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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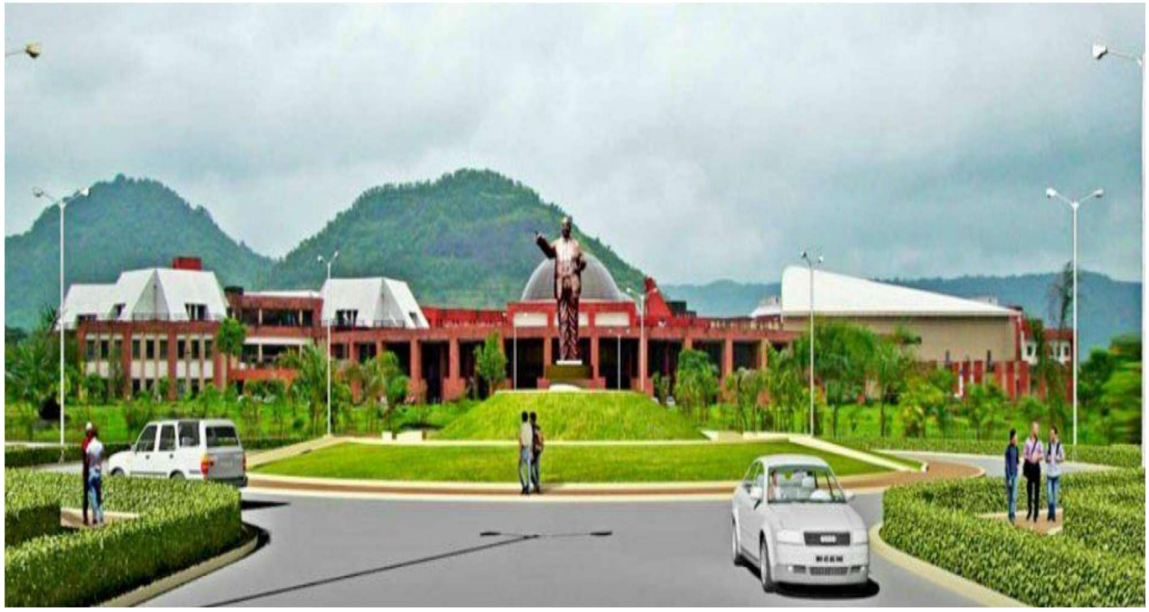
Draft Copy of Curriculum for Undergraduate Degree Programme

B. Tech. in Civil and Environmental Engineering

With effect from (Final Year) AY 2024-25



Dr. Babasaheb Ambedkar Technological University, Lonere

Teaching & Evaluation Scheme for Fourth Year B. Tech. Civil and Environmental Engineering

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
SEMESTER- VII										
1	BTCEC701	Design of RCC Structures- II & Prestressed concrete structures	3	1	--	20	20	60	100	4
2	BTCEC702	Solid Waste Management	3	--	--	20	20	60	100	3
3	BTCEC703	Railway and Bridge Engineering	3	--	--	20	20	60	100	3
4	BTCEC704	Professional Practices	3	1	--	20	20	60	100	4
5	BTCEPE705	A. Ground Improvement Techniques B. Earthquake Engineering C. Town & Urban Planning D. Valuation of Land & Building E. Rehabilitation and Retrofitting of Structures F. Environmental Policies and Legislation	3	--	--	20	20	60	100	3
6	BTCEOE706	A. Research Methodology B. Operation Research C. Legal Aspects in Civil Engineering Contracts D. Application of AI & ML in Civil Engineering E. Tunneling and Underground Excavations	3	--	--	--	--	--	--	Audit
7	BTHM707	A. Essence of Traditional Indian Knowledge B. Foreign Language##	2	--	--	--	--	--	--	Audit
8	BTCEL708	Design & Drawing of Prestressed Concrete Structures	--	--	2	30	--	20	50	1
9	BTCEL709	Professional Practices Lab	--	--	2	30	---	20	50	1
10	BTCES710	Seminar	--	--	2	--	-	50	50	1
11	BTCEM711	Project Stage- I	--	--	4	--	50	50	100	3
12	BTCEP712	Field Training / Internship / Industrial Evaluation	--	--	--	---	--	50	50	1
		TOTAL	**20**	**2**	**10**	**160**	**150**	**490**	**800**	**24**

Dr. Babasaheb Ambedkar Technological University, Lonere

Teaching & Evaluation Scheme for Fourth Year B. Tech.

Civil and Environmental Engineering

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
SEMESTER- VIII										
5	BTCESS801#	A. Characterization of Construction Materials B. Geo synthetics of Reinforced Soil Structures C. Higher Surveying D. Environmental Impact assessment E. Plastic Waste Management F. Sustainable River Basin	02**	--	--	20	20	60	100	3
6	BTCESS802#	A. Energy Efficiency Acoustics & Day lighting in Building B. Environmental Remediation of contaminated sites C. Remote Sensing Essentials D. Solid & Hazardous Waste Management E. Soil Structure Interaction	02**	--	--	20	20	60	100	3
3	BTCEM803*	Project Stage II or Internship	--	--	24	100	--	100	200	12
		TOTAL	**20**	**2**	**10**	**160**	**150**	**490**	**800**	**24**

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Teaching & Evaluation Scheme for Fourth Year B. Tech.

Civil and Environmental Engineering

Sr. No.	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
SEMESTER- VII										
1	BTCEC701	Design of RCC Structures- II & Prestressed concrete structures	3	1	--	20	20	60	100	4
2	BTCEC702	Solid Waste Management	3	--	--	20	20	60	100	3
3	BTCEC703	Railway and Bridge Engineering	3	--	--	20	20	60	100	3
4	BTCEC704	Professional Practices	3	1	--	20	20	60	100	4
5	BTCEPE705	G. Ground Improvement Techniques H. Earthquake Engineering I. Town & Urban Planning J. Valuation of Land & Building K. Rehabilitation and Retrofitting of Structures L. Environmental Policies and Legislation	3	--	--	20	20	60	100	3
6	BTCEOE706	F. Research Methodology G. Operation Research H. Legal Aspects in Civil Engineering Contracts I. Application of AI & ML in Civil Engineering J. Tunneling and Underground Excavations	3	--	--	--	--	--	--	Audit
7	BTHM707	C. Essence of Traditional Indian Knowledge D. Foreign Language##	2	--	--	--	--	--	--	Audit
8	BTCEL708	Design & Drawing of Prestressed Concrete Structures	--	--	2	30	--	20	50	1
9	BTCEL709	Professional Practices Lab	--	--	2	30	---	20	50	1
10	BTCES710	Seminar	--	--	2	--	-	50	50	1
11	BTCEM711	Project Stage- I	--	--	4	--	50	50	100	3
12	BTCEP712	Field Training / Internship / Industrial Evaluation	--	--	--	---	--	50	50	1
		TOTAL	**20**	**2**	**10**	**160**	**150**	**490**	**800**	**24**

Detailed Syllabus (VII Semester)

Design of RCC Structure and Prestressed Concrete Structures

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

Course Contents
Limit State Method for RC Structures

Module 1: **(06 Lectures)**
Limit State of Collapse (Torsion) - Types of torsion, behavior of R.C. rectangular sections subjected to torsion, Design of sections subjected to combined bending and Torsion

Module 2: **(06 Lectures)**
Analysis and design of axially and eccentrically loaded short columns (Circular and Rectangular), detailing of reinforcement, and construction of Interaction diagrams for uni-axial bending, concept of bi-axial bending.

Pre-stressed Concrete Structure

Module 3: **(08 Lectures)**
Introduction to prestressed concrete, concepts, types, systems and methods of pre stressing,

Module 4: **(10 Lectures)**
Stress analysis for rectangular and symmetrical I sections, Pressure Line, Cable Profiles
Losses in Prestressing for Pre-tensioned & Post tensioned members

Module 5: **(06 Lectures)**
Design of Rectangular and Symmetrical I sections, Design of End Block
Structural audit of various structures such as load bearing wall type, RCC, Steel Framed, Prestressed Concrete, etc. conceptual introduction to elaborate necessity, implementation of audit, format of reporting, consequences

Text Books

1. IS: 456, IS 1343, SP16, SP24, SP34 of Recent Editions, Bureau of Indian Standards, New Delhi
2. Karve & Shah, “Limit State Theory & Design”, Structures Publications, Pune
3. Lin T.Y., “Prestressed Concrete”, John Willey & Sons New York
4. Jain A.K., “Reinforced Concrete Design (Limit State)”, Nemchand Brothers, Roorkee
5. Sinha S.N., “Reinforced Concrete Design”, Vol. I, II, Tata Mc-Graw Hill
6. Sinha& Roy, “Fundamentals of Reinforced Concrete”, S. Chand & Co. New Delhi
7. Sinha& Roy, “Prestressed Concrete”, S. Chand & Co. New Delhi
8. Krishnaraju N., “Prestressed Concrete”, Tata Mc-Graw Hill

Reference Books

1. Punmia B.C., “Reinforced Concrete Design”, Vol. I, II, Laxmi Publications
2. Varghese P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, New Delhi
3. Relevant Publications by Bureau of Indian Standards, New Delhi
4. Indian Standard codes related with nondestructive testing, Government Resolutions related to Structural Audits (BMC Act, etc.), Field manuals and reports by Expert Consultants.

Course Outcomes: On completion of the course, the students will be;
CO1: Able to identify the behavior, analyze and design of the beam sections subjected to torsion.
CO2: Able to analyze and design of axially and eccentrically loaded column and construct the interaction diagram for them. CO3: Understand various concepts, systems and losses in pre-stressing.
CO4: Able to analyze and design the rectangular and symmetrical I-section pre-stressed beam/girders.

Solid Waste Management

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1 **(6 Lectures)**

Solid Waste: Definitions, Types of solid wastes, sources of solid wastes, Characteristics, and perspectives; properties of solid wastes, Sampling of Solid wastes, Elements of solid waste management - Integrated solid waste management, Solid Waste Management Rules.

Module 2 **(6 Lectures)**

Engineering Systems for Solid Waste Management: Solid waste generation; on-site handling, storage and processing; collection of solid wastes; Stationary container system and Hauled container systems – Route planning - transfer and transport; processing techniques.

Module 3 **(6 Lectures)**

Engineering Systems for Resource and Energy Recovery: Processing techniques; materials recovery systems; recovery of biological conversion products – Composting, pre and post processing, types of composting, Critical parameters, Problems with composing - recovery of thermal conversion products; Pyrolysis, Gasification, RDF - recovery of energy from conversion products; materials and energy recovery systems.

Module 4 **(6 Lectures)**

Landfills: Evolution of landfills – Types and Construction of landfills – Design considerations – Life of landfills- Landfill Problems – Lining of landfills – Types of liners – Leachate pollution and control –Monitoring landfills – Landfills reclamation.

Module 5 **(6 Lectures)**

Hazardous waste Management: Sources and characteristics, Effects on environment, Risk assessment – Disposal of hazardous wastes – Secured landfills, incineration - Monitoring – Biomedical waste disposal, E-waste management, Nuclear Wastes, Industrial waste Management

TEXT BOOKS:

1. Tchobanoglous G, Theisen H and Vigil SA ‘Integrated Solid Waste Management, Engineering Principles and Management Issues’ McGraw-Hill, 1993.
2. Vesilind PA, Worrell W and Reinhart D, ‘Solid Waste Engineering’ Brooks/Cole Thomson Learning Inc., 2002.

REFERENCE BOOKS:

1. Peavy, H.S, Rowe, D.R., and G. Tchobanoglous, ‘Environmental Engineering’, McGraw Hill Inc., New York, 1985.
2. Qian X, Koerner RM and and Gray DH, ‘Geotechnical Aspects of Landfill Design and Construction’Prentice Hall, 2002.

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

CO1: Identify the physical and chemical composition of solid wastes

CO2: Analyze the functional elements for solid waste management.

CO3: Understand the techniques and methods used in transformation, conservation, and recovery of materials from solid wastes.

CO4: Identify and design waste disposal systems

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Railway and Bridge Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(8 lectures)**

Introduction, Tractive resistances & Permanent way: Principles of Transportation, Route surveys and alignment, railway track, development and gauges, Hauling capacity and tractive effort.

i) Rails: types, welding of rails, wear and tear of rails, rail creep.

ii) Sleepers: types and comparison, requirement of a good sleeper, sleeper density.

iii) Rail fastenings: types, Fish plates, fish bolts, spikes, bearing plates, chain keys, check and guard rails.

iv) Ballast: Requirement of good ballast, various materials used as ballast, quantity of ballast, different methods of plate laying, material trains, calculation of materials required, relaying of track

Module 2: **(8 lectures)**

Geometric Design; Station & Yards; Points and Crossings & Signaling and interlocking: Formation, cross sections, Super elevation, Equilibrium, Cant and Cant deficiency, various curves, speed on curves. Types, locations, general equipments, layouts, marshalling yards, Definition, layout details, design of simple turnouts, Types of signals in stations and yards, principles of signaling and inter-locking.

Module 3: **(8 lectures)**

Bridge Site Investigation and Planning; Loading Standards &Component parts: Selection of site, alignment, collection of bridge design data: essential surveys, hydraulic design, scour, depth of bridge foundation, Economical span, clearance, afflux, type of road & railway bridges. : Design loads and forces, Impact factor, Indian loading standards for Railways Bridges and Highway Bridges, Bridge super structure and sub-structures, abutments, piers, wing walls, return walls, approaches, floors & flooring system, choice of super structure.

Module 4: **(6 lectures)**

Bridge Foundations, Construction, Testing and Strengthening of Bridges: Different types of foundation: piles and wells, sinking of wells, coffer-dams. Choice of bridges and choice of materials, details of construction underwater and above water, sheet piles coffer dams, Erection of bridges, girders, equipments and plants. inspection and Data collection, strengthening of bridges, Bridge failure.

Module 5: **(6 lectures)**

Airport site selection, Air craft characteristics, various surface of an airport, Windrose diagram, Geometric elements of run way and taxiway , holding apron, parking configuration , terminal building , visual aids, air traffic control, airport marking and lighting

Reference Books

1. Chakraborty and Das; Principles of transportation engineering; PHI
2. Rangwala SC; Railway Engineering; Charotar Publication House, Anand
3. Rangwala SC; Bridge Engineering; Charotar Publication House, Anand
4. Ponnuswamy; Bridge Engineering; TMH
5. Railway Engineering by Arora &Saxena - DhanpatRai& Sons
6. Railway Track by K.F. Antia
7. Air-port Engineering by S.K.Khanna and M.G.Arora
8. Principles and Practice of Bridge Engineering S.P. Bindra - DhanpatRai& Sons
9. Bridge Engineering - J.S. Alagia - Charotar Publication House, Anand
10. Railway, Bridges & Tunnels by Dr. S.C. Saxena.

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

CO1: Gain comprehensive knowledge of materials ,components and maintenance of railway transportation system ,

CO2:Understand principles of Geometric Design and Railway Operations

CO3: Comprehend process of Bridge Site Investigation and Design criteria for various bridges

CO4: Understand components of Bridges, their Construction and failure causes and respective maintenance strategies

CO5: Understandsite selection of airport with its geometric elements and role of air traffic control, airport marking, and lighting in airport operation

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Professional Practices

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

Course Contents

Module 1: Introduction of Estimate **(8 Lectures)**
Introduction to estimating, purpose, types, items of inclusion, modes of measurement for different works, administrative approval and technical sanction to estimates; Quantity Surveying: Specifications: purpose general and detailed specifications for various items of work, prime cost, provisional sums and provisional quantities, taking out quantity, P.W.D. method, recording of measurements

Module 2: Costing **(8 Lectures)**
Analysis of rates for various items of construction of civil engineering works, standard schedule of rate, price escalation, detailed and approximate estimates for buildings, R.C.C works, culverts, earthwork for canals, roads including hill roads and other civil engineering works.

Module 3: Tendering **(8 Lectures)**
Types, preparation of tender papers, conditions of contracts, competitive bidding, types of bids, invitation of tenders, scrutiny and acceptance of tenders, award of jobs, introduction to B.O.T. and similar other basis of execution.

Module 4: Contracts **(6 Lectures)**
Essentials of legally valid contract, types and forms of contract between various agencies, organizational set up of P.W.D. classification of works, method of carrying out work in P.W.D. mode of payment, bill forms, introduction to arbitration.

Module 5: Valuation **(6 Lectures)**
Principles, types, price and cost, attributes of value, valuer and his duties, factors affecting the valuation of properties, methods of valuation, different types of lease. Valuation from yield and from life, gross yield and net yield, sinking fund, depreciation, different methods of calculating depreciation, depreciated cost, obsolescence.

Text Books

1. Dutta B.N.(2012)"Estimating and Costing", UBS Publishers Distributors, New Delhi.
2. Namavati R.H.(2016)"Professional Practice Estimating and Valuation", Lakhani book Depot, Mumbai.
3. Patil B.S.(2015)"Civil Engineering Contracts and Estimates", Universities Press, Hyderabad.
4. Bhasin P.L.(1987)"Quantity Surveying", S.Chand &Co. Ltd., Mumbai.
5. Rangwala S.C.(1990),"Elements of Estimating and Costing", Charotar Publication, Anand.
6. Birdi G.S.(2014) "Estimating and Costing", Dhanpat Rai & Sons, N. Delhi.
7. Chakroborty M.(2010) "Estimating, Costing & Specification in Civil Engineering", M. Chakraborty Publication, Nepal.
8. Rangwala S.C. (2011) "Valuationo freal Properties", Charotar Publication, Anand.

References

1. Govt. of Maharashtra P.W. and Housing Department Publication edition 1979 and 1981.
2. P.W.D. Maharashtra, "Standard Specifications", Volumes I & II.
3. C.P.W.D. Specifications.
4. C.P.W.D. Schedule of Rates.
5. P.W.D. Maharashtra Schedule of Rates.
6. Publications of Bureau of Indian Standards: IS1200 all parts, and other relevant.

Course Outcomes: On completion of the course, the students will be able to:
CO1: Understand the importance of preparing the types of estimates under different conditions for various structures.
CO2: Know about the rate analysis and bill preparations and to study about the specification writing.
CO3: Know the various types of contract, accounts in PWD, methods for initiating the works in PWD and tendering.
CO4: Understand the valuation of land and buildings, various methods and factors affecting valuation.

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Ground Improvement Techniques

Teaching Scheme: (3 Lectures) hours/week

Course Contents

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

Need for engineered ground improvement, classification of ground modification techniques; suitability, feasibility and desirability of ground improvement technique; objectives of improving soil.

In-situ densification methods in granular soils Introduction, Vibration at the ground surface, impact at the ground surface, vibration at depth, impact at depth.

Module 2 **(6 Lectures)**

Ground Improvement in Cohesive Soil: Compressibility, vertical and radial consolidation, preloading methods. Types of Drains, Design of vertical Drains, construction techniques. Stone Column: Function Design principles, load carrying capacity, Construction techniques, settlement of stone column foundation

Module 3 **(8 Lectures)**

In-situ densification methods in cohesive soils: Introduction, preloading, sand drains, sand wicks, band drains, stone and lime columns.

Reinforced earth: Principles, components of reinforced earth, governing design of reinforced earth walls, design principles of reinforced earth walls

Module 4 **(8 Lectures)**

Geotextiles: Introduction, types of geotextiles, functions and their applications, tests for geotextiles, geogrids and its functions.

Dewatering: Dewatering – methods of dewatering and pressure relief, well point systems, deep well drainage, vacuum dewatering, electro osmosis, capacity of pumps and pumps design, installation and operation of dewatering systems – single line, two line, flow to a single well, multiple well systems.

Grouting: Introduction; Kinds of grout- Cementitious grouts and Chemical grouts; Grouting methods- Intrusion grouting, Permeation grouting, compaction grouting and jet grouting.

Module 5 : Stabilization of soils **(10 Lectures)**

Mechanical Stabilization -Soil aggregate mixtures, properties and proportioning techniques, soft aggregate stabilization, compaction, field compaction control;

Cement Stabilization-Mechanism, factors affecting and properties, use of additives, design of soil cement mixtures, construction techniques;

Lime and Bituminous Stabilization-Type of admixtures, mechanism, factors affecting, design of mixtures, construction methods.

References

1. Ground improvement Techniques, P. Purushothama Raju, USP, 1999.
2. Designing with Geosynthatics by Robert M. Koerner, 5th Edition, Prentice Hall,2005.
3. Construction and Geotechnical methods in Foundation Engineering by R. M. Koerner, McGraw-Hill , 1984.
4. Current Practices in Geotechnical Engineering Vol.-I, Alam Singh and Joshi, International Book Traders, 1985.

Textbooks

1. Engineering Principles of ground modification by MR Hausmann, McGraw-Hill , 1990.
2. R. M. Korner, Design with Geosynthetics, Prentice Hall, New Jersy, 3rd Edn. 2002
3. P. Purushothama Raj, Ground Improvement Techniques, Tata Mc Graw Hill, New Delhi, 1995.
4. Dr. B. C. Chattopadhyay and J.Maity, Ground Control and Improvement Techniques, PEEDOT, Howrah, 2011.
5. G. V. Rao and G. V. S. Rao, Text Book On Engineering with Geotextiles, Tata McGraw Hill
6. T. S. Ingold and K. S. Miller, Geotextile Hand Book, Thomas Telfrod, London
7. N. V. Nayak, Foundation Design Manual, Dhanpat Rai and Sons, Delhi.
8. M. P. Moasley, Ground Improvement Techniques.

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

CO1: Study the behavior of soil

CO2: Understand the ground improvement techniques.

CO3: Study the application of ground improvement techniques.

CO4: Solve the field problems related to problematic soils and solve the problems using different Ground Improvement techniques

CO5: Design drainage, dewatering for the field problems

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Earthquake Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Earthquake Basics **(04 Lectures)**

Interior of Earth, plate tectonics, faults, consequences of earthquake, Basic parameters of earthquake, magnitude & intensity, scales, Seismic zones of India, damages caused during past earthquakes (worldwide).

Module 2: Fundamentals of Earthquake Vibrations of buildings **(08 Lectures)**

Static load v/s Dynamic load (force control and displacement control), simplified single degree of freedom system, mathematical modeling of buildings, natural frequency, resonance v/s increased response, responses of buildings to different types of vibrations like free and forced, damped and un-damped vibration, response of building to earthquake ground motion, Response to multi degree (maximum three) of freedom systems up to mode shapes.

Module 3: Design Philosophy **(08 Lectures)**

Philosophy of earthquake resistant design, earthquake proof v/s earthquake resistant design, four virtues of earthquake resistant structures (strength, stiffness, ductility and configuration), seismic structural configuration, Introduction to IS: 1893 (Part I), IS: 875 (Part V). Seismic load: Seismic Coefficient Method – base shear and its distribution along height. Introduction to Response spectrum, IS code provisions.

Module 4: Lateral Loads on Buildings **(08 Lectures)**

Lateral Load Distribution (SDOF): Rigid diaphragm effect, centers of mass and stiffness, torsionally coupled and uncoupled system. Lateral Load Analysis: Analysis of frames using approximate methods like portal & cantilever methods

Module 5: **(08 Lectures)**

Ductile Detailing: Concepts of Detailing of various structural components as per IS: 13920 provisions. Special topics: Introduction to Earthquake Resistant Features of un-reinforced & reinforced masonry Structure, Confined Masonry, Soil liquefaction, Structural controls, Seismic strengthening.

Reference Books:

1. Manish Shrikhande & Pankaj Agrawal; Earthquake resistant design of structures, PHI Publication, New Delhi
2. S.K.Duggal; Earthquake resistance design of structures; Oxford University Press, New Delhi.
3. A.K.Chopra; Dynamics of structures , Pearson, New Delhi
4. Clough & Penzin; Dynamics of structures
5. Park & Pauly; Behaviour of RC structure
6. John M.Biggs; Introduction to Structural Dynamics
7. C V R Murthy - Earthquake Tips, NICEE
8. IITK-GSDMA EQ26 – V -3.0 Design Example of a Six Storey Building
9. S S Rao; Mechanical Vibration; Pearson, New Delhi.

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

CO1: Determine the response of SDOF & MDOF structural system subjected to vibration including earthquake.

CO2: Apply the concept of Earthquake Resistant Design & concept of lateral load distribution on buildings.

CO3: Determine the lateral forces generated in the structure due to earthquake.

CO4: Apply the concept of ductile detailing in RC structures.

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Town and Urban Planning

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Town planning principles, Surveys and Zoning (08 Lectures)

Evolution of planning-objects of town planning-Economic justification for town planning principles of Town planning-Necessity of town planning-origin of towns-growth of towns-stages in town development-personality of town-Distribution of land uses-Forms of planning-site for an ideal Town Requirements of new Towns-Planning of the modern Town-Powers required for enforce T.P. schemes-cost of Town planning-present position of Town Planning in India Necessity-collection of Data-Types of surveys-Uses of surveys Meaning of the term-Uses of land-objects and principles of Zoning-Advantages of Zoning-Importance of Zoning-Aspects of Zoning-Transition Zone-Economy of Zoning-Zoning powers-Maps for Zoning.

Module 2: Slums and Housing (06 Lectures)

Causes of slums-Characteristics of slums-Effects of slums-Slum clearance-Works of improvement Open plot scheme-Slum clearance and rehousing Prevention of slum formation-Resources for slum clearance programmes -The Indian slum. Importance of housing-Demand for houses-Building site-Requirements of residential buildings Classification of residential buildings-Design of residential areas-Rural Housing-Agencies for housing Investment in housing- HUDCO- CIDCO- Housing problem in India

Module 3: Public buildings, Parks and playgrounds, Master Plan with Re-planning existing towns (08 Lectures)

Location of Public Buildings – Classification of public Buildings - Principles of design of public buildings - Town centres - Grouping of public buildings - Civic aesthetics. Types of recreation-Location of urban green spaces-classification of parks-park systems-park design-Finance of parks-parkways-playgrounds-space standards-Landscape architecture. Master Plan Objectives and Necessity-Data to be collected-Drawings to be prepared-Features of master plan-Planning standards-Report-stages of preparation-Method of Execution-conclusion

Module 4: Building Bye-laws and Execution of Urban planning (08 Lectures)

Objects of bye-laws-importance of bye-laws-Function of local authority-Responsibility of owner Applicability of bye-laws-set-back-Light plane-Floor space index-Off-street parking-Fire protection Minimum plot sizes-Some other terms-Principles underlying building bye-laws-Building bye-laws for residential area of a typical town planning scheme-Building bye-laws-Development control rules- General rules of metropolitan Area-CMDA rules. Airports-Location-size-Noise control-Parts of an airports-Betterment and compensation-city blocks conurbations-Cul-de-sac streets-Focal point-Green belt-Public utility services-Rapid transit –Remote sensing application –urban planning using remote sensing-site suitability analysis-Transportation planning

Module 5: MRTP Acts and Planning Approaches (06 Lectures)

Different town planning works with reference to M.R.T.P. Act. (Brief idea about various provisions)Land acquisition act necessity and procedure of acquisition. village planning- Planning process, Multilevel planning, Decentralization concepts, Rural developments- planning methodology, Growth centre approach, Area Development approach, Integrated rural development approach

Reference Books:

1. Ramegowda K A., “Urban and regional planning”, University of Mysore
2. Rangwala K. S. and Rangwala P. S., “Town Planning ”, Charotar Publishing House,15th Edition,1999.
3. Engineering Optimization: Methods and Application, A. Ravindran and K. M. Ragsdell, Wiley India
4. National Building Code of India- Part-III.
5. Municipal and Panchayat bye-laws, CMDA Rules and Corporation bye-laws
6. John Rate life, “An Introduction to town and country planning”, London
7. Harvey M. Rubenstain , “A Guide to site and Environmental planning”, New York

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

CO1: Comprehend the evolution, principles, and necessity of town planning through concepts of land use distribution, zoning, and the economic justification for town planning.

CO2: Identify the housing demand, Slum causes, characteristics, and their effects as well as slum prevention strategies.

CO3: Design and Plan of Public Spaces by creating master plans and their execution considering importance of urban green spaces, park systems, and playgrounds.

CO4: Apply building Bye-laws with a deeper understanding of development control rules and general metropolitan area rules.

CO5: Understand Legislation and Planning Approaches with reference to the MRTP Act and Land Acquisition Act.

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Valuation of Land & Building

Teaching Scheme: (3Lectures) hours/week

Course Contents

Module 1: **(Lectures 08)**

Cost approach to value: Advanced studies: land characteristics, belting theory, hypothetical plotting scheme, hypothetical building scheme, transfer of development rights, estimating cost of construction using building cost indices, replacement cost new, reproduction cost, reinstatement value.

Market approach to value: Advanced studies: Market comparison techniques, adjustment grid model, regression analysis, automated sales analysis, residual technique, comparison by weightages assigned to various factors to comparison

Module 2: **(Lectures 06)**

Income approach to value: Advanced studies : principles of income approach sale analysis techniques and deriving rate of interest from sale transaction, rate of capitalization, reversionary value of land, impact of other forms of investments on value of property and vice versa. Data collection, surveys, enquiries and investigations and analysis. Limitations of various approaches to value.

Module 3: **(Lectures 08)**

Various purposes of valuation: Fiscal: Stamp duty on transfer of property, Rating, Direct Tax Acts - Income Tax including capital gains, Wealth Tax, Court fees including probate and partition.

Various purposes of valuation: Non-Fiscal: Bank Finance and securitization, Auction reserve, Compulsory acquisition, Insurance, Sale / Purchase, Betterment levy, Standard / fair rent under rent law, Various forms of obsolescence including depreciation.

Module 4: **(Lectures 08)**

Valuation of special types of properties: Hotels, Cinema, Petrol Pump, Hill station properties – Time shared property. Valuation of transferable development rights: easement rights – life interest.

Valuation of properties: Forcible or unauthorized occupancies. Mass appraisals techniques: value contour maps. Valuation for financial statements accounting treatment of reserve created by revaluation of assets.

Module 5: **(Lectures 06)**

Effects of legislation on Valuation: rent control law, town planning law etc. Valuation of agricultural lands by market approach & income approach. Elementary considerations in valuation of plantation, forest, orchards, queries, intangible assets like goodwill, royalty rights etc. Valuer's role, functions and responsibility. Code of ethics for valuers. Valuation Standards published by – International Valuation Standards Committee. Royal Institution of Chartered Surveyors, U.K. Introduction to Valuation Tables, discounted cash flow I.R.R., N.P.V., Layer approach, Ellwood approach, equitable yield and equated yield. Property portfolio analysis.

Reference Book:

1. The Real Estate Handbook, Maury Seldin & James H. Boykin (ISBN 087094-917-9)
2. Theory and Practice of Valuation, Roshan H. Namavati
3. Valuation Relating to Standard Rent, Roshan H. Namavati
4. Valuation of Real Property, Shyamles Datta
5. Law of Land Acquistion and Compensation, V.G. Ramachandran
6. Parks' Valuation – 5th Edition (1998), D.N. Banerjee, Eastern Law House, Calcutta.
7. Basic Real Estate Appraisal, Richard M.Betts & Silas J. Ely
8. The Real Estate Handbook, Maury Seldin & James H. Boykin (ISBN-087094-917-9)
9. Theory and Practice of Valuation, Roshan H. Namavati (v) Parks'
10. Valuation – 5th Edition (1998), D.N. Banerjee, Eastern Law House, Calcutta.
11. Valuation Relating to Standard Rent, Roshan H. Namavati

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

CO1: To make the students to know about the cost approach to value.

CO2: To make the students know about the purpose of valuation: fiscal.

CO3: To make the students know about the purpose of valuation: Non-fiscal.

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Rehabilitation and Retrofitting of structures

Teaching Scheme: (3Lectures) hours/week

Course Contents

Module 1: Introduction **(04 Lectures)**

Overview of distress, deterioration in concrete structures, Scenario of distressed structures world over, Need for repairs and upgrading of structures, General introduction to process (Road-map) to a durable concrete repair

Module 2: Deterioration of concrete structures **(08 Lectures)**

Types of deterioration – Signs, causes & symptoms, Mechanism of deterioration, contributing factors like permeability, inadequate durability & micro-structure of concrete. Physical deterioration due to moisture, temperature, shrinkage, freeze-thaw, abrasion, erosion, cavitation, crystallization of salts, Efflorescence, exposure to severe environment like marine exposure. Chemical deterioration due to corrosion of reinforcement (chloride induced, carbonation induced), Alkali-silica reaction, sulphate attack, Acid attack.

Deterioration due to water leakage, fire – detection & mitigation of the same. Deterioration due to ageing, inadequate maintenance, Design & construction deficiencies, overloading etc. Visual deterioration of structures- Types of cracks, causes & characteristics of cracking in various structural components like beam, column, slab, masonry walls. Measurement of cracks, interpretation of the cause of particular type of crack.

Module 3: Conditional/damage assessment & Evaluation of structures **(08 Lectures)**

Structural assessment: Conditional evaluation / Structural Appraisal of the structure – Importance, objective & stages, Conditional/damage assessment procedure, Preliminary & Detailed investigation – Scope, Objectives, Methodology & Rapid visual inspection of structures

Damage Assessment allied Tests (Destructive, Semi-destructive, Non- destructive): Field & laboratory testing procedures for evaluating the structure for strength, corrosion activity, performance & integrity, durability. Interpretation of the findings of the tests.

Module 4: Repairs, rehabilitation & Retrofitting of concrete structures **(08 Lectures)**

Repair materials - Criteria for durable concrete repair, Methodology, performance requirements, repair options, selection of repair materials, Preparatory stage of repairs, Different types of repair materials & their application, types of repair techniques. Retrofitting/Strengthening: Need for retrofitting, Design philosophy of strengthening structures, Techniques available for strengthening including conventional and advanced techniques. Seismic retrofit of concrete structures :Deficiencies in structure requiring seismic retrofit, Design philosophy, Techniques to enhance the seismic resistance of structures, advanced techniques for making seismic resistant structures

Module 5: Allied topics **(08 Lectures)**

Protection & maintenance of structures - Importance of protection & maintenance, Categories of maintenance, Building maintenance. Corrosion mitigation techniques to protect the structure from corrosion. Long term health monitoring / Structural health monitoring (SHM)– Definition and motivation for SHM, Basic components of SHM and its working mechanism, SHM as a tool for proactive maintenance of structures.

Reference Books:

1. Concrete microstructure, Properties and materials – P Kumar Mehta and Paulo J.M.Monterio
2. Handbook on Repairs and Rehabilitation of RCC buildings – CPWD, Government of India.
3. Concrete technology – A.R.Shanthakumar, Oxford University Press, India
4. Concrete Technology by M.L.Gambhir, Tata McGraw-Hill Education, Third Edition
5. Appraisal and Repair of Reinforced concrete by R.Holland, Thomas Telford Ltd. London.
6. J.H.Bungey, S.G.Millard & M.G.Grantham , Testing of Concrete in Structures, 4th Edition, Taylor & Francis, London & New York, 2006.
7. V. M. Malhotra, Nicholas J. Carino 2004 “Handbook on Nondestructive Testing of Concrete”
8. “Repair and Strengthening of Concrete structures” , FIP guide, Thomas Telford, London.
9. Concrete Structures, Protection, Repair and Rehabilitation by R.Dodge Woodson.
10. Structural Condition assessment by Robert T. Ratay.
11. Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.

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

CO1: Identify and define all the terms and concepts associated with deterioration of concrete structures.

CO2: Carry out the damage assessment and Rapid Visual inspection of a building showing signs of deterioration and thus should be able to detect the possible cause /source of deterioration.

CO3: Develop a knowhow of the Concrete repair industry equipped with variety of repair materials and techniques.

CO4: Describe and apply the importance of quality control in concrete construction and significance of protection and maintenance of structures.

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Environmental policies and Legislation

Teaching scheme: (3 Lectures) hour/week

Course Contents

Module 1: Introduction **(06 Lectures)**

Indian Constitution and Environmental Protection – National Environmental policies – Precautionary Principle and Polluter Pays Principle – Concept of absolute liability – multilateral environmental agreements and Protocols – Montreal Protocol, Kyoto agreement, Rio declaration – Environmental Protection Act, Water (P&CP) Act, Air (P&CP) Act – Institutional framework (SPCB/CPCB/MoEF).

Module 2: Water (P & CP) Act, 1974 **(06 Lectures)**

WATER (P&CP) ACT, 1974 8 Power & functions of regulatory agencies - responsibilities of Occupier Provision relating to prevention and control Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Water Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation**.**

Module 3: Air (P & CP) Act, 1981 **(08 Lectures)**

Power & functions of regulatory agencies - responsibilities of Occupier Provision relating to prevention and control Scheme of Consent to establish, Consent to operate – Conditions of the consents – Outlet – Legal sampling procedures, State Air Laboratory – Appellate Authority – Penalties for violation of consent conditions etc. Provisions for closure/directions in apprehended pollution situation.

Module 4: Environment (Protection) Act 1986 **(10 Lectures)**

Genesis of the Act – delegation of powers – Role of Central Government - EIA Notification – Sitting of Industries – Coastal Zone Regulation - Responsibilities of local bodies mitigation scheme etc., for Municipal Solid Waste Management - Responsibilities of Pollution Control Boards under Hazardous Waste rules and that of occupier, authorisation – Biomedical waste rules – responsibilities of generators and role of Pollution Control Boards

Module 5: **(06 Lectures)**

Relevant Provisions of Indian Forest Act, Public Liability Insurance Act, CrPC, IPC -Public Interest Litigation - Writ petitions - Supreme Court Judgments in Landmark cases

Text Books

1. Rosencranz, A., Divan, S. and Noble, M.L., Environmental Law and Policy in India : Cases, Materials and Statutes, Tripathi Pvt. Ltd, Bombay, 1992.
2. Welford, R., Corporate Environmental Management, Earthscan Publications Ltd., London, 1988.
3. Asolekar, S. R. and Gopichandran, R. Preventive Environmental Management - An Indian Perspective Foundation Books Pvt. Ltd., New Delhi (the Indian association of Cambridge University Press, UK), 2005.

Reference Books:

1. Pollution Control Acts, rules and notifications issued by CPCB [Ministry of and Environment and forest, Goverment of India], Paryavaran Bhawan, CGO Complex, New Delhi-110003.
2. Mohanty, S.K. “Environment & Pollution Law Manual”, Universal Law Pub.
3. Sengar, D.S. “Environmental Law”, PHI.

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

CO1: Gain knowledge about the environment and ecosystem.

CO2:Students will learn about natural resource, its importance and environmental impacts of human activities on natural resources.

CO3:Gain knowledge about the conservation of biodiversity and be familiar with the laws, policies and institutions in the field of environment

CO4: acquire the skills needed for interpreting laws, policies and judicial decisions in a holistic perspective

CO5: acquire the ability to evaluate the role of law and policy in conservation and management of natural resources and prevention of pollution

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Research Methodology

Teaching scheme: (3 Lectures) hour/week

Course Contents

Module 1: **(08 Lectures)**

Introduction to engineering research: Definition, characteristics and types, basic research terminology, qualities of a researcher, research methodology, overview of engineering research methods, role of Information and Communication Technology (ICT) in research ,Research and Integrity, Scientific misconduct: Falsification, Fabrication and Plagiarism (FFP), Conflict of research, Predatory publishers and Journals, Open access publication, citation and acknowledgement, reproducibility and accountability, software tools for similarity check

Module 2: **(06 Lectures)**

Research formulation: Defining and formulating there search problem, selecting the problem, necessity of defining the problem, literature survey significance in defining a problem, various sources, and critical review, identifying gap areas from literature review and research databases, development of working hypothesis.

Module 3: **(08 Lectures)**

Research design and data analysis: Research design basic principles, need of research design, features of good design, important concepts relating to research design, observation and facts, laws and theories, method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis, hypothesis testing, generalization and interpretation

Module 4: **(08 Lectures)**

Technical writing: Types (thesis, report, journal papers etc.), qualities, structure and components of good technical document, use of software tools (Word processing, latex, etc.), illustrations and tables, bibliography, referencing and footnotes. Oral presentation planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication

Module 5: **(06 Lectures)**

Patent Rights and IPR Patents and its basics, process of filing patent at national and international level, Introduction and significance of intellectual property rights, commercialization, royalty, copyright, trade related aspects of IPR, Administration of patent system in India, licensing and transfer of technology, case studies

Text books:

1. Fisher R. A., Statistical Methods for Research Workers, Macmillan Pub Co 1970.
2. Montgomery D. C., Design and Analysis of Experiments, John Wiley, 2001
3. Kothari C. R., Research Methodology: Methods and Techniques, Second Edition, New Age International Publishing, 2004.
4. Panneer selvam R., Research Methodology, Prentice Hall Publication, 2004.

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

CO1: Critically evaluate current research
CO2: Formulate research problem.
CO3 : Develop hypothesis and a research proposal
CO4: Illustrate method of communication of scientific results for peer review.
CO5: Student will be have a clear view of writing research paper and report.

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Operation Research

Teaching scheme: (3 Lectures) hour/week

Course Contents

Module 1: Introduction of Operations Research **(06 Lectures)**

Introduction to operations research and optimization techniques, applications of operations research in civil engineering, introduction to linear and non-linear programming methods, formulation of linear optimization models for civil engineering applications (objective function, constraints), graphical solutions to L P problems, local & global optima, unimodal function, convex and concave function

Module 2: Stochastic Programming **(08 Lectures)**

Sequencing: n jobs through 2, 3 and M machines, queuing theory: elements of queuing system and its operating characteristics, waiting time and ideal time costs, Kendall's notation, classification of Queuing models, single channel Queuing theory: Model I (Single channel Poisson Arrival with exponential services times, Infinite population (M/M/1): (FCFS/ /), simulation: Monte Carlo simulation

Module 3: Linear programming **(08 Lectures)**

The transportation model and its variants, assignment model and its variants, The simplex method, method of big M, two phase method, duality

Module 4: Nonlinear programming **(08 Lectures)**

Single variable unconstrained optimization: sequential search techniques-dichotomous, Fibonacci, golden section, multivariable optimization without constraints: the gradient vector and hessian matrix, gradient techniques, steepest ascent/decent technique, Newton's Method, Multivariable optimization with equality constraints: Lagrange multiplier technique

Module 5: Dynamic programming, Games Theory and Replacement Model **(06 Lectures)**

Dynamic programming: multi stage decision processes, principle of optimality, recursive equation, applications, Games theory: 2 persons games theory, various definitions, application of games theory, replacement of items whose maintenance and repair cost increase with time ignoring time value of money

Reference Books:

1. Operations Research, Premkumar Gupta and D. S. Hira, S. Chand Publications
2. Engineering Optimization: Methods and Application, A. Ravindran and K. M. Ragsdell, Wiley India
3. Engineering Optimization, S. S. Rao, New Age International (P) Ltd
4. A System Approach to Civil Engineering Planning & Design, Thomas K. Jewell - Harper Row Publishers
5. Introduction to game theory, StefTijs, Hindustan Book Agency, New Delhi
6. Operations Research, Hamdy A. Taha, Pearson Publication

Course Outcome (CO): On completion of the course, the students will be able to:

CO1: Develop the skill for problem formulation
CO 2: Understand various components for formulating a problem
CO3: Enable the students to solve the queuing models, assignment and transportation models.
CO4: Develop decision making, especially, under uncertain scenario, risks, etc.

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Legal Aspects in Civil Engineering Contracts

Teaching scheme: (3 Lectures) hour/week

Course Contents

Module 1: **(08 Lectures)**
Professional Practice and Administration Contracts: The standard form of building contracts, Indian contract Act, The right of building owner, Right of Contractor, Types of Civil Engineering contracts, RERA

Module 2: **(08 Lectures)**
Bailment: Nature of Transactions, Delivery of Bailee, care to be taken, Bailee's Responsibility, Termination, Bailment of pledges. **Injunction:** Types Temporary, Perpetual, Mandatory when referred, Indemnity and Guarantee: Difference between the two, The Contract of Guarantee and Indemnity,

Module 3: **(06 Lectures)**
Industrial Acts and Labour Laws: Indian factories Act, Industrial Dispute Act, Payment of Wages Act, Work Compensation Act, Trade Union Act, The Building and Other Constructions Workers' (Regulation of Employment and Conditions of Service) Act, 1996

Module 4: **(06 Lectures)**
Arbitration and Award: Indian Arbitration Act, Arbitration Agreement, Conduct of Arbitration, Power and Duties of Arbitration, Rules of Evidence, E- Tendering, Preparation and publication of ward, Methods of Enforcement impending and Awards.

Module 5: **(08 Lectures)**
Safety Engineering: Sources, Classification, Cost of Accident and Injury Workmen's Compensation Act, Safety Programme, Safety Organization. Employers Liability Act, Employers Insurance Act, Safety and Health Standards Occupations Hazards, personal Protective equipment, preventive measures Factory Act, Fatal accidents

Reference Books:
1. Indian Contract Act Avatar Singh.
2. Indian contract Act Jhamb.

Text Books:
1. Indian arbitration Act by B. S. Patil.
2. Indian Contract Act.
3. Safety Engineering, Govt. of India Publication.
4. Professional Practice, Roshan Namavati.
5. Legal Aspects of building and Engineering Contracts by B. S. Patil.

Course Outcome (CO):
CO1: Students will learn Indian contract act, Arbitration act and contract administration.
CO2: Student will gain knowledge about bailment and FIDIC.
CO3: Students will understand the labour laws.
CO4: Students will be exposed to safety engineering and relevant act.

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Applications of AI and ML in Civil Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction to AI and ML in Civil Engineering: (05 Lectures)

Understanding the fundamentals of AI and ML, Overview of AI techniques and Algorithms, AI and ML applications in Civil Engineering, Modeling concept.

Module 2: AI and ML Techniques: (08 Lectures)

Artificial Neural Networks, Machine Learning Algorithm, Neural Language Processing, Concurrent Neural Networks, Linear regression, Descriptive statics- Data exploration (histograms, scatter Plot etc), measure of central tendency, positions, dispersion and other measures, statistical analysis- measure of distribution (Skewness and Kurtosis), relation between attributes and other statistical graphs, data management- data acquisition, data pre processing and preparation, data quality and transformation.

Module 3: AI and ML in Transportation Engineering and Construction Planning: (06 Lectures)

AI applications in Traffic flow optimization and analysis, intelligent transportation systems and traffic control, real time traffic prediction using ML Algorithms.
Resource allocation and optimization in construction projects, Implementing AI based construction planning tools.

Module 4: AI and ML in Water Resource Engineering and Environment Engineering: (07 Lectures)

Model application in Water Resource Engineering- Classification, prediction and forecasting: time series data, Fuzzy model application in Water Resources Engineering: Runoff Hydrograph Simulation, Hydrograph Simulation at watershed scale, Peak discharge prediction
Predictive models for Air pollution levels, Water availability, climate change impacts, Waste management data analysis,

Module 5: AI and ML in Structural Design and Structural Health Monitoring: (07 Lectures) Implementing AI and ML in Structural Design task, AI and ML for structural analysis and simulation, Structural design optimization, Importance of predictive maintenance in civil infrastructure, Models for structural health assessment.

Text Books:

1. Gebrail Bekdas (2019), "Artificial Intelligence and Machine Learning applications in Civil, Mechanical and Industrial Engineering" IGI Global Publication
2. G. Tyfure (2012), "Soft Computing in Water Resources Engineering", WIT Press, Southampton, UK
3. N. K. Bose and P. Liang (1996), "Neural Networks Fundamentals with Graphs, Algorithms, and applications" Tata McGraw- Hill Publication.

Reference Books:

1. B. Kosko (1993), "Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence", Prentice- Hall.
2. Publications in peer reviewed international unpaid journals.

Course Outcomes: On completion of the course, the students will be able to:
CO1: Understand the fundamental concepts of artificial intelligence and machine learning and their relevance to civil engineering applications.
CO2: Analyze real-time traffic data and apply machine learning models to optimize traffic flow and control in transportation systems.
CO3: Implement AI-based approaches to optimize water resource management and predict water demand, air quality model, climate change in civil engineering projects.

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Tunneling and Underground Excavation

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Tunneling Methods **(6 Lectures)**

Types and purpose of tunnels; factors affecting choice of excavation technique; Methods - soft ground tunneling, hard rock tunneling, shallow tunneling, deep tunneling; Shallow tunnels – cut and cover, cover and cut, pipe jacking, jacked box excavation techniques, methods of muck disposal, supporting, problems encountered and remedial measures.

Module 2: Tunneling by Drilling and Blasting **(8 Lectures)**

Unit operations in conventional tunneling; Drilling – drilling principles, drilling equipment, drilling tools, drill selection, specific drilling; Blasting - explosives, initiators, blasting mechanics, blast holes nomenclature; types of cuts- fan, wedge and others; blast design, tunnel blast performance - powder factor, parameters influencing, models for prediction; mucking and transportation equipment selection.

Module 3: Tunneling by Road headers and Impact Hammers **(8 Lectures)**

Cutting principles, method of excavation, selection, performance, limitations and problems. Tunneling by Tunnel Boring Machines: Boring principles, method of excavation, selection, performance, limitations and problems; TBM applications.

Module 4: Excavation of large and deep tunnels Introduction **(6 Lectures)**

Purpose and use of large and deep tunnels; excavation issues governing large and deep tunnels; excavation methods of large and deep tunnels - unit operations, different equipment, types of rocks.
pressure and methods to deal, roof and wall supports, case studies from hydel, road and rail tunnels.

Module 5: Shield Tunneling **(8 Lectures)**

Introduction; advantages of shield tunneling; classification; different types of shields tunneling techniques – open shield, close shield, half shield; conventional shields, special features in shield tunneling; factors affecting selection of a shield; slurry shield, earth pressure balance shield, slime shields, other shield development methods, problems encountered with possible remedies.

Text Books:

1. Srinivasan R., (2016). Harbour, Docks and Tunnel Engineering, Charotar Pub. House.
2. Saxena S. C. (2015). Tunnel Engineering, Dhanpat Rai Publications.
3. Tatiya R. R., (2013), Surface and Underground Excavation, CRC Press.

Reference Books:

1. Stack, B. (1982). Handbook of Mining and Tunnelling Machinery, Wiley, New York.
2. Chugh, C.P., (1977). Drilling Technology Handbook, Oxford & IBH Publication.
3. Bickel J.O. and. Kuesel T.R, (2018). Tunnel Engineering Handbook, CBS Publishers and Distributors Pvt. Ltd.
4. Brebbia C.A., Kaliampakos D., Prochazka P., (2008). Underground Spaces Design, Engineering and Environmental Aspects, WIT Press,

Web links:

1. https://www.isrm.net
2. www.nirm.in
3. http://umich.edu/~gs265/tunnel.html
4. http://se.sze.hu/images/ngm_se108_1/Tunnels_2015-03-20_Toth_1-Excavation.pdf
5. https://www.usbr.gov/ssle/safety/RSHS/sec23.pdf
6. https://www.osha.gov/Publications/osha3115.html

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

CO1: Understand types of tunnels and tunneling methods conforming to site conditions.
CO2: Investigate various tunneling operations and relevant machinery required.
CO3: Understand methods and operations of excavating large and deep tunnels.
CO4: Propose suitable tunneling and excavations methods to optimize the same.

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Essence of Indian Traditional Knowledge

Teaching Scheme: 1 Lecture / week

Course Contents

Module 1: **(4 Lectures)**
Ancient Education System in India, History of Indian Knowledge System, Sources of knowledge transmission and preservation, Indian Artistic Tradition: Chitrakala, Moorthikala, Vasthukala, Sthapthya, Sangeetha, Nruthya, Sahithya

Module 2: **(4 Lectures)**
Indian Linguistic Tradition (Phonology, morphology, syntax & semantics), Yoga & Holistic Health care.

Module 3: **(4 Lectures)**
Philosophical Traditions in ancient India, Relevance in today's life.

Module 4: **(4 Lectures)**
Glimpses of ancient Indian science and technology, Ancient structures in India, Traditional materials, Construction styles and Techniques, Developments in construction materials, living styles and habitation, Town Planning, Case Studies.

Module 5: **(6 Lectures)**
Developments in water supply, sanitation, irrigation and agriculture, Case Studies.
Developments in transportation and communication, Case Studies.

Text / Reference Books:

1. V. Sivaramakrishna, "Cultural Heritage of India", Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edi., 2014.
2. Swami Jitatmanand, "Modern Physics and Vedant", Bharatiya Vidya Bhavan.
3. Fritz of Capra, "Tao of Physics".
4. Fritz of Capra, "The wave of Life".
5. 5Jha V. N. (English Trans,), "Tarkasangraha of Annam Bhatta", Inernational Chinmay Foundation, Velliarnad, Arnakulam.
6. "Yoga Sutra of Patanjali", Ramakrishna Mission, Kolkata.
7. Jha GN (English Trans.), R N Jha, "Yoga-darshanam with Vyasa Bhashya", Vidyanidhi Prakasham, Delhi, 2016.
8. Jha RN, "Science of Consciousness Psychotherapy and Yoga Practices", Vidyanidhi Prakasham, Delhi, 2016.
9. P R Sharma (English translation), "Shodashang Hridayam".
10. Indian Journal of Traditional Knowledge.
11. https://www.niscair.res.in/sciencecommunication/researchjournals/rejour/ijtk/ijtk0.asp
12. Swayam Course by Prof. D. P. Mishra, IIT Kanpur: https://swayam.gov.in/nd1_noc19_ae07/preview.

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Foreign Language

Student may take foreign language course from online platform NPTEL/SWAYAM/any other approved foreign language course by university such as;
German I https://onlinecourses.nptel.ac.in/noc19_hs51/preview
Spanish https://onlinecourses.swayam2.ac.in/cec19_lg03/preview
French https://onlinecourses.swayam2.ac.in/cec19_lg04/preview
Japanese https://onlinecourses.nptel.ac.in/noc19_hs52/preview

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Design and Drawing of Prestressed Concrete Structures Lab

Practical: 2 Hours / Week Term Work: 50 Marks

Term work shall be based on the syllabus. It consists of:

1. Assignment on prestress Loss calculation.
2. Assignment on stress calculation.
3. Assignment on resistance of PSC members against shear and torsion.
4. Design, detailing and drawing of prestressed slab.
5. Design, detailing and drawing of prestressed girder.
6. Two site visit reports of R.C.C. and P.S.C structure.

There should be separate design data for a group size of **maximum four** students.

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Professional Practices Lab

Practical: 2 Hours / Week

Term work include detailed study and working of following set of assignments
1) Detailed estimate for a two storied RCC or load bearing wall building
2) Preparing detailed estimate for any four of the following:
- a) A small culvert
- b) A stretch of a road about 1 Km. long including earthwork
- c) A reach of canal about 1 Km. long
- d) A percolation tank
- e) A factory shed of steel frame
- f) Water supply scheme
- g) Drainage scheme
- h) Water Treatment plants

3) Valuation report including valuation certificate for any one of the following:
- a) A building for residential purpose or commercial purpose
- b) A hotel
- c) A theatre
- d) Any one construction machine.

4) Drafting of Detailed specification for any five civil engineering items. This shall include at least one item each from Roads, Irrigation works, Water Supply, Sanitation and buildings.
Assignment (1) and (2) shall include Rate Analysis of at least two items.

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Field Training / Internship / Industrial Training (Evaluation)

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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Seminar

Teaching Scheme: 2 hours per week

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

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Project Stage I

Term work shall consist of detailed report for chosen topic and output of final working proposed. Report shall summarise the literature survey, spell out the scope of work, methodology and results. Viva-voce Examination shall be based on work carried out by the student.

Dr. Babasaheb Ambedkar Technological University, Lonere

Teaching & Evaluation Scheme for Fourth Year B. Tech.

Civil and Environmental Engineering

Semester VIII

Course Code	Type of Course	Course Title	Weekly Teaching Scheme			Evaluation Scheme[$]				Credits
			L	T	P	CA	MSE	ESE	Total	
BTCESS801A	(Self-Study Course) [#]	Characterization of Construction Materials	02[*] [*]	--	--	20	20	60	100	3
BTCESS801B		Geo synthetics and Reinforced Soil Structures								
BTCESS801C		Higher Surveying								
BTCESS801D		Environmental Impact Assessment								
BTCESS801E		Structural Dynamics								
BTCESS801F		Engineering Systems & Development								
BTCESS801G		Sustainable River Basin Management								
BTCESS801H		Modern Construction Materials								
BTCESS802A	(Self-Study Course) [#]	Energy Efficiency Acoustics and Day lighting in Building	02 [**]	--	--	20	20	60	100	3
BTCESS802B		Environmental Remediation of Contaminated Sites								
BTCESS802C		Remote Sensing Essentials								
BTCESS802D		Mechanical Characterization of Bituminous Materials								
BTCESS802E		Soil Structure Interaction								
BTCEM803*	Project Stage-II	Project Stage II or Internship	--	--	24	100	--	100	200	12
		Total	04	--	24	140	40	220	400	18

Characterization of Construction Materials

https:// archive. nptel. ac. in/ content/ syllabus_pdf/ 105106200 . pdf

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Geo- synthetics and Reinforced Soil Structures

https://archive.nptel.ac.in/content/syllabus_pdf/105106052.pdf

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Higher Surveying

https://archive.nptel.ac.in/content/syllabus_pdf/105103176.pdf

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Environmental Impact Assesment

https://archive.nptel.ac.in/content/syllabus_pdf/124107160.pdf

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Structural Dynamics

https://archive.nptel.ac.in/content/syllabus_pdf/105106151.pdf

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Engineering systems and development

https:// archive. nptel. ac. in/ content/ syllabus_pdf/ 110104074 . pdf

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Sustainable River Basin Management

https://archive.nptel.ac.in/content/syllabus_pdf/105106145.pdf
https://onlinecourses-archive.nptel.ac.in/noc15_ce03/preview

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Modern Construction Materials

https://archive.nptel.ac.in/content/syllabus_pdf/105106053.pdf

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Energy Efficiency Acoustics and Daylighting in Building

https://archive.nptel.ac.in/content/syllabus_pdf/105102175.pdf

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Environmental Remediation of Contaminated Sites

https://archive.nptel.ac.in/content/syllabus_pdf/105107181.pdf

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Remote Sensing Essentials

https://archive.nptel.ac.in/content/syllabus_pdf/105107201.pdf

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Mechanical Characterization of Bituminous Materials

https://archive.nptel.ac.in/content/syllabus_pdf/105106203.pdf

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Soil Structure Interaction

https://archive.nptel.ac.in/content/syllabus_pdf/105105200.pdf

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Project Stage II or Internship

Term work shall consist of a detailed report for chosen topic and output of final working proposed. Report shall summarise the literature survey, spell out the scope of work, methodology and results. Viva-voce Examination shall be based on work carried out by the student in Industry based project or In-house project or Internship.

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