Dr. Babasaheb Ambedkar Technological University, Lonere

(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
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Draft Copy of Curriculum for Undergraduate Degree Programme

B. Tech. in Civil and Environment Engineering

With effect from (Third Year) AY 2023-24

Dr. Babasaheb Ambedkar Technological University
Lonere 402 103, Dist.- Raigad, Maharashtra, INDIA.

Dr. Babasaheb Ambedkar Technological University, Lonere-Raigad

Teaching & Evaluation Scheme

for Third Year B. Tech. Civil & Environment Engg.

Semester- V										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 10	BTCEC 501	Limit State Design of Steel Structures	3	1	-	20	20	60	100	4
PCC 11	BTCEC 502	Soil Mechanics	3	1	-	20	20	60	100	4
PCC 12	BTCEC 503	Air Pollution and Control	3	-	-	20	20	60	100	3
PCC 13	BTCEC 504	Transportation Engineering	3	-	-	20	20	60	100	3
PEC 1	BTCEPE 506	**Elective -I** A. Material Testing and Evaluation B. Environmental Sanitation C. Remote Sensing Technique D. Numerical Methods in Civil Engineering	3	1	-	20	20	60	100	3
HSSMC 3	BTHM507	Basic Human Values	2	-	-	50	50	-	100	Audit
LC 7	BTCEL508	Soil Mechanics Lab	-	-	2	15	15	20	50	1
LC8	BTCEL509	SDD of Steel Structures Lab.	-	-	2	15	15	20	50	1
Internship	BTCEP410	Internship – 2 Evaluation	-	-	-	-	-	-	-	Audit
	BTCEP411	Seminar on Topic, Field Visit to Superstructure Work	0	0	2	30	-	20	50	1
		Total	**17**	**3**	**6**	**210**	**180**	**360**	**750**	**20**

Semester- VI										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 14	BTCEC601	Design of RCC Structure	3	1	-	20	20	60	100	4
PCC 15	BTCEC602	Concrete Technology	3	1	-	20	20	60	100	3
PCC 16	BTCEC603	Industrial Waste Treatment	3	-	-	20	20	60	100	4
PCC 17	BTCEC604	Project Management	3	1	-	20	20	60	100	4
PEC 2	BTCEPE605	Elective -II	3	-	-	20	20	60	100	3

		A. Advanced Environmental Engineering B. Environmental Impacts Assessment C. Foundation Engineering								
LC 9	BTCEL606	Concrete Technology Lab	-	-	2	15	15	20	50	1
LC 10	BTCEL607	SDD of RC Structures Lab.	-	-	2	15	15	20	50	1
Project	BTCEM608	Community Project (Mini Project)	-	-	2	15	15	20	50	1
Internship	BTCEP609	Field Training/ Internship/Industrial Training (minimum of 4 weeks which can be completed partially in third semester and fourth semester or in at one time)	-	-	2	50	-	-	50	Credits to be evaluated in VII Semester
		Total	**15**	**3**	**8**	**195**	**145**	**360**	**700**	**21**

Detailed Syllabus

Semester- V										
Course Category	**Course Code**	**Course Title**	**Teaching Scheme**			**Evaluation Scheme**				**Credit**
			L	**T**	**P**	**CA**	**MSE**	**ESE**	**Total**	
PCC 10	BTCEC 501	Limit State Design of Steel Structures	3	1	-	20	20	60	100	4
PCC 11	BTCEC 502	Soil Mechanics	3	1	-	20	20	60	100	4
PCC 12	BTCEC 503	Air Pollution and Control	3	-	-	20	20	60	100	3
PCC 13	BTCEC 504	Transportation Engineering	3	-	-	20	20	60	100	3
PEC 1	BTCEPE 506	**Elective -I** E. Material Testing and Evaluation F. Environmental Sanitation G. Remote Sensing Technique H. Numerical Methods in Civil Engineering	3	1	-	20	20	60	100	3
HSSMC 3	BTHM507	Basic Human Values	2	-	-	50	50	-	100	Audit
LC 7	BTCEL508	Soil Mechanics Lab	-	-	2	15	15	20	50	1
LC8	BTCEL509	SDD of Steel Structures Lab.	-	-	2	15	15	20	50	1
Internship	BTCEP410	Internship – 2 Evaluation	-	-	-	-	-	-	-	Audit
	BTCEP411	Seminar on Topic, Field Visit to Superstructure Work	0	0	2	30	-	20	50	1
		Total	**17**	**3**	**6**	**210**	**180**	**360**	**750**	**20**

BTCEC501 Limit State Design of Steel Structures

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

Course Contents

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

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

Module 2: Connections **(6 Lectures)**

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

Module 3: 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 4: Beams and Columns and Column Bases **(10 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

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 5: Industrial Roofing **(8 Lectures)**

Gantry girder: Forces acting on a gantry girder, commonly used sections, introduction to 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

Note: Contents in Module 1 to part of 5 shall be taught with help of relevant text or reference books based on elastic design concept and shall be taught with reference to IS 800 2007

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. (2017) “Design of Steel Structures”, Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Gambhir M. L. (2017) “Fundamentals of Structural Steel Design”, Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Negi L. S. (2017) “Design of Steel Structures”, Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Chandra Ram (2016) “Design of Steel Structures”, Vol. I & Vol. II, Standard Book House, New Delhi
- Subramanian N. (2010) “Steel Structures: Design and Practice” Oxford Univ. Press, Delhi
- Sai Ram K. S. (2015) “Design of Steel Structures”, Pearson Education, Delhi

Reference Books

- Arya A. S. and Ajamani J.L. (2014) "Design of Steel Structures", Nemchand and Brothers, Roorkee
- Vazirani V.N. and Ratwani M.M. (1988) "Design of Steel Structures", Standard Book House, 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. (1991) "Design of Steel Structures" McGraw Hill, New York
- Salmon C. G. and Johnson J. E. (2008) "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.

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BTCEC 502 Soil Mechanics

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

Course Contents

Module 1: Introduction **(8 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 **(10 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 **(10 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 **(10 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

Earth Pressure Theories: 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. Publishers and Distributors 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 behaviour.

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

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

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BTCEC 503 Air Pollution and Control

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction, Sources& Effects of Air Pollution (6 Lectures)

The Structure of the atmosphere, Composition of dry ambient air and properties of air. BIS Definition and scope of Air Pollution, Scales of air pollution, Types of exposures. Air Pollutants, Classifications, Natural and Artificial, Primary and Secondary, point and Non-Point, Line and Area Sources of air pollution. Stationary and mobile sources, composition of particulate& gaseous pollutant, units of measurement. Effect of different air pollutants on man, animals, vegetation, property, aesthetic value and visibility, air pollution episodes. Global effects of air pollution- global warming, ozone depletion, acid rain and heat island effect.

Module2: Meteorology and Air pollution (6 Lectures)

Solar radiation, wind circulation, factors affecting dispersion of pollutants, Lapse rate, Stability conditions, wind velocity profile, Maximum mixing depth (MMD), visibility, Wind rose diagram, General characteristics of stack plume (Plume behaviour). Gaussion diffusion model for finding ground level concentration. Plume rise. Formulae for stack height and determination of minimum stack height.

Module3: Air Sampling and Analysis (6 Lectures)

Air pollution survey, basis and statistical considerations of sampling sites. Devices and methods used for sampling gases and particulates. Stack emission monitoring, isokinetic sampling. Analysis of air samples chemical and instrumental methods. Ambient air quality monitoring.

Module4: Photochemical Smog, Odour Pollution and Indoor Pollution (6 Lectures)
Chemistry of air pollution, Chain reactions of hydrocarbons, nitrogen oxide, Sulphuric oxides and intermediates, photochemical smog formation, air pollution indices -aerosols, fog, smog index. Odour pollution: Theory, sources, measurement and methods of control of odour pollution.
Indoor air pollution: Causes of air pollution, sources and effects of indoor air pollutants, changes in indoor air quality, control of indoor air pollutants and air cleaning systems.

Module5: Control of Air Pollution, Gaseous Pollutants and Legislation (6 Lectures)
By process modification, change of raw materials, fuels, process equipment and process operation by use of air pollution control equipment for particulate and gaseous pollutants. Design of control equipment as Settling chamber, cyclone, fabric filter, Electro static precipitator and Wet scrubber. Principles of removal of gaseous pollutants, design of incineration, absorption adsorption systems. Control of air pollution from automobiles. Vehicular pollution, composition, quantity and control. Air (Prevention and Control) Pollution Act, 1981.Emission standards for stationary and mobile sources. National Ambient air quality standards, 2009 **Text Books**

- H. C. Perkins, Air Pollution.
- Peavy and Rowe, Environmental Engineering, Mc-Graw Hill Publication.
- N.D. Nevers, Air Pollution Control Engineering, Mc-Graw Hill Publication.
- M. N. Rao et al. Air Pollution, Tata Mc-Graw Hill Publication.

References Books

- Richard W. Boubel et al., Fundamentals of Air Pollution, Academic Press, New York.
- C.S. Rao., Environmental Pollution Control Engineering, Wiley Eastern Limited, New Delhi (1991).
- John H. Seinfeld, Air Pollution: Physical and Chemical Fundamental, Mc-Graw Hill book Co. 1988.
- Paul N. Cheremisinoff, Richard A. Young, Air Pollution Control and Design Handbook, Part-I, Marcel Dekker Inc., New York1977).
- Paul N. Cheremisinoff (ed.), Encyclopedia of Environmental Control Technology, Vol. 2, Air Pollution Control, GuldPublishing Company. (1989)

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

CO1: Identify the sources of air pollutants and their effect on human, plants and materials.
CO 2: Apply knowledge of meteorology for controlling air pollution
CO 3: Design air pollution controlling equipment.
CO 4: Apply knowledge of legislation for prevention and control of air pollution.

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BTCEC 504 Transportation Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction (6 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: (8 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 **(8 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 **(8 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

Other modes of Transport

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", VolIKhanna Publishers, N. Delhi
- Shahani P.B, "Road Techniques" Khanna Publishers, N. Delhi ISBN NO: 978-81-7409-197-1
- 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:

CO1: Comprehend various types of transportation systems and their history of the development
CO2: Comprehend to various types of pavements
CO3: Design the pavements by considering various aspects associated with traffic safety measures.

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Elective I

BTCEPE506 A. Materials, Testing &Evaluation

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(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.

Module 2: **(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.

Module 3: **(6 Lectures)**

Composite Materials: RCC, FRC, steel/concrete composite bridge decks, fibre reinforced plastics structural insulated panels. Comparison of Different Materials, Introduction, comparison of strengths of various materials, comparison for environmental impact, health and safety.

Module 4: **(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 5: **(8 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.

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Text Books

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

Reference Books

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

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

CO1: To develop skill to construct strong and durable structures by applying knowledge of material science.

CO2: To make the students aware of quality assurance and control in their real life as a professional.

CO3. To propose suitable material in adverse conditions

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BTCEPE506 B. Environmental Sanitation

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Epidemiology **(6 Lectures)**

Principles of protecting the environmental sanitation measures, Inspect and Rodent Control

Module 2: Food and milk sanitation, hotel management with reference to sanitation **(8 Lectures)**

Food preservation, pasteurization methods and plants. Housing need – lighting and ventilation, natural and artificial provisions.

Module 3: Solid wastes **(8 Lectures)**

Characteristics, collection, disposal by landfill, composting, incineration and other methods. Handling and disposal of Hazardous Wastes. Industrial Hygiene– Occupational hazards – Various operations in industrial units, Engineering and safety measures. Radiological health – radioactive wastes and disposal.

Module 4: Noise Pollution and control **(6 Lectures)**

Engineering and medical divisions – various programmes. Rural sanitation various methods of collection and disposal of fecal matter – community toilets – septic tanks and soak pits – biogas plants.

Module 5: Public Health **(8 Lectures)**

Occupational hazards, Industrial hygiene, Rural Water Supply and sanitation, biogas – community toilets

Text Books

- Municipal and Rural Sanitation (Sanitary Science & Water Engineering) by V. M. Ehlers, Ernest W. Steel- Tata Mcgraw-hill Education (1977)
- Environmental Sanitation by Joseph A. Salvato – John Wiley & Sons Inc
- Environmental Protection by Emil T. Chanlett – Mcgraw –hillI nc., us

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

CO1: An outlook on epidemiological concept vis-a-vis various sanitary measures.

CO2: Knowledge on sanitary aspects in relation to different social institutions..

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BTCEPE506 C. Remote Sensing Technique

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction to Photogrammetry **(6 Lectures)**

Principles& types of aerial photograph, geometry of vertical aerial photograph, Scale & Height measurement on single vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of stereoscopy, fiducial points, parallax measurement using fiducial line.

Module 2: Hydraulic Processes: Pressurized Pipe Flow **(6 Lectures)**

Basic concept of remote sensing, Data and Information, Remote sensing data Collection, Remote sensing advantages & Limitations, Remote Sensing process. Electro-magnetic Spectrum, Energy interactions with atmosphere and with earth surface features (soil, water, vegetation), Indian Satellites and Sensors characteristics, Resolution, Map and Image and False colour composite, introduction to digital data, elements of visual interpretation techniques

Module 3: Geographic Information Systems **(6 Lecture)**

Introduction to GIS; Components of a GIS; Geospatial Data: Spatial Data-Attribute data – Joining Spatial and Attribute data; GIS Operations: Spatial Data Input- Attribute data Management –Data display- Data Exploration- Data Analysis. COORDINATE SYSTEMS: Geographic Coordinate System: Approximation of the Earth, Datum; Map Projections: Types of Map Projections-Map projection parameters-Commonly used Map Projections - Projected coordinate Systems

Module 4: Vector Data Model **(6 Lectures)**

Representation of simple features- Topology and its importance; coverage and its data structure, Shape file; Data models for composite features Object Based Vector Data Model; Classes and their Relationship; The geobase data model; Geometric representation of Spatial Feature and data structure, Topology rules

Module 5: Raster Data Model **(6 Lectures)**

Elements of the Raster data model, Types of Raster Data, Raster Data Structure, Data Conversion, Integration of Raster and Vector data.

Data Input: Metadata, Conversion of Existing data, creating new data; Remote Sensing data, Field data, Text data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing

Text Books:

- Remote Sensing and GIS Lillesand and Kiefer, John Willey 2008.
- Remote Sensing and GIS B. Bhatta by Oxford Publishers 2015.
- Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015

Reference Books

- Concepts & Techniques of GIS by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India)
- Publications.
- Principals of Geo physical Information Systems – Peter A Burragh and Rachael A.
- Mc Donnell, Oxford Publishers 2004.
- Basics of Remote sensing & GIS by S. Kumar, Laxmi Publications.

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

CO1: Retrieve the information content of remotely sensed data
CO2: Analyze the energy interactions in the atmosphere and earth surface features
CO3: Interpret the images for preparation of thematic maps
CO4: Apply problem specific remote sensing data for engineering applications
CO5: Analyze spatial and attribute data for solving spatial problems
CO6: Create GIS and cartographic outputs for presentation

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BTCEPE506 D. Numerical Methods in Civil Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(8 Lectures)**
Basis of Computations, Matrix Operations on Computer, Multiplication and Inversion, Solution of Simultaneous Equations, Gauss Elimination Method, Cholesky Decomposition method, Gauss Jordan and Gauss Sceidal Methods

Module 2: **(8 Lectures)**
Roots of Equation, Trial and Error, Bisection, Secant Iteration, Newton Rapson Method, Solution of Ordinary Differential Equation, Euler's Method, Modified Euler's Method and Runga Kutta Methods

Module 3: **(8 Lectures)**
Interpolation with Newton's Divided Differences, Lagrange's Polynomial, Finite Difference Method, Central, Forward and Backward Differences, Least Square Polynomial Approximations Application in Deflection of Determinate Beams, Buckling Load of Long Columns

Module 4: **(4 Lectures)**
Numerical Integration: Trapezoidal Rule, Simpon's Rules, Gauss Quadrature Rules

Module 5: **(8 Lectures)**
Statistical Analysis of Experimental Data, Mean, Median, Mode, Deviation, Measures of Dispersion, Least Square Method, Regression Analysis: Linear, Parabolic, Curve Fitting

Text Books:

- Balaguruswami E., "Numerical Methods", Tata Mc-Graw Hill
- Scheid F, "Numerical Analysis (Schaum's series)", Tata Mc-Graw Hill
- Chapra. S. C. and Canale R. P., "Numerical Methods for Engineers", by, Tata Mc-Graw Hill
- Shantha Kumar M , "Computer Based Numerical Analysis", Khanna Publication
- Grewal B.S. and Grewal J.S., "Numerical Methods in Engineering and Science", Khanna Publication, N. Delhi

- Sastry, S.S., "Introductory Methods of Numerical Analysis", Printice Hall of India, New Delhi

Reference Books:

- Jain, Aryengon, “Numerical Methods for Scientific and Engineering Applications”, Wiley Eastern Publication
- Numerical Recipe, Oxford Publishing
- Manuals for the Commercial Computer Programmes

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

CO1: Apply numerical methods to obtain approximate solutions to mathematical problems
CO2: Analyze and evaluate accuracy of various numerical methods and their applicability

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BTHM507 Basic Human Rights

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Basic Concepts **(Lectures 06)**

Individual, group, civil society, state, equality, justice. Human Values, Human rights & Human Duties: Origin, Contribution of American bill of rights, French revolution. Declaration of independence, Rights of citizen, Rights of working & exploited people

Module 2: Fundamental Rights and Economic Program **(Lectures 06)**

Society, religion, culture, and their inter-relationship. Impact of social structure on human behavior, Social Structure and Social Problems: Social and communal conflicts and social harmony, rural poverty, unemployment, bonded labour.

Module 3: Workers and Human Rights **(Lectures 08)**

Migrant workers and human rights violations, human rights of mentally and physically challenged. State, Individual liberty, Freedom and democracy.

NGOs and Human Rights in India

Land, Water, Forest issues.

Module 4: Human Rights in Indian Constitution and Law **(Lectures 08)**

i) The Constitution of India: Preamble; ii) Fundamental rights; iii) Directive principles of state policy; iv) Fundamental duties; v) Some other provisions

Module 5: UDHR and Indian Constitution **(Lectures 08)**

Universal declaration of human rights and provisions of India; Constitution and law; National human rights commission and state human rights commission.

Reference Books

- Shastry, T. S. N., “India and Human Rights: Reflections”, Concept Publishing Company India (P Ltd.), 2005.
- C. J. Nirmal, “Human Rights in India: Historical, Social and Political Perspectives (Law in India)”, Oxford India.

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BTCEL508 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 Atterberg'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.

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BTCEL509 SDD of Steel Structures Laboratory

Practical: 2 Hours / Week

Term work shall consist of detailed analytical report for structural design and drawing of any one of the following steel structures from Group A and B. Student may use IS 800 1984 or 2007.

Group A

1) Industrial Shed: Roof Truss with Necessary Bracing System, Purlins, Column and Column Bases

2) Industrial Shed: With Portal or Gable Frames of Solid or Open Web Sections with Necessary Bracing System, Purlins,
Column and Column Bases

3) Industrial Shed: Gantry Girder, Columns with Necessary Bracing System, Purlins, Column and Column Bases

4) G + 3 Building Structure

Group B

1) Foot Bridge: Analysis using Influence lines for Main Truss, Cross Beams, Raker, and Joint Details

2) Plate Girder: Analysis and Design of Rivetted or Welded Plate Girder.

3) Elevated Water Tank: Analysis and Design of Staging and Tank Body.

4) Steel Chimneys

Course Outcomes: on completion of the course, student will be able to

CO1: simulate a practical design requirement in to a theoretical statement to solve mathematically to arrive at a safe economical and realistic feasible solution that can be executed.

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Evaluation of (BTCEP410) Field Training/Internship/Industrial Training

Evaluation of industrial training undergone by students in Summer Vacation after Semester IV. A neat detailed report on activities carried out during training has to be submitted, along with a presentation to evaluate the training work.

Evaluation of (BTCEP411) Seminar on Topic of Field Visit to Superstructure Construction

Student shall visit to ongoing construction sites in field to witness and collect necessary information from works of execution of superstructure of buildings or other. It is desirable to collect basic information on components of superstructure, tools and plants, construction machinery, 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.

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Detailed Syllabus

Semester- VI										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 14	BTCEC601	Design of RCC Structure	3	1	-	20	20	60	100	4
PCC 15	BTCEC602	Concrete Technology	3	1	-	20	20	60	100	3
PCC 16	BTCEC603	Industrial Waste Treatment	3	-	-	20	20	60	100	4
PCC 17	BTCEC604	Project Management	3	1	-	20	20	60	100	4
PEC 2	BTCEPE605	Elective -II D. Advanced Environmental Engineering E. Environmental Impacts Assessment F. Foundation Engineering	3	-	-	20	20	60	100	3
LC 9	BTCEL606	Concrete Technology Lab	-	-	2	15	15	20	50	1
LC 10	BTCEL607	SDD of RC Structures Lab.	-	-	2	15	15	20	50	1
Project	BTCEM608	Community Project (Mini Project)	-	-	2	15	15	20	50	1
Internship	BTCEP609	Field Training/ Internship/Industrial Training (minimum of 4 weeks which can be completed partially in third semester and fourth semester or in at one time)	-	-	2	50	-	-	50	Credits to be evaluated in VII

										Semester
		Total	**15**	**3**	**8**	**195**	**145**	**360**	**700**	**21**

BTCEC601 Design of RC Structures

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

Course Contents

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

Basic Aspects of Structural Design, Introduction to Design Philosophies, Stress Strain behaviour of Materials Working stress method, Ultimate load method and Limit state method, Comparison of Different Philosophies, Factor of Safety, Estimation of Loads.

Working Stress Method

Module 2: **(8 Lectures)**

Stress block parameters, permissible stresses, balanced, under reinforced and over reinforced section, analysis and design for flexure, shear, analysis and design of singly and doubly reinforced beams. Design of axial and uniaxial eccentric loaded columns, Isolated Column Footings, WSM design requirements as per Annexure B of IS 456:2000

Limit State Method

Module 3: Introduction to LSM **(10 Lectures)**

Introduction to limit state approach, types and classification of limit states, characteristics strength and characteristics load, load factor, partial safety factors, strain variation diagram, stress variation diagram, serviceability criteria

Limit State of Collapse in Shear and Bond

Design for shear: shear failure, types of shear reinforcement, minimum shear reinforcement, design of shear reinforcement

Design for bond: types, factors affecting, resistance, check for development length, detailing of reinforcement

Module 4: Limit State of Collapse in Flexure **(16 Lectures)**

Design of beams: Analysis and Design: Singly and Doubly Reinforced Beams, Flanged (L and T) sections.

Design of Slabs: One-Way and Two-Way Slab: Behaviour of slabs, types, support conditions, analysis and design with various conditions Staircases, effective span and load distribution, design of dog- legged and open well stair case.

Module 5: Limit State of Collapse in Compression **(10 Lectures)**

Design of columns, and footings

Analysis and design of axially and eccentrically loaded short columns (Circular and Rectangular), construction of Interaction diagrams for uni-axial bending and its application in design, concept of design charts, concept of bi-axial bending, concept of interaction surface, Design of isolated column footing for axial load, and uni-axial bending.

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 Concrete”

- 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
- Pillai S Unnikrishna, and Menon Devdas., "Reinforced Concrete Design" Tata Mc-Graw Hill

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:
CO1: comprehend the various design philosophies used in design of reinforced concrete.
CO2: Analyze and design the reinforced concrete sections using working stress and limit state method.

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BTCEC602 Concrete Technology

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

Course Contents

Module 1 **(6 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 **(6 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 **(6 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 **(8 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 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 5 **(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", DhanapatRai 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

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BTCEC603 Industrial Waste Treatment

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction (8 Lectures)

Water use in industry, Industrial water quality requirements, Deterioration of water quality, Classification and characterization of Industrial wastewater, Standards of Disposal, Monitoring of wastewater flow, Quality and quantity variations in waste discharge. Liquid wastes from industries – their volumes and characteristics, Effect of disposal into natural water courses, Municipal sewers and on land, River standards and effluent standards. Designated Water Quality Standards, Type of samples-Grab and Composite.

Module 2: Treatment objectives and strategies (6 Lectures)

Waste Volume reduction, Strength reduction techniques, Segregation, proportioning, Waste Neutralization methods for acidic and alkaline waste, Equalization tank- online and offline, design problem. Recycle, reuse and byproduct recovery, Concept of Zero liquid Discharge (ZLD)

Treatment objectives and strategies, Treatment techniques for removal of specific pollutants in industrial wastewaters, e.g., oil and grease, cyanide, fluoride, calcium, magnesium, toxic organics, heavy metals, radioactivity.

Module 3: Manufacturing processes for industries (6 Lectures)

Manufacturing process flow sheets along with sources and characteristics of wastewater for various industries sugar, Distillery, Textile, Tannery, Paper and pulp mill, dairy, Fertilizer, steel mill, power plant etc.

Development of Treatment flowsheets based on characteristics of industrial wastewater. Industrial wastewater Treatment alternatives (Treatment Flowsheets) for above listed industries

Dewatering and disposal of sludge – floatation, vacuum filtration, centrifugation, filter press and membrane filters.

Module 4: Effluent Treatment Plants (8 Lectures)

Water pollution control act and Environmental Protection act - organizational set up of central and state boards for water pollution control, other important provisions. Classification of river on water use, minimal

national standards, socio-economic aspects of water pollution control. Modern Trends in Environmental Engineering, Cleaner Production Technologies, Environmental Bio-Technology, Bioremediation.
$Common Effluent Treatment Plants (CETPs): Concept, Need, Objectives, Methodology, grouping of industries, Location, Design, Operation and Maintenance Problems and Economical aspects.

Module 5: Treatability and environmental aspects **(8 Lectures)**
Treatability index, Population equivalent, Treatability aspects of raw industrial wastewater with domestic sewage, partially treated industrial wastewater with domestic sewage, Completely treated industrial wastewater with domestic sewage. Stream and effluent standards, Introduction to Water Quality Index (WQI) - simple problems.
Introduction to environmental impact assessment and environmental audit.
ISO 14000- introduction, how it is helpful to industries. Importance of Environmental management plan and environmental monitoring plan, Consent to operate and consent to establish
Text Books

- Metcalf and Eddy,1995, Wastewater Engineering - Collection, Treatment, Disposal and Reuse, McGraw Hill Pub. Co.
- Nelson Leonard Nemerow,2007 Industrial Waste Treatment, Butterworth-Heinemann,
- Nelson Nemerow, Theories and Practices of Industrial waste treatment
- M. N. Rao & Datta. Waste water treatment:
- IS Standard guide for treatment and disposal of various industries.
- Industrial Waste Treatment: Contemporary Practice and Vision for the Future
- Woodard, F., Industrial Waste Treatment Handbook, Butterworth-Heinemann, Woodard & Curran
- J.D. Edwards, Industrial Wastewater Treatment CRC Press
- Government of India Publication, “Water Supply and Treatment Manual”
- Publications by renowned organizations such as WHO, NEERI, MERI, MPCB, CWPRS, etc.
- Hammer M.J., “Water and Waste Water Technology”, PHI Private Limited
- Peavy and Rowe, Environmental Engineering , TMH.
- Numersorn, N.L., Liquid Waste from Industry – Theories, Practice and Treatment, Addison-Wesley,

Course Outcomes: On completion of the course, the students will be able to:
CO1: Identify and analyze the characteristics of industrial wastewater
CO2: Describe pollution effects of disposal of industrial effluent.
CO3: Identify and design treatment options for industrial handling industrial liquid waste

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BTCEC604 Project Management

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(8 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: **(6 Lectures)**

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

Module 3: **(8 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: **(8 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: **(6 Lectures)**

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

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:

CO1: Understand various steps in project Management, different types of charts.

CO2: Construct network by using CPM and PERT method.

CO3: Determine the optimum duration of project with the help of various time estimates.

CO4: Know the concept of engineering economics, economic comparisons, and linear break even analysis problems.

CO5: Understand the concept of total quality Management including Juran and Deming's philosophy.

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Elective -II

BTCEPE605 A. Advanced Environmental Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Low cost wastewater treatment methods **(8 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 2: Industrial Waste Water Treatment Management **(8 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 3: Waste Water Treatment Methods **(8 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 4: Environmental Sanitation **(6 Lectures)**

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

Module 5: Insects and Rodent Control **(6 Lectures)**

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 in 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

- Masters G.M. (2008) "Introduction to Environmental Engineering and Science"Prentice-Hall of India Pvt. Ltd., N. Delhi
- Metcalf & Eddy (1982) "Waste Water Engineering Treatment & Disposal", Tata McGraw Hill, New Delhi
- Garg S. K. (1979) "Sewage Disposal and Air Pollution Engineering", Khanna Publishers,New Delhi
- Rao M.N.& Datta A. K. (2018)"Waste water treatment", Oxford & Ibh Publishing Co Pvt Ltd, New Delhi

Reference Books

- Peavey H. S., Rowe D.R. (2017) "Environmental Engineering", McGraw-Hill Book Co., New Delhi
- Viessman W. and Hammer M. J. (2008) "Water Supply and Pollution Control",Pearson Publications, N. Delhi
- Hammer M. J. (2012) "Water and Waste water Technology", Prentice-Hall of India Private Limited,New Delhi
- Canter L. W. (1995) "Environmental Impact Assessment", Tata McGraw Hill Publication,New Delhi

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

CO1: Determine the sewage characteristics and design various sewage treatment plants.

CO2: Understand municipal water and wastewater treatment system design and operation.

CO3: Apply environmental treatment technologies and design processes for treatment of industrial waste water.

CO4: Understand the rural sanitation schemes.

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BTCEPE605 B. Environmental Impact Assessment

Teaching Scheme: (3 Lectures) hours/week

Course Contents

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

The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

Module 2: Identifying the Key Issues **(6 Lectures)**

Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection - Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic Impacts, Ecological Impacts, Global Environmental Issues

Module 3: EIA Methodologies **(8 Lectures)**

Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods,

Reviewing the EIA Report:

Scope, Baseline Conditions, Site and Process alternatives, Public hearing, Construction Stage Impacts, Project Resource Requirements and Related Impacts, Prediction of Environmental Media Quality, Socio-economic Impacts, Ecological Impacts, Occupational Health Impact, Major Hazard/ Risk Assessment, Impact on Transport System

Module 4: Review of EMP and Monitoring **(8 Lectures)**

Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, What should be monitored? Monitoring Methods, Who should monitor? Pre-Appraisal and Appraisal.

Module 5: Case Studies **(6 Lectures)**

Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Tannery industry.

Text Books

- Wathern. P Environmental Impact Assessment- Theory and Practice, Routledge Publishers, London, 2004.
- Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.
- Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007.
- Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.
- Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002

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

CO1: Identify the environmental attributes to be considered for the EIA study
CO2: Formulate objectives of the EIA studies
CO3: Identify the methodology to prepare rapid EIA
CO4: Prepare EIA reports and environmental management plans

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BTCEPE605 C. Foundation Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

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

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: (10 Lectures)

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: (10 Lectures)

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, Design of Foundation on Swelling Soils, Ground Improvement Methods: for general considerations, for Cohesive Soils, for Cohesionless Soils,

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 4: (10 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 5: Slope Stability (10 Lectures)

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", DhanpatRai 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:

CO1: To predict soil behavior under the application of loads and come up with appropriate solutions to foundation design queries.

CO2: Analyze the stability of slope by theoretical and graphical methods.

CO3: Analyze the results of in-situ tests and transform measurements and associated uncertainties into relevant design parameters.

CO4: Synthesize the concepts of allowable stress design, appropriate factors of safety, margin of safety, and reliability.

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BTCEL608 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.

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BTCEL609 SDD of RC Structures Laboratory

Practical: 2 Hours / Week

Term work shall consist of detailed analytical report for structural design and drawing of the following RC structures:

A) G + 2 Building

B) Any one of the following

(The introduction, analysis and design of these topics shall be studied in self-study mode. If required the subject teacher should address the student’s queries during tutorials).

1) Retaining wall
2) Elevated water tank: analysis and design of staging and tank body.
3) Staircase of special form such as helicoidal stair
4) Shell roofs
5) Special foundation type such as combined footing, raft, pile foundation

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BTCEM610 Mini Project

Student shall choose a topic of his interest in consultation with faculty in the department. The topic for mini 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.

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BTCEP611 Field Training/ Internship/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 for minimum 4 weeks which can be completed partially in V Semester and VI Semester or in at one time after VI Semester. Evaluation will be done in VII Semester.

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$NOTE: the highlighted point of CETP is repeated in both the subjects **BTCEC603 Industrial Waste Treatment** and **BTCEPE605 A. Advanced Environmental Engineering**