Proposed Course Contents for
B. Tech. in Civil Engineering
w.e.f. June 2020

7th Semester - 8th Semester
Department of Civil Engineering

Program Objectives

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

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

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

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

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

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

Program Educational Objectives

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

At the end of the program the student will be able to:

<table>
<thead>
<tr>
<th>PO 1</th>
<th>Apply the knowledge of mathematics, basic sciences, and civil engineering to the solution of complex engineering problems.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PO 2</td>
<td>Identify, formulate, research literature, and analyze complex civil engineering problems reaching substantiated conclusions.</td>
</tr>
<tr>
<td>PO 3</td>
<td>Design solutions for complex engineering problems and design of civil engineering structures that meet the specified needs.</td>
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<tr>
<td>PO 4</td>
<td>Use civil engineering research-based knowledge related to interpretation of data and provide valid conclusions.</td>
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<tr>
<td>PO 5</td>
<td>Create, select, and apply modern civil engineering and IT tools to complex engineering activities with an understanding of the limitations.</td>
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<tr>
<td>PO 6</td>
<td>Apply reasoning acquired by the civil engineering knowledge to assess societal and safety issues.</td>
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<tr>
<td>PO 7</td>
<td>Understand the impact of engineering solutions on the environment, and demonstrate the knowledge for sustainable development.</td>
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<tr>
<td>PO 8</td>
<td>Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.</td>
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<tr>
<td>PO 9</td>
<td>Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.</td>
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<tr>
<td>PO 10</td>
<td>Communicate effectively on complex engineering activities with the engineering community and with society at large.</td>
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<tr>
<td>PO 11</td>
<td>Understand the engineering and management principles and apply these to the multidisciplinary environments.</td>
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<tr>
<td>PO 12</td>
<td>Recognize the need for life-long learning in the broadest context of technological change.</td>
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</table>

## Program-Specific Outcomes (PSOs)

<table>
<thead>
<tr>
<th>PSO 1</th>
<th>Make the students employable in engineering industries.</th>
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</thead>
<tbody>
<tr>
<td>PSO 2</td>
<td>Motivate the students for higher studies and research.</td>
</tr>
<tr>
<td>PSO 3</td>
<td>Motivate the students for various competitive examinations.</td>
</tr>
</tbody>
</table>
Abbreviations

PEO: Program Educational Objectives
PO: Program Outcomes
CO: Course Outcomes
L: No. of Lecture hours (per week)
T: No. of Tutorial hours (per week)
P: No. of Practical hours (per week)
C: Total number of credits
BSH: Basic Science and Humanity
BSC: Basic Sciences Course
PCC: Professional Core Course
OEC: Open Elective Course
PEC: Professional Elective Course
BHC: Basic Humanity Course
ESC: Engineering Science Course
HSMC: Humanity Science and Management Course
NCC: National Cadet Corps
NSS: National Service Scheme
CA: Continuous Assessment
MSE: Mid Semester Exam
ESE: End Semester Exam
SS: Self Study Course
# B. Tech. Civil Engineering

## Course Structure for Semester VII (Fourth Year) w.e.f. 2020-2021

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Type of Course</th>
<th>Course Title</th>
<th>Weekly Teaching Scheme</th>
<th>Evaluation Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTCVC701</td>
<td>Core</td>
<td>Design of Concrete Structures - II</td>
<td>2 1 --</td>
<td>20 20 60 100</td>
<td>3</td>
</tr>
<tr>
<td>BTCVC702</td>
<td>Core</td>
<td>Infrastructure Engineering</td>
<td>3 2 --</td>
<td>20 20 60 100</td>
<td>3</td>
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<tr>
<td>BTCVC703</td>
<td>Core</td>
<td>Water Resources Engineering</td>
<td>3 1 --</td>
<td>20 20 60 100</td>
<td>4</td>
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<tr>
<td>BTCVC704</td>
<td>Core</td>
<td>Professional Practices</td>
<td>2 1 --</td>
<td>20 20 60 100</td>
<td>3</td>
</tr>
<tr>
<td>BTCVE705A</td>
<td>Elective IV</td>
<td>Construction Techniques</td>
<td></td>
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<tr>
<td>BTCVE705B</td>
<td></td>
<td>Engineering Economics</td>
<td></td>
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<tr>
<td>BTCVE705C</td>
<td></td>
<td>Finite Element Method</td>
<td>3 2 --</td>
<td>20 20 60 100</td>
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<tr>
<td>BTCVE705D</td>
<td></td>
<td>Limit State Design of Steel Structures</td>
<td></td>
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<tr>
<td>BTCVE705E</td>
<td></td>
<td>Plastic Analysis and Design</td>
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<tr>
<td>BTCVE705F</td>
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<td>Water Power Engineering</td>
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<tr>
<td>BTCVOE706A</td>
<td>Elective V</td>
<td>Advanced Structural Mechanics</td>
<td></td>
<td>Audit (AU/NP)</td>
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<tr>
<td>BTCVOE706B</td>
<td></td>
<td>Air Pollution Control</td>
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<tr>
<td>BTCVOE706C</td>
<td></td>
<td>Bridge Engineering</td>
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<tr>
<td>BTCVOE706D</td>
<td></td>
<td>Introduction to Earthquake Engineering</td>
<td>3 2 --</td>
<td>20 20 60 100</td>
<td>3</td>
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<tr>
<td>BTCVOE706E</td>
<td></td>
<td>Town and Urban Planning</td>
<td></td>
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<tr>
<td>BTCVOE706F</td>
<td></td>
<td>Tunneling and Underground Excavations</td>
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<tr>
<td>BTCVL707</td>
<td>Laboratory</td>
<td>Design &amp; Drawing of RC &amp; Steel Structures</td>
<td>2 2 30 --</td>
<td>20 50 1</td>
<td></td>
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<tr>
<td>BTCVL708</td>
<td>Laboratory</td>
<td>Professional Practices</td>
<td>2 2 30 --</td>
<td>20 50 1</td>
<td></td>
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<tr>
<td>BTCVT709</td>
<td>Training</td>
<td>Field Training /Internship/Industrial</td>
<td>2 2 20 50</td>
<td>50 50 1</td>
<td></td>
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<tr>
<td>BTCVS710</td>
<td>BTS</td>
<td>Seminar</td>
<td>2 2 --</td>
<td>20 50 1</td>
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<tr>
<td>BTCVP711</td>
<td>BTP</td>
<td>Project Stage-I**</td>
<td>2 6 50 50</td>
<td>50 100 3</td>
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</table>

**Total** 16 3 12 160 150 490 800 23

**In case of students opting for Internship and Industry Project in the eighth semester, the Project must be industry-based.**
# B. Tech. Civil Engineering

Course Structure for Semester VIII [Fourth Year] w.e.f. 2020-2021

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Type of Course</th>
<th>Course Title</th>
<th>Weekly Teaching Scheme</th>
<th>Evaluation Scheme</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BTCVSS801A</td>
<td>(Self-Study Course)</td>
<td>Characterization of Construction Materials</td>
<td></td>
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<tr>
<td>BTCVSS801B</td>
<td>(Self-Study Course)</td>
<td>Geosynthetics and Reinforced Soil Structures</td>
<td>03**</td>
<td>20  20  60</td>
<td>100</td>
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<tr>
<td>BTCVSS801C</td>
<td></td>
<td>Higher Surveying</td>
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<tr>
<td>BTCVSS801D</td>
<td></td>
<td>Maintenance and Repair of Concrete Structures</td>
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<tr>
<td>BTCESS801E</td>
<td></td>
<td>Structural Dynamics</td>
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<tr>
<td>BTCESS802A</td>
<td>(Self-Study Course)</td>
<td>Energy Efficiency Acoustics and Daylighting in Building</td>
<td>03**</td>
<td>20  20  60</td>
<td>100</td>
</tr>
<tr>
<td>BTCESS802B</td>
<td>(Self-Study Course)</td>
<td>Environmental Remediation of Contaminated Sites</td>
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<td></td>
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<tr>
<td>BTCESS802C</td>
<td></td>
<td>Remote Sensing Essentials</td>
<td>03**</td>
<td>20  20  60</td>
<td>100</td>
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<tr>
<td>BTCESS802D</td>
<td></td>
<td>Mechanical Characterization of Bituminous Materials</td>
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<tr>
<td>BTCESS802E</td>
<td></td>
<td>Soil Structure Interaction</td>
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<tr>
<td>BTCEP803</td>
<td>Project Stage-II</td>
<td>In-house Project or Internship and Project in Industry*</td>
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<tr>
<td><strong>Total</strong></td>
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<td></td>
<td></td>
<td>04  30  90  40  220</td>
<td>350  21</td>
</tr>
</tbody>
</table>

*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 03 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, the University/Institute have to conduct exam for such courses.

* Six months of Internship and Project in the Industry. One Faculty guide from the Institute and one Mentor from the Industry should be identified to monitor the progress of work. During the Project/Internship period of work, a review of work should be taken twice followed by a final presentation at the end of Project period.
Detai led Syllabus (VII Semester)

BTCVC701  Design of Concrete Structures - II

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

Course Contents
Limit State Method for RC Structures

Module 1: (6 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: (6 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
Prestressed Concrete

Pre-stressed Concrete

Module 3: (5 Lectures)
Introduction to prestressed concrete, concepts, types, systems and methods of pre stressing,

Module 4: (5 Lectures)
Stress analysis for rectangular and symmetrical I sections, Pressure Line, Cable Profiles

Module 5: (4 Lectures)
Losses in Prestressing for Pre-tensioned & Post tensioned members

Module 6: (6 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
- IS: 456, IS 1343, SP16, SP24, SP34 of Recent Editions, Bureau of Indian Standards, New Delhi
- Lin T.Y., “Prestressed Concrete”, John Willey & Sons New York
- Jain A.K., “Reinforced Concrete Design (Limit State)”, Nemchand Brothers, Roorkee
- Sinha& Roy, “Prestressed Concrete”, S. Chand & Co. New Delhi
- Krishnaraju N., “Prestressed Concrete”, Tata Mc-Graw Hill

Reference Books
- Relevant Publications by Bureau of Indian Standards, New Delhi
- 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;
- Able to identify the behavior, analyze and design of the beam sections subjected to torsion.
- Able to analyze and design of axially and eccentrically loaded column and construct the interaction diagram for them.
- Understand various concepts, systems and losses in pre-stressing.
- Able to analyze and design the rectangular and symmetrical I-section pre-stressed beam/girders.

BTCVC702 Infrastructure Engineering

Teaching Scheme : (4 Lectures) hours/week

Course Objectives:
- To discuss elements of Railway Engineering, tunnel engineering, Docks & Harbours
- To discuss elements of Bridge Engineering and Airport Engineering
- To provide information about their processing, Construction and maintenance
- To make students understand function of infrastructural components and their significance

Course Contents

Module 1 (5 Lectures)
Railway Engineering: Permanent Way, gauges, rails, sleepers, ballast, sub grade formation, fixtures and fastenings, Geometric Design of tracks- Horizontal Alignment, Vertical Alignment

Module 2 (5 Lectures)
Points and Crossings: Standard types, Design of simple turnout, various types of Junctions, Stations and Yards: Purpose, Location, Site selection, general layouts of Terminus and Junction, Signalining and Interlocking, Construction and Maintenance of Track, Modern trends in Railways

Module 3: (10 Lectures)
Bridge Engineering: Sub-structures

Determination of design discharge, Linear Water Way, Economical Span, Afflux, Scour depth. Indian Road Congress Bridge Code
Abutments: Definition, Functions, Dimensions, Types, Forces acting on an abutment, Conditions of stability
Piers: Definition, Function, Types, Forces acting on a pier, Conditions of stability, Dimensions, Location, Abutment pier
Wing walls: Definition, Functions, Types, Forces acting on a wing wall, Conditions of stability, Dimensions, Precautions
Materials for sub-structures: Cement concrete, Masonry, Steel

Module 4: (10 Lectures)
Bridge Engineering: Super-structures

Simple bridges or beam bridges: Deck bridges, Through bridges, Semi-through bridges
Introduction, advantages and disadvantages: Continuous bridges, Cantilever bridges, Arch bridges, Bow-string girder type bridges, Rigid frame bridges, Portal frame bridges, Suspension bridges, Cable-stayed bridges, Composite bridges
Materials for super-structures: Cement concrete, Masonry, Steel, Timber

Module 5: (10 Lectures)
Tunnel Engineering: Shape and Size of Tunnel Shafts, Pilot Tunnels, Tunneling in Hard Rock, Tunneling in Soft Materials, Drilling-Patterns, Blasting, Timbering, Mucking, Tunnel Lining, Advances In Tunneling Methods, Safety Measures, Ventilation, Lighting and Drainage of Tunnels

Module 6: (5 Lectures)


Text Books

References
1. Publications of Bureau of Indian Standards, New Delhi, Relevant To the Syl Laboratories

Course Outcomes: On completion of the course, the students will be able to:
- Know about the basics and design of various components of railway engineering
- Understand the types and functions of tracks, junctions and railway stations.
- Know about the aircraft characteristics, planning and components of airport
- Understand the types and components of docks and harbors.

BTCVC703 Water Resources Engineering

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

Course objectives:
1) To study occurrence movement and distribution of water that is a prime resource for development of a civilization.
2) To know diverse methods of collecting the hydrological information, which is essential, to understand surface and ground water hydrology.
3) To know the basic principles and movement of ground water and properties of ground water flow.

Course Contents
Module 1: Introduction (10 Lectures)
Introduction, definition, scope, necessity, ill-effects of irrigation, advantages, types of irrigation systems, difference between weir, barrage and dam, methods of distribution of water, development of irrigation in India Introduction to hydrology: hydrologic cycle, rain, surface and ground water

Water Requirement of Crops
Water requirement of crops, base, delta and duty, methods of improving duty, types of soil, types of soil water, soil moisture, consumptive use, irrigation frequency, irrigation methods, crops season, crop pattern

Module 2: Reservoirs and Dams (10 Lecturers)
Planning of Reservoirs: Classification of Reservoir, Selection of site for Reservoir, Investigation works for Reservoir, Yield and Capacity of Reservoir, Mass Curve and Demand Curve, Storage Calculations, Control Levels, Useful Life of Reservoir, Siltage of Reservoirs, Losses in Reservoirs

Gravity Dams – Estimation of Loading, Design Criteria, Causes of Failure of Gravity Dam, Precaution against Failure, Theoretical and Practical Profile, Stability Calculations, Galleries, Joints, and Earth Dams: Components and their Functions, Design Criterion, Inverted Filters, Downstream Drainage, Causes of Failure of Earthen Dam. Arch Dams – Types, Forces on Arch Dam,

Module 3: Spillway Weirs and Canals (8 Lectures)
Spillway, Necessity and Different Types, Location of Spill Ways, Selection Criterion, Gates for Spillways,

Weirs on Permeable Foundations: Theories of Seepage, Bligh’s Creep Theory, Limitations of Bligh’s Creep Theory, Khosla’s Theory, Piping and Undercutting Canals: Types, Alignment, Kennedy’s and Lacey’s Silt Theories, Canal Losses, Typical Canal Sections, Canal Lining: Necessity and Types, Canal Structures: Cross Drainage Works and Canal Regulatory Works

Module 4: Lift Irrigation (8 Lectures)
Lift irrigation, wells and tube wells, introduction, classification of well, specific yield, deep and shallow wells, comparative advantage of well and canal irrigation, duty of well water, types of tube wells, types of strainers, boring methods. Darcy’s law, permeability, safe yield of basin. Lift irrigation schemes: Various components and their design principles (Only concepts).

Module 5: Hydrology (6 Lectures)
Hydrology, measurement of rainfall, peak flow, base flow, precipitation and its measurement, average depth of precipitation, water losses, flood frequency, catchment area formulae, flood hydrograph, rainfall analysis, infiltration, run off, estimation of runoff, unit hydrograph and its determination, s-hydrograph

Module 6: Water logging and drainage (6 Lectures)
Causes of water logging, preventive and curative measures, drainage of irrigation of lands, reclamation of water logged, alkaline and saline lands, Preventive and Curative Measures

Water Conservation: Rain water Harvesting, Ground Water Recharge, small scale techniques of surface water detention such as: Soil embankments, field ponds, concrete bandhara.

Text Books
5. Bharat Singh, 1979, “Irrigation”, Nemchand Brothers, Roorkee

References Books
1. USBR, “Design of Small Dam”, OXFORD & IBH, Publishing Company

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

- **CO1:** Understand need of Irrigation in India and water requirement as per farming practice in India.
- **CO2:** Understand various irrigation structures and schemes.
- **CO3:** Develop basis for design of irrigation schemes.

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**BTCVC704 Professional Practices**

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

**Pre Requisites:** Building Construction

**Course Objectives:**
1. To discuss introduce methods of quantity surveying, costing, and valuation
2. To facilitate students with concepts of costing involved in infrastructures
3. To make students familiar with process involved during tendering & contracting

**Course Contents**

**Module 1: Introduction**
(04 Lectures)
Introduction to estimating, purpose, types, items of inclusion, modes of measurement for different works, administrative approval and technical sanction to estimates

**Module 2: Quantity Surveying**
(06 Lectures)
Introduction to estimating, purpose, types, items of inclusion, modes of measurement for different works, administrative approval and technical sanction to estimates, 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 3: Costing**
(10 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 4: Tendering**
(6 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 5: Contracts**
(8 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 6: 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**

References
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: IS 1200 all parts, and other relevant

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

BTCVE705A Construction Techniques

Course Objectives:
The main objectives of the course are:

1. To study different methods of construction to successfully achieve the structural design with recommended specifications.
2. To involve the application of scientific and technological principles of planning, analysis, design and management to construction technology.

Teaching Scheme: (3 Lectures + 1 Tutorials) 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: (8 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: (8 Lectures)
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: (8 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: (4 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

Module 6: (4 Lectures)
Diaphragm walls: purpose and construction methods, safety measures in construction, prevention of accidents and introduction to disaster management

Text Books

Reference Books

Course Outcomes: On completion of the course, the students will be able to:
1. Understand the planning of new project with site accessibility and services required.
2. Comprehend the various civil construction equipment's.
3. Familiar with layout of RMC plant, production, capacity and operation process.
4. Recognize various aspect of road construction, construction of diaphragm walls, railway track construction etc.

BTCVE705B Engineering Economics

Course Objectives:
The main objectives of the course are:
1. To learn the economics behind any constructional activities.
2. To Emphasis upon develop interest in investment evaluation and financing projects.

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1 (04 Lectures)
Introduction to engineering economics, importance, demand and supply, types of costs, types of interests, value of money – time and equivalence, tangible and intangible factors, introduction to inflation,

Module 2 (06 Lectures)
Cash Flow diagram, Nominal and effective interest – continuous interest, Single Payment Compound Amount Factor, Uniform series of Payments, comparing alternatives, Present worth Analysis, Annual worth Analysis, Future worth Analysis, Rate of Return Analysis, Break Even Analysis, Benefit/Cost Analysis

Module 3 (06 Lectures)
Economics of Project Parameters, Equipment Economics, Operating Costs, Buy, Rent and Lease Options, Replacement Analysis, Cost Estimates, Type of Estimates, Parametric Estimate, Management Accounting, Financial accounting principles, basic concepts, Financial statements, accounting ratios

Module 4 (06 Lectures)
Investment Evaluation and Financing Projects, Taxation, Depreciation, switching between different depreciation methods, Inflation, Sources of finance, equity, debit, securities, borrowings, debentures, Working capital requirement, financial institutes

Module 5 (08 Lectures)

Module 6 (06 Lectures)
PPP in Projects Public Private Participation in Projects- PPP Models, BOOT, BOT, Joint Ventures, BOOT, BOT, Annuity, DBFO, External Commercial Borrowings, International Finance, FIDIC

Text Books

References

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

CO1: Adopt as per principles of economics and financing
CO2: Analyze available alternatives and propose best suitable among them
CO3: Apply various models of financial management and accounting

BTCVE705C Finite Element Method

Course Objectives:
The main objectives of the course are:

1. To solve 1 D, 2 D and dynamic problems using Finite Element Analysis approach.
2. To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction to FEM & Approximate Methods (06 Lectures)
Introduction, Overview of Various Methods to Solve Integral & Differential Equations (Point Collocation Method, Method of Least Square, Weighted Residual Method, Galerkin’s Method), Variational Calculus (Hamilton’s
Module 2: One Dimensional FE Analysis  
(06 Lectures)

Application of FEM to Solve various 1-D problems (Shape Functions for 1-D Elements, Properties of Shape Functions, Lagrange Interpolating Polynomials), C^0 Continuity, 1-D FE Analysis (Discretization, Selection of Shape Function, Defining Gradients of Primary Unknowns & Constitutive Equations, Derivation of Element Equations, Assembly & Application of Boundary Conditions, Computation of Primary and Secondary Unknowns), Direct Approach for Assembly, Boundary Conditions (Geometric, Natural), Concept of Sub-Structuring (Static Condensation), Stiffness Matrix for Basic Bar & Beam Element, Representation of Distributed Loading, The Assembly Process within the PMPE Approach, Element Stresses)

Module 3: FE Analysis by Direct Approach  
(06 Lectures)

C^1 Continuity, Formulation of 1-D Beam Element, Classical Beam Theory, Element Equation Formulation (Galerkin’s Approach, Rayleigh-Ritz Approach), Derivation of Scalar Functional from Differential Equation and Vice Versa, Simple applications to Beams.

Module 4: Two Dimensional FE Analysis  
(06 Lectures)

Conditions of Symmetry & Anti Symmetry (Applications), 2-D FE Analysis, Review of Theory of Elasticity, CST Element (3-Node Triangular Element), Pascal’s Triangle and Pyramid, Area Co-ordinate, Stepwise Formulation, Equivalent Load Vector, Plane Stress Problems using CST Elements, 2-D Stress Analysis using 4-noded Rectangular Element, Stepwise Formulation, Effect of Aspect Ratio, Explicit & Implicit Iso-parametric Formulation, Iso-parametric Elements for Plane Problems

Module 5: Three Dimensional FE Analysis  
(04 Lectures)

3-D Stress Analysis using FEM, Iso-parametric Formulation, 3-D Brick Element, FEA of Axi-symmetric Solids Subjected to Axi-symmetric and Asymmetric Loads (all contents at introductory level)

Module 6: Applications of FEA  
(04 Lectures)

Computer Implementation of FEM, Application of FEM to Time Dependent Problems, Partial FEM, h-version of FEM, p-version of FEM, Adaptive Meshing, Exposure to Hybrid FEM (Mixed/ Hybrid Formulation, Unidirectional Composites), Introduction to software’s, elementary problem-solving using freeware

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 any three consecutive Modules.

References:
Course Outcomes: Upon completion of the course the students will be able to:
1. Understand the different energy methods in structural analysis and basic concepts of finite element method.
2. Analyze 1-D problems related to structural analysis like Bars, Trusses, Beams and Frames using finite element approach.
3. Find solution to problems using direct approach methods like Rayleigh – Ritz or Galerkin’s Method.
4. Solve 2-D problems using knowledge of theory of elasticity.
5. Students will be able to implement the knowledge of numerical methods in FEM to find the solution to the various problems in statics and dynamics.
6. Analyze 1D, 2D, and 3D structures using different software packages based on FEM.

BTCVE705D Limit State Design of Steel Structures

Teaching Scheme: (3 Lectures) hours/week

Pre Requisites: Engineering Mechanics, Mechanics of Solids, Design of Steel structures

Course Objectives:
- To introduce the design loads and the stresses developed in the steel member
- To discuss the various connections and identify the potential failure modes
- To provide guidelines for various tension, compression and flexural members.
- To make students aware of various guidelines set by Standards & Codes

Course Contents

Module 1: Introduction (4 Lectures)
Introduction, advantages & disadvantages of steel structures, permissible stresses, factor of safety, methods of design, types of connections, various types of standard rolled sections, types of loads and load combinations

Module 2: Connections (4 Lectures)
Types: Riveted, Bolted, Welded; Analysis of axially & eccentrically loaded connections (subjected to bending & torsion), Permissible Stresses, Design of connections, failure of joints

Module 3: Axially Loaded Members (6 Lectures)
Tension members: Common sections, net effective area, load capacity, connection using weld / bolts, design of tension splice
Compression members: Common sections used, effective length and slenderness ratio, permissible stresses, load carrying capacity, connection using weld / bolt

Module 4: Beams (6 Lectures)
Laterally supported & unsupported beams, design of simple beams, built up beams using flange plates, curtailment of flange plates, web buckling & web crippling, secondary and main beam arrangement, beam to beam connections

Module 5: Industrial Roofing (6 Lectures)
Gantry girder: Forces acting on a gantry girder, commonly used sections, introduction to design of gantry girder as laterally unsupported beam, connection details
Roof trusses: Components of an industrial shed, types of trusses, load calculations and combinations, design of purlins, design of truss members, design of hinge & roller supports

Module 6: Columns and Column Bases (8 Lectures)

Simple and built up section; lacing, battening, column subjected to axial force and bending moment, column splices. Column bases: Analysis and design of: Slab base, gusseted base and moment resisting bases, grillage foundation, design of anchor bolt.

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

Use of IS 800: 1984 and 2007, IS 875 (All Parts), IS: Handbook No.1 for Steel Section and Steel Table is permitted for theory examination.

Text Books

Reference Books

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

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

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

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

CO4: Understand provisions in relevant BIS Codes.

BTCVE705E Plastic Analysis and Design

Teaching Scheme: (3 Lectures) hours/week


Course Objectives:
1. To introduce plasticity in various materials & components and their behavior.
2. To understand analysis of determinate and indeterminate members for collapse load
3. To understand philosophy of limit state design
4. To introduce potential design considerations for design calculations

**Course Contents**

**Module 1**  (8 Lectures)
Plasticity in ductile materials, stress-strain for mild steel, elasto-plastic behavior of beam in flexure, shape factor for different cross sections, yield zones, concept of plastic hinge

**Module 2:**  (8 Lectures)
Collapse loads of determinate and indeterminate structures such as beams and rectangular portal frames, statical and kinematical methods, mechanisms. Bending moment diagram at collapse

**Module 3:**  (6 Lectures)
Philosophy of Limit State design, requirement of steel for design, Limit State of Strength and Serviceability, partial safety factors, design of laterally supported beams, shear resistance

**Module 4:**  (6 Lectures)
Secondary design considerations, design of beams with high shear, interaction of bending and shear, interaction of bending and axial force

**Module 5**  (4 Lectures)
Design of portal frames, design of corner connection with and without haunches.

**Module 6**  (4 Lectures)
Consideration of deformations, calculation of deflections for plastically deformed structures

**Text Books:**
- Bureau of Indian Standards, “IS: 800 Code of Practice for General Construction in Steel”
- Arya A.S. and Ajmani J.L., “Design of Steel Structures”, Nemchand& Bros., Roorkee
- Beedle L.S., “Plastic Design of Steel Frames”, John Wiley & Sons

**References:**
- Bureau of Indian Standards, “Handbook for Structural Engineers SP 6”
- INSDAG Kolkata, “Teaching Resource for Structural Steel Design”
- “Steel Designers Manual” ELBS

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

CO1: Understand modes of structural collapse

CO2: Perform the plastic analysis and design of various determinate and in-determinant structures.

CO3: Adapt plastic theory of design for various structures

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**BTCVE705F Water Power Engineering**
Teaching Schemes: Lectures: 3 Hours/Week

Course Objectives:

1. To introduce hydraulic energy sources and methods of generation’
2. To provide information of components, layout, and arrangements of power station
3. To inculcate the knowledge of essential collateral components and their practical significance.

Course Contents

Module 1 (08 Lectures)

Module 2 (08 Lectures)
Tunnels: Classification, Location, Hydraulic Design, Tunnel Linings
Surge Tank: Functions, Behavior, Location, Types of Surge Tanks, Basic Design Criteria of Simple Surge Tank, Forebay

Module 3 (06 Lectures)
General Arrangements of Power Station, Power House, Sub-structure and super structure Under Ground Power Station: Necessity, Types, Development and Economics

Module 4 (06 Lectures)
Turbines: Classification, Characteristics of Different Types, Choice of Specific Type, Turbine Setting and Cavitation, Tail Race: Functions, Types, Channel and Tunnel Draft Tubes

Module 5 (04 Lectures)
Pumped Storage Plants, Purpose, General Layout, Types, Typical Arrangements of the Upper Reservoirs, Economics of Pumped Storage Plants

Module 6 (04 Lectures)
Tidal Power Stations: Necessity, Advantages, Classification, Limitations

Text Books
3. Deshmukh M. M. “Water Power Engineering”, Dhanapatra and Sons N. Delhi

References
1. Creager and Justin, “Hydro – Electric Hand Book”
Course Outcomes: On completion of the course, the students will be able to:

CO1: Identify potential energy sources and adapt as per the requirement

CO2: inculcate basics of electricity generation and power plants

CO3: propose suitable energy source for running a project optimistically.

BTCVOE706 A Advanced Structural Mechanics

Teaching Schemes: Lectures: 3 Hours/Week

Course Contents

Module 1: Review of basic concepts in structural analysis (06 Lectures)
structure, loads, response, statically determinate structures, principle of virtual work and displacement-based and force-based energy principles deriving stiffness and flexibility coefficients, Force method, Displacement Methods

Module 2: Matrix concepts and Matrix analysis of structures (06 Lectures)
Matrix; vector; basic matrix operations; rank; solution of linear simultaneous equations; eigenvalues and eigenvectors. Introduction; coordinate systems; displacement and force transformation matrices; Contra-gradient principle; element and structure stiffness matrices; Element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches

Module 3: Matrix analysis of structures with axialelements: (08 Lectures)
Introduction: Axial stiffness and flexibility; stiffness matrices for an axial element (two dof), plane truss element (four dof) and space truss element (six dof); One-dimensional axial structures: Analysis by conventional stiffness method (two dof per element) and reduced element stiffness method (single dof); Analysis by flexibility method;

Plane trusses: Analysis by conventional stiffness method (four dof per element) and reduced element stiffness method (single dof); Analysis by flexibility method;

Space trusses: Analysis by conventional stiffness method (six dof per element) and reduced element stiffness method (single dof).

Module 4: Matrix analysis of beams and grids (10 Lectures)
Conventional stiffness method for beams: Beam element stiffness (four dof); generation of stiffness matrix for continuous beam; dealing with internal hinges, hinged and guided-fixed end supports; accounting for shear deformations;

Reduced stiffness method for beams: Beam element stiffness (two dof); dealing with moment releases, hinged and guided-fixed end supports;

Flexibility method for fixed and continuous beams: Force transformation matrix; element flexibility matrix; solution procedure (including support movements); Stiffness method for grids: Introduction; torsional stiffness of grid element and advantage of torsion release; analysis by conventional stiffness method using grid element with six dof; analysis by reduced stiffness method (three dof per element);

Module 5: Matrix analysis of plane frames: (06 Lectures)
Conventional stiffness method for plane frames: Element stiffness (six dof); generation of structure stiffness matrix and solution procedure; dealing with internal hinges and various end conditions;

Reduced stiffness method for plane frames: Element stiffness (three dof); ignoring axial deformations; dealing with moment releases, hinged and guided fixed end supports;

Flexibility method for plane frames: Force transformation matrix; element flexibility matrix; solution
procedure (including support movements); Ignoring axial deformations;

Module 6: Matrix analysis of spaceframes: (04 Lectures)
Stiffness method for space frames: Introduction; element stiffness matrix of space frame element with 12 dof and 6 dof; coordinate transformations; analysis by reduced stiffness method (six dof per element);

References

BTCVOE706B Air Pollution Control

Teaching Scheme: Lectures: 3 Hours / Week

Course Objectives:

a. To discuss the sources of air pollutants and their effect on human, plants and materials
b. To get the knowledge of meteorology for controlling air pollution
c. To facilitate students with design methodologies of air pollution control equipment
d. To make aware of legislation for prevention and control of air pollution

Course Contents

Module 1: Introduction to Air Pollution (04 Lectures)
The Structure of the atmosphere, Composition of dry ambient air and properties of air. BIS Definition and scope of Air Pollution, Scales of air pollution, Types of exposures. Air Pollutants,

Module 1: Classification (04 Lectures)
Classifications, Natural and Artificial, Primary and Secondary, point and Non-Point, Line and Area Sources of air pollution. Stationary and mobile sources, composition of particulate & gaseous pollutant, units of measurement. Effect of different air pollutants on man, animals, vegetation, property, aesthetic value and visibility, air pollution episodes. Global effects of air pollution - global warming, ozone depletion, acid rain and heat island effect.

Module 3: Meteorology and Air pollution (06 Lectures)

Module 4: Air Sampling and Analysis (06 Lectures)
Air pollution survey, basis and statistical considerations of sampling sites. Devices and methods used for sampling gases and particulates. Stack emission monitoring, isokinetic sampling. Analysis of air samples chemical and instrumental methods. Ambient air quality monitoring.

Module 5: Photochemical Smog, Odour Pollution & Indoor Pollution (08 Lectures)
Chemistry of air pollution, Chain reactions of hydrocarbons, nitrogen oxide, Sulphur oxides and intermediates, photochemical smog formation, air pollution indices - aerosols, fog, smog index. Odour pollution: Theory, sources, measurement and methods of control of odour pollution. Indoor air pollution: Causes of air pollution, sources and
Module 6: Control of Air Pollution (08 Lectures)


Text Books


Reference Books


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

- Identify the sources of air pollutants and their effect on human, plants and materials.
- Apply knowledge of meteorology for controlling air pollution
- Design air pollution controlling equipment.
- Apply knowledge of legislation for prevention and control of air pollution.

BTCVOE706C Bridge Engineering

Teaching Scheme: (3 Lectures) hours/week

Course Contents

Module 1: Introduction (4 Lectures)

History of bridges, components and definitions, classification of road bridges, span length, classical examples of each type, people involved in the total process, history of analysis

Module 2: Selection of site and initial decision process (8 Lectures)

Survey and alignment, geotechnical investigations and interpretations

River Bridge: Selection of bridge site and planning, collection of bridge design data, hydrological calculation, waterway calculation, scour calculation, depth of foundation, freeboard.

Road Bridge: Selection of bridge site and planning, collection of bridge design data, vertical clearance.

Module 3: Standard loading for bridge design as per different codes (6 Lectures)

Road Bridges: IRC, BS code, AASHTO code. dead load, live load, impact factor, centrifugal force, wind loads, hydraulic forces, longitudinal forces, seismic forces, earth pressure, buoyancy, lane concept, equivalent loads, trafficload, width of roadway and footway, use of influence lines for maximum forces
in members, transverse distribution of live loads among deck longitudinal, load combinations for different working state and limit state designs.

**Railway Bridges:** Loadings for railway bridges, rail road data, pre-design considerations, rail road v/s highway bridges.

**Module 4: Superstructures (6 Lectures)**

Selection of main bridge parameters, design methodologies, choices of superstructure types: orthotropic plate theory, load distribution techniques, grillage analysis, finite element analysis (Preferable), different types of superstructure (RCC and PSC), Longitudinal analysis of bridge, slab bridge and voided slab bridge, beam-slab bridge, box girder bridge.

**Transverse analysis of bridge:** Slab bridge and voided slab bridge, beam-slab bridge, box girder bridge, temperature analysis, distortional analysis, effects of differential settlement of supports, reinforced earth structures.

**Typical details:** Slab bridge, slab-girder bridge (straight/skew), box girder bridge (straight/skew).

**Module 5: Substructure (4 Lectures)**

Pier, abutment, wing walls, importance of soil structure interaction

**Foundations:** open foundation, pile foundation, well foundation, examples - simply supported bridge, continuous bridge.

**Module 6: Bearings and deck joints (6 Lectures)**

Different types of bridge bearings and expansion joints, Design of bearings and joints.

**Parapets for highway bridges:** Definitions, classification of bridge parapets, various details

**Text/Reference Books**

- Victor D. J., Essentials of Bridge Engineering, Oxford & IBH.
- Raju N. K., Design of Bridges, Oxford & IBH.
- Ponnuswamy S., Bridge Engineering, Tata McGraw Hill
- Raina V. K., Concrete Bridge Practice, (Construction, Maintenance, Rehabilitation), 2nd Edition, Shroff Publishers,

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

1. Understand components of bridges and its various types.
2. Understand site selection criteria and comprehend various forces acting on bridges.
3. Analyze bridge structures using different analysis techniques.
4. Understand the importance of different types of bridge bearings.
BTCVOE706D  Introduction to Earthquake Engineering

Course Objectives:
The main objectives of the course are:

1. To provide a coherent development to the students for the courses in sector of earthquake engineering.
2. To involve the application of scientific and technological principles of planning, analysis, design of buildings according to earthquake design philosophy.

Teaching Scheme: (3 Lectures) hours/week

Pre-Requisites: Structural Mechanics I & II

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)

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.

Reference Books


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.

BTCVOE706E Town and Urban Planning

Teaching Scheme: Lectures: 3 Hours / Week

Course Objectives:

1. To discuss town and Urban planning with essential attributes
2. To provide information of various aspects involved town and Urban planning
3. To make students familiar with various standards, acts, laws and guidelines

Course Contents

Module 1: (06 Lectures)

Necessity and scope of Town Planning, Brief history, Greek and Roman Towns, Planning in ancient India - Indus Valley Civilization, Vedic Period, Buddhist Period, Medieval Period, Mogul Period, British Period, Post-Independence Period, Theories in urban and regional planning

Module 2: (06 Lectures)

Town Planners in Modern Era such as Sir Patrick Geddes, Sir Ebenezer Howard, Clarence stein, Sir Patrick Abercrombie, Le Corbusier, Present Status of Town Planning in India, Efficiency Measures, Planners skills, Integrated Area Planning in India. Distribution and sizes of Settlements

Module 3: (06 Lectures)

Layout of Residential Units, Neighborhood Unit Planning, Radburn Plan, Grid Iron Pattern, Shoe String Development, Growth Pattern of Towns, Concentric Satellite, Ribbon Development, Scattered growth

Module 4: (08 Lectures)

Elements of Town, Various Zones, Development Control Rules and Building Bye Laws, Urban Roads: Objective, Classification, Road Networks, Data Collection Surveys, Analysis of data,

Town aesthetics, Landscape Architecture, Suitability of Trees, Treatment of Traffic Islands, Open Spaces Walkways Public Sit-outs, Continuous Park System, Green ways

Module 5: (04 Lectures)

Town Planning works with reference to M.R.T.P. Act, Land Acquisition Act, Necessity and procedure of acquisition
Module 6: (04 Lectures)

Text Books:
4. MRTP Act 1966 & 2002
5. Land Acquisition Act - 1894

Reference Books

Outcomes: Upon completion of the course the students will be able to:
1. Understand town and Urban planning and their essential attributes
2. Identify elements of planning and regulations of the same
3. Implement guidelines provided by standard authorities

BTCVOE706F Tunneling and Underground Excavations

Course Objectives:
The main objectives of the course are:
1. To understand the need of utilization of Underground Space for various applications.
2. To develop the plan for infrastructure for transport.

Teaching Scheme: Lectures: 3 hours/week

Course Contents

Module 1 (06 Lectures)
Tunneling Methods: 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 (08 Lectures)
Tunneling by Drilling and Blasting: 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 (06 Lectures)
Tunneling by Road headers and Impact Hammers: 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 (06 Lectures)
Excavation of large and deep tunnels: Introduction; 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 rock pressure and methods to deal, roof and wall supports, case studies from hydel, road and rail tunnels.

Module 5 (6 Lectures)
Shield Tunneling: Introduction; advantages of shield tunneling; classification; different types of shield 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.

Module 6 (4 Lectures)

Text Books:

References:

Web links:
1. https://www.isrm.net
2. www.nirm.in
3. http://umich.edu/~gs265/tunnel.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.
BTCVL707 Design Drawing of RC & Steel Structures

**Practical:** 2 Hours / Week Term Work: 50 Marks

**Part A - Design and Drawing of Steel Structures**
Term work shall consist of detailed analytical report for structural design and drawing of any one of the following steel structures. Student may use IS 800 1984 or 2007.

1) Industrial Shed: Roof Truss with Necessary Bracing System, Purlins, Column and Column Bases
2) Industrial Shed: With Portal or Gable Frames of Solid or Open Web Sections with Necessary Bracing System, Purlins, Column and Column Bases
3) Industrial Shed: Gantry Girder, Columns with Necessary Bracing System, Purlins, Column and Column Bases
4) G + 3 Building Structure

**Part B - Design and Drawing of RC Structures**
Term work shall consist of detailed analytical report for structural design and drawing of any one of the following RC structures:

1) G + 2 Building
2) Elevated water tank: analysis and design of staging and tank body.

**Course Outcomes:** On completion of the course, student will be able to simulate a practical design requirement into a theoretical statement to solve mathematically to arrive at a safe economical and realistic feasible solution that can be executed.

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BTCVL708 Professional Practices Laboratory

**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.

BTCVT709  Field Training /Internship/Industrial

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

BTCVS710  Seminar

Student shall choose a topic of his/her interest in consultation with faculty in the department. The topic for seminar may be related to Recent Developments in Civil Engineering area and/or interdisciplinary area. Student shall attempt to collect necessary information and present a summary indicating comprehension of the topic and acquired depth of knowledge. A brief report on topic of seminar shall be submitted. Evaluation shall be based on report and power point presentation.

BTCVP711  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. In case of students opting for Internship in the eighth semester, the Project must be industry-based.

Detailed Syllabus (VIII Semester)

BTCVSS801  Characterization of Construction Materials

By Prof. Manu Santhanam, Prof. Piyush Chaunsali  IIT Madras

The objective of the course is to introduce students to the characterization of construction materials and their behaviour, with a view of developing their understanding of the mechanisms that govern the performance of these
materials. The course will be focused primarily on cement and concrete, and include the following techniques; the physics of the techniques and their application to cement science, including lab demonstrations and experiments will be covered.

**Week 1:** Introduction to course; Structure of Construction Materials – An Overview
**Week 2:** Calorimetry
**Week 3:** X-ray diffraction
**Week 4:** X-ray diffraction
**Week 5:** Thermal analysis
**Week 6:** Surface area measurement
**Week 7:** Optical microscopy
**Week 8:** Scanning electron microscopy
**Week 9:** Image analysis
**Week 10:** Spectroscopic techniques
**Week 11:** Mercury intrusion porosimetry
**Week 12:** Impedance analysis and ultrasonic methods


**BTCVSS801B Geosynthetics and Reinforced Soil Structures**

**BTCVSS801C Higher Surveying**

**BTCVSS801D Maintenance and Repair of Concrete Structures**
BTCVSS801E Structural Dynamics
Link- https://swayam.gov.in/nd1_noc20_ce21/preview

BTCVSS802A Energy Efficiency Acoustics & Daylighting in Building
Link-https://swayam.gov.in/nd1_noc20_ce08/preview

BTCVSS802B Environmental Remediation of Contaminated Sites
Link-https://swayam.gov.in/nd1_noc20_ce31/preview

BTCVSS802C Remote Sensing Essentials
Link-https://swayam.gov.in/nd1_noc20_ce29/preview

BTCVSS802D Mechanical characterization of Bituminous Materials
Link- https://swayam.gov.in/nd1_noc20_ce04/preview

BTCVSS802E Soil Structure Interaction
Link-https://swayam.gov.in/nd1_noc20_ce22/preview

BTCVC803 Project Stage II or Internship
Term work shall consist of detailed report for chosen topic and output of final working proposed in previous semester. 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.

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