

Module 5: Ventilation **(10 Lectures)**

Definition, necessity of ventilation, functional requirements, various system & selection criteria.

Air conditioning: Purpose, classification, principles, various systems

Thermal Insulation: General concept, Principles, Materials, Methods, Computation of Heat loss & heat gain in Buildings

Module6: Introduction to Acoustics **(10 Lectures)**

Absorption of sound, various materials, Sabine's formula, optimum reverberation time, conditions for good acoustics

Sound insulation: Acceptable noise levels, noise prevention at its source, transmission of noise, Noise control-general considerations

Reference Books

- Shah, Kale, Pataki, "Building Drawing", Tata McGraw- Hill
- Sane Y. S.,"Building Design and Drawing", Allied Book Stall, Pune
- Jain V.K., "Automation Systems in Smart and Green Buildings", Khanna Publishers, N. Dehli ISBN No 978-81-7409-237-3
- Jain V.K., "Handbook of Designing and Installation of Services in High Rise Building Complexes", Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-245-8
- Deodhar S.V., "Building Science and Planning", Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-199-8
- Jain A.K., "The Idea of Green Building"Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-256-4
- SP 7- National Building Code Group 1 to 5- B.I.S. New Delhi
- I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings

Course Outcomes: On completion of the course, the students will be;

To plan buildings considering various principles of planning and bye laws of governing body.

Comprehend various utility requirements in buildings

Understand various techniques for good acoustics.

BTCVL 607 Concrete Technology Laboratory

Practical: 2 Hours / Week

Term work shall consist of performing minimum five experimental sets from the list below.

1) Testing of Cement: Consistency, Fineness, Setting Time, Specific Gravity,
2) Soundness and Strength Test for Cement
3) Testing of Aggregates: Specific Gravity, Sieve Analysis, Bulking of Fine Aggregate, Flakiness Index, Elongation Index and Percentage Elongation
4) Placement Tests on Concrete: Workability Tests: Slump, Compaction,
5) Strength Tests on Concrete: Compression, Flexure, Split & Tensile Test,
5) Effects of Admixture: Accelerator, Retarder, Super Plasticizer,
6) Exercise and verification of Concrete Mix Design,
7) Non-destructive Testing for Concrete.

BTCVL 608 Building Planning Design and Drawing Laboratory

Practical: 4 hours / week

Term work shall consist of detailed report of in form of set of drawings mentioned below. In practice sessions, free-hand sketching in drawing book shall be insisted.

1) Imperial size sheets based on actual measurement of existing residential building consisting of plan, elevation, section passing through staircase, Site plan. Area statement & brief specifications.
2) Planning & design of a building (Minimum G+1): Full set of drawings for:
    1) Municipal Submission drawing as per local statutory body bye-laws such as Town Planning, Municipal Council or Corporation Authorities.
    2) Foundation / Center Line Drawing.
    3) Furniture layout plan.
    4) Electrification plan.
    5) Water supply & drainage plan.
    6) Project report giving details of Drainage System, Water Supply System, Water Tank, Septic Tank Design of terrace Drainage System.
3) Setting out of planned building actually on ground using conventional or modern surveying instruments

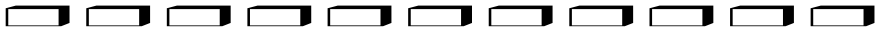
It is desirable to use drawings produced in this submission for carrying out structural design under BTCVL708 and / orBTCVL806 in next semesters. If this is implemented, student shall get extra 10% weightage limited to maximum limit.

Course Outcomes: On completion of the course, the students will be able to:

Draw plan, elevation and section of load bearing and framed structures. Draw plan, elevation and section of public structures.

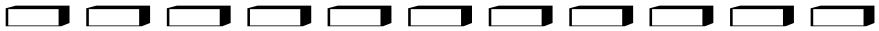
BTCVL 609 Community Project (Mini Project)

Student shall choose a topic of his interest in consultation with faculty in the department. The topic for community project may be related to Civil Engineering area and/or interdisciplinary area. Student shall attempt to collect necessary information and present a summary indicating comprehension of the topic and acquired depth of knowledge. It is desirable to obtain industry or community sponsorship. Simplified tools or devices may be presented in form of working model and a brief report stating development. A power point presentation shall also be submitted.



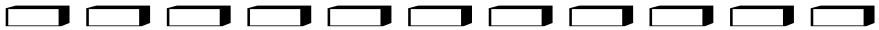
BTCVL 610 Seminar on Topic of Field Visit Road Construction

Student shall visit to ongoing construction sites in field to witness and collect information from works of execution of roads. It is desirable to collect basic information on components of roads, construction machinery, etc. Intention of the work is to introduce the student to the sequential order of execution of road works, preparation of road alignment and various surveys



BTCVL 611 Industrial Training

Students are expected to undergo industrial training for at least four weeks at factory / construction site / design offices or in combination of these. Training session shall be guided and certified by qualified engineer / architect / contractor in civil engineering. A neat detailed report on activities carried out during training is expected. Students should undergo training in Summer Vacation after Semester VI and appear at examination in Semester VII.



Elective III

BTCVE 605 A Waste Water Treatments

Teaching Scheme: (3 Lectures) hours/week

Pre Requisites: Environmental Engineering

Course Contents

Module 1: Wastewater Treatment **(5 Lectures)**

Introduction of wastewater, its types and various sources, Concept of sewage, sullage and storm water, Necessity of treatment of waste water

Preliminary treatment: screening and grit removal units, oil and grease removal, Primary treatment,

Secondary treatment: Activated sludge process, trickling filter, sludge digestion, drying bed. Stabilization pond, septic tank, soakage system, Imhoff Tank, recent trends and advanced wastewater treatment: nutrient removal, solids removal

Module 2: Low cost wastewater treatment methods **(7 Lectures)**

Principles of waste stabilization pond, Design and operation of oxidation pond, aerobic & anaerobic Lagoons, Aerated Lagoon, Oxidation ditch, Septic tank. Concept of recycling of sewage Disposal of waste water-stream pollution, Self Purification, DO sag curve, Streeter Phelp's Equation, Stream classification, disposal on land, effluents standards for stream and land disposals

Module 3: Industrial Waste Water Treatment Management **(6 Lectures)**

Sources of Pollution: Physical, Chemical, Organic and Biological properties of Industrial Wastes – Differences between industrial and municipal waste waters –Effects of industrial effluents on sewers and treatment plants, Prevention vs Control of Industrial Pollution

Pre and Primary Treatment: Equalization, Proportioning, Neutralization, Oil Separation by Floatation, Prevention v/s Control of Industrial Pollution

Module 4: Waste Water Treatment Methods **(7 Lectures)**

Nitrification and De-nitrification – Phosphorous removal – Heavy metal removal – Membrane Separation Process–Reverse osmosis–Chemical Oxidation–Ion Exchange – Air Stripping and Absorption Processes – Special Treatment Methods – Disposal of Treated Waste

Common Effluent Treatment Plants (CETPs): Need, Planning, Design, Operation & Maintenance Problems

Module 5: Environmental Sanitation **(6 Lectures)**

Communicable diseases, Methods of communication, Diseases communicated by discharges of intestines, nose and throat, other communicable diseases and their control

Insects and Rodent Control-Mosquitoes, life cycles, factors of diseases control methods - natural &chemical, Fly control methods and fly breeding prevention, Rodents and public health, plague control methods, engineering and bio-control methods

Module 6:Rural Sanitation **(5 Lectures)**

Rural areas, Population habits and environmental conditions, problems of water supply and sanitation aspects, low cost excreta disposal systems, Rural sanitation improvement schemes

Text Books

- Manual on sewerage and sewage Treatment-Government of India Publication
- Masters G.M., "Introduction to Environmental Engineering and Science"
- Metcalf & Eddy, "Waste Water Engineering Treatment & Disposal", Tata McGraw Hill, 1982
- Garg S.K., "Sewage Disposal and Air Pollution Engineering", Khanna Publishers
- Rao M.N.&Datta, Waste water treatment
- EhalersVictor& Earnest W Steel, Municipal and Rural sanitation

Reference Books

- Peavey, Rowe D.R. and Tchobanoglous, "Environmental Engineering", McGraw-Hill Book Co.
- Viessman and Hammer, "Water Supply and Pollution Control", Harper Collins College Pub.
- Hammer M.J., "Water and Waste water Technology", Prentice-Hall of India Private Limited
- Canter, "Environmental Impact Assessment", Tata McGraw Hill Publication
- Bhatia H. S., Environmental Pollution and Control, Galgotia Publication Pvt. Ltd., New Delhi

Course Outcomes: On completion of the course, the students will be able to:

Determine the sewage characteristics and design various sewage treatment plants.
Understand municipal water and wastewater treatment system design and operation.
Apply environmental treatment technologies and design processes for treatment of industrial waste water.
Understand the rural sanitation schemes.

BTCVE 605 C Geographic Data Analysis and Applications

Teaching Scheme: (3 Lectures) hours / Week

Pre Requisites: Mathematics - I and Mathematics – II

Course Contents

Module 1: **(6 Lectures)**

Basic concepts of GIS- Information systems, spatial and non-spatial information, geographical concepts and terminology, advantages of GIS, basic components of GIS, commercially available GIS hardware and software, organization of data in GIS.

Module 2: **(6 Lectures)**

GIS data- Field data, statistical data, Maps, aerial photographs, satellite data, points, lines and areas features, vector and raster data, advantages and disadvantages, data entry through keyboard, digitizers and scanners, digital data, preprocessing of data rectification and registration, interpolation techniques.

Module 3: **(6 Lectures)**

Data management- DBMS, various data models, run-length encoding, quadtrees, data analysis-data layers, analysis of spatial and non-spatial data, data overlay and modeling, data processing: raster based and vector based, data presentation –hardcopy devices, softcopy devices.

Module 4: **(6 Lectures)**

Remote sensing and GIS integration- Principles of electromagnetic remote sensing, imaging characteristics of remote sensing systems, extraction of metric and descriptive information from remotely sensed images, integration of remote sensing &GIS.

Module 5: **(6 Lectures)**

Digitizing, Editing and Structuring of map data: Digitizing: manual, semiautomatic and automatic, editing: error detection and correction, tolerances, topology creation, Attribute map generation.

Digital Elevation Model: Need of DEM, Various structures of DEM: line,

Module 6: **(6 Lectures)**

Applications of GIS- Map revision, land use, agriculture, forestry, archaeology, municipal geology, water resources, soil erosion, land suitability analysis, change detection

Term Work:

Each student to appear for at least one written test during the semester. At least 10 assignments based on above syllabus and the graded answer paper for the semester test to be submitted.

Text/Reference Books:

1. Lo C P, Yeung A K W, Concepts and Techniques of Geographic Information Systems, Prentice Hall. India.
2. Kang-tsung Chang, Introduction to Geographic Information Systems, Tata McGraw Hill
3. Deepankar Chakrabarti, Suchandra Choudhury Sujit Choudhury, "Introduction to Geographic Information Technology", Kindle Edition
4. Chakraborty Debashis, "Fundamentals of Geographic Information Systems"
5. Sabins F F, "Remote Sensing Principles and Interpretation"
6. Katara Pratibha,"Remote Sensing and GIS Technology"

BTCVE 605 D Advanced Engineering Geology

Teaching Scheme: (3Lectures) hours/week

Pre Requisites: Engineering Geology

Course Contents

Module 1 **(6 Lectures)**

Stratigraphy and Indian geology: geological time scale, physiographic divisions of India and their geological, geomorphologic and tectonic characteristics, study of important geological formations of India namely: Vindhyan, Gondwana, and Deccan traps with respect to: distribution, lithology, tectonics, economic importance etc. significance of these studies in civil engineering

Module 2 **(6 Lectures)**

Sub-surface exploration: Steps in geological studies of project site, engineering consideration of structural features, exploratory drilling, preservation of cores, core logging, graphical representation of core log, limitations of exploratory drilling method, numerical problems on core drilling, introduction to geological map

Sub-surface water: Runoff, fly off and percolation of surface water, juvenile, connate and meteoric water, water table, zones of subsurface water, perched water table, aquifer theory

Module 3 **(8 Lectures)**

Engineering geology of Deccan traps: Types of basalts and associated volcanic rocks, engineering characteristics, infillings of gas cavities, compact and amygdaloidal basalt as construction material, effect of jointing, hydrothermal alteration and weathering on engineering behaviour, tail channel erosion problem in Deccan trap region, suitability for tunnelling, problems due to columnar basalt, dykes, red bole, tachylitic basalt, volcanic breccias and fractures, laterites: origin, occurrence and engineering aspects, ground water bearing capacity of rocks of Deccan trap region, percolation tanks

Module 4 **(6 Lectures)**

Geology of soil formations: Soil genesis, geological classification of soils, residual and transported soils, soil components, characteristics of soils derived from different types of rocks, nature of alluvium and sand from rivers of Deccan trap region, scarcity of sand

Module 5 **(6 Lectures)**

Geophysics: Various methods: magnetic, gravitational and electrical resistivity methods, applications of electrical resistivity method using Wennerconfiguration in civil engineering problems such as: finding thickness of over burden and depth of hard rock, locating the spot for ground water well, seepage of water finding,

Rock mechanics: General principles, engineering properties of rocks and their dependence upon geological characters, in- built stresses in rocks, measurements of these stresses

Module 6 **(6 Lectures)**

Plate tectonics, seismic zones of world, seismic activity of Deccan trap region, various theories on the origin of the seismic activity of Deccan trap region, prediction of earthquake, earthquake resistant constructions, numerical problems based on seismic data,cause and prediction and preventive measurement of landslide in Deccan trap region.

Text Books

- Gupte R. B., "A Text Book of Engineering Geology", Pune VidyarthiGrihaPrakashan, Pune.
- Gokhale K.V.G.K. and Rao D. M., "Experiments in Engineering Geology", TMN, New-Delhi.
- Mukerjee P. K., "A Text Book of Geology", The World Press Pvt. Ltd., Calcutta.
- Prabin Singh, "Engineering and General Geology", S. K. Katariya and sons, Delhi.

Reference Books

- Tyrrell G. W., "Principles of Petrology", B. I. Publication Pvt. Ltd., New Delhi.
- Holmes A., "Principles of Physical Geology", ELBS Chapman &Hall,London.
- Billings M. P., "Structural Geology", Prentice Hall of India Private Ltd., New Delhi.
- Farmer L. W., "Engineering Properties of Rocks", Champman& Hall, London.
- Reddy, "Engineering Geology for Civil Engineering", Oxfard& IBH Publishing Co. N. Delhi.
- SathyaNarayan SwamiB. S., "Engineering Geology", DhanpatRai& Co.(P) Ltd, Delhi

Course Outcomes: On completion of the course, the students will be able to:

1) Understand geological time scale and physiographic division of India and their geological characteristics and different geological formation in India.
2) Perform sub surface exploration and interpret core log.
3) Solve numerical problem based on core drilling and seismic data.
4) Familiar with origin of earthquake, seismic wave and landslide in Deccan trap.

BTCVE 605 E Advanced Soil Mechanics

Teaching Scheme: (3Lectures) hours/week

Pre Requisites: Soil Mechanics

Course Contents

Module 1: Introduction to Clay Minerals (6 Lectures)

Introduction to Clay minerology; Gravity forces, surface forces and their dependency on particle size; Primary and Secondary valence bonds; Structural units of clay minerals; Electrical charges on clay minerals; Structural composition and behavior of the minerals like Kaolinite, Montmorillonite, Illite, Halloysite etc.

Module 2: Stress Distribution in Soil (8 Lectures)

Boussinesq's equation for point load, vertical pressure under loaded circular area and uniformly loaded rectangular area. Newmark's method for uniformly distributed loads, preparation and use of Newmark's chart.

Module 3: Earth work and Earth moving Equipments (4 Lectures)

Planning of Earth work, Earth moving equipment: dozers, scrapers, loader-backhoe, excavators; compaction equipments: static and drum rollers, vibratory rollers, sheep-foot rollers, pneumatic tyre rollers, small compactors; selection of equipments.

Module 4: Ground Improvement and Modifications (6 Lectures)

Improvement by excavating and replacing, mixing additives, applications, in-situ ground improvement- compaction piles, compaction with dynamics loads, pre-loading using sand drains, grouting, replacing existing soils with stronger soil in bore hole, response of sands and clays to externally applied stress, impact compaction of sands, vibratory compaction in sands, types of drains.

Module 5: Reinforced Soils (6 Lectures)

Soil reinforcement and its applications, Mechanism of soil reinforcement; Geosynthetics: Introduction; Geotextile, Geojute, Geomembrane, Geogrid, Applications of Geosynthetics in Civil Engineering, testing of geotextile, using Geogrids as a reinforcements, design with geo-synthetics.

Module 6: Grouting and injection methods (6 Lectures)

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

Text Books

- Murthy V.N.S., "Soil Mechanics & Foundation Engineering", U.B.S. Pub. And Distri. N. Delhi
- Punmia B.S., "Soil Mechanics & Foundation Engineering", Laxmi Publications
- Arora K. R., "Soil Mechanics" Standard Publishers, N. Delhi
- Shashi K Gulathi and Manoj Datta, "Geotechnical Engineering", Mc-Graw Hill Publications (India) Pvt. Ltd.

Reference Books

- Alam Singh, "Text book of soil mechanics in theory and practice", Asian Pub. House, Mumbai
- Taylor D.W., "Fundamentals of Soil mechanics"
- Terzaghi and Peak "Soil mechanics" John Willey and Sons, New-York

- Scott R. F., “Principal of soil mechanics”
- Lambe T.W, “Soil Testing” by Willey Eastern Ltd., New Delhi
- Donald P. Coduto, Man-Chu Ronald Yeung, William A. Kitch, “ Geotechnical Engineering”, Pearson Publications

Course Outcomes: On completion of the course, the students will be able to:

CO1: Behavior of soil based on its particle size and mineral content

CO2: Ability to understand the Earth work equipment

CO3: Ability to understand the necessity of ground improvement and potential of a ground for improvement

CO4: Understand the soil reinforcement mechanisms

CO5: Understand the grouting and injection methods.