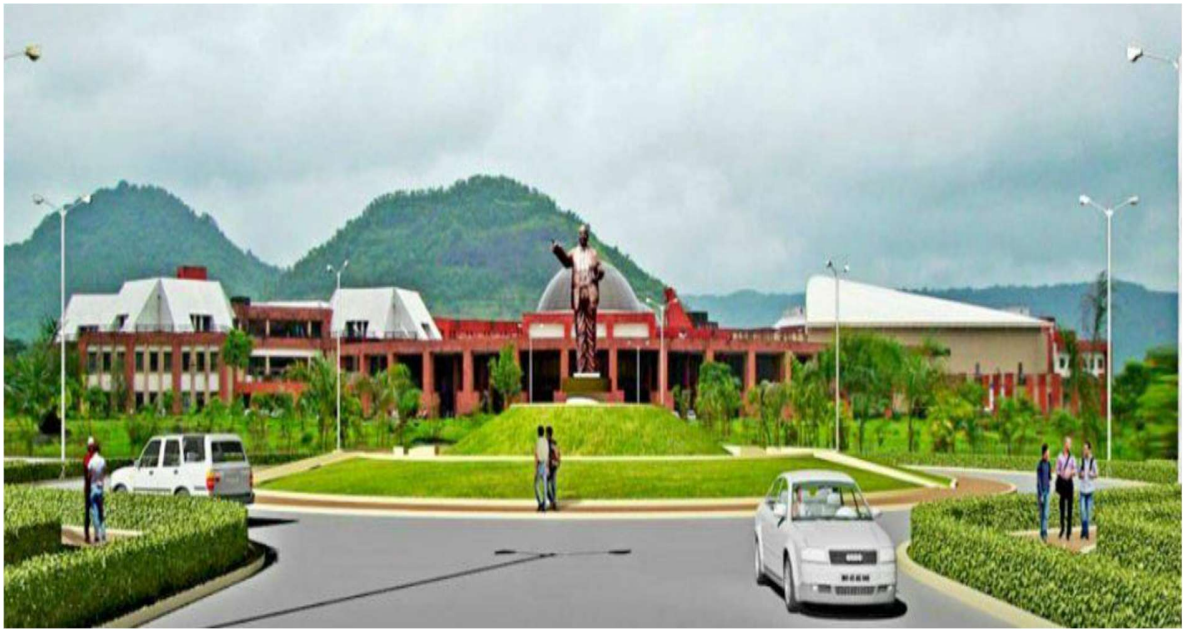
Dr. Babasaheb Ambedkar Technological University,Lonere

Course Structure and Detailed Syllabus for B. Tech in Civil and Infrastructure Engineering
Final Year Engineering
(Effective from Academic year 2024-25)



(Established as a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
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Dr. Babasaheb Ambedkar Technological University, Lonere

Teaching & Evaluation Scheme for Final Year B.Tech.

Civil & Infrastructure Engg.

Semester – VII

Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				Credit
			L	T	P	CA	MSE	ESE	Total	
PCC 17	BTCIC 701	Construction Techniques	2	-	-	20	20	60	100	2
PCC 18	BTCIC 702	Quantity Surveying & Valuation	2	1	-	20	20	60	100	3
PCC 19	BTCIC 703	Port & Harbour Engineering	2	1	-	20	20	60	100	3
PCC 20	BTCIC 704	Infrastructure Planning	3	-	-	20	20	60	100	3
PEC3	BTCIPE 705	A. Advanced Infrastructure Engineering B. Multimodal Urban Transportation Systems C. Traffic Engineering and Management D. Advanced Design of RC Structures E. Applied Hydrology and Flood Control F. Introduction to Earthquake Engineering G. Solid Waste Management H. Legal aspects in Civil Engineering I. Infrastructure Laws and Professional Ethics J. Infrastructure Project Economics, Valuation and Contracts K. Pipeline Transport Engineering	3	-	-	20	20	60	100	3
OEC3	BTCIOE706	A. Advanced Concrete Technology B. Disasters Management: Preparedness & Planning C. Internet of Things D. Non-Destructive Testing E. Machine Learning F. Introduction to Biomechanics G. Visual Surveillance Systems	3	-	-	20	20	60	100	3
HSSMC5	BTHM707	A. Essence of Indian Traditional Knowledge B. Foreign Language##	2	-	-	50	-	-	50	Audit
LC 11	BTCIL708	Quantity Surveying & Valuation Lab	-	-	2	20	-	30	50	1
Seminar	BTCIS709	Seminar	-	-	2	20		30	50	1
Project	BTCIM710	Project Phase - I	-	-	2	50	-	50	100	2
Internship	BTCIP711	Internship - 3 Evaluation	-	-	-	-	-	-	-	1
		Total	**17**	**2**	**6**	**260**	**120**	**470**	**850**	**22**

Dr. Babasaheb Ambedkar Technological University, Lonere

Teaching & Evaluation Scheme for Final Year B.Tech.

Civil & Infrastructure Engg.

Semester – VIII										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme $				Credit
			L	T	P	CA	MSE	ESE	Total	
Project /Internship	BTCIM801	Major Project Work /Internship* (Industry based project or In-house project)	-	-	24	100	-	100	200	12
Self-Study Course# 1	BTCISS802	A. Infrastructure Planning and Management B. Characterization of Construction Materials C. Geosynthetics and Reinforced Soil Structures D. Higher Surveying E. Maintenance and Repair of Concrete Structures F. Structural Dynamics G. Engineering systems and development H. Air Pollution and Control I. Sustainable River Basin Management J. Modern Construction Materials K. Structural Reliability L. Retrofitting and Rehabilitation of Civil Infrastructure	2**	-	-	20	20	60	100	3
Self-Study Course# 2	BTCISS803	A. Offshore Structures Under Special Environmental Loads Including Fire Resistance B. Computer Methods of Structural Analysis of Offshore Structures C. Energy Efficiency, Acoustics and Daylighting in Building D. Environmental Remediation of Contaminated Sites E. Mechanical Characterization of Bituminous Materials F. Soil Structure Interaction G. Organisational Behaviour H. Finite Element Analysis I. Design of Bridges J. Rural Water Resources Management K. Watershed Management L. Urban Transportation Systems Planning M. Structural Optimization	2**	-	-	20	20	60	100	3
		Total	**4**	**-**	**24**	**140**	**40**	**220**	**400**	**18**

Student may take foreign language course from online platform NPTEL/SWAYAM/any other approved foreign language course run by university

The subjects are to be studied on self-study mode using SWAYAM/NPTEL/any other online source approved by the University.

** If required Coordinator may be appointed for each Self-study course and an administrative load of 02 hours per week may be considered for monitoring and assisting the students, and to conduct examination (if required), evaluation and preparation of result.

$ If the examination schedule for the online Self study course chosen by student do not match with the University's Academic Schedule, University/Institute have to conduct exam for such courses.

* Internship of One Semester as per BTCIM801: One Faculty guide from the Institute side and one Mentor from the Industry should be identified to monitor the progress of work. During the period of Internship, a review of work should be taken followed by a final presentation at the end.

Detailed Syllabus (VII Semester)

BTCIC 701 Construction Techniques

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

Course Contents

Module 1: (8 Lectures)
Introduction, planning of a new project, site access and services, mechanical and manual construction, excavation in earth: Understanding basics and functions of equipment, earthmoving equipment - Tractors, Bulldozers, Scrappers, Power shovel, Hoes, simple numerical problems based on cycle time and production rates, drag line, Clamshell, Trenchers, Compactors- types and performance, operating efficiencies, lifting capacities

Module 2: (6 Lectures)
Excavation in hard rock, Rippers, jack hammers, drills, compressors and pneumatic equipment, blasting explosives, detonators, fuses, drainage in excavation – necessity and methods of dewatering

Module 3: (6Lectures)
RMC Plant, layout and production capacity, type of concrete mixers, machinery for vertical and horizontal transportation of concrete, grouting, Shotcreting, under water concreting, Type of formwork, Slip formwork, equipment for placing of concrete in normal and difficult situations

Module 4: (6 Lectures)
Prefabricated construction: Relative economy, steel construction: planning and field operations, erection equipment, cranes of various types such as tower, crawler, luffing jib tower crane, floating and dredging equipment

Module 5: (8 Lectures)
Road construction aspects, asphalt mixing and batching plant (Hot Mix Plant), sensor paver for rigid roads, crushing plants belt conveyers, cableway, construction of a new railway track, aspects of bridge construction
Diaphragm walls: purpose and construction methods, safety measures in construction, prevention of accidents and introduction to disaster management

Text Books
1. Peurifoy R.L. (2010). Construction, Planning, Equipment & Methods, McGraw hill Book Co. N. Delhi
2. Verma Mahesh, (1975). Construction Equipment, Metropolitan book Co., New York
3. Singh J., (2006). Heavy Construction - Planning, Equipment & Methods, Oxford & IBH Pub., N. Delhi

Reference Books
1. Quin A. (1961), Planning and Construction of Docks and Harbors, Mc-Graw Hill Company, New York.
2. Stubbs F. W., (1971). Hand Book of Heavy Construction, Mc-Graw Hill Inc, US 2nd edition.
3. Boyes R.G.H, (1975). Structural & cut off Diaphragm Walls, Applied Science Publishers Ltd. London.
4. Ataev S. S., (1999). Construction Technology, Mir Publishers, Moscow.

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

CO:1 Understand the planning of new project with site accessibility and services required.
CO:2 Comprehend the various civil construction equipment's.
CO:3 Familiar with layout of RMC plant, production, capacity and operation process.
CO:4 Recognize various aspect of road construction, construction of diaphragm walls, railway track construction etc.

BTCIC 702 Quantity Surveying & Valuation

Teaching Scheme: (2 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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BTCIC 703 Port & Harbour Engineering

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

Course Contents

Module 1: **(8 Lectures)**

Introduction to ports, layout of ports, Visakhapatnam port, ships and size of ships, port planning, Harbour layout, site characteristics & navigation channel, bathymetric survey, tide, surge, tsunami and wave, wave rose diagram.

Module 2: **(8 Lectures)**

Breakwater, Design of breakwater, berm breakwater, dredging and methods of disposal. Introduction to berthing structures, types of berthing structures, analysis of berthing structures, design of offshore berthing structures.

Module 3: **(8 Lectures)**

Single buoy mooring and open jetty, slipway, drydock, floating dock, shiplift, soil structure interaction, calculation of fixity depth, pile load test, ground improvement techniques, analysis of pile with spring support.

Module 4: **(6 Lectures)**

Coastal structures and environmental management, BOQ & cost estimate, proposed mega terminal Chennai, preliminary project report on shipyard, procedures & clearances before implementation of a project. Detailed project report, environmental studies of a project.

Module 5: **(4 Lectures)**

Empirical relation between SPT & several soil properties, model studies for a deep-water port a case study.

References:

- Port Design - Guidelines and recommendations by C. A. Thoresen, Tapir Publications.
- Design of Marine Facilities for the Berthing, Mooring and Repair of Vessels by J. W. Gaythwaite, Van Nostrand.
- Handbook of Offshore Engineering by S.K. Chakrabarti, Elseviers, 2005.
- Planning and Design of Ports and Marine Terminals, Agerschou, H., Lundgren, H., Sorensen, T., Ernst, T., Korsgaard, J., Schmidt, L.R. and Chi, W.K., A Wiley-Interscience Publication. (1983).
- Per brun (1983). “Port Engineering” Gulf Publishing Co.

BTCIC 704 Infrastructure Planning

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(06 Lectures)**

Definitions of infrastructure, governing features, Infrastructure organizations & systems, overview of Infrastructure development in India - power sector, water supply and sanitation sector, transportation, urban and rural.

Module 2: **(07 Lectures)**

Infrastructure Planning and appraisal of major infrastructure projects, Infrastructure project budgeting and funding, regulatory framework, sources of funding, procurement strategies, scheduling and management of planning activities, screening of project ideas.

Module 3: **(08 Lectures)**

Financial management inflation - depreciation, taxes, personnel cost, equipment costs, overheads. time value of money, investment criteria, project cash flows – elements and basic principles of estimation, financial estimates and projections, cost of capital, rate of return, project risk analysis, life cycle analysis.

Module 4: **(07 Lectures)**

Challenges in construction and maintenance of Infrastructure, multi-criteria analysis for comparison of infrastructure alternatives, political and social perspectives of infrastructure planning, procurement strategies, efficient use of resources, mapping and facing the landscape of risks in Infrastructure projects.

Module 5: **(07 Lectures)**

Economic Analysis Concepts and Applications, Principles of methodologies for economic analysis of public works, social welfare function, indifference curves and tradeoffs, Demand curves and price elasticities.

Guidelines for Assignments: Minimum Six assignments consisting theoretical as well as numerical aspects of the Course shall be performed by the candidate.

Guidelines for Class Test: Class Test shall cover Syllabus of minimum Three Modules.

References:

- S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.
- J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.
- P. Chandra, Projects: Planning, analysis, selection, financing, implementation, and review, Tata McGraw-Hill, New Delhi, 2009.
- J. D. Finnerty, Project financing - Asset-based financial engineering, John Wiley & Sons, New York, 1996.
- S. Goodman and M. Hastak, Infrastructure planning handbook: Planning, engineering, and economics, McGraw-Hill, New York, 2006.
- J. Parkin and D. Sharma, Infrastructure planning, Thomas Telford, London, 1999.
- L. Squire and H. G.van der Tak, Economic analysis of projects, John Hopkins University Press, London, 1975.
- T. J. Webster, Managerial economics: Theory and practices, Elsevier, New Delhi, 2003.

BTCIPE 705 A. Advanced Infrastructure Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Course Outcomes:

1. Understand the fundamentals of advanced infrastructure engineering with a focus on the Indian context.
2. Apply smart technologies and sustainable practices in the planning, construction, and maintenance of infrastructure.
3. Analyze and solve challenges in infrastructure development using innovative materials and techniques.
4. Evaluate and implement modern monitoring and maintenance strategies using digital tools and AI.
5. Develop infrastructure solutions that address India's socio-economic and environmental needs.

Module 1: Fundamentals of Infrastructure Engineering and Development in India

- **Introduction to Infrastructure Engineering**
  - Definition, scope, and importance in India.
  - Overview of key sectors: transportation, energy, water, and urban development.
- **Current Infrastructure Landscape in India**
  - Major projects: Bharatmala, Sagarmala, Smart Cities Mission, and PM Gati Shakti.
  - Challenges in infrastructure: funding, land acquisition, environmental issues.
- **Infrastructure Development Frameworks**
  - Public-Private Partnerships (PPPs).
  - Policy frameworks and regulatory bodies (e.g., NITI Aayog, MoRTH, CERC).
- **Sustainability in Indian Infrastructure**
  - Introduction to green and sustainable development principles in India.

Module 2: Smart and Sustainable Infrastructure

- **Smart Infrastructure Technologies**
  - Role of IoT, AI, and Big Data in Indian infrastructure projects.
  - Case studies: Mumbai Metro, FASTag, and digital land records.
- **Sustainability Practices in Infrastructure**
  - Green building certifications in India (e.g., GRIHA, IGBC).
  - Renewable energy integration (solar, wind) and energy-efficient solutions.
- **Urban Infrastructure and Smart Cities**
  - Components of smart cities: mobility, governance, waste management.
  - Challenges and solutions in urbanization (focus on Tier 1 and Tier 2 cities).
- **Infrastructure for Rural Development**
  - Rural electrification (Saubhagya Scheme), PMGSY (roads), and clean water initiatives (Jal Jeevan Mission).

Module 3: Advanced Materials and Construction Techniques in India

- **Innovative Materials**
  - Self-healing concrete, geopolymer cement, bamboo as a construction material.
  - Use of indigenous materials for cost-effective and eco-friendly construction.
- **Advanced Construction Technologies**
  - 3D printing in housing (e.g., IIT Madras initiatives).
  - Modular and prefabrication construction methods.
- **Smart Road Construction**
  - Implementation of perpetual pavements and plastic roads in India.
  - Role of bituminous and concrete innovations in Indian highways.
- **Resilience and Disaster Management in Construction**

- Infrastructure resilience to floods, earthquakes, and cyclones (e.g., Gujarat earthquake reconstruction).

Module 4: Infrastructure Operations, Maintenance, and Governance

- **Operations and Maintenance Strategies**
  - Lifecycle costing and asset management.
  - Predictive maintenance using AI and IoT.
- **Digital Twin and Monitoring Systems**
  - Application of digital twins in Indian infrastructure (e.g., railways and metros).
  - Real-time monitoring of large-scale projects (examples: NTPC plants, highways).
- **Policy and Governance in Indian Infrastructure**
  - Role of policies such as the National Infrastructure Pipeline (NIP).
  - Ethical issues, land acquisition challenges, and environmental clearances.
- **Financing Infrastructure Projects**
  - Infrastructure bonds, sovereign funds, and international funding (e.g., JICA, World Bank).

Module 5: Future Trends and Innovations in Indian Infrastructure

- **Role of AI and Machine Learning**
  - AI-driven urban planning (e.g., Bengaluru's traffic optimization).
  - Machine learning for predictive analytics in infrastructure systems.
- **Decarbonization of Indian Infrastructure**
  - Carbon capture, utilization, and storage (CCUS) in power plants.
  - Role of green hydrogen and electric vehicle (EV) ecosystems.
- **High-Speed and Modern Transport**
  - Bullet trains: Mumbai-Ahmedabad corridor.
  - Development of electric highways and hyperloop feasibility in India.
- **Smart Grid and Energy Systems**
  - Smart grid initiatives and renewable energy integration (e.g., Gujarat's solar park).
  - Electrification of remote and underserved areas.

Textbooks

1. Infrastructure Development and Financing in India by K. Narindar Jetli and Vishal Sethi.
2. Smart Cities: Foundations, Principles, and Applications by Houbing Song, Ravi Srinivasan, et al.
3. Sustainable Infrastructure: Principles into Practice by Jan Adamowski and Bernard Amadei.
4. Innovative Materials and Techniques in Concrete Construction by Michael Grantham.
5. Digital Twin Technologies and Smart Infrastructure Development by T.M. Vinod Kumar.

Reference Books

1. Building Smart Cities in India: Challenges and Opportunities by Pratap Padode and Sameer Kochhar.
2. Urban Infrastructure: Planning, Management, and Development by Ashutosh Kumar Tripathi.
3. Renewable Energy and Sustainable Development in India by Malti Goel.
4. Project Management for Infrastructure Development by A. K. Chitkara.
5. Resilient Infrastructure Systems: Sustainability and Risk Mitigation by Kasthurirangan Gopalakrishnan.

BTCIPE 705 B. Multimodal Urban Transportation Systems

Teaching Scheme: (3 Lectures) hours/week

Course Outcomes

- Identify the sustainability principles in transportation
- Introduce the concept of Travel Demand Management (TDM)
- Disseminate the techniques of urban public transit planning, operations and management
- Imbibe the concepts of non-motorized urban transport
- Demonstrate the applications in intelligent transportation systems (ITS)

Course Contents

Module 1: Overview of urban transportation: (6 Lectures)

urbanization and transport, key issues & challenges in urban transportation, overview of travel demand modelling, overview of vehicular level of service (LOS). Introduction to public transportation, basic operating elements of public transportation, bus Transportation

Module 2: Public Transportation: (6 Lectures)

Financing public transportation, Transit marketing, Rail transportation, Intermediate public transportation, measuring performance of transit systems, Advanced operation concepts of public transportation, Bus & Rail Transit Capacity, Station Capacity, Transit stop location.

Module 3: Non-Motorized Transportation (NMT) Planning: (6 Lectures)

Introduction to NMT Systems, Assessing existing NMT scenario, Data collection and analysis in NMT Planning, Complementarity and Selection of Interventions, Alternative Selection through Economic & Financial Analysis

Module 4: (6 Lectures)

Basic NMT characteristics, pedestrian data collection and flow characteristics, pedestrian flow models, pedestrian flow characteristics, pedestrian level of service (PLOS)based on flow models, other types pedestrian level of service, Bicycle facilities and level of service (BLOS), Bicycle compatibility index (BCI)

Module 5: Introduction to Intelligent Transportation system (ITS) (10 Lectures)

Introduction to Intelligent Transportation system (ITS), its components, applications and communication, electronic toll collection (ETC), public bicycle sharing (PBS) system with ITS, multimodal transportation environment, Design of multimodal transport transfer facilities, park & ride facility planning, Introduction to pedestrian road safety and associated risk factors, road crash estimation and elements of predictive methods, sustainable strategies for urban transportation

References:

- Introduction to Multimodal Urban Transportation Systems by Prof. Arkopal Kishore Goswami, IIT Kharagpur. Link - https://drive.google.com/file/d/1A3lyMOXjscxn2ZnkqgtikGodqCY32jPf/view
- https://archive.nptel.ac.in/courses/105/105/105105204/
- Multimodal Transport Systems, Slim Hammadi, Mekki Ksouri, ISBN 978-1-848-214118, December 2013, Wiley-ISTE.
- Proceedings of the Third International Conference on Urban Public Transportation Systems Paris, France 2013, Steven L. Jones, ISBN 9780784413210.

BTCIPE 705 C. Traffic Engineering and Management

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Course Outcomes

Upon completing the course, students will:

1. Comprehend traffic engineering principles and their application in real-world scenarios.
2. Design efficient and safe traffic control systems and geometric layouts.
3. Utilize ITS for smart traffic management and urban mobility solutions.
4. Evaluate environmental and safety impacts of traffic and propose mitigation strategies.
5. Plan and implement traffic policies and demand management techniques for sustainable urban transport.

Module 1: Fundamentals of Traffic Engineering

Introduction to Traffic Engineering Scope, objectives, and significance. Elements of a traffic system: road users, vehicles, roads, and the environment.
Traffic Flow Characteristics-Fundamental traffic flow parameters: speed, density, and flow.Relationships between parameters: Greenshield's and Greenberg's models.
Traffic Surveys and Studies-Traffic volume studies, speed studies, origin-destination (O-D) studies,Parking studies and accident analysis.

Module 2: Traffic Design and Control

Geometric Design of Roads-Design considerations: sight distance, super-elevation, and road alignment,Intersection design: at-grade and grade-separated intersections.
Traffic Control Devices-Traffic signals, signs, and road markings, Signal design: Webster's method, coordination of signals.
Traffic Calming and Management Measures-Speed breakers, rumble strips, roundabouts, and pedestrian safety measures.

Module 3: Intelligent Transportation Systems (ITS)

Introduction to ITS-Components and applications in traffic management, ITS technologies: sensors, adaptive traffic signals, and GPS.
Urban Traffic Management Systems-Area Traffic Control (ATC) systems in Indian cities, Examples: FASTag for toll management, B-TRAC in Bengaluru.
Public Transport Systems-Integration of metro systems, BRT (Bus Rapid Transit), and feeder services.

Module 4: Traffic Safety and Environment
Traffic Safety Engineering-Road safety audits and crash analysis, Measures for accident reduction and road safety education.
Environmental Impact of Traffic-Noise and air pollution due to traffic,Mitigation measures: vehicle emissions standards (BS VI), promoting EVs.
Sustainable Urban Mobility-Non-motorized transport (NMT) infrastructure, walking, and cycling.

Module 5: Traffic Planning and Policy
Transportation Planning-Four-step process: trip generation, distribution, mode choice, and assignment,Urban transportation planning in India: JNNURM, AMRUT, Smart Cities Mission.
Traffic Demand Management (TDM)-Carpooling, congestion pricing, and high-occupancy vehicle lanes.
Traffic Policies in India-National Urban Transport Policy (NUTP),Role of statutory bodies: IRC, MoRTH.

Textbooks

1. Traffic Engineering and Transport Planning by L.R. Kadiyali.
2. Principles of Highway Engineering and Traffic Analysis by Fred L. Mannering and Scott S. Washburn.
3. Transportation Engineering: An Introduction by C.J. Khisty and B. Kent Lall.
4. Traffic Engineering by Roger P. Roess, Elena S. Prassas, and William R. McShane.
5. Highway Traffic Analysis and Design by R.J. Salter.

Reference Books

1. Urban Transportation Systems: Choices for Communities by Sigurd Grava.
2. Road Traffic Safety Management by Patrick M. McCarthy.
3. Intelligent Transport Systems: Technologies and Applications by Asier Perallos, Unai Hernandez-Jayo, et al.
4. Transportation Planning Handbook by ITE (Institute of Transportation Engineers).
5. Transportation Engineering by Nicholas J. Garber and Lester A. Hoel.

BTCIPE 705 D. Advanced Design of RC Structures

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Circular Slabs (10 Lectures)
Introduction, Slabs freely supported at edges and carrying UDL, Slabs fixed at edges and carrying UDL, , Slabs simply supported at the edges with load UDL w Uniformly distributed along the circumference of a concentric circle, Slab simply supported at edges with UDL inside a concentric circle, Slab simply supported at edges with a central hole and carrying UDL Slab simply supported at edges with a central hole and carrying w Uniformly distributed along the circumference of a concentric circle.

Module 2: Flat Slabs (10 Lectures)
Introduction, Components of Flat Slab Construction, IS Code Recommendations (IS: 456-2000), Direct Design Method, Equivalent Frame Method, Shear in Flat Slab, Slab Reinforcement, Openings in Flat Slab.

Module 3: Domes (5 Lectures)
Introduction, Nature of Stresses in Spherical Domes, Analysis of Spherical Domes, Stresses due to Wind load, Design of RC Domes, Conical Domes.

Module 4: Bunkers and Silos (5 Lectures)
Introduction, Janssen's theory, Airy's theory ,Bunkers, Hopper Bottom, Indian Standard on Design of Bins(IS :4995-1968)

Module 5: Chimneys (6Lectures)
Introduction, wind pressure, stresses in chimney shaft due to self weight and wind, stresses in horizontal reinforcement due to wind shear, stresses due to Temperature difference ,combined effect of self load ,wind and temperature, temperature stresses in horizontal reinforcement, Design of RC Chimneys.

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;

1. Able to identify the behavior, analyze and design of circular slabs, flat slab.
2. Able to analyze design domes, bunkers and silos and Chimneys.

BTCIPE 705 E. Applied Hydrology and Flood Control

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(6 Lectures)**

Precipitation: Types of precipitation, measurement, Presentation of rainfall data mass rainfall curves, Hyetograph, Concepts of depth area duration analysis, Frequency analysis frequency of point rainfall and plotting position, Intensity duration curves, Maximum Intensity duration frequency analysis.

Module 2: **(6 Lectures)**

Runoff, Introduction, Factors affecting runoff, Rainfall Runoff relationships, Empirical Techniques to determine runoff, Runoff hydrograph Introduction, Factors affecting Flood Hydrograph, Components of Hydrograph, Base flow separation, Effective rainfall, Unit hydrograph theory, S curve hydrograph, uses and limitations of Unit Hydrograph

Module 3: **(6 Lectures)**

Floods: Types of floods, Estimation of peak flow, Rational formula and other methods, Flood frequency analysis, Gumbel's method, Design floods.

Module 4: **(6 Lectures)**

Flood Estimation and Routing: Estimation of design flood, SPF/MPF empirical methods, Statistical methods, Frequency analysis, Unit hydrograph method, Flood estimation in small watersheds and mountainous region, Estimation by lumped, distributed model, Routing, Lumped, Distributed, Hydraulic and hydrological routing.

Module 5: **(6 Lectures)**

Flood Control and Management: Flood routing, Hydrological channel routing by Muskingham method, Hydrologic reservoir routing. Flood control methods, Structural and non-structural measures Flood plain Zoning, Flood disaster monitoring and mitigation procedure, Methods of forecasting, Data analysis and warning, Flood fighting Remote Sensing for flood management.

Text books:

1. Das G., Hydrology and Soil Conservation Engineering 2nd Edition. Prentice Hall of India Pvt. Ltd. New Delhi. 2009.
2. Subramanya K., Engineering Hydrology, Tata McGraw-Hill Book Co., New Delhi. 1984.
3. Chow V.T., Maidment D.R., and Mays L.W., Applied Hydrology, McGraw Hill, 1998.
4. Applied Hydrology by K.N. Mutreja, Tata Mc-Graw Hill Book Co., New Delhi. 1985.

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

CO1: Understand the hydrologic extremes of floods.

CO2: Estimate severity and extent of damages and mitigation measures to combat them.

CO3: Understand the climate system, being aware of the impact of climate change on society.

CO4: Understand role of hydrological cycle precipitation and runoff in civil engineering systems.

BTCIPE 705 F. Introduction to Earthquake Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1 **(6 Lectures)**

Elements of seismology: Terminology, structure of the earth, causes of an earthquake, seismic waves, magnitude and intensity, seismograph, strong motion earthquakes, Accelerogram, prominent earthquakes of India.

Module 2 **(6 Lectures)**

Structural dynamics: Free and forced vibrations of single degree of freedom systems, un-damped and viscously damped vibrations, equations of motion, Duhamel integral.

Module 3: **(6 Lectures)**

Response Spectrum Theory: construction of Design Response Spectrum, effect of foundation and structural damping on design spectrum, design spectrum of IS 1893, evaluation of lateral loads.

Module 4 **(6 Lectures)**

Principles of Earthquake Resistant Design (EQRD), planning aspects, resistance of structural elements and structures for dynamic load, design criteria, ductile detailing of RCC members, energy absorption, provisions of IS 13920.

Module 5 **(6 Lectures)**

Construction aspects of masonry and timber structures, retrofitting and strengthening techniques of low cost and low-rise buildings, provisions of IS 4326.

Module 6 **(6 Lectures)**

Dynamic properties of soils, field and Laboratory tests, site evaluation, behavior under dynamic loads, effect on bearing capacity, settlement, liquefaction.

Text Books

1. IS 456, IS 1498, IS 1893, IS 1905, IS 2131, IS 13920, IS 4326 of recent editions, Bureau of Indian Standards, New Delhi.
2. Chopra A.K. (2001). Dynamics of Structures, 2nd Edi, Pearson Education Pvt. Ltd., India, ISBN 81-7808-472-4.
3. Mario Paz,(1985). Structural Dynamics, CBS Publication.
4. Arya A.S., (1987). Elements of Earthquake Engineering, South Asian Pub., New Delhi.

Reference Books

1. Clough R.W. and Penzien J.(1993), Dynamics of Structures, McGraw Hill New York
2. Humar J. L., (2002). Dynamics of Structures, 2nd Edition Swets and Zeitlinger, Netherlands.
3. FarzadNaiem, (2001). The Seismic Design Handbook, Kluwer Academic Pub. Massachusetts, ISBN: 0-7923-7301-4.
4. Dowrick D. J., (1977). Earthquake Resistant Design for Engineers & Architects, John Wiley and Sons Ltd.
5. Pauley T. and Priestley M.J.N., (1992). Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley & Sons Inc., USA, ISBN 0-471-54915-0.
6. Nayak N. V., (1985). Foundation Design Manual, Dhanpatrai and Sons, Delhi.
7. Housner G.W. & Hudson D. E., (1950). Applied Mechanics- Dynamics, East-West Edition, N. Delhi.
8. Kramer S. L., (2003). Geotechnical Earthquake Engineering, Pearson Education.

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

CO1 Capture complexities in earthquake resistant design of structures
CO2 Grasp Nature of earthquake vibration and associated forces on structures
CO3 Understand importance of designing the building to targeted seismic performance.

BTCIPE 705 G. Solid Waste Management

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Municipal Solid Waste Management **(06 Lectures)**

Sources, Types, Quantities, Composition, sampling of wastes, Properties of wastes, Numericals related to moisture content, density and Energy content, Problems and issues of solid waste management - Need for solid waste management- Awareness programme, Legal issues related to solid waste disposal Functional Elements of SWM- waste generation (factors affecting), storage, collection, transfer and transport, processing, recovery and disposal in the management of solid waste.7R concept

Module 2: Waste Segregation, Storage, Collection and Transport **(06 Lectures)**

Segregation - wet and dry method, Volume reduction at source, Recycling and Reuse of waste, Methods of collection - House to House collection, On site storage of municipal solid waste, Hauled container and stationary container system, Collection routes; Optimization of transportation routes, Numericals on container and collection systems. Transfer station -Significance, Site selection, Types, Material Recovery facility

Module 3: Waste processing techniques and Energy Recovery **(06 Lectures)**

Waste transformation- Biological and Thermal Biological Conversion Technologies – Composting, Factors affecting for composting, Various Composting Methods as Indore and Bangalore, Vermi, Mechanical and In vessel composting, Numericals on aerobic and anaerobic composting Thermal conversion technologies – Incineration, Pyrolysis, Gasification, Refuse derived fuel

Module 4: Landfills for Disposal of Waste **(07 Lectures)**

Landfill Classification-Sanitary, Secure and Bioreactor, Design criteria for landfill site selection, operation and maintenance, Landfill methods -Trench, Area, Slope Leachate generation, Characteristics and it's control methods. Landfill gas management and landfill closure IoT in solid waste management

Module 5: Hazardous Waste Management **(07 Lectures)**

Sources, Characteristics and classification of hazardous wastes, Storage, Handling, Collection, Transportation and Minimization, Need for Hazardous Waste Management Treatment and Disposal Hazardous Site remediation – onsite and offsite Techniques. Hazardous waste management using secure landfill, Disposal practices in Indian Industries, Hazardous Waste Management Rules 2016.

Module 6: Assorted Solid Wastes **(07 Lectures)**

Biomedical waste -Need for Biomedical Waste Management, Sources, Classification, Storage and Segregation Color coding, Collection and Transportation, Treatment and Disposal. Latest Biomedical waste management rules.
Electronic Waste -Types, Component separation, Collection, Recycling and Recovery, E waste management techniques and Latest E- waste management rules
Plastic Waste -Problems related to plastic wastes, Plastic waste management- Recycling & recovery, Energy production, Plastic waste management Rules and Regulation
Construction and Demolition waste -Composition, Recycling and reduction, Proper 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 'Practice 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

BTCIPE 705 H. Legal aspects in Civil Engineering

Teaching Scheme: (3 Lectures) hours/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.

BTCIPE 705 I. Infrastructure Laws and Professional Ethics

Teaching Scheme: (3 Lectures) hours/week

Course Outcomes

Upon completing the course, students will:

1. Understand the legal and regulatory framework governing infrastructure development in India.
2. Analyze ethical issues and apply professional values in managing infrastructure projects.
3. Navigate disputes and compliance challenges in infrastructure contracts and projects.
4. Evaluate the impact of infrastructure laws on environmental sustainability and social equity.
5. Develop strategies for integrating ethical principles in planning and executing infrastructure projects.

Course Contents

Module 1: Introduction to Infrastructure Laws in India

Legal Framework for Infrastructure Development
Overview of laws regulating infrastructure in India.
Role of the Constitution of India in infrastructure development (Articles 246, 21, and 19).

Land Acquisition and Compensation
Right to Fair Compensation and Transparency in Land Acquisition Act, 2013.
Issues in land acquisition and rehabilitation in India.

Environmental and Sustainability Laws
Environmental Protection Act, 1986.
Forest Conservation Act, 1980; National Green Tribunal Act, 2010.

Module 2: Contractual and Regulatory Framework

Contracts and Dispute Resolution
Essentials of construction and infrastructure contracts.
Dispute resolution mechanisms: Arbitration and Conciliation Act, 1996.

Public-Private Partnerships (PPP)
Legal and regulatory provisions for PPPs in India.
Case studies: NHDP (National Highways Development Project), Delhi Metro.

Regulatory Bodies and Compliance
Role of authorities like NITI Aayog, MoRTH, and regulatory commissions.
Compliance with FDI norms in infrastructure.

Module 3: Ethics in Infrastructure Development

Ethical Principles in Engineering and Management
Core values: integrity, responsibility, fairness, and respect for laws.
Importance of transparency in decision-making.

Conflict of Interest and Professional Integrity
Identifying and mitigating conflicts of interest.

Case studies: Ethical dilemmas in large infrastructure projects.

Corporate Social Responsibility (CSR)

CSR as a statutory requirement in infrastructure projects.
Case studies of CSR in Indian infrastructure (e.g., Tata, L&T).

Module 4: Risk, Safety, and Legal Compliance

Workplace Safety and Risk Management

Legal provisions for safety under the Factories Act, 1948 and OSHA norms.
Risk management strategies in construction and operation phases.

Infrastructure Project Failures and Lessons Learned

Case studies: Flyover collapses, dam failures, and other disasters.
Ethical and legal accountability in failures.

Cybersecurity and Data Protection in Infrastructure

IT Act, 2000 and cybersecurity challenges in smart infrastructure.

Module 5: Emerging Issues and Global Perspectives

Sustainable Development Goals (SDGs)

Alignment of Indian infrastructure laws with global goals.
Examples: Renewable energy projects, green buildings.

International Infrastructure Laws and Standards

FIDIC contracts and World Bank policies for international projects.
Comparison with laws in developed countries.

Future of Ethics in Infrastructure

Role of AI, machine learning, and ethical AI in infrastructure.
Balancing innovation with legal and ethical considerations.

Textbooks

1. Infrastructure Development and Financing in India by K. Narindar Jetli and Vishal Sethi.
2. Professional Ethics and Human Values by R. S. Naagarazan.
3. Legal Aspects of Business by Akhileshwar Pathak.
4. Law Relating to Infrastructure Projects by R.P. Singh.
5. Environmental Law in India by P. Leelakrishnan.

Reference Books

6. Construction Contracts: Law and Management by Will Hughes and Ronan Champion.
7. Principles of Engineering Ethics by Michael S. Pritchard and Elaine E. Englehardt.
8. Handbook on PPP in Infrastructure by the Government of India and Asian Development Bank.
9. Ethics and Professionalism in Engineering by Richard H. McCuen and Kristin L. Gilroy.
10. Risk and Safety Management in Construction by Simon Burtonshaw-Gunn**.**

BTCIPE 705 J.Infrastructure Project Economics, Valuation and Contracts

Teaching Scheme: (3 Lectures) hours/week

Course Outcomes

Upon completing the course, students will:

1. Understand the economic principles underlying infrastructure projects and their significance.
2. Perform financial and economic analyses to evaluate project feasibility and value.
3. Manage risks and uncertainties in infrastructure project development.
4. Draft and negotiate contracts while ensuring compliance with laws and best practices.
5. Explore innovative financing models and assess the economic impact of modern infrastructure systems.

Course Contents

Module 1: Fundamentals of Infrastructure Project Economics
Introduction to Infrastructure Economics-Economic characteristics of infrastructure: public goods, natural monopolies, and externalities, Economic role of infrastructure in India's development.
Cost-Benefit Analysis (CBA)-Principles and components of CBA,Case studies of infrastructure projects: highways, metros, and renewable energy.
Demand Forecasting for Infrastructure-Methods for demand estimation,Examples from transportation and energy sectors in India.

Module 2: Project Valuation and Financial Feasibility
Financial Analysis of Infrastructure Projects-Key financial metrics: NPV, IRR, payback period, and sensitivity analysis.
Project financing mechanisms: debt, equity, and hybrid instruments,
Public-Private Partnerships (PPP)-Models of PPP: BOT, BOOT, DBFO, and EPC,Risk allocation in PPP contracts.
Valuation Techniques-Market, income, and cost-based valuation methods,Valuation of intangible benefits in public infrastructure projects.

Module 3: Risk and Uncertainty in Infrastructure Projects
Types of Risks in Infrastructure Projects-Construction risk, financial risk, operational risk, and political risk.
Strategies for risk identification, assessment, and mitigation.
Uncertainty in Project Economics-Scenario analysis and Monte Carlo simulations,Case studies of Indian projects: Delhi Metro, Solar Parks.
Infrastructure Funding Challenges-Role of financial institutions: World Bank, ADB, and Indian banks.
Viability gap funding (VGF) in infrastructure projects.

Module 4: Contracts and Dispute Management
Introduction to Infrastructure Contracts-Key elements of contracts: scope, timeline, payment terms, and penalties.
FIDIC contracts and their relevance to Indian projects.
Dispute Resolution Mechanisms-Arbitration, mediation, and litigation in infrastructure contracts.
Case studies of disputes in Indian projects: NHAI arbitration cases.
Regulations and Compliance-Indian Contract Act, 1872.Compliance with environmental and labor laws in infrastructure contracts.

Module 5: Emerging Trends and Case Studies
Emerging Models of Financing-Green bonds, infrastructure investment trusts (InvITs), and REITs.
Crowdfunding for infrastructure projects.
Smart Infrastructure and Economic Impact-Economic valuation of smart cities and ITS (Intelligent Transportation Systems).
Role of ESG (Environmental, Social, Governance) factors in valuation.
Case Studies
Detailed evaluation of iconic Indian projects: Ganga Rejuvenation Plan, Mumbai-Ahmedabad Bullet Train.
Lessons from international infrastructure projects.

Textbooks

- Infrastructure Economics by Ashoka Mody.
- Public-Private Partnership Projects in Infrastructure by Jeffrey Delmon.
- Project Valuation and Investment Analysis by Phillip R. Daves and Michael C. Ehrhardt.
- Construction Contracts: Law and Practice by Jimmie Hinze.
- Financial and Economic Analysis of Infrastructure Projects by David C. Korten.

Reference Books

- Risk Management in Infrastructure Projects by Nigel J. Smith.
- Economic Analysis of Infrastructure Investment by David F. Aschauer.
- The Indian Infrastructure Sector: Policy and Finance by H. Balasubramaniam.
- FIDIC Contracts in Practice by Ellis Baker, Ben Mellors, Scott Chalmers.
- Public-Private Partnership and Infrastructure Financing by Akintola Akintoye and Matthias Beck.

BTCIPE705K. Pipeline Transport Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Outcomes

Upon completing the course, students will:

- Understand the fundamentals of pipeline systems for the transport of fluids, slurries, and gases.
- Apply design principles and computational tools to develop efficient and safe pipeline systems.
- Analyze the mechanical and hydraulic behavior of pipelines under various loading and flow conditions.
- Evaluate construction techniques, maintenance strategies, and failure prevention methods for pipelines.
- Incorporate sustainability and environmental considerations into the planning and operation of pipeline projects.

Course Contents

Module 1: Fundamentals and Applications in Pipeline Engineering

1. Introduction to Pipeline Transport-Overview of pipeline transport systems,Types of pipelines (water, oil, gas, slurry, sewerage),Historical development and significance,Regulatory and environmental considerations.

2. Material Selection and Design-Materials for pipelines: Steel, HDPE, PVC, and composites, Pipeline design principles, Thickness, pressure ratings, and stress analysis.

3. Construction and Installation-Trenching and laying methods, Welding, jointing, and field-testing techniques,HDD (Horizontal Directional Drilling) and trenchless technologies.

4. Operation and Maintenance Corrosion: Causes, effects, and prevention techniques (cathodic protection).Pigging, cleaning, and inspection technologies. Failure modes and repair techniques.

Module 2: Pipeline Hydraulics and Flow Mechanics

1. Fluid Mechanics in Pipelines-Basic fluid mechanics concepts, Steady and unsteady flows, Flow regimes: Laminar and turbulent.

2. Hydraulic Design-Bernoulli's equation and energy considerations, Pressure drop calculations and surge analysis, Pump and compressor selection.

3. Slurry and Multiphase Flow Characteristics of slurry flow,Multiphase flow challenges in oil and gas pipelines.

Module 3: Advanced Pipeline Systems

1. Offshore and Subsea Pipelines -Offshore pipeline design, Challenges of deepwater installations, Subsea systems and maintenance.

2. Environmental Impact and Risk Assessment-Environmental risks associated with pipeline construction, Risk mitigation techniques, Regulatory frameworks and compliance.

3. Innovations and Emerging Technologies-3D printing for pipelines,AI and IoT in predictive maintenance, Carbon-neutral pipeline technologies.

4. Project Management in Pipelines-Cost estimation, scheduling, and resource allocation, Case studies on large-scale pipeline projects.

Module 4: Pipeline Geotechnical and Safety

1. Geotechnical Considerations-Soil-pipeline interactions, Buried pipelines and trench design, Stability under seismic conditions,

2. Structural Analysis of Pipelines-Buckling, bending, and axial load analysis,Stress-strain behavior of pipeline materials.

3. Safety and Standards-International standards (ASME, ISO),Pipeline safety protocols,Emergency response planning.

4. Environmental Considerations-Impact on ecosystems during installation,Sustainable practices in pipeline transport.

Module 5: Integrated Water and Energy Pipelines

1. Basics of Water and Energy Transport-Design and operation of water transmission pipelines,Oil and gas pipeline transport systems.

2. Energy Pipelines-Transportation of LNG, CNG, and hydrogen,Design of high-pressure gas pipelines.

3. Integration and Optimization-Coupled systems for water and energy pipelines,Renewable energy systems with pipelines.

4. Policy and Economics-Energy policies and their impact on pipeline transport,Economic feasibility studies.

5. Sustainability and Future Trends-Net-zero carbon technologies,Innovations in hydrogen and carbon capture pipelines

Reference Books

1. "Pipeline Design for Water Engineers" by Bruce E. Larock, Roland W. Jeppson, and Gary Z. Watters
2. "Pipeline Engineering" by Henry Liu
3. "Pipeline Planning and Construction Field Manual" by E.W. McAllister
4. "Oil and Gas Pipelines: Integrity and Safety Handbook" by Ramesh Singh
5. "Subsea Pipeline Design, Analysis, and Installation" by Qiang Bai and Yong Bai
6. "Hydraulics of Pipeline Systems" by Bruce E. Larock
7. "Design of Buried Pipes" by Reynold King Watkins and Loren Runar Anderson
8. "Pipeline Rules of Thumb Handbook" by E.W. McAllister
9. "Fluid Mechanics" by Frank M. White
10. "Trenchless Technology: Pipeline and Utility Design, Construction, and Renewal" by Mohammad Najafi

BTCIOE706 A. Advanced Concrete Technology

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Course Outcomes:

At the end of the course, the student will be able to:
CO1: Discuss the concrete ingredients and its influence at gaining strength.
CO2: Design of concrete mix and grade as per IS codes.
CO3: Summarise the concepts of conventional concrete and its differences with other concretes like no fines, light weight etc.
CO4: Describe the application and use of fiber reinforced concrete.
CO5: Design and develop the self compacting and high performance concrete.

UNIT I (10-Lectures)
UNIT – II (10-Lectures)
UNIT –III (10-Lectures)
UNIT – IV (10-Lectures)
UNIT – V (10-Lectures)

Design and manufacture of Self compacting concrete – High performance concrete – Very high strength concrete – High density concrete

Course Contents

Module 1: (08 Lectures)

Properties of cement, fine aggregate and coarse aggregates, Additives and Admixtures in Concrete, Rheology of Concrete.

Module 2: (08 Lectures)

Manufacturing and methods of concreting, Properties of fresh and hardened concrete, mix design by I.S. method

Module 3: (08 Lectures)

Design and manufacture of normal concrete, Light weight concrete – Cellular concrete – No fines concrete – Aerated & foamed concrete

Module 4: **(06 Lectures)**
Design and manufacture of fiber reinforced concrete – Polymer concrete – Fly ash concrete

Module 5: **(08 Lectures)**
Design and manufacture of Self compacting concrete – High performance concrete – Very high strength concrete – High density concrete

Reference Books:

1. Neville, A.M. and Brookes, J.J., "Concrete Technology", 2 nd Edition, Pearson Education, 2010.
2. Gambhir, M.L., "Concrete Technology", 2 nd Edition, Tata McGraw Hill Publishers, New Delhi, 2009.
3. Neville, A.M., "Properties of Concrete", 3rd Edition, Longman Scientific and General, 1992.
4. Shanta Kumar A.R., "Concrete Technology", 2 nd Edition, Oxford University Press, New Delhi, 2000.
5. Krishna Raju. N, "Design of Concrete Mixes", 2nd Edition, CBS Publishers and Distributors, 2009.
6. Shetty, M.S., "Concrete Technology", 3 rd Edition, S.Chand Publications, 2008.

BTCIOE706 B. Disasters Management: Preparedness & Planning

Teaching Scheme: (3 Lectures) hours/week

Course Outcomes

Upon completing the course, students will:

1. Understand disaster management principles, frameworks, and preparedness strategies.
2. Conduct risk and vulnerability assessments for diverse disaster scenarios.
3. Develop and implement emergency action plans for disaster-prone areas.
4. Collaborate with stakeholders to enhance community resilience and awareness.
5. Analyze and apply lessons from disaster case studies to improve planning and response.

Course Contents

Module 1: Introduction **(03 Lectures)**
Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change

Module 2: Natural Disaster and Manmade disasters **(09 Lectures)**
Natural Disaster: Meaning and nature of natural disasters, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

Module 3: Disaster Management, Policy and Administration **(06 Lectures)**
Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management. Policy and administration: Importance and principles of disaster management policies, command and co ordination of in disaster management, rescue operations-how to start with
and how to proceed in due course of time, study of flowchart showing the entire process.

Module 4: Institutional Framework for Disaster Management in India **(06 Lectures)**
Importance of public awareness, Preparation and execution of emergency management programme. Scope and responsibilities of National Institute of Disaster Management (NIDM) and National Disaster Management Authority (NDMA) in India. Methods and measures to avoid disasters, Management of casualties, set up of emergency facilities, the importance of effective communication amongst different agencies in such situations. Use of Internet and software for effective disaster management. Applications of GIS, Remote

sensing and GPS in this regard.

Module 5: Financing Relief Measures (09 Lectures)

Ways to raise finance for relief expenditure, the role of government agencies and NGOs in this process, Legal aspects related to finance raising as well as overall management of disasters. Various NGOs and the works they have carried out in the past on the occurrence of various disasters, Ways to approach these teams. International relief aid agencies and their role in extreme events.

Module 6: Preventive and Mitigation Measures: (06 Lectures)

Pre-disaster, during disaster and post-disaster measures in some events in general Structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication .Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans. Do's and Don'ts in case of disasters and effective implementation of relief aids

Textbooks

1. Disaster Management and Preparedness by Larry Collins.
2. Natural Disasters: Preparedness, Mitigation, and Management by S. N. Prasad and S. C. Sharma.
3. Introduction to International Disaster Management by Damon P. Coppola.
4. Disaster Management in India by Vinod K. Sharma.
5. Community-Based Disaster Risk Reduction by Rajib Shaw.

Reference Books

6. Handbook of Disaster Risk Reduction and Management by Christian N. Madu and Chu-Hua Kuei.
7. Earthquake Resistant Design of Structures by Pankaj Agarwal and Manish Shrikhande.
8. Disaster Policy and Politics: Emergency Management and Homeland Security by Richard Sylves.
9. Climate Change and Natural Disasters by Vinita Vishwanath.
10. GIS for Disaster Management by Esri Press.

BTCIOE706 C. Internet of Things

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: **(7 Lectures)**

Introduction to IoT Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs, Machine to Machine, Difference between IoT and M2M, Software define Network.

Module 2: **(5 Lectures)**

Network & Communication aspects, Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

Module 3: **(6 Lectures)**

Challenges in IoT Design challenges, Development challenges, Security challenges, other challenges.

Module 4: **(7 Lectures)**

Domain specific applications of IoT, Home automation, Industry applications, Surveillance applications, Other IoT applications.

Module 5: **(7 Lectures)**

Developing IoTs Introduction to Python, Introduction to different IoT tools, developing applications through IoT tools, developing sensor-based application through embedded system platform, Implementing IoT, concepts with python.

Text Books:

1. Pethuru Raj and Anupama C. Raman "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by (CRC Press).
2. Samuel Greengard "The Internet of Things" MA: MIT Press, 2015.

Reference Books:

1. Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
2. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice.

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

CO1: Understand the concepts of Internet of Things.
CO2: Analyze basic protocols in wireless sensor network.
CO3: Design IoT applications in different domain and be able to analyze their performance.
CO4: Implement basic IoT applications on embedded platform.

BTCIOE706 D.Non-Destructive Testing

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Course Outcomes:

CO1: To have a better knowledge in the field of advanced techniques in ultrasonic NDE

CO2: Inspect and evaluate the surface imperfections using penetrant testing method.

CO3: Have a basic knowledge of ultrasonic testing which enables them to perform inspection of samples.

CO4: Calibrate the instrument and evaluate the component for imperfections.

CO5: Differentiate various defect types and select the appropriate NDT methods for the specimen.

Module 1:

Visual Testing Fundamentals of Visual Testing – vision, lighting, material attributes, environmental factors, visual perception, direct and indirect methods – mirrors, magnifiers, boroscopes and fibroscopes – light sources and special lighting – computer enhanced system – Employer defined applications, metallic materials including raw materials and welds – Inspection objectives, inspection checkpoints, sampling plan, inspection pattern etc – classification of indications for acceptance criteria - Codes, Standards and Specifications (ASME,ASTM,AWS etc.)

Module 2:: Liquid Penetrant Testing Principles – types and properties of liquid penetrants – developers – advantages and limitations of various methods - Preparation of test materials – Application of penetrants to parts, removal of excess penetrants, post cleaning – Control and measurement of penetrant process variables – selection of penetrant method – solvent removable, water washable, post emulsifiable – Units and lighting for penetrant testing – Interpretation and evaluation of test results - dye penetrant process, applicable codes and standards.

Module 3:

Ultrasonic Inspection Methods and Equipment Principle of pulse echo method, through transmission method, resonance method – Advantages, limitations – contact testing, immersion testing, couplants – Data presentation A, B and C scan displays, comparison of contact and immersion method. Pulse Echo instrumentation, controls and circuits, pulse generation, signal detection, display and recording methods, gates, alarms and attenuators, detectability of defects.

Module 4:

Phased Array Techniques Principles of phased array inspection – phased array probes and their characteristics – Phased array wedges – Focal law sequencing – Beam shaping, steering – principles of inspection sensitivity – Scanning with phased array probes- linear, sectorial, C scan mapping – Instrumentation – phased array instruments, calibration methods, checking probe elements – beam angles and beam shape – data collection and data analysis, principles of data analysis – data acquisition, defect detection, sizing, interpretation and characterization – procedures for verification of flaw existence and position, reporting, applications – Case studies.

Module 5:

Leak Testing Introduction to leak testing– objectives – terminologies – measurement of leakage –Types of leak – Types of flow in leaks – Principles of Fluid dynamics – Leak Testing of Pressure Systems Without and with a Tracer Gas – Halogen diode leak testing – Helium mass spectrometer leak testing and subsystems – Choosing the Optimum Leak Testing Method – System response in leak testing – Measurement of Leak Rate Using Calibrated Leaks – Common errors in Leak testing- Leak testing for special applications-standards

References:

1.J. Krautkramer and H. Krautkramer, Ultrasonic Testing of Materials, Springer, 4 th edition (1990).
2. B. Raj, C.V. Subramanian and T. Jayakumar, Non Destructive Testing of Welds, Woodhead Publishing, 1st edition (2000).
3. L. Schmerr and J. Song, Fundamentals of Ultrasonic Nondestructive Evaluation, Springer, 1998.
4. Non-Destructive Examination and Quality Control, ASM International, Vol.17, 9th edition (1989)
5. J. Prasad and C. G. K. Nair, Non-Destructive Test and Evaluation of Materials, Tata McGraw-Hill Education, 2nd edition (2011).
6. B. Raj, T. Jayakumar and M. Thavasimuthu, Practical Non Destructive Testing, Alpha Science International Limited, 3 rd edition (2002).

7. T. Tangachari, J. Prasad and B.N.S. Murthy, Treatise on non-destructive testing and evaluation,Navbharath Enterprises, Vol.3, (1983).

BTCIOE706 E. Machine Learning

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 preprocessing 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.

☑☑☑☑☑☑☑☑☑☑

BTHM707 A. Essence of Indian Traditional Knowledge

Teaching Scheme: (2 Lectures) hours/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.

BTHM707 B. Foreign Language##

Teaching Scheme: (2 Lectures) hours/week

Course Contents

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

BTCIL708 Quantity Surveying & Valuation Lab

Teaching Scheme: 2 hours/week

Course Contents

Practical: 2 Hours / Week

Term work include detailed study and working of following set of assignments

Assignment 1. Prepare a checklist of items with units for a detailed estimate of the given structure based on the provided drawing.

Assignment 2. Prepare an approximate estimate for the given civil engineering works.

Assignment 3. Calculate the quantity of items of work from the given set of drawings using a standard measurement sheet for a load-bearing residential structure using any method and perform rate analysis for the same.

Assignment 4. Calculate the quantity of items of work from the given set of drawings using a standard measurement sheet for a RCC residential structure using any method and perform rate analysis for the same.

Assignment 5. Prepare rate analysis for given items of works using the District Schedule Rate (DSR).

Assignment 6. Prepare a bar bending schedule for reinforcement work, detailing cutting, bending, and placing of reinforcement steel bars.

Assignment 7. Creating a Simple Tender Notice.

Assignment 8. Collection of Documents Required in Tendering.

Assignment 9. Perform valuation of the Building.

Assignment 10. Application of spreadsheet program in Quantity Survey and Valuation.

BTCIS709 Seminar

Teaching Scheme: 2 hours/week

Course Contents

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

BTCIM710 Project Phase - I

Teaching Scheme: 2 hours/week

Course Contents

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.

Detailed Syllabus (VIII Semester)

Semester – VIII										
Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme $				Credi
			L	T	P	CA	MSE	ESE	Total	
Project /Internship	BTCIM801	Major Project Work /Internship* (Industry based project or In-house project)	-	-	24	100	-	100	200	12
Self-Study Course# 1	BTCISS802	A. Infrastructure Planning and Management B. Characterization of Construction Materials C. Geosynthetics and Reinforced Soil Structures D. Higher Surveying E. Maintenance and Repair of Concrete Structures F. Structural Dynamics G. Engineering systems and development H. Air Pollution and Control I. Sustainable River Basin Management J. Modern Construction Materials K. Structural Reliability L. Retrofitting and Rehabilitation of Civil Infrastructure	2**	-	-	20	20	60	100	3
Self-Study Course# 2	BTCISS803	A. Offshore Structures Under Special Environmental Loads Including Fire Resistance B. Computer Methods of Structural Analysis of Offshore Structures C. Energy Efficiency, Acoustics and Daylighting in Building D. Environmental Remediation of Contaminated Sites E. Mechanical Characterization of Bituminous Materials F. Soil Structure Interaction G. Organisational Behaviour H. Finite Element Analysis I. Design of Bridges J. Rural Water Resources Management K. Watershed Management	2**	-	-	20	20	60	100	3

		L. Urban Transportation Systems Planning M. Structural Optimization								
		Total	**4**	**-**	**24**	**140**	**40**	**220**	**400**	**18**

*BTCIM801 Major Project Work /Internship**
(Industry based project or In-house project)

Teaching Scheme: 24 hours/week

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 in Industry based project or In-house project or Internship.

BTCISS802 A. Infrastructure Planning and Management

https://onlinecourses.nptel.ac.in/noc21_mg81/preview

BTCISS802 B. Characterization of Construction Materials

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

BTCISS802 C. Geo-synthetics and Reinforced Soil Structures

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

BTCISS802 D. Higher Surveying

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

BTCISS802 E. Maintenance and Repair of Concrete Structures

https://archive.nptel.ac.in/content/syllabus_pdf/105106202.pdf

BTCISS802 F. Structural Dynamics

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

BTCISS802 G. Engineering systems and development

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

BTCISS802 H. Air Pollution and Control

https://onlinecourses.nptel.ac.in/noc23_ce14/preview

BTCISS802 I. Sustainable River Basin Management

https://nptel.ac.in/content/syllabus_pdf/105106145.pdf

https://onlinecourses-archive.nptel.ac.in/noc15_ce03/preview

BTCISS802 J. Modern Construction Materials

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

BTCISS802 K.Structural Reliability

https://onlinecourses.nptel.ac.in/noc21_ce58/preview

BTCISS802 L. Retrofitting and Rehabilitation of Civil Infrastructure

https://onlinecourses.nptel.ac.in/noc22_ce20/preview

BTCISS803 A. Offshore Structures Under Special Environmental Loads Including Fire Resistance

https://onlinecourses.nptel.ac.in/noc21_oe01/preview

BTCISS803 B. Computer Methods of Structural Analysis of Offshore Structures

https://onlinecourses.nptel.ac.in/noc20_oe03/preview

BTCISS803C. Energy Efficiency, Acoustics and Daylighting in Building

https://onlinecourses.nptel.ac.in/noc24_ce47/preview

BTCISS803 D. Environmental Remediation of Contaminated Sites

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

BTCISS803 E Mechanical Characterization of Bituminous Materials

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

BTCISS803 F Soil Structure Interaction

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

BTCISS803 G. Organisational Behaviour

https://onlinecourses.nptel.ac.in/noc20_mg51/preview

BTCISS803 H. Finite Element Analysis

https://archive.nptel.ac.in/courses/105/105/105105041/

BTCISS803 I. Design of Bridges

https://onlinecourses.nptel.ac.in/noc22_ce63/preview

BTCISS803 J. Rural Water Resources Management

https://onlinecourses.nptel.ac.in/noc22_ce45/preview

BTCISS803 K. Watershed Management

https://onlinecourses.nptel.ac.in/noc24_ag05/preview

BTCISS803 L. Urban Transportation Systems Planning

https://onlinecourses.nptel.ac.in/noc21_ce35/preview

BTCISS803 M. Structural Optimization

https://archive.nptel.ac.in/courses/105/108/105108127/