The National Institute of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
Recognised by AICTE, New Delhi, Grant-in-Aid by Government of Karnataka,
Accredited by NAAC, New Delhi

BLOWN UP SYLLABUS

2025-26

IV Year B.E. (2022/2023 admitted batch)

Department of Civil Engineering

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TABLE OF SCHEME AND EXAMINATION FOR VII & VIII SEMESTER (2022/2023 admitted batch)

VII Semester											
Sl. No	Type of Course	Course Code	Course Title	Teaching Hrs/Week			Examination				Credits
				L	T	P	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	IPCC	BCV701	Design of Steel Structural Elements	3	0	2	3	50	50	100	**4**
2	PCC	BCV702	Estimation and Contract Management	3	2	0	3	50	50	100	**4**
3	PEC	BCV713X	Professional Elective Course - Group III	3	0	0	3	50	50	100	**3**
4	OEC	BCV754X	Open Elective Course - Group II	3	0	0	3	50	50	100	**3**
5	PROJ	BCV785*	Major Project	0	0	12	3	100	100	200	**6**
							Total	**300**	**300**	**600**	**20**

VIII Semester											
Sl. No	Type of Course	Course Code	Course Title	Teaching Hrs/Week			Examination				Credits
				L	T	P	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
1	PEC	BCV801X	Professional Elective - Group IV (Online Course)	-	-	-	-	-	50	100	**3**
2	OEC	BCV802X	Open Elective - Group III (Online Course)	-	-	-	-	-	50	100	**3**
3	INT	BCV803	Internship (Industry/ Research) (14-16 weeks)	0	0	20	3	100	100	200	**10**
							Total	**100**	**200**	**400**	**16**

***Note: Major Project (BCV785) work** shall begin during the start of 6th semester and the project batches, guide allocation shall be done during the same time frame. However, evaluation shall be carried out during 7th semester, as mentioned in the curriculum.

List of Professional and Open Elective Course

For VII Semester

Professional Elective Course - Group III		
Sl. No	**Course Code**	**Course Title**
1	BCV713A	Traffic Engineering and ITS
2	BCV713B	Earthquake Resistant Structures
3	BCV713C	Design and Execution of Pile Foundations
4	BCV713D	Fire Resistance of Structures
5	BCV713E	Analysis and Design of Water Distribution and Collection System
Open Elective Course - Group II# #Offered by Department of Civil Engineering to other branch students.		
Sl. No	**Course Code**	**Course Title**
1	BCV754A	Road Safety Engineering
2	BCV754B	Conservation Of Natural Resources
3	BCV754C	Energy Efficiency, Acoustics and Day lighting In Building
4	BCV754D	Precast Members – Systems & Construction
5	BCV754E	Earth Observation using Geo-informatics
6	BCV754F	Building Services-HVAC, Acoustics and Fire Safety
7	BCV754G	Air Pollution and Control

List of Professional Elective - Group IV (Online Course)*

Open Elective - Group III (Online Course)*

For VIII Semester

* Subject to change and availability in NPTEL portal.

Students are advised to contact department NPTEL Coordinator and proctors for course approval.

For more information visit: https://nptel.ac.in/

A student has to register for **12 weeks course** with 3 no. of lectures per week and 36 Total no. of hrs. of engagement.

Tentative dates: To be announced.

DETAILED SYLLABUS

VII SEMESTER

Code: **BCV701** **Course: Design of Steel Structural Elements**
Credits: **4** **L:T:P 3:0:2**
SEE: **50%** **CIE: 50%**
SEE Hours: **3** **Max. Marks:100**

Prerequisites if any	NIL
Learning objectives	1. Understand the behaviour of structural elements in steel structures and well versed with Steel design principles according to the guidelines of IS: 800-2007 2. Apply their knowledge of Structural mechanics to analyse and design the steel structures 3. Design the steel structural elements of different forms and connections under different stresses

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Explain the engineering properties and the behaviour of steel structural elements according to the guidelines	Understand
CO2	Analyse and design the structural bolted and welded connections of Steel Elements	Analyze
CO3	Analyse and design the steel structural elements (Tension Members, Column Bases, Compression Members & Beams)	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	3	2				1						1		1		
CO2	3	3										1		3	2	
CO3	3	3	3									1		3	3	

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	Introduction: Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability	1	-	-
1.2	Serviceability Limit states, Failure Criteria of steel	1	-	-
1.3	Design Consideration, Loading and load combinations, IS code provisions, Specification and Section classification	1	-	-
1.4	Plastic Behavior of Structural Steel: Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load	1	-	-
1.5	load factor, Shape factor, Theorem of plastic collapse	1	-	-
1.6	Methods of Plastic analysis	2	-	-
	Module – 2			
2.1	**Bolted Connections:** Introduction, Types of Bolts, Behavior of bolted joints	1	-	-
2.2	Design of High Strength friction Grip (HSFG) bolts,	2	-	-
2.3	Design of Simple bolted Connections (Lap and Butt joints)	3		
2.4	Bracket connections (both types)	3		
	Module – 3			
3.1	**Welded Connections:** Introduction, Types and properties of welds, Effective areas of welds	1	-	-
3.2	Advantages and Disadvantages of Bolted and Welded Connections, Weld Defects	1	-	-
3.3	Simple welded joints for truss members and Bracket connections (both types)	3	-	-
	Module – 4			
4.1	**Design of Tension Members:** Introduction, Types of Tension members, Slenderness ratio	1	-	-
4.2	Modes of Failures, Factors affecting the strength of tension members	1	-	-
4.3	Design of Tension members with Lug angles	2	-	-
4.4	**Design of Column Bases:** Design of Simple Slab Base	2		

4.5	Design of Gusseted Base	3		
	Module – 5			
5.1	**Design of Compression Members:** Introduction, Failure modes, Behavior of compression members	1	-	-
5.2	Sections used for compression members, Effective length of compression members	1	-	-
5.3	Design of built-up Compression members	2	-	-
5.4	Design of Lacing and Battened Systems	3		
5.5	**Design of Beams:** Introduction & Design of Laterally supported beam	3		
	List of Experiments:			
1	Design a Bolted Connections using M S Excel	-	-	2
2	Design a welded Connections using M S Excel	-	-	2
3	Design of Tension members using M S Excel	-	-	2
4	Design of Compression Members using MS Excel	-	-	2
5	Design of Simple Slab Base using M S excel	-	-	2
6	Design of Gusseted Base using M S Excel	-	-	2
7	Draw the following using AutoCAD. Column bases and Gusseted bases with bolted and welded connections.	-	-	3
8	Draw the following using AutoCAD. Roof Truss – Welded and Bolted	-	-	3
9	Draw the following using AutoCAD. Connections – Beam to beam, Beam to Column by Bolted and Welded Connections.	-	-	3
10	Draw the following using AutoCAD. Built-up Columns with lacings and battens.	-	-	3
11	Drawing of Gantry Girder for the given data using AutoCAD.			2
12	Drawing of Welded Plate girder for the given data using Auto CAD.			2
	Total No. of Lecture Hours	40	-	-
	Total No. of Tutorial Hours		-	-
	Total No. of Practical Hours			**28**

Self-learning topics identified: (Maximum of 5 topics)

1. Moment resistant connections
2. Distortion and residual stresses in welded joints
3. Splices in beams
4. Splices in compression members
5. Laterally unsupported beams

Textbooks:

1. N Subramanian, “Design of Steel Structures”, Oxford University Press, New Delhi, India.
2. S K Duggal, “Limit State Design of Steel Structures” McGraw Hill Publications Chennai.

Reference Books:

1. M. L. Gambir, "Fundamentals of Structural Steel Design", Tata McGraw Hill, 2017.
2. Ramachandra and Virendra Gehlot, ―Limit State Design of Steel Structures, Scientific Publishers, 2012.
3. Bureau of Indian Standards, IS 800-2007; IS 875 - 1987; SP- 6 (1) or ―Steel Tables

Online Resources:

1. Design of Steel Structures, IIT Kharagpur – Prof. Damodar Maity (NPTEL – Video Lecture Course) (https://nptel.ac.in/courses/105105162)
2. Design of Steel Structures, IIT Madras – Prof. Satish Kumar S.R. (NPTEL – Web Lecture Course) (https://nptel.ac.in/courses/105106113)

Code: BCV702 **Course: Estimation And Contract Management**
Credits: 4 **L:T:P 3:2:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	NIL
Learning objectives	1. Estimate the quantities of work, develop the bill of quantities and arrive at the Cost of civil engineering Project 2. Understand and apply the concept of Valuation for Properties 3. Understand, Apply and Create the Tender and Contract document

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Taking out quantities and work out the cost and preparation of abstract for the estimated cost for various civil engineering works.	Apply
CO2	Prepare the specifications and analyze the rates for various items of work.	Apply
CO3	Assess contract and tender documents for various construction works	Understand
CO4	Prepare valuation reports of buildings	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3					2		2			1		3		
CO2	3					2		2					2		
CO3	3					3		2	1						3
CO4	3	2				2		2					3		

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
Module – 1				
1.1	**Quantity Estimation for Building:** study of various drawing attached with estimates, important terms, units of measurements, abstract,	01	00	00

1.2	Types of estimates	01	00	00
1.3	Estimation of building by Short wall and long wall method & Centre-line method.	02	02	00
1.4	Estimate of R.C.C structures including Slab, beam, column, footings	02	02	00
	Module – 2			
2.1	Estimate of Steel truss, manhole	02	00	00
2.2	Septic tanks and slab culvert	01	02	00
2.3	**Quantity Estimation for Roads:** Computation of volume of earthwork fully in banking, cutting, partly Cutting and partly Filling by mid-section, trapezoidal and Prismoidal Methods	03	02	00
	Module – 3			
3.1	**Specification for Civil Engineering Works:** Objective of writing specifications essentials in specifications, general and detail specifications of different items of works in buildings and roads.	04	00	00
3.2	**Analysis of Rates :** Factors Affecting Cost of Civil Works , Concept of Direct Cost , Indirect Cost and Project Cost	01	00	00
3.3	Rate analysis and preparation of bills, Data analysis of rates for various items of Works, Sub-structure components, Rate analysis for R.C.C. slabs, columns and beams	03	06	00
	Module – 4			
4.1	**Contract Management-Tender and its Process:** Invitation to tender, Prequalification, administrative approval& Technical sanction.	01	00	00
4.2	Bid submission and Evaluation process.	01	00	00
4.3	Contract Formulation: Letter of intent, Award of contract, letter of acceptance and notice to proceed. Features / elements of standard Tender document (source: PWD / CPWD / International Competitive Bidding – NHAI / NHEPC / NPC). Law of Contract as per Indian Contract act 1872, Types of Contract, Joint venture. **Contract Forms:** FIDIC contract Forms, CPWD, NHAI, NTPC, NHEPC	02	00	00
	Module – 5			
5.1	**Contract Management-Post award :**Basic understanding on definitions, Performance security, Mobilization and equipment advances, Secured Advance, Suspension of work, Time limit for completion, Liquidated damages and bonus, measurement and payment, additions and alterations or variations and deviations, breach of contract, Escalation, settlement of account or final payment, claims, Delay's and Compensation, **Disputes & its resolution mechanism,** Contract management and administration.	04	00	00
5.2	**Valuation:** Definitions of terms used in valuation process, Purpose of valuation, Cost, Estimate, Value and its relationship, Capitalized value. Freehold and lease hold and easement, Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation: Rent fixation, valuation for mortgage, valuation of land.	02	06	00
	Total No. of Lecture Hours	**30**		

Total No. of Tutorial Hours	**20**	
Total No. of Practical Hours		**00**

Self-learning topics identified:

1. Doors, windows and ventilators, various types of claddings
2. Form work
3. Usage of software for estimating bill of quantities

Textbooks:

1. Datta B.N., “Estimating and costing”, UBSPD Publishing House, New Delhi.
2. B.S. Patil, “Civil Engineering Contracts and Estimates”, Universities Press.
3. M. Chakraborthi; “Estimation, Costing and Specifications”, Laxmi Publications.

Reference Books:

1. MORTH Specification for Roads and Bridge Works – IRC New Delhi
2. Kohli D.D and Kohli R.C, “Estimating and Costing", 12 th Edition, S.Chand Publishers, 2014.
3. Vazirani V.N and Chandola S.P, “Estimating and costing", Khanna Publishers, 2015.
4. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
5. Duncan Cartlidge , "Quantity Surveyor’s Pocket Book", Routledge Publishers, 2012.
6. Martin Brook, "Estimating and Tendering for Construction Work", A Butterworth-Heinemann publishers, 2008.
7. Robert L Peurifoy , Garold D. Oberlender , “ Estimating Construction Costs” – 5ed , Tata McGraw-Hill , New Delhi.
8. David Pratt, “Fundamentals of Construction Estimating” – 3ed, Edition.
9. PWD Data Book, CPWD Schedule of Rates (SoR). and NH SoR – Karnataka FIDIC Contract forms. B.S. Ramaswamy “Contracts and their Management” 3ed, Lexis Nexis(a division of Reed Elsevier IndiaPvt Ltd).

Online Resources:

https://youtu.be/ofkpm4lhJcg

https://youtu.be/GGikveOcaJw

Code: BCV785 **Course: Major Project**
Credits: 6 **L:T:P 0:0:12**
SEE: 50% **CIE: 50%**
SEE Hours: - **Max. Marks:200**

Prerequisites if any	None
Learning objectives	Demonstrate a sound technical knowledge of their selected project topic.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Plan and work out an action plan in a team for completion of a civil engineering problem.	Understand Apply
CO2	Prepare documents in team and make individual presentations	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1			3	3	3									3		2
CO2									3	3				2		3

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

List of Projects:				
1	The project is offered to the students in order to inculcate research attitude and develop corresponding skills. A group of maximum four students work as a team for major project. Major project could be in the form of experimental investigation, computational work, data collection and its analysis etc. At the end of the major project, a report will be made wherein the details of the work undertaken, methodology adopted, conclusions drawn are provided. Evaluation of the major project is done as per the rubrics.	-	-	144
Total No. of Lecture Hours				
	Total No. of Tutorial Hours			
	Total No. of Practical Hours			**144**

ELECTIVES

Code: BCV713A **Course: Traffic Engineering and ITS**
Credits: 3 **L:T:P 3:0:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	1. Transportation Engineering
Learning objectives	1. Gain knowledge of traffic engineering elements for road safety 2. Gain knowledge of intelligent transportation systems and its application in developing nations.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand principles of traffic engineering and various traffic surveys involved.	Understand
CO2	Apply concepts of intelligent transportation systems though sensors and models.	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3	PSO4
CO1	3	3												3	3		
CO2	3	3	3											3	3		

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	Traffic Planning and Characteristics: Road Characteristics-Road user characteristics, PIEV theory	02	-	-
1.2	Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India,	02	-	-
1.3	Integrated planning of town, country, regional and all urban infrastructures,	02	-	-
1.4	Sustainable approach- land use & transport and modal integration.	02	-	-
	Module – 2			
2.1	Traffic Surveys: Traffic Surveys- Speed, journey time and delay surveys,	03	-	-
2.2	Vehicles Volume Survey; Methods and interpretation, Origin Destination Survey, presentation, Parking Survey	03	-	-
2.3	Accident Analyses-Methods, interpretation and presentation, Level of service-Concept, applications and significance.	03	-	-
	Module – 3			
3.1	Traffic Design and Visual Aids: Intersection Design- channelization, Rotary intersection design,	02	-	-
3.2	Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings	02	-	-
3.3	Networking pedestrian facilities & cycle tracks.	02	-	-

Module – 4				
4.1	Traffic Safety and Environment: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards,	04	-	-
4.2	Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation.	03	-	-
4.3	Introduction to Intelligent Transportation Systems (ITS) -Definition – Role and Responsibilities – Advanced Traveller Information System – Fleet Oriented ITS	03	-	-
Module – 5				
5.1	Architecture – ITS Architecture Framework – Hardware Sensors – Vehicle Detection –Techniques – Dynamic Message Sign – GPRS – GPS	02	-	-
5.2	Advanced Transport Management System Video Detection – Virtual Loop Cameras - ANPR – IR Lighting – Integrated Traffic Management – Control Centre – Junction Management Strategies-	02	-	-
5.3	ATMS – Advanced Traveler Information Systems (ATIS)- Route Guidance – Data Collection – Analysis – Dynamic Traffic Assignment (DTA) – Components	03	-	-
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		-	-
	Total No. of Practical Hours			**-**

Self-learning topics identified: (Maximum of 5 topics)

1. Blind spots and black spots
2. Geometric design elements of highways
3. Advanced methods for traffic data collection and analysis

Textbooks:

1. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
2. Indian Roads Congress (IRC) Specifications: Guidelines and Special Publications on Traffic Planning and Management

Reference Books:

1. Handbook of Road Safety Measures, Second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson
2. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US

Online Resources:

1. https://nptel.ac.in/courses/105107210
2. https://www.civil.iitb.ac.in/tvm/nptel/591_ITS_1/web/web.html

Code: BCV713B **Course: Earthquake Resistant Structures**
Credits: 3 **L:T:P 3:0:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	Design of RC structures, Analysis of Structures
Learning objectives	1. To impart the aspects of seismology and the effects on civil engineering structures 2. To help analyze lateral loads caused due to earthquakes and incorporate ductile detailing to RC structural elements.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand the different types of dynamics structural systems and causes that lead to the distress in structures due to earthquakes	Understand
CO2	Analyse simple civil engineering structures for seismic loads	Analyze
CO3	Apply ductile detailing to enhance the seismic performance of RC structural elements	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	2	3												2		
CO2		3	2												2	
CO3			3												2	

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	**Introduction to structural dynamics:** Basic Definitions, Concept of degrees of freedom, D'Alembert's principle	1		
1.2	Principle of virtual displacement and energy principles, Types of Vibrations, Damping and its types.	2		
1.3	Analytical Model of dynamic system, Free vibration of damped and undamped system having single degree of freedom. Concept of equivalent spring	2		
1.4	Numerical problems on determining natural period, natural frequency, mass, stiffness, amplitude, and acceleration for undamped free vibration systems	3		
	Module – 2			
2.1	**Engineering Seismology:** Terminologies (Focal depth, Epicenter, etc.); Causes of Earthquakes; Theory of plate tecton characteristics faults; Classification of Earthquakes	1		
2.2	Types and characteristics of seismic waves; Magnitude and intensity of earthquakes, local site effects	2		
2.3	Earthquake ground motion characteristics: Amplitude, frequency and duration; Seismic zoning map of India	2		
2.4	Earthquake measuring instruments- Seismoscope, Seismograph and accelerograph.	2		
	Module – 3			
3.1	**Seismic Performance of Buildings and Over View of IS-1893 (Part-1):** Types of damages to building observed during past earthquakes	1		
3.2	Plan irregularities; mass irregularity; stiffness irregularity; Concept of soft and weak storey;	1		
3.3	Torsional irregularity and its consequences; configuration problems; continuous load path	1		

3.4	Architectural aspects of earthquake resistant buildings; Lateral load resistant systems.	2		
3.5	Seismic design philosophy; Structural modeling	2		
3.6	Code based seismic design methods.	2		
	Module – 4			
4.1	**Determination of Design Lateral Forces:** Equivalent lateral force procedure and dynamic analysis procedure.	2		
4.2	Step by step procedures for seismic analysis of RC buildings using Equivalent static lateral force method (maximum of 4 storeys and without infill walls) with numerical problems	3		
4.3	Step by step procedures for seismic analysis of RC buildings using response spectrum methods (maximum of 4 storeys and without infill walls) with numerical problems	3		
	Module – 5			
5.1	**Ductility considerations and earthquake resistant design of masonry structures:** Factor affecting ductility, ductile detailing of flexural members, columns and frame members as per IS13920.	1		
5.2	Seismic Design of Ductile Reinforced Concrete Beams, Seismic Design of Ductile Reinforced Concrete column	2		
5.3	Performance of Unreinforced, Reinforced, Infill Masonry Walls, Box Action, Lintel and sill Bands	1		
5.4	Elastic properties of structural masonry, lateral load analysis,	2		
5.5	Recommendations for Improving performance of Masonry Buildings during earthquakes;	1		
5.6	Retrofitting of Masonry buildings.	1		
	Total No. of Lecture Hours	40		
	Total No. of Tutorial Hours			
	Total No. of Practical Hours			

Self-learning topics identified:

1. Seismic isolation of structures
2. Requirements of ductile detailing of steel structures.

Textbooks:

1. Pankaj Agarwal and Manish Shrikande, “Earthquake resistant design of structures”, PHI India
2. Anil K. Chopra, “Dynamics of Structures: Theory and Applications to Earthquake Engineering”, Pearson Education, Inc.

Reference Books:

1. S.K. Duggal, “Earthquake Resistant Design of Structures”, Oxford University Press
2. IS-13920 – 2016, Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Forces, BIS, New Delhi.
3. IS-1893 – 2016, Indian Standard Criteria for Earthquake Resistant Design of Structures, Part-1, BIS, New Delhi.
4. IS-13828 – 1993, Indian Standard Guidelines for Improving Earthquake Resistance of Low Strength Masonry Buildings, BIS, New Delhi.
5. IS-3935 – 1993, Repair and Seismic Strengthening of Buildings-Guidelines, BIS, New Delhi.

Online Resources:

1. https://archive.nptel.ac.in/courses/105/101/105101004/
2. https://nptel.ac.in/courses/105102016

Code: BCV713C **Course: Design and Execution of Pile Foundations**
Credits: 3 **L:T:P 3:0:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	
Learning objectives	1. Introduce the concept of Piling works, design requirements, construction procedures and different load test which need to be conducted on the piles 2. Understand the Environmental, Health and Safety standards which need to be in place for the handling of the pile works.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Comprehend Basic design concepts of pile foundations	Understand
CO2	Compute capacity of piles and select suitable type of pile foundation based on soil conditions	Apply
CO3	Apply different construction procedures and execute different load testing on piles	Analyze
CO4	Compute bill of quantities for pile foundations	Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	3	3										2		3	2	2
CO2	3	3										2		3	2	2
CO3	2	3										2		3	2	3
CO4		2									3	2		2		2

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	Overview of Pile foundations, Selection Criteria, Common Design considerations,	2		
1.2	General Terminologies and Indian standard codes. Materials and Equipment, Construction procedures, workmanship, Vertical and Lateral Capacity calculations, Load tests.	4		
1.3	Case Studies of Bored cast insitu piles and Driven cast insitu piles	2		
	Module – 2			
2.1	Materials and Equipment, Construction procedures, workmanship, Vertical and Latera calculations	4		
2.2	Load tests, Case Studies of precast driven piles, precast driven piles in pre-bored hole reamed piles	4		
	Module – 3			
3.1	Introduction to Grouping and Settlement of piles, Pile Group efficiency and Spacing, Capacity of Pile group, Settlement of Pile group	2		
3.2	Introduction & Types of testing on piles and General requirements for testing, Pile Integrity tests - introduction & Equipment Types of Pile Integrity test	3		
3.3	Data Recording & Interpretation of results, Introduction to quality assurance of piles.	3		

Module – 4				
4.1	Quality Control of BCIS, DCIS piles, Quality records and checklists.	4		
4.2	Materials, Equipment, manufacturing procedure, Design and installation, suitability and application and failure modes of spun piles and helical piles	4		
Module – 5				
5.1	Introduction to Bill of quantities for Bored cast insitu, Driven Cast insitu, Precast driv Precast driven piles in pre-bored holes and undreamed piles. Challenges in bored and driven piles	4		
5.2	Software demonstrations (e.g., PLAXIS) and step-by-step design techniques for deep foundations. Modelling in Plaxis 2D	4		
	Total No. of Lecture Hours	40		
	Total No. of Tutorial Hours			
	Total No. of Practical Hours			

Self-learning topics identified:

1.Pile Foundations for Offshore Structures
2.Pile Driving Analysis
3.Franki piles
4.Pile Raft foundation

Textbooks:

1. VNS Murthy “Advanced Foundation Engineering”, CBS Publisher (2017)

2. IS 2911- Indian standard code driven cast insitu, bored cast insitu, Driven precast piles 2.
3. IS 14593-Indian standard code for bored cast insitu piles founded on rocks – Guidelines

Reference Books:

1. Tomlinson M j., “Foundation design and construction”-sir Isac Pirman & sons Ltd. London (1963) 1st edition
2. Poulos and Davis. “Pile foundation analysis and design”- Elastc solution for soil & Rock Mechanics. John Wiley sons. (1974)
3. Chellis R.D., “Pile foundation – Theory – Design – Practice”- McGraw Hill (1963)
4. Bowels J.E., “Analytical and computer methods in foundation engineering” (1974)
5. Willkern and Fang., “Foundation engineering Hand Book”-Von No strand and remhold Co (1975)

Online Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105207/
2. https://archive.nptel.ac.in/courses/105/108/105108069/
3. E-learning content on L&T EduTech Platform.

Code: BCV713D **Course: Fire Resistance of Structures**
Credits: 3 **L:T:P 3:0:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	Design of Reinforced concrete structures
Learning objectives	1. To determine causes of accidental fires leading to various fire spread scenarios 2. To understand the behavior of structural elements under fire.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Describe the concepts of fire severity and fire resistance	Understand
CO2	Design of concrete and steel structures to resist fire exposure	Apply

Mapping with POs and PSOs:

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2		PSO 1	PSO 2	PSO 3
CO1	3	2		2										3	2	-
CO2	3	2	2											3	2	-

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	**Fire Safety in Buildings:** Fire safety objectives: Life safety, Property protection and Environmental protection.	2	-	-
1.2	Process of Fire development: Fire behaviour,	2	-	-
1.3	Factors affecting the growth phase, human behaviour,	1	-	-
1.4	Detection and control of the fire. Fire resistance: Objectives for fire resistance, Examples of Fire resistance, Fire design time, trade-offs.	1	-	-
	Module – 2			
2.1	**Fire Spread and Control**	2	-	-

	Causes of Fire spread. Controlling fire spread fire spread within room of origin,			
2.2	Compartmentation, Fire spread to adjacent rooms,	1	-	-
2.3	Fire spread to other storeys, and Fire spread to other buildings,	1	-	-
2.4	Building construction for fire safety, Fire following earthquake, Fire during construction and alterations.	2	-	-
	Module – 3			
3.1	**Fire and Heat** Combusiotn, Fire Initiation: Sources and Mechanisms, Pilot Ignition and Auto-ignition,	1	-	-
3.2	Flame Spread. Pre-flashover Fires: Burning Items in Open Air,	1	-	-
3.3	Burning Items in Rooms, t-Squared Fires, Fire Spread to Other Items,	2	-	-
3.4	Calculation of fire load, Pre-flashover Fire Calculations. Conditions Necessary for Flashover	2	-	-
3.5	Numerical on design fires	4	-	-
	Module – 4			
4.1	**Fire Resistance** Definition, Assessing Fire Resistance,	1	-	-
4.2	Fire resistance tests: Standards, Test equipment, Failure criteria,	1	-	-
4.3	Standard of construction. Approved Fire-resistance ratings, Listings, Expert opinion.	2	-	-
4.4	Fire resistance by calculation, Fire model, Heat transfer model, Structural model.	1	-	-
4.5	Fire resistance of assemblies: Beams, Columns and floors.	1	-	-
4.6	Numerical on fire resistance calculation	3	-	-
	Module – 5			
5.1	**Design of Structures Exposed to Fire** Design equation, Loads for fire design, Structural analysis for fire design, Computer calculations.	2		
5.2	Material properties in fire, Testing regimes, Components of strain.	2		
5.3	Design of individual members exposed to fire, Tension members, Compression members, Beams.	2		
5.4	Design of structural assemblies exposed to fire: Frames, Redundancy, Disproportionate collapse, Continuity, Plastic design.	3		
	Total No. of Lecture Hours	40		

Total No. of Tutorial Hours		
Total No. of Practical Hours		

Textbooks:

1. Andrew H. Buchanan, **"Structural Design for Fire Safety"** John Wiley & Sons. Ltd, 2001.

Reference Books:

1. J.A. Purkiss, **"Fire Safety Engineering Design of Structures",** BH Elsevier Ltd., 2007.
2. V. K. Jain **"Fire Safety in Buildings",** New age international publishers, 2007.
3. U.S Bendev Etal, **"Fire Resistance of Buildings",** Amerind Publishing Co. Pvt. Ltd, 2009.
4. Bureau of Indian Standards, "Hand Book of Functional Requirements of Buildings", (SP-41 & SP-32).

Code: **BCV713E** **Course: Analysis & Design of Water Distribution and Collection Systems**
Credits: **3** **L:T:P 3:0:0**
SEE: **50%** **CIE: 50%**
SEE Hours: **3** **Max. Marks: 100**

Prerequisites if any	Hydraulics and Water Supply Engineering
Learning objectives	1. Understanding the principles of water distribution network analysis and design with the application of software tools. 2. Getting an insight in to the hydraulic design of collection system.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Explain the functioning of water distribution system with different elements, various parameters and their interrelationships, formulate equations for pipe networks and analyse them using appropriate method.	Understand Apply, Analyze
CO2	Demonstrate the understanding of wastewater collection system with various appurtenances, estimate the quantity of sanitary sewage and storm water, hydraulic design of sewers.	Understand Apply
CO3	Demonstrate the usage of software tools for the analysis and design of water distribution and collection systems.	Understand, Apply, Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2										3			
CO2	3		3	2										3			
CO3	3	3	3		3				2					3	3	1	

Mapping Strength: **Strong– 3** **Medium – 2** **Low – 1**

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	Water Distribution System – Introduction, System Configuration	1	-	-
1.2	Water Demand, Pipe Systems and Piping Materials	1	-	-
1.3	Elements and Types of Water Distribution Networks	1	-	-
1.4	Reservoirs, Pumps and Pumping Stations, Valves	1	-	-
1.5	Flow Hydraulics and Network Analysis	1	-	-
1.6	Frictional Head Loss in Pipes – Empirical Formulae, Friction Coefficient Relationships, General Head Loss Formula, Simple Pipe Flow Problems on Determination of Head Loss, Discharge and Diameter	2	-	-
1.7	Head Loss in Pipes due to Minor Appurtenances	1	-	-
	Module – 2			
2.1	Network Synthesis, Network Parameters – Pipe lengths, Pipe Diameters, Pipe Roughness Coefficients	1	-	-
2.2	Labelling Network Elements – Branched and Looped Networks, Parameter Interrelationships	1	-	-
2.3	Formulation of Equations – Single Source Networks with known Pipe Resistances	3	-	-
2.4	Solution to Equations; Hardy Cross Method – Method of Balancing Heads	3	-	-

Module – 3				
3.1	Collection System – Introduction, System layout	1	-	-
3.2	Types of Collection System –Separate, Combined and Partial Systems	1	-	-
3.3	Quantity of Wastewater – DWF, WWF, Sources, Factors Affecting the Quantity of Sanitary Sewage	2	-	-
3.4	Determination of Quantity of Sanitary Sewage, Peak Factor, Peak Flow	2	-	-
3.5	Determination of Quantity of Storm Water – Rational Method, Runoff Coefficient, Time of Concentration	1	-	-
3.6	Hydraulics of Sewers – Types of Flows, Hydraulic Principles	1	-	-
Module – 4				
4.1	Design of Sewers; Design Criteria of Sewers – Design Period, Minimum Velocity, Maximum Velocities, Self-Cleansing Velocity, Sewer Gradient	1	-	-
4.2	Materials, Shapes and Sizes of Sewers,	1	-	-
4.3	Hydraulic Formulae – Manning's Formula, Chezy's Formula and Hazen-Williams Formula	1	-	-
4.4	Hydraulic Elements of Sewers for Partial Flow Conditions	1	-	-
4.5	Hydraulic Design of Separate and Combined Systems	3	-	-
4.6	Sewer Appurtenances – Manhole, Drop Manholes Street Inlets, Catch Basins, Flushing Devises, Sand, Grease and Oil Traps, Sewer Outlets	2	-	-
Module – 5				
5.1	Introduction to EPANET and its Hydraulic Modeling Capabilities	1	-	-
5.2	Steps in using EPANET	1	-	-
5.2	Modeling/Design of Simple Water Distribution Networks using EPANET	3	-	-
5.3	Hydraulic Design of Sanitary Sewers using MS-Excel	2	-	-
Total No. of Lecture Hours		**40**		-
	Total No. of Tutorial Hours		-	-
	Total No. of Practical Hours			**-**

Self-learning topics identified:

1. Operation and Maintenance of Water Distribution System
2. Special Valves, Equivalent Pipes
3. Measurement of flows in Existing Sewers
4. Sewer Transitions

Textbooks:

1. Pramod Bhave, R Gupta, "Analysis of Water Distribution Networks" - Narosa Publishing House, 2009.
2. P. N. Modi, S. M. Seth, "Sewage Treatment Disposal & Wastewater Engineering" – Standard Book House, 2020.

Reference Books and Manuals:

1. Prabhata K. Swamee, Ashok K. Sharma "Design of Water Supply Pipe Networks" - John Wiley & Sons, 2008.
2. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Wastewater Engineering" – Laxmi Publications, 2016
3. EPANET User Manual

Code: BCV754A **Course: Road Safety Engineering**
Credits: 3 **L:T:P 3:0:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	NA
Learning objectives	1. Gain knowledge of traffic surveys to identify risk and accidents. 2. Gain knowledge of road safety management measures.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Comprehensive understanding of the principles, strategies, and techniques related to ensuring safety on roadways	Understand
CO2	To design effective road safety measures, and contribute to the improvement of road safety practices	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3	PSO4
CO1	3	3												3	3		
CO2	3	3	3											3	3		

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	Accident Investigations and Risk Management: Collection of accident data, assessment of road safety	02	-	-
1.2	Methods to identify and prioritize hazardous locations and elements,	02	-	-
1.3	Determine possible causes of crashes, crash reduction capabilities and countermeasures	02	-	-
1.4	Effectiveness of safety design features, accident reconstruction, condition and collision diagram.	02	-	-
	Module – 2			
2.1	Traffic Engineering Studies: Statistical methods in traffic safety analysis	03	-	-
2.2	Regression methods, poisson distribution, chi- squared distribution	03	-	-
2.3	Statistical comparisons- traffic management measures and their influence on accident prevention	03	-	-
	Module – 3			
3.1	Road Safety in Transport Planning and Geometric Design: vehicle and human characteristics	02	-	-
3.2	Road design and safety elements, redesigning junction	02	-	-

3.3	Cross section improvements, traffic control, traffic calming measures, road safety furniture	02	-	-
	Module – 4			
4.1	Role of signs and markings in safety: Types of signs – design specifications – guidelines for installation	04	-	-
4.2	Role of signs in safety; types of road markings – design specifications	03	-	-
4.3	Role of road markings in safety	03	-	-
	Module – 5			
5.1	Traffic management systems for safety: road safety audits and tools for safety management systems	02	-	-
5.2	Road safety audit process, road safety improvement strategies	02	-	-
5.3	ITS and Safety	03	-	-
	Total No. of Lecture Hours	**40**	-	-
	Total No. of Tutorial Hours		-	-
	Total No. of Practical Hours			**-**

Self-learning topics identified: (Maximum of 5 topics)

4. Identification of blind spots and black spots
5. Traffic signal types
6. Geometric design elements of highways

Textbooks:

3. Traffic Engineering and Transportation Planning – L.R. Kadiyali, Khanna Publishers
4. Fundamentals of Transportation Engineering - C.S.Papacostas, Prentice Hall India.

Reference Books:

1. Handbook of Road Safety Measures, Second Edition, Rune Elvik, Alena Hoye, Truls Vaa, Michael Sorenson

Online Resources:

1. https://archive.nptel.ac.in/courses/105/105/105105215/
2. https://nptel.ac.in/courses/105105215

Code: BCV754B **Course: Conservation of Natural Resources**
Credits: 3 **L:T:P:S 3:0:0:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	Nil
Learning objectives	1. Learn types of land forms, soil conservation and sustainable land use planning. 2. Apprehend water resources, types, distribution, planning and conservation. Water pollution and types of uses. 3. Know the atmospheric composition of air, pollution and effects on human beings, animals and plants. Air pollution control. 4. Apprehend basics of biodiversity and ecosystems and know the current environmental issues

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Apprehend various components of land as a natural resource and availability and demand of water resources as applied to India.	Understand & Apply
CO2	Analyse the components of air as resource and its pollution.	Understand & Apply
CO3	Discuss biodiversity & its role in ecosystem functioning and critically appreciate the environmental concerns of today.	Understand

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	2						2							2	2	
CO2	2						2							2	2	
CO3	2						2							2	2	

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	**Land:** Land as a resource, types of lands, conservation of land forms, deforestation, effect of land use changes.	3	-	-
1.2	Soil health, ecological and economic importance of soil, impact of soil degradation on agriculture and food security	3	-	-
1.3	Need for soil conservation, sustainable land use planning.	2	-	-
	Module – 2			
2.1	**Water:** Global water resources, Indian water resources, Resources system planning. Water use sectors- domestic, industrial, agriculture. Water deficit and water surplus basins in India.	3	-	-
2.2	Equitable distribution, Inter-basin water transfers, Interlinking of rivers – Himalayan component, peninsular component, issues involved.	3	-	-

2.3	Ground water its potential in India, conjunctive use, recharge of ground water. Contamination of ground water, sea water ingress, problems and solutions.	3	-	-
	Module – 3			
3.1	**Air:** Introduction, composition, sources and classification of air pollutants, National Ambient Air quality standards (NAAQS), Air quality index,	3	-	-
3.2	Effects of air pollution on human health. Economic effects of air pollution.	3	-	-
3.3	Control of air pollution by equipment, smoke and its control. Ozone depletion – impacts, photochemical changes.	3	-	-
	Module – 4			
4.1	**Biodiversity:** Introduction, Flora and Fauna, Importance of biodiversity, Economic values medicinal plants, drugs, fisheries biogeochemical cycling. Threat to biodiversity, natural & anthropogenic disturbance, habitat loss.	3	-	-
4.2	Conservation of biodiversity, National parks, wild life sanctuaries, zoological gardens, gene banks, pollen culture, ecological restoration, social forestry.	3	-	-
4.3	Ecosystem: Definition, Types: forest, grass land, marine, desert, wetlands, estuarine, lotic, lentic. Abiotic & biotic components of ecosystem	2	-	-
	Module – 5			
5.1	**Global warming:** concept, indicators, factor and effects. Global climate change-indicators, health impacts, effect on biodiversity, Introduction to global efforts in conservation of biodiversity,	3	-	-
5.2	Status of EIA in India. EIA regulations in India,	3	-	-
5.3	List of projects needing environmental clearance ,under EIA notifications. Case study power/ thermal power projects	2	-	-
	Total No. of Lecture Hours	42	-	-
	Total No. of Tutorial Hours		-	
	Total No. of Practical Hours			-

Textbooks:

1. Asish Ghosh “Natural Resource Conservation and Environment Management” A.P.H. Publishing Corporation, 2003

Reference Books:

1. P.Jaya Rami Reddy, “A Textbook of Hydrology”, University Science Press, New Delhi, 2011.
2. Krishnamurthy K.V., “An advanced textbook of Biodiversity- principle & practices.” Oxford and IBH publications Co. Pvt ltd, New Delhi. 2004.
3. Odum, E.P., “Fundamentals of Ecology”, W.B sounders, Philadelphia, USA, 1971
4. Singh J.S, Singh S.P & Gupta, S.R., “Ecology, environment and resource conservation”, Anamaya publications, 2006

Online Resources:

1. NPTEL MOOC course on “Natural Resource Management” by Prof. Sudip Mitra IIT Guwahati.

Code: BCV754C **Course: Energy Efficiency, Acoustics And Daylighting In Building**
Credits: 3 **L:T:P 3:0:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks: 100**

Prerequisites if any	NA
Learning objectives	1. To facilitate learners to understand climatology, heating res in building and energy 2. To expose the learners to building acoustics, indoor air quality and day lighting. 3. To impart fundamental knowledge on Life cycle assessment and Energy efficiency in buildings

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

COs	Course Outcomes	Bloom's level
CO1	Understand the climatology, heating in building and apply shading design concepts for building.	L1, L2
CO2	Comprehend concepts of building acoustics, indoor air quality and building lighting	L1, L2
CO3	Demonstrate the Life Cycle Assessment of Buildings and Green project management	L1, L2

Mapping with POs and PSOs:

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2		PSO 1	PSO 2	PSO 3
CO1	2		1			1	1					1		1		
CO2						1	1							1		
CO3	2					1	1					1		1		

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	**Introduction to Climatology and heating ress in building**: Basics of climatology, Earth	02	-	-
1.2	Sun relationship, Solar angles and sun path diagram, Design of shading systems. Basics of Thermodynamics, Convection/radiation heat transfer,	04	-	-
1.3	Heat gain through various elements of a building, Thermal Comfort models	03		

	and case studies			
	Module – 2			
2.1	**Building acoustics, Indoor air quality and Lighting in buildings**: Basics of sound and Building acoustics	02	-	-
2.2	Acoustic defects, prevention of sound transmission and acoustic measure for office building.	02	-	-
2.3	Indoor Air Quality – Effects, control of contaminants and moisture in indoor environment, Integrated approach for IAQ management. Fundamentals of lighting – Day lighting and its metrics	04	-	-
2.4	Strategies for day lighting and its control. Artificial lighting– Design and control strategies – Visual comfort enhancement.	03	-	-
	Module – 3			
3.1	Energy efficient buildings, Water and Waste management in buildings : Energy efficiency – Energy efficiency in building envelope and energy efficient HVAC and Lighting as per Energy conservation building code (ECBC) 2017	03	-	-
3.2	Energy simulation, Energy management system - Renewable energy and Energy Audit, (demand control ventilation)	02	-	-
3.3	Water Efficiency – Planning and design of water management system, Rainwater harvesting, Water efficient design and fixtures, Treatment and reuse and Water efficient landscape system.	02	-	-
3.4	Waste management – Types of waste and its treatment methods, Construction and demolition waste management, Waste management in residential, commercial buildings, health care facilities.	02	-	-
	Module – 4			
4.1	**Life Cycle Assessment of Buildings and Green project management**:	02	-	-
4.2	Materials – Green product certifications, features of sustainable building Materials and sustainable alternatives for structural, envelope and finishing materials.	02	-	-
4.3	Low carbon cement, Zero emission bricks and lean construction practices.	01	-	-

4.4	Life cycle assessment and its types – Modelling and Analysis, Green house Gas emission. Different phases of Green building project management.	02	-	-
	Module – 5			
5.1	Energy efficiency in HVAC system–Variable Frequency Drive (VFD), Air volume drive. Rooftop solar installations and solar water heaters, Heat recovery system in buildings	02	-	-
5.2	Building Management System(BMS) – Occupancy sensors and energy efficient lighting controls, Smart Buildings.	02	-	-
	Total No. of Lecture Hours	**40**		
	Total No. of Tutorial Hours		**00**	
	Total No. of Practical Hours			**00**

Self-learning topics identified: (Maximum of 5 topics)

1. Building exterior and interior lighting
2. Landscape design
3. Seven LCA impact categories

Textbooks:

1. Harhara Iyer G, Green Building Fundamentals, Notion Press
2. Dr.Adv. Harshul Savla, Green Building: Principles & Practices
3. Arvind Kishan, Baker & Szokolay, Climate Responsive Architecture, Tata McGraw Hill, 2002.
4. Donald Watson and Kenneth Labs; Climatic Building Design - Energy-Efficient Building Principles and Practice; McGraw-Hill Book Company, 1983.

Reference Books:

1. The Sustainable Habitat Handbook (6VolumeSet), GRIHAVersion2019
2. National Building Code–2016,Volume1&2,BureauofIndianStandards
3. Energy Conservation Building Code–2017(withamendmentsupto2020), Bureau of Energy Efficiency

Online Resources;

1. Energy Efficiency Acoustics and Daylighting in Building – NPTEL Course

Code: BCV754D **Course: Precast Members – Systems & Construction**
Credits: 3 **L:T:P 3:0:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	
Learning objectives	1. Compute loads (Dead, Superimposed, Live, Wind, Seismic) of various elements & services 2. Adapt appropriate vertical & lateral load resisting systems for the various loads acting on the building.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Design and detailing precast building including connections, adhering to the code requirements & functional aspects	Understand
CO2	Comprehend the selection of mould and adopt the required transportation & erection methodology	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	03													03		
CO2		03	03												03	

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	Introduction to Precast and its elements: tractors, end users) and Limitations, Residential, Commercial & Industrial Applications of precast, Materials used, Code provisions and clauses.	03	-	-
1.2	Major elements (Beam, slab, wall, column, foundation, staircase, roof elements, façade) Classification, Types and shapes, selection, application, erection, advantages,	03	-	-
1.3	Infra works - Pipes & drains, duct bank, baggage handling tunnel, culvert and sleeper, facia element, pavement and channel.	03		
	Module – 2			
2.1	Precast Structural Systems, Production, Storage, & Logistics: Structural System: Skeletal System, Portal Frame system, Large Panel system, Cell Block system and hollow block system,	02	-	-
2.2	Guide lines of selection – Residential & office buildings,Industrial Buildings, Commercial buildings, Structural Stability and Structural Behavior.	02	-	-
2.3	Plant and Production: Introduction -Types & Process, Production Design and shop drawings, check lists, Moulding, Casting and its types, Concreting, Curing, Demoulding and inspection.	03	-	-
2.4	Storage, Delivery, Handling- introduction and types of equipment, lifting devices, Erection and installation –	03	-	-

	Horizontal components, vertical components, special elements, Quality Inspection and Tolerance			
Module – 3				
3.1	Modeling, Analysis and design of Wall system: Design Basis Criteria: Geometric parameters and Occupancy,	03	-	-
3.2	Location and Associated Parameters, Systems and material specifications, analysis tools, Loads and Load Combinations –	03	-	-
3.3	gravity loads, lateral loads (seismic and wind) ETABS software, Modeling, Analysis and Design of structural elements for RC Wall system:	02	-	-
3.4	Design of RC wall, beam, slab & staircase, Design for stripping, stacking, transportation anderection for all elements	02	-	-
Module – 4				
4.1	Joints Connections for RC Wall system, Modelling, Analysis, Design of the Frame system: Joints connections for RC wall system – Wall to foundation, wall to wall horizontal connection, wall to wall vertical connection,	02	-	-
4.2	beam to wall connection, beam to beam connection, slab to wall progressive c diaphragm action & slab to beam connection, staircase to beam orwall connection.	02	-	-
4.3	Modeling, Analysis and design for Frame system and its connections	01	-	-
4.4	ETABS Modeling, Analysis and Design for frame system (foundation, column, beam, slab etc.)	02		
Module – 5				
5.1	Prestressed concrete and Preventive Measures and case studies: Prestressed Concrete, Various types of slab design and its check, Slab to beam connection	02	-	-
5.2	Preventive Measures, Testing requirements, water tightness, temporary suppo related preventive measures, progressive collapse – introduction and design, c defects and remedies. Case Studies - Residential Project, Commercial Project	02	-	-
Total No. of Lecture Hours		**40**		
	Total No. of Tutorial Hours		**00**	
	Total No. of Practical Hours			**00**

Reference Books:

1. Planning and design handbook on precast building structures 2014 *fib* Bulletin No. 74 **ISBN:** 978-2-88394-114-4
2. Precast Concrete Structures CRC Press; 2nd edition by Kim S. Elliott (Author)

Online Resources:

1. E-learning content on L&T EduTech Platform.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Visit to Site to understand prestressing.

Code: BCV754E **Course: Earth Observation using Geoinformatics**
Credits: 3 **L:T:P 3:0:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	Highschool Geography, Remote sensing and GIS
Learning objectives	1. Outline basic concepts Earth observation, image processing and enhancement on remotely sensed imagery 2. Extract information from remotely sensed data using a variety of manual and automated techniques

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Describe concepts and components of Earth Observation system	Understand
CO2	Understand satellite remote sensing and image processing	Analyze
CO3	Demonstrate the use of Remote sensing, GIS, Satellite data for various applications including mapping	Understand Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3				2										
CO2	3				2										
CO3	2				2	2									

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	**Introduction to Earth Observation (EO)** Earth - Orbit, Rotation, Time. Oceans - Depth, Bottom relief, Waves, Tides, Currents.	01		
1.2	Climate and the atmosphere – Origin, nature, composition and vertical division of the atmosphere.	02		
1.3	Climate Change: Causes and Impacts. Monsoons: The Hydrological cycle, Concepts of the origin of monsoon – Indian Monsoons.	02		
1.4	Meteorological parameters and their measurements - Geographical, seasonal and vertical distribution of temperature, pressure, wind and precipitation.	02		
	Module – 2			
2.1	**Introduction to Remote Sensing, Satellites and Sensors** Definition of remote sensing, remote sensing process.	02		
2.2	Physics of remote sensing, electromagnetic energy, electromagnetic spectrum, black body radiation, laws governing electromagnetic radiation, atmospheric effects, scattering and absorption.	03		
2.3	EO satellites and data products: Remote sensing platforms, satellites and orbits, geostationary and sun synchronous satellites, Earth resource satellites – IRS mission, LANDSAT, other satellite missions.	03		
2.4	Sensors – active and passive sensors, sensor resolutions (spectral, spatial, radiometric and temporal).	02		

Module – 3-				
3.1	**Satellite Image Processing and Classification for EO** Introduction, elements of visual image interpretation, image interpretation strategies and keys.	02		
3.2	Basics of digital image processing (Brief introduction only): image display and band combinations, true and false color composites.	02		
3.3	Image preprocessing, radiometric and geometric corrections, image enhancements, image histogram, contrast manipulation, image filtering, low pass and high pass filters, ground truth and image resampling.	02		
3.4	Image classification (Brief introduction only): - methods, supervised and unsupervised, accuracy assessment of image classification, numerical example.	03		
Module – 4				
4.1	**EO using Google Earth Engine** GEE Mission statement, History, Data sets, Timelapse, Computation platforms, Code editors, sample codes and commands	01		
4.2	JavaScript and the Earth Engine API, Exploring Images, Survey of Raster Datasets	02		
4.3	Image Manipulation: Bands, Arithmetic, Thresholds, and Masks, Interpreting an Image: Classification.	02		
4.4	Filter, Map, Reduce, Exploring Image Collections, Aggregating Images for Time Series	02		
Module – 5				
5.1	**EO Applications** Agriculture: Precision farming, Crop health mapping, Crop pests, Illicit crop monitoring	02		
5.2	Forestry: Forest stock mapping, Burn scar mapping, Illegal deforestation	01		
5.3	Risk and Disaster management: Continental scale mapping, Urban growth, Soil sealing, Land use and land cover classification, flooding and EWS.	02		
5.4	Natural resource management: Water resource management, Energy infrastructure optimization, Oil and gas.	02		
	Total No. of Lecture Hours	**40**		
	Total No. of Tutorial Hours			
	Total No. of Practical Hours			

Self-learning topics identified:

1. List of open source spatial data sources
2. Common image processing and GIS software
3. List of Earth resource satellites/missions by countries.

Textbooks:

1. Lillesand T.M., and R.W. Kiefer, "**Remote sensing and Image interpretation**", 4th edition,
2. John Wiley & Sons, 2012.
3. Burrough, P. A., McDonnell, R., McDonnell, R. A., & Lloyd, C. D. **"Principles of geographical information systems"**, 3rd Edition, Oxford university press, 2015.
4. Chang, K. T. **"Introduction to geographic information systems",** 9th Edition, Boston: McGraw-Hill Higher Education, 2019.

Reference Books:

1. Reddy, M. A. **"Remote Sensing and Geographical Information Systems: An Introduction"**, 4th Edition, Book Syndicate, 2012.
2. DeMers, M. N. **"Fundamentals of geographic information systems"**, 4th Edition, John Wiley & Sons, 2008.

Online Resources:

1. https://nptel.ac.in/courses/107105088 NPTEL MOOC course on "**Geographic Information System**"
   IIT Kharagpur, Prof. Bharath H Aithal.
2. https://www.e-education.psu.edu/geog485/node/91
3. https://business.esa.int/newcomers-earth-observation-guide
4. https://www.ukspace.org/wp-content/uploads/2019/05/The-many-uses-of-Earth-Observation-data.pdf

Code: BCV754F **Course: Building Services-HVAC, Acoustics And Fire Safety**
Credits: 3 **L:T:P : 3:0:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	
Learning objectives	1. To learn the basics of MEP systems (Mechanical, Electrical and plumbing) 2. To expose the learners to building acoustics 3. To impart knowledge on HVAC and fire protection systems in building

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	**Course Outcomes**	**Bloom's level**
CO1	To design the electrical system design for buildings	Design
CO2	To understand and plan Heating, Ventilation, and Air conditioning systems in building	Analyze
CO3	To understand the fire safety aspects in buildings	Understand
CO4	To understand plumbing system design in buildings	Understand

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	3	2												3	2	
CO2	3	3												3	2	
CO3	2	2												3	2	
CO4	3	3												3	2	

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	**No. of Tutorial Hours**	**No. of Practical Hours**
	Module – 1			
1.1	**Advanced Electrical System Design for Buildings:** Basics of Electrical System, Electrical terminologies, Major Electrical equipment,	2	-	-
1.2	Building power distribution and its schemes, Fundamentals of Power& distribution transformers, HT, LT, DG Sets, Cables & Wires, UPS and its importance,	2	-	-
1.3	Introduction of HT, LT switch gears systems, Importance of Lighting design & different Light fixtures used in buildings– Interior, external, street & offices, RMU, HT consumer,	2	-	-
1.4	Substation Building in Master plan – Space planning for RMU, HT, DG-set, HSD yard, Space provision for Electrical Equipment including Substation, Various equipment clearance requirements, HVAC, PHE,	2	-	-
1.5	FPS service electrical load input for designing electrical power distribution, Pedestals & ceiling support requirement for all Electrical equipment.	2	-	-
	Module – 2			
2.1	**Extra Low Voltage System for Infrastructure and Building Acoustics:** Introduction & Brief of ELV Systems, Concept of Building Management System (BMS) &Fire Alarm System,	1	-	-

2.2	Interface with Architecture/Structure, Access control, CCTV & Public address system purpose, BMS Brief and purpose,	2	-	-
2.3	BMS interfaces with Electrical, HVAC, Fire & Life Safety and PHE, BMS interfaces with airport systems.	2	-	-
2.4	Basics of sound and Building acoustics – Acoustic defects and prevention of sound transmission	2	-	-
	Module – 3			
3.1	**Heating, Ventilation & Air conditioning systems:** Basics of HVAC - Psychrometry and its importance - Major Components of Air conditioning System- Fundamental concepts of Heat transfer	1	-	-
3.2	Airconditioning system, Ventilation system, Pressurization Systems and their importance to Life safety, Chilled water system, Cooling towers and major HVAC equipment	2	-	-
3.3	Pumping system in HVAC, Importance of Thermal and Acoustic Insulation, Introduction and basics of Variable Refrigerant Flow (VRF) systems, Radiant cooling, Under floor distribution,	2	-	-
3.4	Chilled beams–Space planning Importance of Static weight/Operating weights of mechanical equipment-Importance of Floor slab and Terrace roof slab openings/cut-outs.	2	-	-
	Module – 4			
4.1	Fire Protection and Life Safety System: Basics of Fire Protection System - Active Fire protection system - Passive Fire protection system -	1	-	-
4.2	Basics of Smoke Control and Fire Stop Systems Codes & Standards and Statutory Compliance - Fire and its Classes - Hazard Classification based on building occupancy-	2	-	-
4.3	Means of Egress and its components - Importance of Life Safety - Refuge Area, Fire Tower and Fire Lift-Occupant Load and Capacity factors-	2	-	-
4.4	Fire Stopping Materials Compartmentation in a building-Smoke control & management in Fire Zoning–	2	-	-
	Module – 5			
5.1	Plumbing for water supply and sanitary system: Scope of works in Public Health Engineering Sanitary fixtures and types-Water supply and treatment	2	-	-
5.2	Rain water drainage system - Landscape irrigation features – Water demand calculation based on building occupancy– Piping for different plumbing systems in buildings	2	-	-
5.3	Pump selection–Plant room sizing Sewage treatment process-External water supply, storm drainage & sewerage system	2	-	-
5.4	Solid waste management - Interfacing PHE system with Architect and Structural engineers.	2	-	-
	Total No. of Lecture Hours	39	-	-
	Total No. of Tutorial Hours		-	-
	Total No. of Practical Hours			

Self-learning topics identified: (Maximum of 5 topics)

Textbooks:

1. M.K. Giridharan, Electrical Systems Design, I. K. International Pvt Ltd
2. John W. Mitchell, James E. Braun, Principles of Heating, Ventilation, and Air Conditioning in Buildings, Wiley.
3. A.C. Panchdhari, Water Supply And Sanitary Installations, New Age International.

Reference Books:

1. Tyler G. Hicks, Handbook of Mechanical Engineering Calculations, 2nd Edition, McGraw-Hill Education.

Online Resources:

NPTEL Course on Urban utilities Planning Water Supply, Sanitation and Drainage

1. Urban Utilities Planning Issues: Drainage
2. Urban Utilities Planning Issues: Water supply
3. Urban Utilities Planning Issues: Sanitation

Code: BCV754G **Course: Air Pollution and Control**
Credits: 3 **L: T:P 3:0:0**
SEE: 50% **CIE: 50%**
SEE Hours: 3 **Max. Marks:100**

Prerequisites if any	
Learning objectives	• Understand the sources, classification, effects of air pollutants, and measurement of air pollutants, air pollution standards and control regulations. • Understand the basic concepts of various meteorological factors which influence the dispersion of air pollutants. • Gain Knowledge about the monitoring of particulate matter and Prediction of dispersion of air pollutants using models • Understand and analyze the basic mechanisms involved, working principles and design aspects of various air pollution controlling equipment.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	**Course Outcomes**	**Bloom's level**
CO1	Identify the major sources of air pollution and understand their effects on health and environment.	Understand
CO2	Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.	Understand Apply
CO3	Evaluate sampling techniques for atmospheric and stack pollutants and design control techniques for particulate and gaseous emissions.	Understand Analyze

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	2	3												3		
CO2		2	3											3	2	
CO3	2	3			2									3	3	

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
	Module – 1			
1.1	Definition, Sources of air pollution, characterization and classification of atmospheric pollutants, air pollution episodes.	03		
1.2	Effects of air pollutants on human health, vegetation, animals, and materials and monuments	03		
1.3	Elemental properties of the atmosphere – scales of motion, heat, pressure, wind,	02		

	moisture, relative humidity			
	Module – 2			
2.1	Meteorology: Wind circulation, solar radiation, lapse rates, atmospheric stability conditions, wind velocity profile	03		
2.2	Maximum Mixing Depth, Temperature Inversions, Wind rose diagram, heat island effect	03		
2.3	Stack emissions, plume behavior, estimation of effective stack height, heat island. effect.	03		
	Module – 3			
3.1	Pollutants dispersion models: Point, line, and areal sources model	02		
3.2	Gaussian plume dispersion model – for point source (with and without reflection), Gaussian dispersion coefficient, Determination of ground level concentrations	03		
3.3	Air Quality Monitoring, Air Quality Index	02		
	Module – 4			
4.1	Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution)	03		
4.2	Monitoring and analysis of air pollutants (PM2.5, PM10, SO_X, NO_X, CO, NH_3)	03		
4.3	Air pollution emission standards, National and international policies, acts, rules, and regulations.	02		
	Module – 5			
5.1	Air Pollution Control Equipment: Mechanisms, Control equipment for particulate matter – gravity settling chambers, centrifugal collectors, wet collectors, scrubbers, fabric filters, electrostatic precipitator (ESP)	03		
5.2	Control Equipment for gaseous pollutants – adsorption, absorption, condensation, and combustion.	03		
5.3	Indoor Air Pollution – sources, effects, and control.	02		
	Total No. of Lecture Hours	40		
	Total No. of Tutorial Hours		---	
	Total No. of Practical Hours			---

Textbooks:

1. Howard S Peavy, Donald R Rowe and George Tchobanoglous, “Environmental Engineering” , Tata Mc-G raw Hill Publication.
2. M. N. Rao and H V N Rao, “Air pollution”, Tata Mc-G raw Hill Publication.

Reference Books:

1. Noel De Nevers, “Air Pollution Control Engineering” , Waveland Pr Inc.
2. Anjaneyulu Y, “Text book of Air Pollution and Control Technologies”, Allied Publishers
3. H. C. Perkins, “Air pollution”. Tata McGraw Hill Publication41
4. Mackenzie Davis and David Cornwell, “Introduction to Environmental Engineering” McGraw-Hill Co.
5. Martin Crawford “Air Pollution Control Theory” Tata McGraw Hill Publication

Online Resources:

1. NPTEL course by By Prof. Alok Sinha, Prof. Bhola Ram Gurjar, IIT Roorkee titled “Air Pollution and Control”

DETAILED SYLLABUS

VIII SEMESTER

Code: BCV803 **Course: Internship (Industry/ Research) (14-16 weeks)**
Credits: 10 **L: T:P 0:0:20**
SEE: 50% **CIE: 50%**
SEE Hours: -- **Max. Marks: 200**

Prerequisites if any	Major Civil Engineering Subjects
Learning objectives	1. Understand current research in the research field. 2. Familiarize with the field and imparts the skill required for carrying out research. 3. Understand and apply to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures.

Course Outcomes:

On the successful completion of the course, the student will be able to

COs	Course Outcomes	Bloom's level
CO1	Understand and acquire the workflow of the project and simultaneously learn the tools and techniques to meet with the project requirements	Apply
CO2	Understand the significance of research, inculcate the research aptitude and design experiments and procedures to meet the research objectives	Apply

Mapping with POs and PSOs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12		PSO1	PSO2	PSO3
CO1	3	3			2			2	2	2		2		3		
CO2	2	3			3			3	2	2		2		3		

Mapping Strength: Strong– 3 Medium – 2 Low – 1

Course Structure

Sl. No.		No. of Lecture Hours	No. of Tutorial Hours	No. of Practical Hours
1	Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes. The mandatory Research internship /Industry internship is for 24 weeks. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent University examination after satisfying the internship requirements.	NA	NA	240
	Total No. of Lecture Hours	**NA**		
	Total No. of Tutorial Hours		NA	
	Total No. of Practical Hours			240