Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

(An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune)

Curriculum Structure and Syllabus
of
Final Year B.Tech Civil Engineering
(Regulations 2023)

Effective from Academic Year 2026-27

Institute Vision

To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute.
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with ability to think and act independently in demanding situations

EOMS Policy

"We at PCCOE are committed to offer exemplarily Ethical, Sustainable and Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders.

We shall strive for technical development of students by creating globally competent and sensible engineers, researchers and entrepreneurs through Quality Education.

We are committed for Institute's social responsibilities and managing Intellectual property.

We shall achieve this by establishing and strengthening state-of-the-art Engineering Institute through continual improvement in effective implementation of Educational Organizations Management Systems (EOMS)."

Course Approval Summary

A) Board of Studies - Department of Civil Engineering

Sr. No	Name of the course	Course code	Page number	Signature and stamp of BoS
1	Estimating , Costing and Tenders	BCI27PC23 /BCI28PC23	15	
2	Estimating , Costing and Tenders Lab	BCI27PC24 /BCI28PC24	17	
3	Construction Management	BCI27PC25 /BCI28PC25	19	
4	Building and Sustainability Audit Lab	BCI27PC26 /BCI28PC26	21	
5	Rural Water Supply Engineering (PEC 4)	BCI27PE41/ BCI28PE41	23	
6	Rural Water Supply Engineering Lab (PEC 4 Lab)	BCI27PE42 / BCI28PE42	25	
7	Water and Climate (PEC 4)	BCI27PE43/ BCI28PE43	27	
8	Water and Climate Lab (PEC 4 Lab)	BCI27PE44/ BCI28PE44	29	
9	Air Pollution and Control (PEC 4)	BCI27PE45/ BCI28PE45	31	
10	Air Pollution and Control Lab (PEC 4 Lab)	BCI27PE46/ BCI28PE46	33	
11	Design of Rain Water Harvesting System (PEC 4)	BCI27PE47/ BCI28PE47	34	
12	Design of Rain Water Harvesting System Lab (PEC 4 Lab)	BCI27PE48/ BCI28PE48	36	
13	Advanced Concrete Technology (PEC 4)	BCI27PE49/ BCI28PE49	38	
14	Advanced Concrete Technology Lab (PEC 4 Lab)	BCI27PE50/ BCI28PE50	40	
15	Quality and Safety in Construction (PEC-4)	BCI27PE51/ BCI28PE51	42	
16	Quality and Safety in Construction Lab (PEC-4 Lab)	BCI27PE52/ BCI28PE52	44	
17	Analysis and Design of Reinforced Concrete Bridges (PEC 4)	BCI27PE53/ BCI28PE53	45	
18	Analysis and Design of Reinforced Concrete Bridges Lab (PEC 4 Lab)	BCI27PE54/ BCI28PE54	47	
19	Railway, Airport, Dock and Harbour Engineering (PEC 4)	BCI27PE55/ BCI28PE55	49	
20	Railway, Airport, Dock and Harbour Engineering Lab (PEC 4 Lab)	BCI27PE56/ BCI28PE56	51	
21	Construction and Demolition Waste Management (PEC 5)	BCI27PE60/ BCI28PE60	53	
22	Construction and Demolition Waste Management Lab (PEC 5 Lab)	BCI27PE61/ BCI28PE61	55	
23	Disaster Management (PEC 5)	BCI27PE62/ BCI28PE62	57	
24	Disaster Management Lab (PEC 5 Lab)	BCI27PE63/ BCI28PE63	59	

25	Advanced Water Treatment (PEC 5)	BCI27PE64/ BCI28PE64	60	
26	Advanced Water Treatment Lab (PEC 5 Lab)	BCI27PE65/ BCI28PE65	62	
27	Software Modeling of Hydrological Events (PEC 5)	BCI27PE66/ BCI28PE66	64	
28	Software Modeling of Hydrological Events Lab (PEC 5 Lab)	BCI27PE67/ BCI28PE67	66	
29	Construction Contracts & Legal Aspects in Construction (PEC 5)	BCI27PE68/ BCI28PE68	67	
30	Construction Contracts & Legal Aspects in Construction Lab (PEC 5 Lab)	BCI27PE69/ BCI28PE69	69	
31	Formwork and Plumbing Systems (PEC-5)	BCI27PE70/ BCI28PE70	70	
32	Formwork and Plumbing Systems Lab (PEC-5 Lab)	BCI27PE71/ BCI28PE71	72	
33	Advanced Construction Techniques (PEC-5)	BCI27PE72/ BCI28PE72	74	
34	Advanced Construction Techniques Lab (PEC-5 Lab)	BCI27PE73/ BCI28PE73	76	
35	Structural Dynamics (PEC 5)	BCI27PE74/ BCI28PE74	77	
36	Structural Dynamics Lab (PEC 5 Lab)	BCI27PE75/ BCI28PE75	79	
37	Retrofitting & Rehabilitation of Structures (PEC 5)	BCI27PE76/ BCI28PE76	80	
38	Retrofitting & Rehabilitation of Structures Lab (PEC 5 Lab)	BCI27PE77/ BCI28PE77	82	
39	Advanced Soil Mechanics (PEC 5)	BCI27PE78/ BCI28PE78	84	
40	Advanced Soil Mechanics Lab (PEC 5)	BCI27PE79/ BCI28PE79	86	
41	Research Methodology	BCI27EL02/ BCI27EL06	88	
42	MOOC (PEC 6)	BCI28PE81/ BCI27PE80	91	
43	Internship	BCI28EL03/ BCI27EL05	93	
44	Project	BCI28EL04/ BCI27EL07	94	

Approved by Academic Council:

Chairman, Academic Council
Pimpri Chinchwad College of Engineering

INDEX

CURRICULUM FRAMEWORK
(Regulations 2023)
LIST OF ABBREVIATIONS

Sr. No.	Abbreviation	Type of Course
1	BSC	Basic Science Course
2	ESC	Engineering Science Course
3	PCC	Programme Core Course
4	PEC	Programme Elective Course
5	MDM	Multidisciplinary Minor
6	OEC	Open Elective Course
7	VSEC	Vocational and Skill Enhancement Course
8	AEC	Ability Enhancement Course
9	EEM	Entrepreneurship/Economics/Management Course
10	IKS	Indian Knowledge System
11	VEC	Value Education Course
12	ELC	Experiential Learning Courses
13	LLC	Liberal Learning Courses

COURSE WISE CREDIT DISTRIBUTION

Sr No.	Type of Course	No. of Courses	Total Credits	
			NO.	%
1.	Basic Science Course	8	14	8.75
2.	Engineering Science Course	6	12	7.5
3.	Programme Core Course	26	48	30
4.	Programme Elective Course	11	18	11.25
5.	Multidisciplinary Minor	6	14	8.75
6.	Open Elective Course	3	6	3.75
7.	Vocational and Skill Enhancement Course	4	8	5
8.	Ability Enhancement Course	2	4	2.5
9.	Entrepreneurship/Economics/Management Course	2	4	2.5
10.	Indian Knowledge System	1	2	1.25
11.	Value Education Course	2	4	2.5
12.	Experiential Learning Courses	4	22	13.75
13.	Liberal Learning Courses	2	4	2.5
TOTAL		**77**	**160**	**100**

SEMESTER WISE CREDIT DISTRIBUTION

Sr. No.	TYPE OF COURSE	NO. OF CREDIT/ SEMESTER								TOTAL
		1	2	3	4	5	6	7	8	
1.	Basic Science Course	7	7	-	-	-	-	-	-	14
2.	Engineering Science Course	7	5	-	-	-	-	-	-	12
3.	Programme Core Course	-	2	8	8	12	10	8	-	48
4.	Programme Elective Course	-	-	-	-	4	6	6	2	18
5.	Multidisciplinary Minor	-	-	2	2	4	2	4	-	14
6.	Open Elective	-	-	4	2	-	-	-	-	6
7.	Vocational and Skill Enhancement Course	2	2	2	-	-	2	-	-	8
8.	Ability Enhancement Course	-	2	-	2	-	-	-	-	4
9.	Entrepreneurship/Economics/Management Course	-	-	2	2	-	-	-	-	4
10.	Indian Knowledge System	2	-	-	-	-	-	-	-	2
11.	Value Education Course	-	-	2	2	-	-	-	-	4
12.	Experiential Learning Courses	-	-	-	2	-	-	4	16	22
13.	Liberal Learning Courses	2	2	-	-	-	-	-	-	4
TOTAL		**20**	**20**	**20**	**20**	**20**	**20**	**22**	**18**	**160**

SEMESTER WISE COURSE DISTRIBUTION

Sr. No.	TYPE OF COURSE	NO. OF COURSES/ SEMESTER								TOTAL
		1	2	3	4	5	6	7	8	
1.	Basic Science Course	4	4	-	-	-	-	-	-	8
2.	Engineering Science Course	3	3	-	-	-	-	-	-	6
3.	Programme Core Course	-	1	5	5	6	5	4	-	26
4.	Programme Elective Course	-	-	-	-	2	4	4	1	11
5.	Multidisciplinary Minor	-	-	1	1	2	1	1		6
6.	Open Elective	-	-	2	1	-	-	-	-	3
7.	Vocational and Skill Enhancement Course	1	1	1	-	-	1	-	-	4
8.	Ability Enhancement Course	-	1	-	1	-	-	-	-	2
9.	Entrepreneurship/Economics/Management Course	-	-	1	1	-	-	-	-	2
10.	Indian Knowledge System	1	-	-	-	-	-	-	-	1
11.	Value Education Course	-	-	1	1	-	-	-	-	2
12.	Experiential Learning Courses	-	-	-	1	-	-	1	2	4
13.	Liberal Learning Courses	1	1	-	-	-	-	-	-	2
Total		**10**	**11**	**11**	**11**	**10**	**11**	**10**	**3**	**77**

Curriculum Structure

Final Year B Tech

Civil Engineering

CURRICULUM STRUCTURE
Scheme A
Final Year B. Tech. (Civil Engineering) (Regulations 2023) Semester-VII
(With effect from Academic Year 2026-27)

Course Code	Course Type	Course Name	Credit Scheme				Teaching Scheme (Hours/ week)					Evaluation Scheme and Marks						
												FA		SA	TW	PR	OR	Total
			L	P	T	Total	L	P	T	O	Total	FA 1	FA 2					
BCI27PC23	PCC	Estimating, Costing and Tenders	2	-	-	2	2	-	-	1	3	10	10	30	-	-	-	**50**
BCI27PC24	PCC	Estimating, Costing and Tenders Lab	-	2	-	2	-	4	-	-	4	-	-	-	50	-	50	**100**
BCI27PC25	PCC	Construction Management	2	-	-	2	2	-	-	1	3	10	10	30	-	-	-	**50**
BCI27PC26	PCC	Building and Sustainability Audit Lab	-	2	-	2	-	4	-	-	4	-	-	-	50	-	50	**100**
BCI27PE41/43/45/47/49/51/53/55	PEC	PEC 4	2	-	-	2	2	-	-	1	3	10	10	30	-	-	-	**50**
BCI27PE42/44/46/48/50/52/54/56	PEC	PEC 4 Lab	-	1	-	1		2	-	-	2	-	-	-	25	-	-	**25**
BCI27PE60/62//64/66/68/70/72/74/76/78	PEC	PEC 5	2	-	-	2	2	-	-	1	3	10	10	30	-	-	-	**50**
BCI27PE61/63/65/67/69/71/73/75/77/79	PEC	PEC 5 Lab	-	1	-	1		2	-	-	2	-	-	-	25	-	-	**25**
-	#MDM	Multidisciplinary Minor Project (MDM 5)	-	4	-	4	-	8	-	-	8				100	-	50	**150**
BCI27EL02	RM	Research Methodology	-	4	-	4		8	-	-	8	-	-	-	100	-	50	**150**
Total			**8**	**14**	**-**	**22**	**8**	**28**	**-**	**04**	**40**	**40**	**40**	**120**	**350**	**-**	**200**	**750**

L- Lecture, T- Tutorial, P- Practical, CR- Credit, FA – Formative Assessment, SA –Summative Assessment,

TW – Term Work, PR- Practical Exam, OR – Oral Exam**,** O: other i.e. self directed learning, self study, outside the class efforts.

Note: # Refer separate booklet for Multidisciplinary Minor (MDM) courses

Students must ensure that the same course (content) is not selected under multiple categories such as core courses, Professional Electives, Open Electives or through minor Degree in multidisciplinary studies (MDMS) where choices are given. Each course can only be credited once towards the degree requirements. Students are required to acknowledge and agree to this condition before proceeding with registration.

Scheme A

Semester –VII

List of PEC courses – Professional Elective Course (PEC)– 4

Course Code	Course Name	
BCI27PE41 BCI27PE42	Rural Water Supply Engineering Rural Water Supply Engineering Lab	Choose any one
BCI27PE43 BCI27PE44	Water and Climate Water and Climate Lab	
BCI27PE45 BCI27PE46	Air Pollution and Control Air Pollution and Control Lab	
BCI27PE47 BCI27PE48	Design of Rain Water Harvesting System Design of Rain Water Harvesting System Lab	
BCI27PE49 BCI27PE50	Advanced Concrete Technology Advanced Concrete Technology Lab	
BCI27PE51 BCI27PE52	Quality and Safety in Construction Quality and Safety in Construction Lab	
BCI27PE53 BCI27PE54	Analysis and Design of Reinforced Concrete Bridges Analysis and Design of Reinforced Concrete Bridges Lab	
BCI27PE55 BCI27PE56	Railway, Airport, Dock and Harbour Engineering Railway, Airport, Dock and Harbour Engineering Lab	

List of PEC courses – Professional Elective Course (PEC) – 5

Course Code	Course Name	
BCI27PE60 BCI27PE61	Construction and Demolition Waste Management Construction and Demolition Waste Management Lab	Choose any one
BCI27PE62 BCI27PE63	Disaster Management Disaster Management Lab	
BCI27PE64 BCI27PE65	Advanced Water Treatment Advanced Water Treatment Lab	
BCI27PE66 BCI27PE67	Software Modeling of Hydrological Events Software Modeling of Hydrological Events Lab	
BCI27PE68 BCI27PE69	Construction Contracts and Legal Aspects in Construction Construction Contracts and Legal Aspects in Construction Lab	
BCI27PE70 BCI27PE71	Formwork and Plumbing systems Formwork and Plumbing systems Lab	
BCI27PE72 BCI27PE73	Advanced Construction Techniques Advanced Construction Techniques Lab	
BCI27PE74 BCI27PE75	Structural Dynamics Structural Dynamics Lab	
BCI27PE76 BCI27PE77	Retrofitting and Rehabilitation of Structures Retrofitting and Rehabilitation of Structures Lab	
BCI27PE78 BCI27PE79	Advanced Soil Mechanics Advanced Soil Mechanics Lab	

CURRICULUM STRUCTURE
Scheme A
Final Year B. Tech. (Civil Engineering) (Regulations 2023) Semester-VIII
(With effect from Academic Year 2026-27)

Course Code	Course Type	Course Name	Credit Scheme				Teaching Scheme (Hours/ week)					Evaluation Scheme and Marks						
			L	P	T	Total	L	P	T	O	Total	FA		SA	TW	PR	OR	Total
												FA 1	FA 2					
BCI28PE81	PEC	MOOC (PEC 6)	2			2	2	-	-	-	2	20	30	-	-	-	-	**50**
BCI28EL03	INT/OJT	Internship	-	12		12	-	24	-	-	24	-	-	-	200	-	50	**250**
BCI28EL04	PROJ	Project		4		4	-	8	-	-	8	-	-	-	100	-	50	**150**
Total			**2**	**16**	**0**	**18**	**2**	**32**	-	**-**	**34**	**20**	**30**	**-**	**300**	**-**	**100**	**450**

L- Lecture, T- Tutorial, P- Practical, CR- Credit, FA – Formative Assessment, SA –Summative Assessment,
TW – Term Work, PR- Practical Exam, OR – Oral Exam, O: other i.e. self directed learning, self study, outside the class efforts.

CURRICULUM STRUCTURE
Scheme B
Final Year B. Tech. (Civil Engineering) (Regulations 2023) Semester-VII
(With effect from Academic Year 2026-27)

Course Code	Course Type	Course Name	Credit Scheme				Teaching Scheme (Hours/ week)					Evaluation Scheme and Marks						
			L	P	T	Total	L	P	T	O	Total	FA		SA	TW	PR	OR	Total
												FA 1	FA 2					
BCI27PE80	PEC	MOOC (PEC 6)	2	-	-	2	2	-	-	-	2	20	30	-	-	-	-	**50**
--	#MDM	Multidisciplinary Minor Project (MDM 5)	-	4	-	4	-	8	-	-	8	-	-		100	-	50	**150**
BCI27EL05	INT/OJT	Internship	-	12	-	12	-	24	-	-	24	-	-	-	200	-	50	**250**
BCI27EL06	RM	Research Methodology	-	4	-	4	-	8	-	-	8	-	-	-	100	-	50	**150**
Total			**2**	**20**	**0**	**22**	**2**	**40**	-	**-**	**42**	**20**	**30**	**-**	**400**	**-**	**150**	**600**

L- Lecture, T- Tutorial, P- Practical, CR- Credit, FA – Formative Assessment, SA –Summative Assessment,
TW – Term Work, PR- Practical Exam, OR – Oral Exam, O: other i.e. self directed learning, self study, outside the class efforts.

Note: # Refer separate booklet for Multidisciplinary Minor (MDM) courses

CURRICULUM STRUCTURE
Scheme B
Final Year B. Tech. (Civil Engineering) (Regulations2023) Semester-VIII
(With effect from Academic Year 2026-27)

Course Code	Course Type	Course Name	Credit Scheme				Teaching Scheme (Hours/ week)					Evaluation Scheme and Marks						
												FA		SA	TW	PR	OR	Total
			L	P	T	Total	L	P	T	O	Total	FA 1	FA 2					
BCI28PC23	PCC	Estimating, Costing and Tenders	2	-	-	2	2	-	-	1	3	10	10	30	-	-	-	**50**
BCI28PC24	PCC	Estimating, Costing and Tenders Lab	-	2	-	2	-	4	-	-	4	-	-	-	50	-	50	**100**
BCI28PC25	PCC	Construction Management	2	-	-	2	2	-	-	1	3	10	10	30	-	-	-	**50**
BCI28PC26	PCC	Building and Sustainability Audit Lab	-	2	-	2	-	4	-	-	4	-	-	-	50	-	50	**100**
BCI28PE41/43/45/47/49/51/53/55	PEC	PEC 4	2	-	-	2	2	-	-	1	3	10	10	30	-	-	-	**50**
BCI28PE42/44/46/48/50/52/54/56	PEC	PEC 4 Lab	-	1	-	1		2	-	-	2	-	-	-	25	-	-	**25**
BCI28PE60/62//64/66/68/70/72/74/76/78	PEC	PEC 5	2	-	-	2	2	-	-	1	3	10	10	30	-	-	-	**50**
BCI28PE61/63/65/67/69/71/73/75/77/79	PEC	PEC 5 Lab	-	1	-	1		2	-	-	2	-	-	-	25	-	-	**25**
BCI28EL07	PROJ	Project	-	4	-	4		8	-	-	8	-	-	-	100	-	50	**150**
Total			**8**	**10**	**-**	**18**	**8**	**20**	-	**4**	**32**	**40**	**40**	**120**	**250**	**-**	**150**	**600**

L- Lecture, T- Tutorial, P- Practical, CR- Credit, FA – Formative Assessment, SA –Summative Assessment,

TW – Term Work, PR- Practical Exam, OR – Oral Exam**,** O: other i.e. self directed learning, self study, outside the class efforts.

Students must ensure that the same course (content) is not selected under multiple categories such as core courses, Professional Electives, Open Electives or through minor Degree in multidisciplinary studies (MDMS) where choices are given. Each course can only be credited once towards the degree requirements. Students are required to acknowledge and agree to this condition before proceeding with registration.

Scheme B

Semester –VIII

List of PEC courses – Professional Elective Course (PEC)– 4

Course Code	Course Name	
BCI28PE41 BCI28PE42	Rural Water Supply Engineering Rural Water Supply Engineering Lab	Choose any one
BCI28PE43 BCI28PE44	Water and Climate Water and Climate Lab	
BCI28PE45 BCI28PE46	Air Pollution and Control Air Pollution and Control Lab	
BCI28PE47 BCI28PE48	Design of Rain Water Harvesting System Design of Rain Water Harvesting System Lab	
BCI28PE49 BCI28PE50	Advanced Concrete Technology Advanced Concrete Technology Lab	
BCI28PE51 BCI28PE52	Quality and Safety in Construction Quality and Safety in Construction Lab	
BCI28PE53 BCI28PE54	Analysis and Design of Reinforced Concrete Bridges Analysis and Design of Reinforced Concrete Bridges Lab	
BCI28PE55 BCI28PE56	Railway, Airport, Dock and Harbour Engineering Railway, Airport, Dock and Harbour Engineering Lab	

List of PEC courses – Professional Elective Course (PEC) – 5

Course Code	Course Name	
BCI28PE60 BCI28PE61	Construction and Demolition Waste Management Construction and Demolition Waste Management Lab	Choose any one
BCI28PE62 BCI28PE63	Disaster Management Disaster Management Lab	
BCI28PE64 BCI28PE65	Advanced Water Treatment Advanced Water Treatment Lab	
BCI28PE66 BCI28PE67	Software Modeling of Hydrological Events Software Modeling of Hydrological Events Lab	
BCI28PE68 BCI28PE69	Construction Contracts and Legal Aspects in Construction Construction Contracts and Legal Aspects in Construction Lab	
BCI28PE70 BCI28PE71	Formwork and Plumbing systems Formwork and Plumbing systems Lab	
BCI28PE72 BCI28PE73	Advanced Construction Techniques Advanced Construction Techniques Lab	
BCI28PE74 BCI28PE75	Structural Dynamics Structural Dynamics Lab	
BCI28PE76 BCI28PE77	Retrofitting and Rehabilitation of Structures Retrofitting and Rehabilitation of Structures Lab	
BCI28PE78 BCI28PE79	Advanced Soil Mechanics Advanced Soil Mechanics Lab	

Course Syllabus

Final Year B Tech

Scheme A / B

Semester-VII / VIII

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Estimating , Costing and Tenders				Code:		BCI27PC23 /BCI28PC23	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge: Building Planning, Construction & Materials**,** Design of Reinforced Concrete Structures- Students are expected to demonstrate proficiency in reading and interpreting engineering drawings and data.

Course Objectives: To make the students aware about

1. To make the students aware about the tendering and contracting system.
2. To inculcate a habit of systematic recording of data, for cost estimation and BOQ preparation..
3. To teach the students cost analysis of individual items above for the estimation purpose.
4. To make students aware about valuation and its methods.

Course Outcomes: After learning the course, the students should be able to:

1. Examine various tenders during the bidding process based upon quotations and specifications.
2. Prepare the detailed estimation of cost for Building Structures.
3. Analyse the rates for items of work per unit of its quantity as per provisions in Specifications
4. Justify returns on investment real estate sector by calculating the value of residential property.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Tenders & Contracts:** **Tenders:** Definition. Methods of inviting tenders, tender notice, tendering procedure, Pre-bid conference, Pre and post qualification of contractors, tender documents. 3 bid/ 2 bid or single bid system. Qualitative and quantitative evaluation of tenders. Comparative statement, acceptance/ rejection of tenders. Types of Tender open, restricted, E- tendering. **Contracts:** Definition, objectives & essentials of a valid contract as per Indian Contract Act (1872), termination of contract. Forms of contract- BOT, target Contract, Turn Key contract & FIDIC contract etc, Types of contracts: lump sum, item rate, Percentage rate, **Conditions of contract:** General and Specific conditions. Construction Claims Introduction to ADR techniques.	7
2	**Introduction to Estimates and related terms:** Definitions of estimation and valuation. Purpose of estimation. Type of estimates, data required for estimation as a prerequisite. Meaning of an item of work, and enlisting the items of work for different Civil Engineering projects. Units of measurement. Mode of measurement of building items/ works. Introduction to components of estimates: face sheet, Schedule A & B abstract sheet (BOQ), measurement sheet, Rate Analysis, lead- Lift statement. Provisional sum & prime cost items, contingencies, work charge establishment, centage charges. Introduction to S. S. R. **Taking out quantities:** Methods of estimating - P.W.D. and center-line methods of working out quantities. Calculation of quantities for Load bearing and R.C.C framed structures. Factors to be considered while Preparing detailed Estimates. Bar Bending Schedule	10
3	**Specifications :**Meaning & purpose, types. Drafting detailed specifications for materials, quality, workmanship, method of execution, mode of measurement and payment for major items like, excavation, stone/ brick masonry, plastering, ceramic tile flooring, R.C.C. work. **Rate Analysis :**Meaning and factors affecting rate of an item of work, materials, sundries, labour, tools & plant, overheads & profit. Working out Rate Analysis for the items mentioned in specifications above. Task work or out turn, factors affecting task work.	7

4	**Valuation :**Meaning of price, cost and value. Purpose of valuation. Factors affecting 'value'. Types of value: only Fair Market Value, Book Value, Salvage/ Scrap Value, Distressed Value and Sentimental Value. Concept of freehold and leasehold property. Estimation versus valuation. Meanings of depreciation & obsolescence. **Methods of Valuation:** Methods of valuation of land and building: rental basis, direct comparison method, profit based method, development method, and rent fixation for building. Methods of Valuation of land-belting method of land valuation and other methods. Qualification of Valuer, Valuation report in O1 format. AI driven techniques / Software's for analysis of rates using regional material rates and local labour wedges.	**6**
	Total	**30**

Self-directed learning- Methods of Approximate Estimation-Plinth area, cubical content, service unit, Bay method, approximate quantity method etc

Text Books:

1. Estimating and Costing in Civil Engineering: Theory and Practice: B.N. Dutta – S. Dutta & Company, Lucknow. 27 th Edition 2020.
2. Estimating, Costing Specifications & Valuation in Civil Engineering: M. Chakraborty. 11th Edition 2020
3. Estimating and Costing: R. C. Rangwala - Charotar Publ. House, Anand 17th Edition 2017
4. Building and Engineering Contracts by B.S.Patil , 7th Edition CRC Press 2019

Reference Books:

1. Theory and Practice of Valuation: Dr. Roshan Namavati, Lakhani Publications 2016
2. Valuation Principles and Procedures: Ashok Nain, Dewpoint Publ.2010
3. Laws for Engineers : Dr. Vandana Bhat and Priyanka Vyas –Published by PRO- CARE, 2010

IS Code:

1. IS 1200- Measurement rules for Items of work
2. The Red Book Unit Cost Estimator For Construction & Insurance Damage Repair - Softcover Bergeron, Eugene C.
3. cpwd.gov.in/Publication/Specs2019V1.pdf Std Specification Booklet- PWD Maharashtra
4. IS 650 – 1991- Specification for standard sand testing
5. IS 14032 – 1988- Specification for standard Cement testing
6. IS 2386 (Part I To VIII) 1963- Methods of testing Aggregates
7. IS 3495 (Parts I TO iv) 1976- Methods of Tests for Burned Bricks
8. IS: 2720 (Part. XIII) 1986, IS:2720 (Part.30) 1980- Methods of Tests for Soil.

e-Resources

1. http://mahapwd.gov.in/
2. https://mjp.maharashtra.gov.in/wp-content/uploads/2022/12/MAHARASHTRA_JEEVAN_PRADHIKARAN__4_.pdf
3. https://theconstructor.org/practical-guide/rate-analysis-of-civil-works-elements-and-requirements/10952/
4. https://cpwd.gov.in/Publication/DAR_Vol2_UPDATE_DEC_2021.pdf
5. National Building Code | Bureau of Indian Standards

Program:	B. Tech. (Civil Engineering)			Semester :	VII/VIII (Scheme A / B)		
Course:	Estimating , Costing and Tenders Lab			Code:	BCI27PC24 /BCI28PC24		
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	50	50	-	100

Prior Knowledge: Building Planning, Construction & Materials, Design of Reinforced Concrete Structures

Course Objectives : To make the students aware about

1. **Understanding** tendering system
2. **Understanding** various methods of estimation.
3. **Analyzing** the rate of various materials and labour based on current market rates of materials and wages of labour.
4. **Knowledge** of valuation & its methods.

Course Outcomes: After learning the course, the students will be able to:

1. **Assess** the strengths and limitations of open, selective, and negotiated tenders in achieving fair competition.
2. **Prepare** a detailed bill of quantities (BOQ) and cost analysis covering materials, labor, equipment, and contingencies for the construction work.
3. **Prepare** rate analysis of construction items of work based on provisions in specification.
4. **Evaluate the value** of property by different methods.

Detailed Syllabus

Term work consists of following (Any one from assignment 11 & 12 remaining all are compulsory)

Sr. No	Description	No. of Turns
1	Assignment on various Format used for Estimation of Cost.	1
2	Assignment on various Overhead Charges considered in detailed estimation.	1
3	Market survey for various construction materials and Report writing wrt following points a) Different variety and class available in the market, b) Cost comparison c) Technical specification of each material.	1
4	Calculating quantities of various items of work for a) Entrance steps, b)Flower bed, c) Footing, d) Chajja, e) Surface drain around the building, f) Compound wall.	2
5	Working out quantities using C-L and PWD method for a small single storied load bearing structure and working out cost of building using SSR(Regional)	4
6	Detailed estimate of a two storied R. C. C. framed building using S.S.R (Students are suggested to use Plan prepared at SY & TY Level for BPCM and DSS respectively)	4
7	Working out quantities of steel reinforcement for a column footing, a column, a beam, stairs with waist slab and a RCC slab by preparing bar bending schedule. Estimating quantities for any one of the following: a) community well b) Underground Water Tank c) Pipe Culvert, d) e) Septic tank	4
8	Estimate Earthwork quantity for a road project.(Students are suggested to use survey data of surveying prepared at SY Level for road projects.)	2
9	Drafting detailed specifications of any 2 items of building & analyzing their rates based on prevailing market.	3
10	Drafting of tender notice for Building Structure as per Assignment No 1 or 2. Collect at least 2 Tender Notices.	1
11	Report on - Claims in Construction Contracts.	2

Sr.No	Description	No. of Turns
12.	Preparation of tender documents for the problem No.1 or 2 Tender Notice. b) Schedule A and Schedule B c) Conditions of contracts regarding time- cost over run, extra items etc.	**2**
13.	Report on contents and use of current SSR.	**1**
14.	Assignment on Methods of valuation for Buildings and Land.	**2**
15.	Valuation report O1 Format.	**1**
16.	Report on - Alternate Dispute resolution Methods in Construction Contracts.	**1**
	Total	**30 Turns**

Text Books:

1. Estimating and Costing in Civil Engineering: Theory and Practice: B.N. Dutta – S. Dutta& Company, Lucknow. 27th Edition 2020.
2. Estimating, Costing Specifications & Valuation in Civil Engineering: M. Chakraborty. 11th Edition 2020
3. Estimating and Costing: R. C. Rangwala - Charotar Publ. House, Anand 17th Edition 2017
4. Building and Engineering Contracts by B.S.Patil , 7th Edition CRC Press 2019

Reference Books:

1. Law of contract Part I and Part II, Dr. R.K. Bangia- 2005 Edition, Allahabad Law Agency.
2. Arbitration, Conciliation and Alternative Dispute Resolution Systems- Dr. S.R. Myneni- 2004 Edition, reprinted in 2005- Asia Law House Publishers.
3. Standard General Conditions for Domestic Contracts- 2001 Ministry Of Statistics and Program Implementation, Government of India.
4.FIDIC Document (1999).

IS Code:

1. IS 1200- Measurement rules for Items of work
2. IS 650 – 1991- Specification for standard sand testing
3. IS 14032 – 1988- Specification for standard Cement testing
4. IS 2386 (Part I To VIII) 1963- Methods of testing Aggregates
5. IS 3495 (Parts I TO iv) 1976- Methods of Tests for Burned Bricks
6. IS: 2720 (Part. XIII) 1986, IS:2720 (Part.30) 1980- Methods of Tests for Soil

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Construction Management				Code:		BCI27PC25 /BCI28PC25	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge:

1. Construction Equipment and Material Management
2. Project Management and Economics

Course Objectives:

After Completing this course, student will have adequate background :

1. To understand the principles and practices of construction management
2. To familiarize students with construction laws and regulations
3. To introduce students to risk management in construction projects
4. To develop skills in managing construction projects and teams.

Course Outcomes:

After learning the course, the students should be able to:

1. Explain role of PMC and assess project feasibility.
2. Interpret major laws and ensure compliance in projects.
3. Identify, assess, and manage risks in construction projects.
4. Analyze contracts, resolve disputes, and apply administration practices.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Introduction to Construction Management** Overview of the construction industry and the role of management in delivering projects efficiently and economically, types of construction projects and contracts, along with the key roles and responsibilities of construction managers. Project management Consultancy (PMC), Case study based on PMC, applications of AI in Construction Management.	8
2	**Laws and Regulations related to Construction** Importance of labour laws in construction sector, Building and Other Construction Workers Act, 1996, and the Contract Labour(Regulation & Abolition)Act, 1970,Factories Act, 1948, and Workmen's Compensation Act, 1923, worker safety, welfare, and employer responsibilities, Real Estate Regulatory Authority (RERA), Case studies on above topics.	7
3	**Risk Management in Construction** Concept, importance, and structured process of risk management in construction projects, categories of risks such as financial, operational, strategic,physical,occupational and environmental, along with the methods for identifying, assessing, and prioritizing risk, mitigation measures and management strategies to minimize negative impacts on cost, time, quality, and safety. Case studies.	8
4	**Contract Management and Construction Administration** Fundamentals of contract management and construction administration, highlighting the roles and responsibilities involved in ensuring smooth project execution, sources of contract disputes and the mechanisms available for claims and dispute resolution, arbitration & conciliation and the role of Project Management Consultancy (PMC) in Project management, along with the importance of financial management for effective cost control and resource utilization and promoting sustainability, resilience, safety, skilling.	7
	Total	**30**

Self-directed learning- construction laws, risk, and contract management through case studies. RERA, labour laws, risk mitigation, and dispute resolution, legal compliance and sustainable project delivery, Occupational Safety and Health Administration (OSHA)

Text Books:

1. Construction planning, equipment and methods by Purifoy R and schexnayder C (2006)
2. Construction Technology: Analysis and Choice, 2ed,Bryan, Wiley India(2014)
3. Materials Management An Integrated Approach , by P. Gopalakrishnan and Sundaresan, Prentice Hall of India(2015)
4. Materials Management: Procedures, Text and Cases, Datta .A.K, PHI Learning(2008)
5. Materials of Construction' by Ghose, Tata- McGraw Hill Publication.(2000)
6. Management of Materials , B.K. Roy Chowdhury , S. Chand & Sons (2001)

Reference Books:

1. Journals such as CE & CR. Construction world, International Construction.
2. Construction Technology by Roy Chudley and Roger Greeno, Prentice Hall, 2005
3. Richard J. Tersine, "Modern Materials Management", John Hardin Campbell – 2007
4. Arnold, "Introduction to Materials Management", Pearson Education India,2009
5. Lee and Dobler, Purchasing and Material Management, McGraw Hill Publications

Web References:

1. Construction Management Association of America (CMAA) - https://www.cmaanet.org/
2. Construction Management Association of America (CMAA) Knowledge Library -
3. https://www.cmaanet.org/knowledge-library
4. Construction Management Institute - http://construction-management.org/
5. Construction Management Association of America (CMAA) YouTube Channel –
6. https://www.youtube.com/user/CMAANET
7. Project Management Institute (PMI) - https://www.pmi.org/
8. American Society of Civil Engineers (ASCE) - https://www.asce.org/
9. Construction Industry Institute (CII) - https://www.construction-institute.org/
10. Construction Management Guide - https://www.constructionmanagementguide.com/
11. Construction Executive - https://www.constructionexecutive.com/
12. The Construction Federation of India (CFI) - https://www.cfiindia.com/
13. National Academy of Construction - https://nac.edu.in/
14. Construction Industry Development Council (CIDC) - https://www.cidc.in/index.html

Program:	B. Tech. (Civil Engineering)			Semester :	VII/VIII (Scheme A / B)		
Course:	Building and Sustainability Audit Lab			Code:	BCI27PC26 /BCI28PC26		
	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
Credits	Lecture	Practical	Tutorial	TW	OR	PR	Total
2	-	4	-	50	50	-	100

Prior Knowledge: Knowledge of Environmental Engineering, Basics of Water and Wastewater Quality Parameters, Familiarity with Air, Water, Solid Waste Management concepts, Exposure to Environmental Policies and Regulations, Knowledge of Construction Materials and Practices, Exposure to Sustainability Concepts (SDGs, Circular Economy, ESG),Familiarity with Excel, AutoCAD/Revit, and basic simulation tools

Course Objectives: This course aims to enable students to

1. Provide practical experience in auditing environmental parameters and interpreting regulatory standards for industries, municipalities, and institutions.
2. Develop students' skills in analytical reporting, improvement identification, and linking audits to environmental management practices
3. Introduce Life Cycle Assessment (LCA) concepts, methodologies, and tools applied to construction materials, processes and projects.
4. Promote micro-projects that apply environmental auditing and LCA aligned with industry, government regulations, and sustainability decision-making.

Course Outcomes: After learning the course, the students should be able to:

1. Conduct environmental audits (water, air, waste, energy, noise) and prepare reports using IS standards and regulatory guidelines.
2. Analyze and interpret audit data, recommending improvements for environmental management in real contexts.
3. Apply LCA methodology and use software tools to assess environmental impacts of materials and construction systems.
4. Execute and report micro-projects demonstrating environmental audit and LCA applications linked to industry, policy, and sustainability decisions.

Detailed Syllabus

Sr.No	Description	Duration (H)
A	**Any six experiments from the following** 1. Air Quality Audit – Measurement of PM2.5, PM10, SO_2, NOx (using sampler/portable monitors). 2. Solid Waste Audit – Characterization and quantification of municipal/institutional waste. 3. Noise Audit – Monitoring ambient noise at traffic/industrial locations. 4. Energy Audit (Campus/Building) – Lighting, HVAC, and renewable energy potential assessment. 5. Carbon Footprint Audit – GHG emission estimation (Scope 1 & 2 sources). 6. Green Cover / Tree Audit – Campus vegetation cover and carbon sequestration potential. 7. Construction & Demolition Waste Audit – Quantity and recyclability analysis. 8. Safety Audit of buildings 9. Financial Audit of buildings	20
B	**Any six experiments from the following** 1. Introduction to ISO 14040/14044 framework for Life Cycle Assessment. 2. LCA of cement and concrete – embodied energy and CO_2 emissions. 3. LCA of steel and reinforcement materials. 4. Comparative LCA of conventional bricks vs. fly ash bricks. 5. LCA of bitumen and asphalt pavement materials. 6. LCA of construction equipment operations (excavator, concrete mixer). 7. LCA of water supply system (pumping, treatment, distribution). 8. LCA of wastewater treatment system. **9.** Campus-level carbon footprint analysis (Scope 1 & 2 emissions).	20

	PBL/Micro project (Anyone from 1 or 2) **1. PBL/Micro project based on Unit-A** • Students will conduct a comprehensive environmental audit of a selected site (campus building, industry, municipal ward, or community). • Audit report should cover baseline data, analysis, compliance with IS/MoEF/CPCB norms, and recommendations. Example topics: • Environmental Audit of PCCOE campus. • Water Audit of an institutional building. • Solid Waste Audit of Pimpri-Chinchwad ward. • Energy Audit of a residential/commercial building. **2. PBL/Micro project based on Unit-B** Students will carry out a comprehensive LCA study of a selected construction material, building component, or infrastructure project. Examples: • LCA of a PCCOE campus building. • LCA of precast vs. cast-in-situ concrete. • LCA of a road section (flexible vs. rigid pavement). • LCA of a rainwater harvesting system. Deliverables: Report + Presentation including methodology, inventory data, results, and recommendations.	**20**
	Total	**60**

Text Books:

1. Rao, C.S. – Environmental Pollution Control Engineering, Wiley Eastern Ltd.
2. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G. – Environmental Engineering, McGraw-Hill.
3. MoEFCC – Environmental Audit Reports Guidelines.
4. CPCB Manuals on Water/Air/Noise Monitoring.
5. ISO 14001:2015 – Environmental Management Systems – Requirements with guidance for use.
6. Guinée, J.B. – *Handbook on Life Cycle Assessment: Operational Guide to the ISO Standards*.
7. Curran, M.A. – *Life Cycle Assessment Student Handbook*, Wiley.
8. Muthu, S.S. – *Life Cycle Assessment of Sustainable Materials*.

IS Code:

1. IS 10500: 2012 – Drinking Water Specification.
2. IS 3025 (all parts) – Methods of Sampling and Testing Water and Wastewater.
3. IS 4563: 1968 – Noise levels permissible in industrial areas.
4. IS 5891: 1970 – Air Pollution Measurement Techniques.
5. IS 15883 (Part 1–6): 2020 – Solid Waste Management.
6. ISO 14040:2006 – Environmental Management – Life Cycle Assessment – Principles and Framework.
7. ISO 14044:2006 – Environmental Management – Life Cycle Assessment – Requirements and Guidelines.
8. IS 1893, IS 383, IS 456 (for construction material standards and data).
9. BIS standards for embodied energy of building materials (as referenced in ECBC/GRIHA).
10. National Building Code (NBC) – Sustainability Section.

e-Resources

1. Central Pollution Control Board (CPCB): https://cpcb.nic.in
2. Ministry of Environment, Forest and Climate Change (MoEFCC): https://moef.gov.in
3. Bureau of Indian Standards (BIS): https://bis.gov.in
4. IPCC GHG Protocol: https://ghgprotocol.org
5. National Environmental Engineering Research Institute (NEERI): https://neeri.res.in
6. OpenLCA: https://www.openlca.org
7. Ecoinvent Database: https://ecoinvent.org
8. SimaPro Software: https://simapro.com
9. CML Impact Assessment Methodology: https://www.universiteitleiden.nl/cml
10. IPCC Emission Factors Database: https://www.ipcc-nggip.iges.or.jp/EFDB

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Rural Water Supply Engineering (PEC 4)				Code:		BCI27PE41/BCI28PE41	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge: Fundamentals of Environmental Engineering

Course Objectives:

This course aims to enable students,

1. To provide knowledge of water sources, rural water-related issues, and sustainable methods for strengthening and conserving sources.
2. To study technical competency in planning rural water supply schemes and infrastructure.
3. Build conceptual understanding of socio-economic, financial, and administrative aspects in rural water supply projects.
4. Introduce interdisciplinary and AI-driven technological tools for smart and sustainable management of rural water supply systems.

Course Outcomes:

After learning the course, the students should be able to:

1. Identify appropriate rural water sources, challenges, and quality issues, and propose appropriate and sustainable techniques for strengthening these sources and harvesting rainwater.
2. Explain the different types of rural water supply schemes and infrastructure components, including intake structures, pipelines, treatment units, and distribution systems.
3. Assess socio-economic and administrative aspects of rural water supply projects, including participatory approaches, financial schemes, capacity building, and preventive maintenance.
4. Identify tools and emerging technologies, such as AI, SCADA, GIS, and hydraulic modeling, for the management of sustainable rural water supply systems.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Water Sources and Rural Challenges:** Source of water and population considerations, reservation of water and permissions from authorities, water-relatedissues in rural areas, water supply scheme for single gram Panchayat/Group gram Panchayat, geology/ certificate from Groundwater Directorate of Surveys & Development Agency (GSDA), geology and its relation with groundwater, sustainability strengthening and conserving source, introduction to Rainwater harvesting (RWH), horizontal bore, hydro-fracturing, well sinking, unconventional methods by GSDA, retrofitting of schemes. Use of weep holes, yield test of the open well, tube, and bore well, introduction to Shivkalin Pani Sathawan Yojana, water quality and quantity (case study)	08
2	**Rural Water Supply Schemes & Infrastructure:** Types of schemes: single village vs. regional rural, retrofitting, and reuse of available infrastructure, layout and components of schemes, Intake structures: Jack well (pump house), introduction to pipe material such as Polyvinyl Chloride (PVC), Unplasticized Polyvinyl Chloride (UPVC), Chlorinated Polyvinyl Chloride (CPVC), pipe appurtenances slotted pipe galleries and trench galleries, percolation well, Mains: connecting, rising, gravity, recuperation test (owner's responsibility), introduction to rising main/gravity main, introduction to Water Treatment Plant (WTP) Ground Service Reservoir (GSR)/Membrane bioreactor (MBR), Introduction to distribution, including house connection (Ferrule). Case study on any rural water supply scheme.	07

3	**Socio-Economic & Administrative Aspects:** Various departments are involved in water conservation, utilizing a participatory approach to ensure the project's success. Financial schemes are available within the department. Case studies, such as those from Palsoshi (Bhor), Hiware Bazar, and Lamkani (Dhule), are available with Maharashtra Jeevan Pradhikaran (MJP). Additionally, capacity building is provided for villagers. Periodic maintenance of machinery & components, training to villagers in Operations & Preventive maintenance, leakage detection (techniques & importance) with a case study.	**08**
4	**Interdisciplinary & Sustainability aspects:** Electro-mechanical aspects: pumping machinery, intake/water treatment plant/elevated service reservoirs, hydraulic testing of pipelines, water hammer, flow control, airlocks, introduction to JALTANTRA software of IIT Bombay, Introduction of AI in SCADA-based automation, AI-driven leak detection, and analyze turbidity, color, or contamination in water samples, AI with GIS & GPS: Smart mapping for demand forecasting, water scarcity zones, and optimal distribution planning with case study. Circular Economy in Rural Water Supply with a case study.	**07**
	Total	**30**

Self-directed learning- Advanced Water Treatment Technologies for Rural Systems, Advanced Groundwater Management and Recharge, Reuse of Treated Greywater in Rural Homes and Circular Systems for Rural Water Management, Conduct a comparative study of solar vs. electrical pumping in rural settings.

Text Books:

1. Rural Water Supply and Sanitation, Vayu Education of India, Sanjay Gupta,1st Edition, 2014.
2. Water Supply Engineering, S. K. Garg, Khanna Publications (latest edition)
3. Water Supply Engineering, Dr. P. N. Modi, Standard Book House, 37th Latest Edition.

Reference Books:

1. CPHEEO Manual on Water Supply and Treatment.
2. IWWA Technical Data Book (Available with IWWA Pune Local Centre)
3. Special Reference Material Recommended: Compendium of Training Materials for the Capacity Building under the Unnat Maharashtra Abhiyan (UMA), Prepared by the Institute for Resource Analysis and Policy, Hyderabad & CTARA, IIT Bombay, Supported by UNICEF, Mumbai, March 2018

e-Resources:

1. https://rural-water
2. https://onlinecourses.nptel.ac.in/noc20_ce23/preview
3. http://www.jeionline.org/index.php?journal=mys&page=article&op=view&path%5B%5D=200600062
4. http://libcat.neeri.res.in:80/cgi-bin/koha/opac-detail.pl?biblionumber=11373
5. https://mohua.gov.in
6. https://vizianagaram.ap.gov.in/department/rural-water-supply-officials/

Program:	B. Tech. (Civil Engineering)			Semester :	VII/VIII (Scheme A / B)		
Course:	Rural Water Supply Engineering Lab (PEC 4 Lab)			Code:	BCI27PE42 / BCI28PE42		
	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
Credits	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge: Nil

Course Objectives:

1. To study rainwater harvesting techniques, groundwater recharge methods, and rural water supply practices.
2. To develop skills in participatory approaches, conservation methods, and sustainable management of rural water supply schemes.
3. To study modern tools, software, and government initiatives used for planning, monitoring, and managing rural water supply projects, with an emphasis on integrating circular economy principles

Course Outcomes: After learning the course, the students should be able:

1. To identify the effectiveness and implementation potential of rainwater harvesting in rural settings.
2. To assess the level of community involvement and identify challenges in rural water supply projects with a sustainable approach.
3. Apply techniques to minimize water loss, optimize distribution efficiency, and implement planning and monitoring strategies that incorporate circular economy approaches

Detailed Syllabus

Term work consists of following (Any eight from below)

Sr.No	Description
1.	Case study on rainwater harvesting system in a rural area.
2.	Conduct a community-based survey to assess public participation in rural water supply projects for sustainable management.
3.	Analyze case studies like Hiware Bazar and Palsoshi (Bhor) and report on their success factors.
4.	Report on the impact of government policies and financial schemes on rural water supply projects.
5.	Prepare a basic layout for a single-village water supply scheme for a rural community aiming to adopt circular economy (CE) principles to reduce water waste, promote reuse, and enhance sustainability.
6.	Case Study on AI-driven Leakage Control, Benefits of Water Audit and Leak Detection
7.	Report on Community Involvement for Sustainable Rural Water Supply Scheme.
8.	Community participation and compliant redressal system of operations & maintenance of the rural water supply scheme
9.	Use JALTANTRA software (by IIT Bombay) for water supply system modeling.
10.	Study the implementation of GPS and GIS in rural water supply projects for planning and monitoring.

Text Books:

1. Rural Water Supply and Sanitation, Vayu Education of India, Sanjay Gupta,1st Edition, 2014.
2. Water Supply Engineering, S. K. Garg, Khanna Publications (latest edition)
3. Water Supply Engineering, Dr. P. N. Modi, Standard Book House, 37th Latest Edition.

Reference Books:

1. CPHEEO Manual on Water Supply and Treatment.
2. IWWA Technical Data Book (Available with IWWA Pune Local Centre)
3. Operation and Maintenance Manual for Rural Water Supplies.
4. Special Reference Material Recommended: Compendium of Training Materials for the Capacity Building of the Faculty and Students of Engineering Colleges under the Unnat Maharashtra Abhiyan (UMA), Prepared by the Institute for Resource Analysis and Policy, Hyderabad & CTARA, IIT Bombay, Supported by UNICEF, Mumbai, March 2018

e-Resources:

1. https://rural-water
2. https://indiawater.gov.in/
3. https://jaljeevanmission.gov.in/
4. http://libcat.neeri.res.in:80/cgi-bin/koha/opac-detail.pl?biblionumber=11373
5. https://mohua.gov.in
6. https://vizianagaram.ap.gov.in/department/rural-water-supply-officials/
7. https://www.indiawaterportal.org/articles/hiware-bazar-model-watershed-development

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Water and Climate (PEC 4)				Code:		BCI27PE43/ BCI28PE43	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge: 1. Basic understanding of environmental studies
2. Hydrology and Water Resource Engineering 3. Environmental Engineering

Course Objectives:

1. To impart understanding of different processes and interplay between climate system and the global water cycle
2. To impart understanding of the climate change influences on water resources and the associated vulnerabilities and risks
3. To impart understanding of the concept of Integrated Water Resources Management in relation to climate change
4. To impart understanding of the necessity for integrated assessment, alternative policy and innovative management solutions, framework for water policy guidelines; building resilience; adaptation strategies and interventions needed in sustainable response to changing climate

Course Outcomes:

After learning the course, the students should be able to:

1. Identify the drivers for climate change.
2. Explain the impacts of climate change on various factors.
3. Model the impacts on hydrological systems
4. Interpret mitigation and adaption strategies for water management.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Introduction to Climate Change and Global Water Cycle:** Variation in climate, driving factors of climate change; Current and forecasted changes in global patterns of precipitation and evaporation; Water cycle, global distribution of water and quantitative and qualitative spatio-temporal changes, SDGs and global policy frameworks	07
2	**Hydrological Impacts of Climate Change:** Estimating impacts of climate change on precipitation variability, Climate Models and Downscaling: Basics of GCMs and RCMs, extreme precipitation events, droughts, floods, evapotranspiration, soil moisture, surface and sub-surface water resources, runoff and river discharge, glacial hydrological regime, fluvial landforms	07
3	**Modelling Impacts on Hydrological Systems:** Modelling climate-induced changes in hydrology; Water resource availability and demand, modelling runoff, flood frequency analysis, soil erosion; Socio-economic and environmental impacts; indicators of climate risks to water resources; vulnerability; Factors affecting the vulnerability of water resource, AI-driven decisions in climate risk assessment	09
4	**Mitigation and Adaptation Strategies for water management:** Scale dependent vulnerability-local, regional, global; Vulnerability assessment and adaptation framework – all intra-national governance levels, transboundary water resources; critical knowledge gaps Importance of IWRM for adaptation; Integrated drought management; Potential water resource conflicts, Implications for policy and sustainable development; Risk management	07
	Total	30

Self- directed learning: Use of satellites and sensors for rainfall and water level monitoring, mobile apps for weather forecasting and flood alerts, simple GIS mapping (e.g., Google Earth) to view rivers, lakes, and land use.

Text Books:

1. Climate Change and Water Resources by M. Monirul Qader Mirza, Q.K. Ahmad, A. A. Balkema Publishers, 2005
2. Water and Climate Change by Trevor M. Letcher, CRC Press (Taylor and Francis Group), 2022

Reference Books:

1. Climate Change and Water Resources: Challenges and Solutions Towards an Imminent Water Crisis by Eric and West, Callisto Reference, 2023
2. Watershed : The Story of India's Water InThe Age Of Climate Change, Hacheete India, 2023
3. Floods in Changing Climate: Hydrologic Modeling, Dr. Nageshkumar , Cambridge University Press.

e-Resources:

1. https://www.unwater.org/water-facts/water-and-climate-change
2. https://www.climate.gov/

Program:	B. Tech. (Civil Engineering)			Semester :	VII/VIII (Scheme A / B)		
Course:	Water and Climate Lab (PEC 4 Lab)			Code:	BCI27PE44/ BCI28PE44		
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge: 1. Basic understanding of environmental studies
2. Hydrology and Water Resource Engineering 3. Environmental Engineering

Course Objectives:

This course aims to enable students,

1. To impart understanding of the interlinkages between the water resources and climate system
2. To impart understanding of the effects of change of the climatic system on the water resources
3. To impart understanding of the relation between climate change and integrated water management system
4. To impart understanding of the mitigation and adaption strategies for water resources management in context to climate change.

Course Outcomes: After learning the course, the students should be able to:

1. Identify the inter-linkages between climate change and water resources and explain the adverse effects of climate change on the water resources.
2. Explain the impacts of climate change with the help of different scientific models
3. Illustrate the mitigation and adaption strategies with the help of the case study.

Detailed Syllabus

Term work consists of a journal containing details of assignments (Any Seven from Sr. No. 1 to 10 assignments and Assignment No. 11 is compulsory)

1. Report/Case study on identification on how climate change is interrelated with water resources in the global context.
2. Report / Case Study on quantitative and qualitative spatio-temporal changes in global water cycle due to climate change.
3. Report / Case Study on impacts of climate change on precipitation and droughts.
4. Report / Case Study on impacts of climate change on surface and sub-surface water resources, runoff and river discharge,
5. Report / Case Study on impacts of climate change on glacial hydrological regime/ fluvial landforms
6. Report / Case Study on modeling of runoff modeling
7. Report / Case Study on flood frequency analysis
8. Report / Case study on Importance of IWRM for adaptation strategy against the adverse impacts of climate change on water resources
9. Report / Case study on risk management strategies for adverse impacts of climate change on water resources
10. Report / Case study on global water resource conflicts.
11. Introduction to Simulation of Climate Change Impacts on Watershed Hydrology Using HEC-HMS/SWAT/ MIKE SHE/GIS

Text Books:

1. Climate Change and Water Resources by M. Monirul Qader Mirza, Q.K. Ahmad, A. A. Balkema Publishers, 2005
2. Water and Climate Change by Trevor M. Letcher, CRC Press (Taylor and Francis Group), 2022

Reference Books:

1. Climate Change and Water Resources: Challenges and Solutions Towards an Imminent Water Crisis by Eric and West, Callisto Reference, 2023
2. Watershed: The Story Of India's Water InThe Age Of Climate Change,Hacheete India, 2023

e-Resources

1. **https://www.unwater.org/water-facts/water-and-climate-change**
2. **https://www.climate.gov/**

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Air Pollution and Control (PEC 4)				Code:		BCI27PE45/ BCI28PE45	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge: Basic understanding of environmental studies, Basic concepts of science and mathematics.

Course Objectives: This course aims to enable students,

1. To impart the knowledge of indoor and outdoor air pollution along with the understanding of meteorological parameters affecting air pollution phenomenon.
2. To provide the understanding of the sampling, analysis and pollution control techniques

Course Outcomes: After learning the course, the students should be able to:

1. Explain the ambient air sampling and analysis of particulates and gaseous air pollutants.
2. Calculate the minimum height of the industrial stack.
3. Determine the ground level concentration of the gaseous pollutants downwind of the stack and apply the knowledge of emission inventory.
4. Design the control equipment‘s for control of particulate pollutant for an industry.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Introduction to air pollution, Ambient Air Samplings, Analysis and Standards** Basics of Air Pollution, Air Pollution Sources, Air Pollution episodes, Air pollution survey, basis and statistical considerations of sampling sites, Reconnaissance survey for selection of ambient air quality (AAQ) monitoring location, devices and methods used for sampling of gases and particulates. Stack emission monitoring for particulate matter, isokinetic sampling. Continuous Ambient Air Quality Monitoring Systems (CAAQMS) and Online Continuous Emission Monitoring System (OCEMS) data handling and analysis. Analysis of air samples, chemical and instrumental methods. Ambient air quality monitoring as per the procedure laid down by CPCB. National Ambient Air Quality Standards (NAAQS) 2009, Determination of Air Quality Index, Air Act, Basics of Low-Cost sensors, Introduction to Indoor Air Pollution and aerosols.	07
2	**Meteorological Aspects** Meteorological parameters and measurements, scales of meteorology, Lapse rates, Inversion and its types, Atmospheric stability, Determination of mixing height, Stack height determination, CPCB recommendations, Plume rise estimation using Brigg‘s formula.	07
3	**Emission Inventory (EI), Air Quality Modelling** Types of Emission sources (Point, Line and Area), Data Collection, emission factors, top-down and bottom-up estimation methods for EI, Air Quality Modelling using Gaussian dispersion equation for point source; assumptions, advantages and limitations (Numerical included), Introduction to air quality management, source apportionment studies. Introduction to use of AI in air quality modelling.	07
4	**Control of Air Pollution** Natural self-cleansing properties, Control by process modification, change of raw materials, fuels, process equipment and process operation. Control of particulates from stationary sources: Working principle and design of settling chamber, inertial separators, cyclone, fabric filter and electrostatic precipitator. Scrubbers, Factors affecting selection of device (Numerical included) Absorption, adsorption, incineration/ combustion, and carbon sequestration for CO_2. Reduction strategies to reduce emission load from different sources Control of specific pollutants. Control of emissions from mobile sources (Bharat Stage-I to VI and different types of fuel), Control of emissions from fugitive sources. Shifting towards cleaner vehicular technology, smart transportation systems, reduction in emissions (electric/hydrogen fuel over fossil fuels)	09

Total	**30**

Self- directed learning: Use of satellites and sensors for rainfall and water level monitoring, mobile apps for weather forecasting and flood alerts, simple GIS mapping (e.g., Google Earth) to view rivers, lakes, and land use.

Text Books:

1. Climate Change and Water Resources by M. Monirul Qader Mirza, Q.K. Ahmad, A. A. Balkema Publishers, 2005
2. Water and Climate Change by Trevor M. Letcher, CRC Press (Taylor and Francis Group), 2022

Reference Books:

1. Climate Change and Water Resources: Challenges and Solutions Towards an Imminent Water Crisis by Eric and West, Callisto Reference, 2023
2. Watershed : The Story of India's Water InThe Age Of Climate Change, Hacheete India, 2023
3. Floods in Changing Climate: Hydrologic Modeling, Dr. Nageshkumar , Cambridge University Press.

e-Resources:

1. https://www.unwater.org/water-facts/water-and-climate-change
2. https://www.climate.gov/

Program:	B. Tech. (Civil Engineering)			Semester :	VII/VIII (Scheme A / B)		
Course:	Air Pollution and Control Lab (PEC 4 Lab)			Code:	BCI27PE46/ BCI28PE46		
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge: 1. Basic understanding of environmental studies
2. Hydrology and Water Resource Engineering 3. Environmental Engineering

Course Objectives: This course aims to enable students,

1. To impart the knowledge of sampling and analysis of ambient air for particulate and gaseous pollutants concentration.
2. To impart the knowledge of laws and regulation related to air pollution control.

Course Outcomes: After learning the course, the students should be able to:

1. Discuss the laws and regulations related to air pollution control.
2. Perform the sampling and analysis of ambient air for particulates and gaseous pollutants.
3. Discuss working of air pollution control devices.

Detailed Syllabus

Term work consists of a journal containing details of assignments and a visit report (Any Eight, one site visit compulsory)

1. Presentation (in a group of four) on air pollution in India (different NCAP cities) and laws and regulatory framework associated with it.
2. Report / Case Study on the use of modern technologies to curb air pollution (RS & GIS, new inventions, etc.)
3. Site Visit to Indian Meteorological Institute (IMD) or Indian Institute of Tropical Meteorology/ CSIR-National Environmental Engineering Research Institute (NEERI), Nagpur.
4. Site Visit to any industry to study the pollution control device
5. Sampling and Analysis of PM_{10} and $PM_{2.5}$ in Ambient Air using Sampling and Analysis of SO2 and NO2 (High Volume Sampler/ Fine Dust Sampler) in Ambient Air
6. An interactive session with experts from the Indian Institute of Tropical Meteorology/ Central Pollution Control Board/ State Pollution Control Board/ Municipal corporation or Nagar Panchayat/ smart city centres/ CSIR-National Environmental Engineering Research Institute (NEERI)/any authority with reference to air quality and its report.
7. Hands-on exercise on software for air quality modelling software such as AERMOD, CALINE4, CALPUFF or SCREEN3.
8. Demonstration of sampling and analysis of indoor air quality in classrooms or offices of the institute
9. Demonstration of stack sampling and emission analysis of a sample collected through the stack.
10. Calculation of AQI from the data from the IMD/research papers.

Text Books:

1. Air Pollution and Control, K.V.S.G. Murali Krishna, University Science Press, 2015
2. Air Pollution, M. N. Rao and H. V. N. Rao, 58th Edition, McGraw-Hill Education, 2020
3. Environmental Engineering – Peavy H.S and Rowe D.R, McGraw Hill- Pub.2017

Reference Books:

1. Air Pollution: Health and Environmental Impacts, Gurjar, B.R., Molina, L., Ojha, C.S.P. (Eds.), CRC Press, 2010
2. Fundamentals of Air Pollution, Boubel, R.W., Fox, D.L., Turner, D.B., Stern, A.C., 4th Edition, Academic Press, 2008.
3. Atmospheric Chemistry and Physics, Seinfeld, J.H., Pandis, S.N., 3rd Edition, John Wiley, 2016.

e-Resources:

1. http://cpcb.nic .in https://cpcb.nic.in/uploads/National_Ambient_Air_Quality_Standards.pdf
2. http://moef.nic .in https://moef.gov.in/en/division/environment-divisions/climate-changecc-2/documents-publications/

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Design of Rain Water Harvesting System (PEC 4)				Code:		BCI27PE47/ BCI28PE47	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge:

1. Fundamental concepts of hydrology and water resources engineering.
2. Basic designing skills in civil engineering (survey, estimation, CAD, Engineering Geology).
3. Environmental concerns and sustainability principles.

Course Objectives: This course aims to enable students,

1.To provide comprehensive understanding of rainwater harvesting (RWH) principles and their societal and environmental importance.

2.To develop the ability to analyze rainfall data and estimate the water harvesting potential for diverse catchment areas.

3.To impart skills for the planning and design of RWH structures for domestic, institutional, and urban applications.

4.To enable learners to assess, maintain, and optimize RWH systems for sustainability, compliance, and performance monitoring

Course Outcomes: After learning the course, the students should be able to:

1. Explain the need, importance, and scope of rainwater harvesting and its integration with sustainable water resources management systems.
2. Analyze rainfall and catchment data for estimating RWH potential and selecting suitable locations.
3. Apply design principles to develop RWH systems meeting user requirements and regulatory standards.
4. Evaluate, maintain, and suggest improvements for RWH systems through practical case analysis.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Fundamentals and Need for Rainwater Harvesting** Definition, history and relevance of RWH in water conservation and management, Water scarcity, urbanization, and environmental impact, Advantages and limitations of RWH, Applications in rural, urban, and industrial areas, Ancient methods of RWH	07
2	**Hydrological Data Analysis and Estimation of Rainwater Harvesting Potential** Rainfall measurement, interpretation, and analysis, Runoff estimation from roof-top and surface catchments, Calculation of potential yield and demand assessment, Selection criteria for sites and catchments, cost-effective and durable materials for RWH system, application of GIS land use, land cover and soil type for suitability of RWH system	07
3	**Planning and Design of Rainwater Harvesting Systems** System components: catchment, conveyance, filtration, storage, recharge, Design criteria for tanks (size/capacity), recharge structures, and drainage, Urban vs. rural RWH systems—guidelines and site-specific adaptations, IS codes, standards, and best practices	08
4	**Implementation, Operation, and Case Studies** Installation and construction practices, Operation, monitoring, maintenance, and quality control, filtration and disinfection of harvested rain water, Common problems and troubleshooting, Recent advancements and case studies from India - Bengaluru / Mumbai / Ahmedabad etc. and abroad.	08
	Total	30

Text Books:

1. S. K. Garg “Rain Water Harvesting” (Khanna Publishers).

Reference Books:

1. Manual on Rainwater Harvesting – Central Public Health and Environmental Engineering Organisation (CPHEEO), Ministry of Urban Development, Govt. of India.
2. Sustainable Urban Water Management Handbook – CRC Press.
3. Handbook on Rainwater Harvesting by SOPAC, South Pacific Applied Geoscience Commission.

IS Code:

1. IS 15797:2008 – Roof Top Rainwater Harvesting Guidelines.
2. IS 1172:1993 – Code of Basic Requirements for Water Supply, Drainage, and Sanitation.
3. IS 4987:1994 – Design of Surface Drainage Systems.
4. National Building Code (NBC), 2016 – Provisions on water supply and RWH.

e-Resources

1. Central Ground Water Board (CGWB): https://cgwb.gov.in (Guidelines and manuals).
2. Rainwaterharvesting.org: http://rainwaterharvesting.org (Resources, case studies).
3. Urban Water Security Planning Toolkit: https://cwas.org.in/resources/file_manager/module_3-3_1_rwh_guidelines.pdf.cwas
4. Ministry of Jal Shakti: https://nwm.gov.in (Policy, implementation manuals).

Program:	B. Tech. (Civil Engineering)			Semester :	VII/VIII (Scheme A / B)		
Course:	Design of Rain Water Harvesting System Lab (PEC 4 Lab)			Code:	BCI27PE48/ BCI28PE48		
	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
Credits	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge: Basics of Hydrology and Water Resources Engineering, Concepts of Fluid Mechanics & Hydraulic Measurements, Basics of Surveying and GIS, Awareness of Sustainable Development Goals (SDG-6: Clean Water & Sanitation),Basics of Engineering Geology

Course Objectives: This course aims to enable students,

1. To impart hands-on knowledge and skills in the design, analysis, and implementation of rainwater harvesting systems using standard codes, guidelines, and modern tools.
2. To develop competency in assessing rainfall, runoff, infiltration, and water demand, and to promote sustainable water management through project-based learning.

Course Outcomes: After learning the course, the students should be able to:

1. Measure and analyze rainfall, runoff, infiltration, and percolation characteristics, and apply IS codes and hydrological methods to design appropriate rainwater harvesting structures.
2. Use GIS and relevant software tools to delineate watersheds, analyze catchments, and evaluate the feasibility and performance of rainwater harvesting systems for sustainable urban and rural water management.

Detailed Syllabus

A	**Any six experiments from the following** 1. Study of rainfall measurement techniques (Rain gauge types: Symons, tipping bucket, automatic) 2. Determination of infiltration rate using double-ring infiltrometer. 3. Measurement of percolation rate through soil column test. 4. Runoff estimation using Rational Method / Curve Number (SCS-CN method) for a given catchment. 5. Roof-top catchment area calculation and water yield estimation. 6. Study and design of first-flush device and filtration unit. 7. Design of recharge pit/trench with given soil and rainfall characteristics. 8. Design of percolation tank / recharge well for groundwater recharge. 9. GIS-based watershed delineation and catchment area analysis. 10. Water demand assessment for a residential/institutional building 11. Cost–benefit analysis of a rainwater harvesting system – installation, operation and life cycle costs of RWH system	**20**
B	**Filed visit** Field visit and survey of existing rainwater harvesting system (case study documentation)	**4**
C	**Any one** 1. Design project: RWH system for a residential building (mini-project work) 2. Design project: RWH system for an institutional/commercial campus	**6**
	Total	**30**

Text Books:

1. S. K. Garg "Rain Water Harvesting" (Khanna Publishers).
2. Garg, S.K. – *Irrigation Engineering and Hydraulic Structures*, Khanna Publishers.
3. Modi, P.N. – *Water Resources Engineering and Hydraulic Structures*, Standard Book House.
4. Agarwal, A. & Narain, S. – *Dying Wisdom: Rise, Fall and Potential of India's Traditional Water Harvesting Systems*, CSE, New Delhi.

Reference Books:

1. Manual on Rainwater Harvesting – Central Public Health and Environmental Engineering Organisation (CPHEEO), Ministry of Urban Development, Govt. of India.
2. Sustainable Urban Water Management Handbook – CRC Press.
3. Handbook on Rainwater Harvesting by SOPAC, South Pacific Applied Geoscience Commission.

IS Code:

1. IS 15797:2008: Roof Top Rainwater Harvesting—Guidelines (Bureau of Indian Standards).
2. National Building Code (NBC) Sections on RWH (for structures and compliance)

e-Resources

1. Central Ground Water Board (CGWB): https://cgwb.gov.in (Guidelines and manuals).
2. Rainwaterharvesting.org: http://rainwaterharvesting.org (Resources, case studies).
3. Urban Water Security Planning Toolkit: https://cwas.org.in/resources/file_manager/module_3-3_1_rwh_guidelines.pdf.cwas
4. Ministry of Jal Shakti: https://nwm.gov.in (Policy, implementation manuals).

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Advanced Concrete Technology (PEC 4)				Code:		BCI27PE49/ BCI28PE49	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge: Concrete Technology

Course Objectives: This course aims to enable students,

1. To provide advanced understanding of hydration, microstructure, admixtures, durability, and performance of concrete.
2. To impart practical skills in mix design, testing, and evaluation of high-performance, sustainable, and special concretes.

Course Outcomes: After learning the course, the students should be able to:

1. Analyze cement hydration products, microstructural development, and evaluate the influence of aggregates, SCMs and admixtures on engineering properties of concrete.
2. Design and proportion of advanced concretes mixes using codes and assess fresh concrete properties.
3. Interpret mechanical and durability performances of concrete using tests on hardened concrete.
4. Assess the behavior of special concretes and propose sustainable solutions for modern construction

Detailed Syllabus

Unit	Description	Duration (H)
1	**Properties of Concrete making materials:** Cement: composition and overview of hydration products, Microstructure characterization of cement paste and significance of Interfacial Transition Zone (ITZ). Aggregates: properties; introduction to use of recycled aggregates and Construction and Demolish (C&D) waste aggregates. Supplementary Cementitious Materials (SCMs): pozzolanic action and influence on strength and durability of concrete. Mechanism of different Chemical admixtures including Viscosity Modifying Agents, setting-retarding admixtures.	08
2	**Advanced mix design and fresh concrete properties:** Mix design philosophies: IS 10262, ACI, particle packing concepts, rheology. Mix proportioning of high performance concrete (HPC), Self compacting concrete(SCC), Fiber reinforced concrete (FRC), Introduction to Ultra high performance Concrete (UHPC) **,** Fresh concrete properties: workability, segregation, bleeding, pumping, plastic shrinkage	07
3	**Hardened Concrete Properties & Durability:** Mechanical properties: strength, stress–strain, modulus, creep, shrinkage. Durability: transport properties, permeability, carbonation, chloride ingress, sulphate & acid attack, Alkali Aggregate Reaction (AAR), freeze-thaw. Corrosion of reinforcement. Introduction to Quality 4.0 in concrete: maturity meter, advance NDT tools, health monitoring tools. Durability tests: RCPT, half-cell potential, sorptivity, water absorption,	08
4	**Special Concrete and Sustainability:** **Special concretes:** Self curing concrete, Self-healing concrete, Nano-modified concrete, 3D-printed concrete, Recycled aggregate concrete performance. **New technologies:** Truck-Mounted Mobile Dry RMC, CO_2 Infused Concrete. Sustainability: use of industrial by-products, Low carbon concrete. Case studies of special concrete like 3D printed structures in India. Role of AI in concrete technology.	07
	Total	30

Self-directed learning: Properties of recycled aggregates and Construction and Demolish (C&D) waste aggregates. Microstructure characterization techniques overview (SEM,XRD), advances in SCM , overview of ASTM/ACI/EURO codes related to concrete materials, Use of sensors and quality 4.0 tools.

Text Books:

1. Concrete Technology by A.M.Neville and J. J. Brooks, Longman/Pearson education, ELBS, ISBN 978-0582031511
2. Concrete Technology by A.R. Santhakumar, 2nd Edition, Oxford University Press,2018.
3. Concrete Technology by M. L. Gambhir, 5th Edition, Tata McGraw-Hill Publication,2013
4. Concrete : Microstructure, Properties and Materials by P. Kumar Mehta, Paulo J. M. Monteiro, 4th Edition, McGraw-Hill Education,2014.

Reference Books:

1. Advanced Concrete Technology (Vol 1-4) by J.B.Newman and B.S.Choo, published by Elsevier/ Butterworth-Heinemann.
2. N. Krishna Raju. N, "Design of Concrete Mixes", 5th Edition, CBS Publisher, ISBN: 9788123924670
3. Fiber Reinforced Cement Composite by P.N.Balguru & P.N.Shah. McGraw Hill Publications, 2009
4. Fiber concrete by Bernhard Wietek publish by Springer, ISBN 978-3-658-34481-8, Edition 12021.
5. Concrete Structures, Repair, Rehabilitation and Retrofitting by J. Bhattacharjee, 1st Edition, CBS Publishers & Distributors Pvt. Ltd,2017.

Reference IS Codes:

1. IS 456 – Plain and Reinforced Concrete – Code of Practice
2. IS 383:2016- Coarse and Fine Aggregate for Concrete Specification
3. IS 10262 – Concrete Mix Proportioning – Guidelines
4. IS 516 – Methods of Tests for Strength of Concrete
5. IS 1199 – Methods of Sampling and Analysis of Concrete
6. IS 13311 – Non-destructive Testing of Concrete (Part 1 & 2)
7. IS 5816 – Splitting Tensile Strength of Concrete
8. IS 3085 – Method of Test for Permeability of Cement Mortar and Concrete
9. IS 14959 – Determination of Water Soluble and Acid Soluble Chlorides in Concrete
10. IS 2386 (Part 1-8)- Testing of aggregates
11. IS 3812 (Part 1 &2) fly ash
12. IS 16416- Self compacting concrete

e-Resources

1. https://nptel.ac.in/courses/105106176
2. **https://nptel.ac.in/courses/105106053**
3. **https://nptel.ac.in/courses/105102012**

Program:	B. Tech. (Civil Engineering)			Semester :			VII/VIII (Scheme A / B)
Course:	Advanced Concrete Technology Lab (PEC 4 Lab)			Code:			BCI27PE50/ BCI28PE50
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge: Concrete Technology

Course Objectives : This course aims to enable students,
To provide hands-on experience in testing, designing, and evaluating advanced concretes such as HPC, SCC, and FRC, along with durability and non-destructive testing methods.

Course Outcomes: After learning the course, the students should be able to:
1. Evaluate laboratory test data for the fresh and hardened properties of special concretes (SCC, FRC, HPC) to confirm their compliance with structural design specifications.
2. Evaluate the in-situ quality and long-term performance of concrete using non-destructive (NDT) and durability-based assessment methods.
3. Analyze the techno-economic viability of advanced concretes by integrating Quality 4.0 tools, cost analysis, and field-based observations.

Detailed Syllabus

Term work consists of following practical's-(Any Seven from Sr.No 1 to 11 and Sr.No12 is compulsory)

1. Review of recent peer‑reviewed research article on advanced concretes (HPC, SCC, FRC, durability, FRP strengthening).
2. Mix design and production of *any one* concrete - Self-Compacting Concrete (SCC), or Fibre Reinforced Concrete (FRC), or High-Performance Concrete (HPC)
3. Workability tests on Self-Compacting Concrete (SCC) (any two tests) -Slump flow, T-50, J-Ring, , V-funnel, Visual Stability Index(VSI); Visual Blocking Index (VBI)
4. Compressive strength test on the any one above produced concrete and comparison with conventional concrete.
5. Flexural strength test on Fibre Reinforced Concrete (FRC).
6. NDT testing using rebound hammer, Ultra-Sonic Pulse velocity (UPV)
7. Demonstration and hands on with *any one* Quality 4.0 tool (Digital QA/QC) tools such as- maturity meter, SCADA, digiQC, digital sieve analysis
8. Sorptivity test or carbonation depth test and water absorption test.
9. Half-cell potential test or Rapid Chloride Penetration Test (RCPT) on concrete.
10. Case study report on Ultra high performance Concrete (UHPC) applications in India.
11. Mix design of any grade/type (manual as well as software) and cost analysis for 1 m^3.
12. Visit to an ongoing construction site to study advanced concretes or a precast yard to study concrete from quality control, testing and durability aspects.

Text Books:

1. Concrete Technology by A.M.Neville and J. J. Brooks, Longman/Pearson education, ELBS, ISBN 978-0582031511
2. Concrete Technology by A.R. Santhakumar, 2nd Edition, Oxford University Press,2018.
3. Concrete Technology by M. L. Gambhir, 5th Edition, Tata McGraw-Hill Publication,2013
4. Concrete : Microstructure, Properties and Materials by P. Kumar Mehta, Paulo J. M. Monteiro, 4th Edition, McGraw-Hill Education,2014.

Reference Books:

1. Advanced Concrete Technology (Vol 1-4) by J.B.Newman and B.S.Choo, published by Elsevier/ Butterworth-Heinemann.
2. N. Krishna Raju. N, "Design of Concrete Mixes", 5th Edition, CBS Publisher, ISBN: 9788123924670
3. Fiber Reinforced Cement Composite by P.N.Balguru & P.N.Shah. McGraw Hill Publications, 2009
4. Fiber concrete by Bernhard Wietek publish by Springer, ISBN 978-3-658-34481-8, Edition 12021.
5. Concrete Structures, Repair, Rehabilitation and Retrofitting by J. Bhattacharjee, 1st Edition, CBS Publishers & Distributors Pvt. Ltd,2017.

Reference IS Codes:

1. IS 456 – Plain and Reinforced Concrete – Code of Practice
2. IS 383:2016- Coarse and Fine Aggregate for Concrete Specification
3. IS 10262 – Concrete Mix Proportioning – Guidelines
4. IS 516 – Methods of Tests for Strength of Concrete
5. IS 1199 – Methods of Sampling and Analysis of Concrete
6. IS 13311 – Non-destructive Testing of Concrete (Part 1 & 2)
7. IS 5816 – Splitting Tensile Strength of Concrete
8. IS 3085 – Method of Test for Permeability of Cement Mortar and Concrete
9. IS 14959 – Determination of Water Soluble and Acid Soluble Chlorides in Concrete
10. IS 2386 (Part 1-8)- Testing of aggregates
11. IS 3812 (Part 1 &2) fly ash
12. IS 16416- Self compacting concrete

e-Resources

1. **https://nptel.ac.in/courses/105106176**
2. **https://nptel.ac.in/courses/105106053**
3. **https://nptel.ac.in/courses/105102012**

Program:	B. Tech. (Civil Engineering)			Semester :		VII/VIII (Scheme A / B)	
Course:	Quality and Safety in Construction (PEC-4)			Code:		BCI27PE51/ BCI28PE51	
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
2	2	-	-	10	10	30	50

Prior Knowledge: Nil

Course Objectives: This course aims to enable students,

1. Apply principles of quality assurance and control, standards, and digital tools to ensure construction quality and compliance with specifications.
2. Analyze and implement safety management systems, risk assessments, and preventive measures to promote safe construction practices and occupational health.

Course Outcomes: After learning the course, the students should be able to:

1. Apply quality management principles, material testing methods, and inspection practices to evaluate construction works.
2. Analyze the effectiveness of quality tools, standards, and digital systems in managing construction quality.
3. Examine safety regulations, hazard identification methods, and risk assessment techniques for various construction activities.
4. Evaluate safety management plans, audits, and incident investigation techniques to recommend improvements in construction safety and health practices.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Fundamentals of Construction Quality Management:** **Importance of Quality in Construction:** Understanding quality, Principles of Quality Assurance (QA) vs. Quality Control (QC),Total Quality Management (TQM) and its applications, Plan-Do-Check-Act (PDCA) cycle and its role in process improvement, **Material Testing and Verification:** Standard procedures for quality control testing of common construction materials, Quality of Materials used for Construction projects, on site quality inspections-document to findings to ensure work conforms to project specifications and standards..	7
2	**Tools, Systems, and Audits for Quality:** **Tools of Quality:** In-depth study and practical application of Cause and Effect Diagrams, Check Sheets, Control Charts, Histograms, Pareto Charts, Scatter Diagrams, and Run Charts, Quality Standards and Systems- An overview of ISO 9001:2015 and its relevance to construction, Quality Management Plans and Manuals, Quality Audits- internal and external quality audits, their purpose, and their execution. **Sampling Techniques and its importance, Digital Quality Management-** The use of technology, such as mobile applications ,software, Artificial Intelligence for quality control and documentation.	8
3	**Construction Safety Management:** **Introduction to Safety Management, Legal and Regulatory Frameworks:** An overview of key safety regulations and standards (e.g., Occupational Safety and Health Administration (OSHA) and local labor laws.) **Safety Performance Measurement, Hazard Identification-** Techniques for identifying and mitigating common hazards in construction, Risk Assessment, Personal Protective Equipment (PPE),Introduction to AI tools used to monitor safety.	7
4	**Safety Management for Construction Projects:** Safety Management Plans**,** Implementing safety strategies for various construction processes (e.g., excavation, working at heights, electrical work etc.), Human Factors in Safety. Incident Investigation and identification root causes, Safety Audits and Inspections,	8

	Behavioral-Based Safety (BBS), Construction Health Issues: Awareness of common health risks (e.g., silica exposure, noise, ergonomics) and preventive measures, psychological safety and worker welfare provisions.	
		Total **30**

Self-Directed Learning: Quality and Safety Management through case studies, preparation of QA/QC and Safety Plans, and study of ISO standards and PDCA cycle, digital tools and AI for monitoring for performance and quality improvement with safety compliance.

Text Books:

1. K.K. Chitkara – Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill.
2. Jha, K.N. – Construction Project Management: Theory and Practice, Pearson Education.
3. Goetsch, D.L., and Davis, S.B. – Quality Management for Organizational Excellence: Introduction to Total Quality, Pearson.
4. R. K. Mishra, Construction Safety, AtibsPublishers, 2011
5. S. Rao – Construction Safety Management, Khanna Publishers.

Reference Books:

1. The construction of buildings; seventh edition, Vol.1 & Vol.2 by R. Barry, Oxford: Blackwell Science.5th Edition (1999) ISBN-13
2. Paul Watson and Tim Howarth, Construction Quality Management, Spon Press, 2011
3. Abdul RazzakRumane – Quality Management in Construction Projects, CRC Press.
4. Jeffery O. Rosnick – Construction Safety & Health, Prentice Hall.
5. James J. O'Brien, Construction Inspection Handbook, Total Quality Management, Springer Science
6. Steve Rowlinson, Construction Safety Management Systems, Taylor & Francis 2003
7. International standards on quality and safety in construction - ISO-9001 Quality Management, ISO-45001 – Occupational Health and Safety.
8. Bureau of Indian Standards (BIS) Codes related to Quality & Safety (Concrete, Steel, Occupational Safety).

e-references:

1. **https://onlinecourses.swayam2.ac.in/nou25_ce12/**

Program:	B. Tech. (Civil Engineering)			Semester :			VII/VIII (Scheme A / B)
Course:	Quality and Safety in Construction Lab (PEC-4 Lab)			Code:			BCI27PE52/ BCI28PE52
	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
Credits	Lecture	Practical	Tutorial	TW	OR	PR	Total
01	-	02	-	25	-	-	25

Prior Knowledge:

1. Building Planning and Construction, Project management and Economics.

Course Objectives : This course aims to enable students,

1. To develop practical skills in applying quality management systems, auditing techniques, safety practices, and problem-solving tools through case studies, reports, and field-based exercises in construction projects.

Course Outcomes: After learning the course, the students should be able to:

1. Apply quality management tools, audits, and manuals to evaluate and improve construction processes.
2. Analyze safety practices, accident investigations, and hazard prevention measures through field visits and case studies to enhance construction safety performance.
3. Develop technical documents, visual aids, and professional presentations to effectively communicate quality protocols and safety risks to diverse construction stakeholders.

Detailed Syllabus

Term work consists of following (any eight)

1. Assignment on financial impact of quality failures in a construction project through case studies.
2. Assignment on the structure and application of a Quality Management System (QMS) for construction projects/company.
3. Assignment on application of the seven basic tools of quality to solve a construction-related problem.
4. Preparation of project specific quality manual considering major activities for two storied building.
5. Preparation of quality audit report for any part of construction project.
6. Prepare detail report on Plan-Do-Check-Act (PDCA) cycle for quality management.
7. Visit to a construction site to study the safety and hazardous activities and their precautions.
8. Prepare a presentation in group of 4 students on safety practices and their implementation on construction project.
9. Prepare an accident investigation report at construction site referring case studies.
10. Prepare a poster to educate construction workers on the risks and preventive measures related to different safety aspects.

Text Books:

1. K.K. Chitkara – Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill.
2. Jha, K.N. – Construction Project Management: Theory and Practice, Pearson Education.
3. Goetsch, D.L., and Davis, S.B. – Quality Management for Organizational Excellence: Introduction to Total Quality, Pearson.
4. R. K. Mishra, Construction Safety, AtibsPublishers, 2011
5. S. Rao – Construction Safety Management, Khanna Publishers.

Reference Books:

1. The construction of buildings; seventh edition, Vol.1 & Vol.2 by R. Barry, Oxford: Blackwell Science.5th Edition (1999) ISBN-13
2. Paul Watson and Tim Howarth, Construction Quality Management, Spon Press, 2011
3. Abdul RazzakRumane – Quality Management in Construction Projects, CRC Press.
4. Jeffery O. Rosnick – Construction Safety & Health, Prentice Hall.
5. James J. O'Brien, Construction Inspection Handbook, Total Quality Management, Springer Science
6. Steve Rowlinson, Construction Safety Management Systems, Taylor & Francis 2003
7. International standards on quality and safety in construction - ISO-9001 Quality Management, ISO-45001 – Occupational Health and Safety.
8. Bureau of Indian Standards (BIS) Codes related to Quality & Safety (Concrete, Steel, Occupational Safety).

Program:	B. Tech. (Civil Engineering)				Semester:		VII/VIII (Scheme A / B)	
Course:	Analysis and Design of Reinforced Concrete Bridges (PEC 4)				Code:		BCI27PE53/ BCI28PE53	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge: Engineering Mechanics, Strength of Materials, Structural Analysis, Design of Reinforced Concrete Structures (IS 456 provisions), Design of Steel Structures.

Course Objectives: This course aims to enable students,

1. To understand the fundamental concepts of bridge engineering, bridge components, and IRC loading standards applicable to RC highway bridges.
2. To develop the ability to analyse and design RC slab bridges, slab culverts, and T-beam decks using standard analytical methods and IRC provisions.
3. To acquire competency in analysing and designing reinforced concrete and prestressed concrete bridge girders with appropriate load distribution methods.
4. To gain knowledge of bridge substructure design, including bearings, piers, and abutments, and to perform necessary stability checks for safe bridge systems.

Course Outcomes: After learning the course, the students should be able to:

1. Identify and classify suitable bridge types, interpret IRC loading standards, and evaluate various loads acting on RC highway bridges.
2. Analyse and design RC slab bridges and slab culverts using effective width concepts and Pigeaud's curves in In accordance with IRC provisions.
3. Analyse and design RC and prestressed concrete bridge girders using Courbon's method and apply relevant IRC/IS code requirements for superstructure design.
4. Design bridge substructure components, including piers, abutments, and bearings, and perform essential stability checks for safe and durable bridge systems.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Bridge Engineering Fundamentals & IRC Loads:** Introduction to bridge engineering, types of bridges, classification based on structural form, choice of bridge type, economic span length, geometric alignment, superstructure philosophy, drainage and road kerb considerations, components of bridges including foundations, IRC loading standards for RC highway bridges, dead loads, live loads (Class AA, 70R, Class A), impact load, wind load, earthquake load, longitudinal forces, centrifugal forces, buoyancy, water current forces, thermal forces.	07
2	**Analysis & Design of RC Slab and Culvert Decks:** Analysis of slab decks for solid slab and cantilever slab, effective width concept, use of Pigeaud's curves, bending moment and shear evaluation for slab decks, design of RC slab bridge, design of slab culvert, design of RC slabs supported on all sides for T-beam and slab decks, reinforcement detailing as per IRC:21 and IRC:112 requirements.	08
3	**Analysis & Design of Girders:** Analysis of bridge girders, load distribution using Courbon's method, analysis of longitudinal and cross girders, design of RC T-beam longitudinal girders, design of cross girders, introduction to prestressing concepts, design considerations for post-tensioned prestressed concrete T-beam bridge decks and girders, cable profiles and stress checks. Introduction to AI-assisted structural analysis and optimization tools for improving girder design efficiency, section selection, and code-based design verification.	08

4	**Design of Substructure & Bearings:** Bearings for bridges, including types, functions, and IRC requirements; elastomeric and other bearing types; design considerations for selecting bearings; types and shapes of piers and abutments; suitability of substructure forms; loads on piers and abutments; design of abutments and piers; stability checks, including sliding, overturning, and bearing pressure; and detailing considerations for substructure components.	**07**
	Total	**30**

Self-Directed Learning: IRC loading interpretation, solved examples of RC slab and culvert design, application of Courbon's method for load distribution, basics of PSC girder behavior, and case studies of bridge substructure design, to reinforce classroom learning and develop independent technical understanding.

Text Books:

1. Principles and Practice of Bridge Engineering, S. P. Bindra, Dhanpat Rai & Sons, New Delhi, 2012
2. Reinforced Concrete Structures – Vol. II, B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications, 2018.

Reference Books:

1. Essentials of Bridge Engineering, D. Johnson Victor, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 6th Edition, 2019
2. Bridge Engineering, S. Ponnuswamy, Tata McGraw-Hill, 2nd Edition, 2015
3. Concrete Bridge Practice, V. K. Raina, Tata McGraw-Hill, 4th Edition, 2014

Reference IS Codes and Specifications:

1. IRC 6: Standard Specifications and Code of Practice for Road Bridges – Section II: Loads and Stresses, Indian Roads Congress, New Delhi, 2017 (Reaffirmed)
2. IRC 21: Standard Specifications and Code of Practice for Road Bridges—Section III: Cement Concrete (Plain and Reinforced), Indian Roads Congress, New Delhi
3. IS 456: Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards, New Delhi, 2000 (Fourth Revision)
4. IRC 112: Code of Practice for Concrete Road Bridges, Indian Roads Congress, New Delhi, 2011
5. IRC 78: Standard Specifications and Code of Practice for Road Bridges—Section VII: Foundations and Substructures, Indian Roads Congress, New Delhi
6. IRC 83 (Part I and II): Bearings for Road Bridges – Specifications, Indian Roads Congress, New Delhi (Elastomeric Bearings & POT–PTFE Bearings)
7. IRC SP-13: Guidelines for the Design of Small Bridges and Culverts, Indian Roads Congress, New Delhi

e-Resources

1. https://onlinecourses.nptel.ac.in/noc22_ce73/preview

Program:	B. Tech. (Civil Engineering)			Semester:			VII/VIII (Scheme A / B)
Course:	Analysis and Design of Reinforced Concrete Bridges Lab (PEC 4 Lab)			Code:			BCI27PE54/ BCI28PE54
	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
Credits	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge:

1. Fundamental understanding of structural analysis and reinforced concrete design, including bending moments, shear forces, load calculations, and IS 456 provisions.
2. Ability to interpret structural drawings and apply RC design principles to beams, slabs, and foundations.

Course Objectives:

1. To develop an understanding of the various loads acting on bridges and to enable students to analyse and design RCC bridge superstructure elements such as deck slabs and girders.
2. To introduce students to the analysis and design of RC bridge substructure components, including piers, abutments, and bearings, through practical design assignments.

Course Outcomes: After learning the course, the students should be able to:

1. Apply IRC code provisions to identify bridge components and compute dead and live loads, including load combinations and impact factors for RC bridges.
2. Analyse and design RC bridge superstructure elements such as slab bridges, slab culverts, T-beam girders, and cross girders using appropriate analytical methods and detailing practices.
3. Analyse and design bridge substructure components including abutments, piers, and bearings, and interpret practical aspects through drawings, software study, and site visits.

Detailed Syllabus

Term work consists of the following (any eight):

1. Introduction to IRC Codes & Bridge Components: Reading IRC:5, 6, 21, 112, Identification of deck, girder, pier, bearing in drawings
2. Dead Load Calculations: Self-weight, wearing coat, parapet load sheet
3. Live Load Calculations: Wheel/axle placement, Load combinations, Impact factor computation
4. Analysis of Slab Bridge (Effective Width Method)
5. Analysis Using Pigeaud's Curves: B.M. and S.F. evaluation
6. Design of RC Slab Bridge: Flexure, shear, reinforcement detailing
7. Design of Slab Culvert
8. Design of Longitudinal Girder (RC T-Beam)
9. Design of Cross Girders
10. Design of Abutment: Loads, stability checks
11. Design of Pier: Moment/shear, reinforcement concepts
12. Site/Industrial Visit & Software Study: Visit to an under-construction or completed bridge, Report preparation

Text Books:

1. Principles and Practice of Bridge Engineering, S. P. Bindra, Dhanpat Rai & Sons, New Delhi, 2012.
2. Reinforced Concrete Structures – Vol. II, B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications, 2018.

Reference Books:

1. Essentials of Bridge Engineering, D. Johnson Victor, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 6th Edition, 2019
2. Bridge Engineering, S. Ponnuswamy, Tata McGraw-Hill, 2nd Edition, 2015
3. Concrete Bridge Practice, V. K. Raina, Tata McGraw-Hill, 4th Edition, 2014

Reference IS Codes and Specifications:

1. IRC 6: Standard Specifications and Code of Practice for Road Bridges – Section II: Loads and Stresses, Indian Roads Congress, New Delhi, 2017 (Reaffirmed)
2. IRC 21: Standard Specifications and Code of Practice for Road Bridges—Section III: Cement Concrete (Plain and Reinforced), Indian Roads Congress, New Delhi
3. IS 456: Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards, New Delhi, 2000 (Fourth Revision)
4. IRC 112: Code of Practice for Concrete Road Bridges, Indian Roads Congress, New Delhi, 2011
5. IRC 78: Standard Specifications and Code of Practice for Road Bridges—Section VII: Foundations and Substructures, Indian Roads Congress, New Delhi
6. IRC 83 (Part I and II): Bearings for Road Bridges – Specifications, Indian Roads Congress, New Delhi (Elastomeric Bearings & POT–PTFE Bearings)
7. IRC SP-13: Guidelines for the Design of Small Bridges and Culverts, Indian Roads Congress, New Delhi

e-Resources

1. https://onlinecourses.nptel.ac.in/noc22_ce73/preview

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Railway, Airport, Dock and Harbour Engineering (PEC 4)				Code:		BCI27PE55/ BCI28PE55	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge:
1. Basics of Civil & Environmental Engineering
2. Transportation Engineering fundamentals (Highways & Traffic)

Course Objectives: This course aims at enabling students,
1. To impart fundamental knowledge of railway, airport, dock, and harbour engineering
2. To develop the ability to design and analyze railway track geometry

Course Outcomes: After learning the course, the students should be able to:
1. Identify the components of a railway track system and their functions.
2. Apply geometric design principles to railway track alignment, curves, gradients, stations, yards.
3. Apply the principles of airport planning, runway, and airport capacity analysis
4. Interpret site selection criteria, layout, and construction aspects of docks, harbours, breakwaters, shore protection works.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Railway Engineering – Track & Components:** Introduction to Railway Engineering and Requirements of an Ideal Permanent Way. Gauges of Railway Track in India and Load Transfer Mechanism. Components of Track: Rails, Sleepers, Ballast and Formation. Rail Sections, Forces acting on the Rail, Rail Wear, Rail Welding, Buckling of Rails. Sleepers: Functions, Types, Spacing and Density. Ballast: Functions, Characteristics and Specifications. Track Fastenings and Elastic Fastenings. AI-Driven Railway Automation: Autonomous Trains, Traffic Management, Safety Enhancements.	7
2	**Railway Engineering – Layout & Design :** Geometric Design of Railway Track: Speed, Curves, Cant, Transition Curves, Vertical Curves and Gradients. Coning of Wheels and adzing of sleepers. Points and Crossings – Turnouts, Switches, Crossings and Junctions. Station & Yard Layouts – Types of Stations, Yards and Equipment. Train Resistance, Hauling Capacity, Tractive Effort and Power of Locomotives. Signals and Interlocking – Classification and Principles.	8
3	**Airport Engineering:** Introduction to Airports and Aircraft Characteristics affecting Design. Airport Site Selection and Surveys. Runway Orientation and Wind Rose Analysis. Runway Length – Basic Runway Length and Corrections for Elevation, Temperature and Gradient. Rapid Exit Taxiways (RET).Sustainability aspects in airport planning. Runway Geometric Design and Airport Classification. Airport Capacity: Runway and Taxiway.	8
4	**Dock & Harbour Engineering** : Introduction to Ports, Dry port, Harbours and Docks. Site Selection and Layout of Harbours. Breakwaters: Types and Forces Acting on Them. Tides, Littoral Drift and Shore Protection Works. Wet Docks and Dry Docks – Types, Operations and Shapes.	7
	Total	**30**

Self-directed learning: Introduction to the role of Artificial Intelligence in transportation. Key challenges addressed by AI in traffic engineering, safety, and infrastructure planning. Applications in autonomous vehicles and intelligent traffic management. Recent advancements in AI-driven transportation system design and decision-making, with brief exposure to Intelligent Transportation Systems (ITS) and Multimodal Integration.

Text Books:

1. Railway Engineering- Satish Chandra, M.M. Agarwal , Oxford Publishing House, Second Edition (2013)
2. S.C.Saxena And S.P. Arora, A Text Book of Railway Engineering, Dhanpat Rai Sons, New Delhi (2015)
3. S.C. Saxena, Tunnel Engineering, Dhanpat Rai & Sons, New Delhi
4. S.C. Rangwala, K.S. Rangwala and P.S. Rangwala, Principles of Railway Engineering, Charotar Publishing House,Anand, 27th Edition (2017)
5. Airport planning and Design – S.K. Khanna , M.G. Arora , S.S. Jain, Nem Chand and Brothers, Roorkee, 6th Edition (2019)
6. Airport Engineering by Rangwala, Charotar Publication, 17th Edition (2019)
7. Harbor, Dock and Tunnel Engineering- R Srinivasan, Charotar publishing House, Anand 388001 (2022)

Reference Books:

1. Railway Bridge and Tunnel Engineering., Ketki B. Dalal and Rangwala, Charotar Publication; 3rd Edition (3 April 2021)
2. Railway Track Engineering., J.S. Mundrey, Tata McGraw Hill. 4Th Edition (2009).
3. Ashford, N., and P. H. Wright.Airport Engineering., New York: John Wiley & Sons, 3rd ed. (1992).
4. Airport Engineering.,Saxena S.C, CBS Publishers & Distributors, (2017)
5. Dock &Harbour Engineering., Hasmukh P. Oza & Gautam H. Oza, Charotar Publishing House Pvt. Ltd.; 8th Edition (1 January 2017)
6. Tunnel Engineering Handbook., John O. Bickel, Thomas R. Kuesel, Krieger Publishing Company (1991).
7. Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels., Venkatramaiah. C., Universities Press (India) Private Limited, Hyderabad, 2015.
8. Railway Track Engineering., Mundrey J S, McGraw Hill Education (India) Private Ltd, New Delhi, 2013

Standard Codes / Manuals:

1. Indian Railways Works Manual (IRWM). https://indianrailways.gov.in/railwayboard/uploads/codesmanual/IRWM/worksmanualCh4.htm
2. Indian Railways Permanent Way Manual (IRPWM) https://www.iricen.gov.in/iricen/Track_Manuals/IRPWM%202024%20Corrected%20Up%20To%20ACS%20-%205%20(17.06.25).pdf

e-Resources

1. https://ocw.nnit.edu/courses/l -221 i-transportation-systems•fall-2004 (MIT- Opencourseware)
2. ww.icevirtuallibrary.com

Program:	B. Tech. (Civil Engineering)			Semester :	VII/VIII (Scheme A / B)		
Course:	Railway, Airport, Dock and Harbour Engineering Lab (PEC 4 Lab)			Code:	BCI27PE56/ BCI28PE56		
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Course Objectives:

1. Impart fundamental knowledge of railway, airport, dock, and harbour engineering, including components, layout, and operational principles.
2. Develop the ability to design, analyze, and plan transportation infrastructure, including railway track geometry, airport runways, and harbour layouts.

Course Outcomes: After learning the course, the students should be able to:

1. Analyze railway gauges, track components, and geometric design elements.
2. Apply airport site selection, runway design, and capacity analysis methods.
3. Develop harbour layouts and evaluate coastal and breakwater design aspects.

Detailed Syllabus

Lab assignments (Complete any Eight)

1. Prepare a short report comparing Broad, Metre, and Narrow gauges of Indian Railways, including their advantages, disadvantages, key differences, and the load transfer mechanism for each gauge.
2. Analyze the function and specifications of ballast and sleepers. Prepare a design table showing appropriate sleeper spacing and ballast depth for different track types.
3. Design a horizontal curve for a railway track with given design speed and cant. Include superelevation and transition curve calculations.
4. Prepare a report on different types of railway turnouts and crossings, including points, switches, and junctions, with sketches and design considerations.
5. A review of loading conditions for railway track structures due to train and track vertical interaction.
6. Conduct a site selection analysis for a hypothetical airport in a region. Include wind rose, runway orientation, and environmental constraints.
7. Calculate the basic runway length for a given aircraft type, and apply corrections for elevation, temperature, and gradient.
8. Analyze airport capacity using runway and taxiway data for peak hour operations. Recommend measures to improve efficiency.
9. Prepare a layout plan for a small harbour, including wet and dry dock arrangements.
10. Analyze the forces acting on a breakwater in a coastal location. Discuss design considerations for littoral drift and tidal variations.
11. Conduct a case study on an existing Harbour project (local or international). Include design, construction method, challenges faced, and lessons learned.
12. Conduct a case study on an existing Dock project (local or international). Include design, construction method, challenges faced, and lessons learned.
13. Site visit to any railway station or railway yard or harbour or airport.

Text Books:

1. Railway Engineering. Satish Chandra, M.M. Agarwal , Oxford Publishing House, Second Edition (2013).
2. A Text Book of Railway Engineering, S.C.Saxena And S.P. Arora, DhanpatRai Sons, New Delhi (2015).
3. Principles of Railway Engineering., S.C. Rangwala, K.S. Rangwala and P.S. Rangwala, Charotar Publishing House,Anand, 27th Edition (2017)
4. Airport planning and Design., S.K. Khanna , M.G. Arora , S.S. Jain, Nem Chand and Brothers, Roorkee, 6th Edition (2019)
5. Airport Engineering., Rangwala, Charotar Publication, 17th Edition (2019)
6. Harbor, Dock and Tunnel Engineering., R Srinivasan, Charotar publishing House, Anand 388001 (2022)

Reference Books:

1. Railway Bridge and Tunnel Engineering., Ketki B. Dalal and Rangwala, Charotar Publication; 3rd Edition (3 April 2021)
2. Railway Track Engineering., J.S. Mundrey, Tata McGraw Hill. 4Th Edition (2009).
3. Ashford, N., and P. H. Wright.Airport Engineering., New York: John Wiley & Sons, 3rd ed. (1992).
4. Airport Engineering.,Saxena S.C, CBS Publishers & Distributors, (2017)
5. Dock & Harbour Engineering., Hasmukh P. Oza & Gautam H. Oza, Charotar Publishing House Pvt. Ltd.; 8th Edition (1 January 2017)
6. Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels., Venkatramaiah. C., Universities Press (India) Private Limited, Hyderabad, 2015.
7. Railway Track Engineering., Mundrey J S, McGraw Hill Education (India) Private Ltd, New Delhi, 2013

e-Resources

1. https://ocw.nnit.edu/courses/l -221 i-transportation-systems•fall-2004 (MIT- Opencourseware)
2. ww.icevirtuallibrary.com

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Construction and Demolition Waste Management (PEC 5)				Code:		BCI27PE60/ BCI28PE60	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge: Basic understanding of environmental engineering principles and solid waste management. Familiarity with construction materials, building codes, and regulatory environment for civil engineering projects. Awareness of circular economy principles and environmental impact assessment practices. Ability to interpret government guidelines, standards, and technical documentation.

Course Objectives: This course aims to enable students,

1. To introduce the types, sources, and environmental impacts of construction and demolition (C&D) waste, including the national and global context.
2. To impart knowledge of policies, regulations, and codes governing the management and recycling of C&D waste in India.
3. To familiarize students with technological and operational practices for efficient collection, transportation, recycling, and resource recovery/ material of C&D waste.
4. To develop proficiency in sustainable resource recovery, life cycle management, and best practices through analysis of case studies.

Course Outcomes: After learning the course, the students should be able to:

1. Identify and classify various types of C&D wastes and evaluate their environmental and socio-economic impacts.
2. Interpret and apply relevant policies, IS codes, and regulatory frameworks for safe C&D waste management.
3. Demonstrate technical competence in selecting, designing, and managing processes and technologies used in C&D waste treatment.
4. Evaluate and recommend sustainable, resource-efficient, and circular approaches for C&D waste handling based on practical examples.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Introduction to Construction and Demolition (C&D) Waste** Sources and types of C&D waste: definitions, classification, and composition, Quantities and characteristics of waste from construction, repair, remodeling, and demolition activities, Environmental and socio-economic impacts of C&D waste generation, Overview of global and Indian scenario for C&D waste generation and management.	07
2	**Policies, Rules, and Codes** Construction and Demolition Waste Management Rules, 2016 and latest updates (2025),IS codes and specifications relevant to C&D waste management (including IS 383 and IS 4130), Guidelines from Central and State Pollution Control Boards, Legal obligations and compliance; roles of stakeholders, including bulk waste generators and local authorities.	08
3	**Technologies and Practices for C&D Waste Management** Collection, segregation, storage, and transportation of C&D waste, Processing methods: crushing, screening, sorting, and recycling technologies, Recovery and reuse of building components; recycled aggregates and products, Operation and management of C&D waste processing facilities, environmental monitoring of the CDW plants and the sites, case studies of Indian cities.	07
4	**Resource Recovery, Sustainable Management, and Case Studies** Sustainable practices: waste minimization, reuse, and recycling, Circular economy and life cycle approach for C&D waste, Market for recycled products and barriers to adoption, Successful case studies and best practices from India and worldwide; challenges and future trends	08

Total	**30**

Self-directed learning: Policy frameworks and regulatory compliance for mandatory use of recycled C&D materials in construction projects, Smart monitoring and digital tracking systems for C&D waste generation, transportation, and disposal. Integration of circular economy models for reduction, reuse, and resource recovery in the construction sector, use of C& D Waste in Road construction.

Text Books:

1. Dr. S.K. Singh & Dr. A.K. Jain "Sustainable Construction and Demolition Waste Management in India" .

Reference Books:

1. Erik K. Lauritzen "Construction, Demolition and Disaster Waste Management: An Integrated and Sustainable Approach" by (Taylor & Francis Group, 2018).
2. F Pacheco-Torgal "Advances in Construction and Demolition Waste Recycling" edited by (Elsevier, 2020).

e-Resources

1. https://cpcb.nic.in/displaypdf.php?id=d2FzdGUvQyZEX3J1bGVzXzIwMTYucGRm
2. https://cpcb.nic.in/uploads/hwmd/C&D_rules_2025.pdf
3. https://cpcb.nic.in/openpdffile.php?id=UmVwb3J0RmlsZXMvNTUyXzE1MTEyNjQwMTVfbWVkaWFwaG90bzQ2OTAucGRm
4. https://cpcb.nic.in/openpdffile.php?id=UmVwb3J0RmlsZXMvNTYxXzE1MTE5MzMzNzJfbWVkaWFwaG90bzEyNjcxLnBkZg==

IS Code

1. IS 383: Specification for Coarse and Fine Aggregates from Natural Sources for Concrete (including recycled aggregates section).
2. IS 4130: Safety code for Demolition of Buildings.
3. Construction and Demolition Waste Management Rules, 2016 (latest amendments 2025).

Program:	B. Tech. (Civil Engineering)			Semester :	VII/VIII (Scheme A / B)		
Course:	Construction and Demolition Waste Management Lab (PEC 5 Lab)			Code:	BCI27PE61/ BCI28PE61		
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge: Fundamentals of material testing and solid waste management. Basics of construction technology, building materials, and geotechnical engineering. Ability to follow laboratory protocols and safety procedures.

Course Objectives :

1. To introduce sampling and characterization techniques for construction and demolition (C&D) waste.
2. To familiarize students with laboratory procedures for assessing properties and reuse potential of recycled C&D materials.
3. To enable hands-on evaluation of recycled concrete aggregates in construction applications through standardized laboratory testing.
4. To develop analytical and technical reporting skills pertinent to sustainable C&D waste management

Course Outcomes: After learning the course, the students should be able to:

1. Identify, classify, and quantify construction and demolition waste materials and demonstrate laboratory sampling and preparation techniques through practical exercises.
2. Analyze and interpret fundamental physical and mechanical properties of recycled C&D waste aggregates via standard laboratory tests such as sieve analysis, specific gravity, water absorption, and crushing/impact value.
3. Evaluate the suitability of C&D waste-derived materials for concrete and geotechnical applications using mix design, workability, compaction, and compressive strength tests.
4. Assess leachate potential and sustainability issues of C&D waste, and synthesize laboratory findings into technical reports and recommendations for waste reuse and recycling.

Detailed Syllabus

Term work consists of

List of Laboratory Experiments: (Any Seven practical's from 1 to 10 and Sr.No.11 compulsory)

1. Collection and visual classification of C&D waste samples.
2. Preparation, sampling, and storage protocols for laboratory testing.
3. Sieve analysis/particle size distribution of recycled aggregates.
4. Determination of specific gravity and water absorption.
5. Aggregate crushing value and impact value tests.
6. Mix design and compressive strength test on recycled aggregate concrete.
7. Slump test/workability investigation for recycled aggregate mixtures.
8. Standard or modified proctor compaction test on C&D waste aggregates for use in fills/subgrades.
9. Leachate analysis and basic contaminants screening (pH, heavy metals, etc.).
10. Technical report writing—data interpretation, life cycle perspective, recommendations for recycling/reuse.

    Detailed Project Report

11. Visit to Construction and Demolition Resource Facility Center & its detailed report.Report should include 1. Material balances, 2. energy required, 3. Basic CBA to get an idea of the profitability.

Text Books:

1. Dr. S.K. Singh & Dr. A.K. Jain "Sustainable Construction and Demolition Waste Management in India"

Reference Books:

1. Erik K. Lauritzen “Construction, Demolition and Disaster Waste Management: An Integrated and Sustainable Approach” by (Taylor & Francis Group, 2018).
2. F Pacheco-Torgal "Advances in Construction and Demolition Waste Recycling," edited by (Elsevier, 2020)

Codes:

1. IS 383: Specification for Coarse and Fine Aggregates from Natural Sources for Concrete (including recycled aggregates section).
2. IS 4130: Safety code for Demolition of Buildings.
3. Construction and Demolition Waste Management Rules, 2016 (latest amendments 2025).

e-Resources

1. https://cpcb.nic.in/displaypdf.php?id=d2FzdGUvQyZEX3J1bGVzXzIwMTYucGRm
2. https://cpcb.nic.in/uploads/hwmd/C&D_rules_2025.pdf
3. https://cpcb.nic.in/openpdffile.php?id=UmVwb3J0RmlsZXMvNTUyXzE1MTEyNjQwMTVfbWVkaWFwaG90bzQ2OTAucGRm
4. https://cpcb.nic.in/openpdffile.php?id=UmVwb3J0RmlsZXMvNTYxXzE1MTE5MzMzNzJfbWVkaWFwaG90bzEyNjcxLnBkZg==

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Disaster Management (PEC 5)				Code:		BCI27PE62/ BCI28PE62	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge:
1. Basic understanding of environmental studies
2. Hydrology and Water Resource Engineering

Course Objectives: This course aims at enabling students,
1. To provide basic conceptual understanding of disasters.
2. To understand approaches of Disaster Management
3. To build skills to respond to disaster

Course Outcomes: After learning the course, the students should be able to:
1. Illustrate about concepts of disaster management and types of disasters
2. Investigate the Vulnerability profile of India & legal framework in India
3. Discuss about early warning systems for disaster risk reductions
4. Describe the policy and programmers for disaster risk reductions in India

Detailed Syllabus

Unit	Description	Duration (H)
1	**Introduction to Disaster Management:** Hazards and Disasters, Risk and Vulnerability in Disasters, Natural and Man-made disasters, earthquakes, floods, drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. Man-made disasters: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.	07
2	**Study of Important Disasters:** Earthquakes and its types, magnitude and intensity, seismic zones of India, major fault systems of India plate, flood types and its management, drought types and its management, landside and its management case studies of disasters in Sikkim (e.g) Earthquakes, Landside). Social Economics and Environmental impact of disasters.	07
3	**Mitigation and Management techniques of Disaster :** Basic principles of disaster management, Disaster Management cycle, Disaster management policy, National and State Bodies for Disaster Management, Early Warming Systems, Building design and construction in highly seismic zones, retrofitting of buildings. Role of technology and AI in Disaster Management.	09
4	**Improvement and Adaptation Strategies for water management:** Scale dependent vulnerability-local, regional, global; Vulnerability assessment and adaptation framework – all intra-national governance levels, transboundary water resources; critical knowledge gaps Importance of IWRM for adaptation; Integrated drought management; Potential water resource conflicts, Implications for policy and sustainable development; Risk management	07
	Total	30

Self- directed learning:
Community-Based Disaster Risk Reduction, Psychosocial Impacts and Mental Health in Disaster Situations, Post-Disaster Rehabilitation and Reconstruction, Sustainable Urban Planning for Disaster Resilience

Text Books:

1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
2. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.
3. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
4. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
5. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.
6.H.K.Guptha, ―Disaster management‖, 2nd Edition, University Press, 2001.
7. R. B. Singh (Ed),―Disaster Management‖, Rawat Publication, New Delhi, 2000.

Reference Books:

1. S. Seetharaman, ―Construction Engineering and Management‖, 4th Edition, Umesh publications, New Delhi, 1999
2. Gupta, M.C., ―Manuals on Natural Disaster management in India‖, National Centre for Disaster Management, IIPA, New Delhi, 2002.
3. Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009-2012).

e-Resources

1. https://www.undrr.org/our-work/training
2. https://nidm.gov.in/online.asp
3. https://ndma.gov.in
4. https://nidm.gov.in/

Program:	B. Tech. (Civil Engineering)			Semester :		VII/VIII (Scheme A / B)	
Course:	Disaster Management Lab (PEC 5 Lab)			Code:		BCI27PE63/ BCI28PE63	
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge: Fundamentals of Hydrology and Water Resources Engineering

Course Objectives :

1. To impart knowledge of concepts of Disaster Management and types of disasters
2. To provide knowledge of vulnerability, early warning system and rescue operation during disaster

Course Outcomes: After learning the course, the students should be able to:

1. Analyze disaster management concepts and preparedness strategies
2. Apply science, technology, and policies in disaster risk reduction
3. Evaluate community roles and participatory methods in disaster recovery

Detailed Syllabus

Term work consists of a journal containing details of assignments : (Any Eight)

1. Write a report on concept and significance of Disaster Preparedness
2. Digital poster on applications of Science and Technology in disaster risk reduction (Group activity)
3. Presentation on Remote Sensing Application in Disaster Management
4. Simulation Exercise/Mock drill on Cyclone Early Warning System
5. Role-play / Panel discussion on role of media in disaster Recovery and Management.
6. Assignment on Importance of National Policy on Disaster Management
7. Assignment on case study pertaining to Disaster Risk Assessment in India.
8. Assignment on significance of Participatory Rural Appraisal in Disaster Management.
9. Community Survey Design for Disaster Risk Management Activities, based on questionnaire or checklist that could be used in rural communities
10. Debate on Disaster Management Act in India: Merits and demerits

Text Books:

1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
2. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.
3. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role ofEnvironmental Knowledge, Narosa Publishing House, Delhi.
4. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
5. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.
6. H.K.Guptha, ―Disaster management‖, 2nd Edition, University Press, 2001.
7. R. B. Singh (Ed),―Disaster Management‖, Rawat Publication, New Delhi, 2000.

Reference Books:

1. S. Seetharaman, ―Construction Engineering and Management‖, 4th Edition, Umesh publications, New Delhi, 1999
2. Gupta, M.C., ―Manuals on Natural Disaster management in India‖, National Centre for Disaster Management, IIPA, New Delhi, 2002.
3. Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009-2012).

e-Resources

1. https://www.undrr.org/our-work/training
2. https://nidm.gov.in/online.asp

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Advanced Water Treatment (PEC 5)				Code:		BCI27PE64/ BCI28PE64	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
02	02	-	-	01	10	10	30	50

Prior Knowledge:
Basic Environmental Engineering
Principles of conventional water and wastewater treatment
Chemistry fundamentals (water quality parameters, reactions)

Course Objectives: This course aims to enable students,
1. To impart knowledge on advanced physical, chemical, and biological water treatment processes.
2. To understand design and operational aspects of advanced water treatment technologies.
3. To familiarize students with standards, emerging contaminants, and sustainability issues in water treatment.
4. To enable the selection of appropriate advanced treatment systems for various water qualities.

Course Outcomes: After learning the course, the students should be able to:
1. Explain advanced unit operations in water treatment and assess process suitability.
2. Analyze, design, and evaluate advanced water treatment systems for specific contaminants.
3. Apply relevant national and international water quality standards in engineering design.
4. Critically assess sustainability, operational, and troubleshooting issues in advanced water treatment.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Fundamentals of Advanced Water Treatment** Review of conventional treatment and its limitations, Overview of advanced treatment processes: necessity, Per-and Polyfluoroalkyl Substances (PFAS) and other emerging micropollutants. scope, historical evolution, Water quality goals, emerging contaminants, and case studies, Regulations: BIS IS 10500:2012, WHO, ISO, CPCB norms, and design implications	07
2	**Advanced Physical and Chemical Treatment Processes** Coagulation, flocculation with advanced/alternative coagulants (e.g., polymers, green coagulants), Granular and membrane filtration: rapid sand, pressure filters, micro- and ultra-filtration, Adsorption (activated carbon, advanced adsorbents): isotherms, kinetics, design, Advanced oxidation processes: ozonation, UV, Fenton reactions	08
3	**Membrane and Ion Exchange Processes** Principles, types, and design of membranes: microfiltration, ultrafiltration, nanofiltration, reverse osmosis (RO), electrodialysis, Fouling, scaling, cleaning protocols, operational issues, Ion exchange resins/process design for specific pollutants, Hybrid systems and applications in desalination/water reuse	07
4	**Disinfection, Residuals Management, Sustainability** Advanced disinfection options: UV, ozone, emerging techniques; theory and practice, Byproduct formation, microbial risk, multiple barrier approach, Residuals/sludge management, minimization, recovery, and safe disposal, Sustainability-Life Cycle Assessment (LCA) concepts, energy, circular economy, future trends in advanced water treatment, concepts of SCADA systems, IoT sensors, and AI-based monitoring	08
	Total	30

Self-directed learning: Fundamentals of adsorption, absorption, filtration, types of filtration, mass balance, kinetics, mechanism of disinfection

Text Books:
1. Metcalf and Eddy, Wastewater Engineering: Treatment, and Reuse , Tata McGraw Hill
2. R. Rajagopal, Membrane and Advanced Water Treatment Technologies.

Reference Books:

1. Wesley Eckenfelder, Physicochemical Processes for Water Quality Control by Wiley-Interscience
2. Water Treatment: Principles and Design by MWH, John C. Crittenden, R. Rhodes Trussell, David W. Hand, Kerry J. Howe, George Tchobanoglous by John Wiley & Sons
3. Advanced Oxidation Processes for Water and Wastewater Treatment by Simon Parson by IWA Publishing.

e-Resources

1. Bureau of Indian Standards (BIS): https://www.bis.gov.in
2. Central Pollution Control Board (CPCB): https://cpcb.nic.in
3. United States EPA – Water Research: https://www.epa.gov/water-research
4. WHO Water Quality Guidelines: https://www.who.int/water_sanitation_health

Program:	B. Tech. (Civil Engineering)			Semester :			VII/VIII (Scheme A / B)
Course:	Advanced Water Treatment Lab (PEC 5 Lab)			Code:			BCI27PE65/ BCI28PE65
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	PR	OR	Total
01	-	02	-	25	-	-	25

Prior Knowledge:

1. Basic laboratory techniques in environmental and water engineering.
2. Working principles of conventional water and wastewater treatment processes.
3. Chemical and instrumental analysis techniques for water quality.

Course Objectives: This course aims to enable students,

1. To impart hands-on experience with advanced water treatment technologies and methods.
2. To enable practical understanding of design, operation, and troubleshooting in advanced treatment processes.
3. To develop skills in the application of relevant standards and best practices in laboratory assessment for water quality.

Course Outcomes: After learning the course, the students should be able to:

1. Demonstrate proficiency with advanced laboratory apparatus and procedures for water treatment.
2. Analyze experimental data to evaluate the efficiency of various advanced water treatment processes.
3. Recommend suitable advanced treatment methods for different water quality scenarios.
4. Apply IS and international standards in reporting and interpreting water treatment experimental results.

Detailed Syllabus

Unit	Description	Duration (H)
A	**Any four experiments** 1. Determination of pH, turbidity, conductivity and TDS in water samples. 2. Jar test for optimum coagulant and polymer dosage (conventional and advanced coagulants). 3. Membrane filtration (microfiltration and ultrafiltration): flux, rejection, and fouling studies. 4. Evaluation of activated carbon filter for color/odor/taste removal 5. Assessment of reverse osmosis (RO) process for desalination 6. Determination of nitrate and phosphate removal using ion-exchange resin 7. Sludge characterization and management from advanced treatment residuals 8. Experiment on Advanced Oxidation Processes (AOPs) such as UV/H_2O_2 or Ozonation. 9. Lab safety protocols, chemical handling, and environmental compliance.	12
B	Visit to water treatment plant and its report writing.	04
C	Visit to the wastewater treatment plant and its report writing. demonstration on membrane fouling and cleaning	04
D	Mini project design on a water treatment plant for any industry. to analyze cost and energy implications of various treatment options Introduce Excel-based analysis, Python scripting, or statistical software for lab data interpretation.	10
	Total	**30**

Text Books:

1. Wastewater Engineering: Treatment and Reuse – Metcalf & Eddy (Inc.); George Tchobanoglous, Franklin L. Burton & H. David Stensel (eds.). McGraw-Hill, 4th Edition, 2003.
2. Membrane and Advanced Water Treatment Technologies – R. Rajagopal.

Reference Books:

1. Wesley Eckenfelder, Physicochemical Processes for Water Quality Control by Wiley-Interscience
2. Water Treatment: Principles and Design by MWH, John C. Crittenden, R. Rhodes Trussell, David W. Hand, Kerry J. Howe, George Tchobanoglous by John Wiley & Sons
3. Advanced Oxidation Processes for Water and Wastewater Treatment by Simon Parson by IWA Publishing

e-Resources

1. Bureau of Indian Standards (BIS): https://www.bis.gov.in
2. Central Pollution Control Board (CPCB): https://cpcb.nic.in
3. United States EPA – Water Research: https://www.epa.gov/water-research
4. WHO Water Quality Guidelines: https://www.who.int/water_sanitation_health

Program:	B. Tech. (Civil Engineering)			Semester :		VII/VIII (Scheme A / B)	
Course:	Software Modeling of Hydrological Events (PEC 5)			Code:		BCI27PE66/ BCI28PE66	
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
2	2	-	-	10	10	30	50

Prior Knowledge:
1. Basic Hydrology
2. Fluid Mechanics & Hydraulics
3. Computer Skills

Course Objectives: This course aims at enabling students,
1. To introduce the fundamentals of the hydrological cycle and modeling approaches.
2. To explain rainfall–runoff processes and methods for runoff estimation.
3. To familiarize students with hydrological software tools and data requirements.
4. To develop understanding of flood modeling techniques in urban and rural areas.

Course Outcomes: After learning the course, the students should be able to:
1. Describe hydrological processes and classify hydrological models.
2. Apply rainfall–runoff methods such as SCS-CN and unit hydrograph.
3. Set up basic watershed models using software like SWMM/HEC-HMS.
4. Simulate flood hydrographs, apply routing methods, and interpret case studies.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Fundamentals of Hydrological Modeling** Introduction to hydrological cycle and processes (precipitation, infiltration, evapotranspiration, runoff, groundwater flow). Deterministic vs. stochastic models, lumped vs. distributed models. Conceptual, empirical, and physical models of hydrology. Role of mathematical equations in hydrological simulations.	8
2	**Rainfall–Runoff Modeling Approaches** Rainfall data input and pre-processing (time series, spatial variability). Runoff generation concepts (infiltration models, SCS-CN method). Unit hydrograph theory and applications. Event-based vs. continuous simulation approaches.	7
3	**Introduction to Hydrological Software Tools** Overview of popular hydrological software: SWMM, HEC-HMS, MIKE SHE, WEAP. Data requirements, input formats, and pre-processing in modeling tools. Model setup: watershed delineation, catchment parameters, boundary conditions. Hands-on orientation (demonstration-based).	8
4	**Urban and Rural Flood Modeling** Storm-water drainage systems. Flood hydrographs and flood routing (Muskingum, kinematic wave models). Floodplain modeling and inundation mapping (Case Studies). Applications in urban flood risk management (Case Studies).	7
	Total	**30**

Self-Directed Learning: Modelling Approaches, Case Studies

Text Books:

1. Subramanya, K. – Engineering Hydrology (Tata McGraw-Hill, 2013).
2. Singh, V. P., & Woolhiser, D. A. – Mathematical Modeling of Watershed Hydrology (Springer, 2002).
3. Guo, J. C. Y. – Urban Hydrology and Hydraulic Design (Water Resources Publications, 2006).
4. USACE – HEC-HMS Hydrologic Modeling System Technical Reference Manual (US Army Corps of Engineers, 2016).

Reference Books:

1. Bedient, P. B., Huber, W. C., & Vieux, B. E. – Hydrology and Floodplain Analysis (Pearson, 2012).
2. Shaw, E. M., Beven, K. J., Chappell, N. A., & Lamb, R. – Hydrology in Practice (CRC Press, 2011).
3. Anderson, M. P., Woessner, W. W., & Hunt, R. J. – Applied Groundwater Modeling: Simulation of Flow and Advective Transport (Academic Press, 2015).
4. Chow, V. T., Maidment, D. R., & Mays, L. W. – Applied Hydrology (McGraw-Hill, 2010).

e-Resources

1. NPTEL – Hydrology and Water Resources Engineering Video Lectures (IIT Kharagpur/IIT Roorkee). Available at: https://nptel.ac.in/courses/105105110
2. UNESCO – International Hydrological Programme (IHP) Resources on Hydrological Modelling and Climate Change. Available at: https://en.unesco.org/themes/water-security/hydrology

Program:	B. Tech. (Civil Engineering)			Semester :			VII/VIII (Scheme A / B)
Course:	Software Modeling of Hydrological Events Lab (PEC 5 Lab)			Code:			BCI27PE67/ BCI28PE67
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge: Nil

Course Objectives :

1. Develop skills in setting up, running, and analyzing hydrological models using software tools.
2. Gain practical experience in simulating hydrological processes under various conditions.

Course Outcomes: After learning the course, the students should be able to:

1. Apply hydrological software to model and analyze real-world hydrological events.
2. Interpret simulation results to assess floods, droughts, and water availability, and propose practical water management solutions.

Detailed Syllabus

Term work consists of (any Two from each A, B, and C):

A. SWMM Modeling

1. Model Development
2. Model Parameterization
3. Model Simulation

B. HEC HMS Modeling

1. Model Development
2. Model Parameterization
3. Basin Model Simulation

C. HEC RAS Modeling

1. Model Development
2. Model Parameterization
3. Model Simulation

Text Books:

1. Subramanya, K. – Engineering Hydrology (Tata McGraw-Hill, 2013).
2. Singh, V. P., & Woolhiser, D. A. – Mathematical Modeling of Watershed Hydrology (Springer, 2002).
3. Guo, J. C. Y. – Urban Hydrology and Hydraulic Design (Water Resources Publications, 2006).
4. USACE – HEC-HMS Hydrologic Modeling System Technical Reference Manual (US Army Corps of Engineers, 2016).

Reference Books:

1. Bedient, P. B., Huber, W. C., & Vieux, B. E. – Hydrology and Floodplain Analysis (Pearson, 2012).
2. Shaw, E. M., Beven, K. J., Chappell, N. A., & Lamb, R. – Hydrology in Practice (CRC Press, 2011).
3. Anderson, M. P., Woessner, W. W., & Hunt, R. J. – Applied Groundwater Modeling: Simulation of Flow and Advective Transport (Academic Press, 2015).
4. Chow, V. T., Maidment, D. R., & Mays, L. W. – Applied Hydrology (McGraw-Hill, 2010).

e-Resources

1. NPTEL – Hydrology and Water Resources Engineering Video Lectures (IIT Kharagpur/IIT Roorkee). Available at: https://nptel.ac.in/courses/105105110
2. UNESCO – International Hydrological Programme (IHP) Resources on Hydrological Modelling and Climate Change. Available at: https://en.unesco.org/themes/water-security/hydrology

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Construction Contracts & Legal Aspects in Construction (PEC 5)				Code:		BCI27PE68/ BCI28PE68	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge of: Knowledge of construction management domain

Course Objectives: To make the students aware about

1. Knowledge for preparing construction contracts clauses.
2. Contractual and tender documents satisfying the need of the project.
3. Exhibit role and responsibilities of Arbitrator for resolution of disputes in construction projects.

Course Outcomes: After learning the course, the students will be able to:

1. Prepare construction contracts clauses and conditions.
2. Explain Conditions of Contracts & Construction Claims.
3. Identify role and responsibilities of Arbitrator in contract execution
4. Evaluate Tenders & Bidding process for BOT & Global Tendering including Documentation and Risk Identification.

Detailed Syllabus

Unit	Description	Duration (H)
1.	**Administrative Procedures:** Methods of Executing Works: PWD procedure of work execution, administrative approval, budget provision, technical sanction. Construction Administration, Organizational Structure, Lines of Authority on Construction Projects, Responsibility, Staffing Responsibilities, Methods of execution of minor works in PWD: Piecework, Rate List, Daily Labour. Introduction to registration as a contractor in PWD.	6
2.	**Construction Contracts Formation:** Indian Contract Act (1872): Definition of the contract as per the ACT. Valid, Voidable, Void contracts, Objectives of the act. Clauses 1 to 75- Contract formation, contract performance, valid excuses for non-performance, Breach of contract, effects of breach- understanding the clauses and applying them to situations/scenarios on construction projects.	6
3.	**Contracts, Claims:** Types and causes of construction claims, documentation, Conditions of contract with respect to various parameters. Case study. **Tendering Process:** Methods of inviting tenders, tender notice, bidding procedure, Pre and post qualification of contractors, tender documents. 3 bid/ 2 bid or single bid system. Qualitative and quantitative evaluation of tenders. Comparative statement, Pre-bid conference, acceptance/rejection of tenders. Various forms of BOT & amp; Global Tendering, E-tendering.	9
4.	**Risk Identification:** Familiarization with construction documents, Certainty, Risk and Uncertainty, Risk: Identification, types and Management. Minimizing risks and mitigating losses, use of expected values, utility in investment decisions, decision trees, sensitivity analysis. Control of Quality in Construction. **Disputes and Arbitration:** Settlement through arbitration Indian Arbitration Act 1940 – Clauses and advantages of arbitration. Alternate Dispute Resolution methods- mediation, conciliation, arbitration and Dispute Resolution Boards.	9
	Total	30

Self-directed learning: Introduction to International contracting system-and FIDIC Documents

Text Books:

1. The Indian Contract Act (9 of 1872), 1872- Bare Act- 2006 edition, Professional Book Publishers.
2. The Arbitration and Conciliation Act,(1996), 1996 (26 of 1996)- 2006 Edition, Professional Book Publisher.

Reference Books:

1. Law of contract Part I and Part II, Dr. R.K. Bangia- 2005 Edition, Allahabad Law Agency.
2. Arbitration, Conciliation and Alternative Dispute Resolution Systems- Dr. S.R. Myneni- 2004 Edition, reprinted in 2005- Asia Law House Publishers.
3. Standard General Conditions for Domestic Contracts- 2001 Ministry Of Statistics and Program Implementation, Government of India.
4. FIDIC Document (1999).

e-Resources:

1. https://nptel.ac.in/courses/105/101/105101086/
2. https://nptel.ac.in/courses/105/106/105106050/.

Program:	B. Tech. (Civil Engineering)			Semester :			VII/VIII (Scheme A / B)
Course:	Construction Contracts & Legal Aspects in Construction Lab (PEC 5 Lab)			Code:			BCI27PE69/ BCI28PE69
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge of: Knowledge of construction management domain

Course Objectives: To make the students aware about

1. Knowledge for preparing construction contracts clauses.
2. Contractual and tender documents satisfying the need of the project.
3. Exhibit role and responsibilities of Arbitrator for resolution of disputes in construction projects.

Course Outcomes: After learning the course, the students will be able to:

1. Assess most suitable Tenders during Bidding process
2. Prepare Documentation and construction contracts clauses and Contract conditions..
3. Identify role and responsibilities of Arbitrator in contract execution

Detailed Syllabus

Sr.No	Description
1.	Contract as per the ICA 1872. Valid, Voidable, Void contracts, Objectives of the ICA
2.	Preparation of conditions of Contract related to time of completion & delay,
3.	Preparation of conditions of Contract related to Defects in construction work and Extra items.
4.	Tender form submission and necessary Tender Documents.
5.	Role play - Procedure of Bid Opening
6.	Alternate dispute resolution mechanism for solving contact disputes.
7.	Role play - Methods of Arbitration
8.	Case study related to contract claims.
9.	Case study related to Balance and unbalance tenders.

Text Books:

1. The Indian Contract Act (9 of 1872), 1872- Bare Act- 2006 edition, Professional Book Publishers.
2. The Arbitration and Conciliation Act,(1996), 1996 (26 of 1996)- 2006 Edition, Professional Book Publisher.

Reference Books:

1. Law of contract Part I and Part II, Dr. R.K. Bangia- 2005 Edition, Allahabad Law Agency.
2. Arbitration, Conciliation and Alternative Dispute Resolution Systems- Dr. S.R. Myneni- 2004 Edition, reprinted in 2005- Asia Law House Publishers.
3. Standard General Conditions for Domestic Contracts- 2001 Ministry Of Statistics and Program Implementation, Government of India.
4.FIDIC Document (1999).

e-Resources:

1. https://nptel.ac.in/courses/105/101/105101086/
2. https://nptel.ac.in/courses/105/106/105106050/.

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Formwork and Plumbing Systems (PEC-5)				Code:		BCI27PE70/ BCI28PE70	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge:
Building planning, Concrete technology

Course Objectives: This course aims at enabling students,
1. Study and analyze different formwork system, design guidelines and procedures in construction practices.
2. Study different types, components of plumbing system and design provisions in plumbing system

Course Outcomes: After learning the course, the students should be able to:
1. Select appropriate material and type of formwork considering site requirements
2. Analyze the loads, pressure distribution and design aspects for formwork as per codes.
3. Apply the principles of plumbing hydraulics to identify the suitable plumbing components and sustainable plumbing practices.
4. Analyze plumbing design requirements including water demand, pipe sizing and layout planning as per Indian Standards.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Formwork Fundamentals and Materials** Introduction to Formwork: Define formwork as a temporary structure; discuss requirements, factors for its selection. Types of Formwork Formwork Materials: Differentiate between conventional materials (timber, plywood, steel) and advanced materials (aluminum, plastic, fiber-reinforced polymer composites). Accessories and Economy: common formwork accessories and strategies for achieving economy in formwork design and construction, Planning for Formwork: planning and layout for formwork systems Case studies on formwork and materials	7
2	**Formwork analysis:** Loads on Formwork: various loads acting on formwork, including dead loads, live loads, and the lateral pressure of fresh concrete as per IS 14687: concrete density, height of discharge, temperature, rate of placing Pressure Distribution: Understand the factors influencing lateral pressure, such as concrete density, temperature, and rate of placing, and study the resulting pressure distribution, Design Considerations: allowable stresses and deflection limits, and identify common deficiencies in formwork design, illustrative examples. Case studies on design of formwork system	8
3	**Plumbing system fundaments and Components:** Importance of Plumbing: significance of premise plumbing, history of plumbing, and the role of relevant codes and organizations, Plumbing Hydraulics: Introduce concepts of frictional and minor losses in pipes. System Components: Identify common plumbing fixtures, water efficient fixtures pipe materials, different types of fittings, valves, traps Sustainable Plumbing: Discuss the need for sustainable practices and the use of water-efficient fixtures. Plumbing Failures,	8
4	**Plumbing System Planning and Design** Water Demand and Pipe Sizing: water demand in different building types and the methods for pipe sizing in building (fixture unit method, fixture value method, etc) Code Provisions: provisions related to pressure and velocity in plumbing systems. Plumbing System Layouts: Develop skills in laying out plumbing fixtures in a toilet and creating comprehensive plumbing plans for a multi-story building, Future of Plumbing: Role of plumbing engineer and future challenges, Case studies on recent plumbing systems	7
	Total	30

Self directed learning: Explore IS and international codes like IS 14687, IS 4014, NBC etc. Autocad Plumbing layouts and 3D models, Emerging technologies like sustainable material for formwork, IOT enabled plumbing sensors.

Text Books:

1. Formwork And Scaffold Engineering by Kumar Neeraj Jha, Pearson Education, ISBN: 9789356066274
2. Modern Practices in Formwork for Civil Engineering Construction Works, Dr. Janardan Jha & Prof. S. K. Sinha, University Science Press (An Imprint of Laxmi Publications Pvt. Ltd.
3. Formwork for Concrete Structures, Robert L. Peurifoy and Garold D. Oberlender, McGrawhill Publication.
4. Plumbing: Design and Practice, Deolalikar S. G., Tata Mcgraw-Hill Publication.
5. Water Supply and Sanitary Installation (Within Building), Design, Construction and Maintenance Panchdhari A. C., New Age International publishers

Reference Books:

1. Formwork by Michael P. Hurst, Addison-Wesley Longman Ltd; First Edition (June 1, 1983).
2. Formwork for Concrete, Hurd, M.K., Special Publication No.4, American Concrete Institute, Detroit; Fifth edition
3. Design and Construction of Formwork for Concrete Structures by A.E. Wynn, George Philip Manning, Cement & Concrete Association.
4. Plumbing Engineering Design Handbook 2010, American Society of Plumbing Engineers (ASPE)
5. Plumbing, Sanitation and Domestic Engineering" Volume – 1to 4 by G. S. Williams, Mc Graw Hill.
6. Austin C.K., Formwork for Concrete, Cleaver-Hume Press Ltd., London, 1996.

IS Codes:

1. IS 6461: Part V:Reaffirmed 2002; Glossary of terms relating to cement concrete: Formwork for concrete, Bureau of Indian Standard, New Delhi.
2. IS 14687: Falsework for Concrete Structures – guidelines, Bureau of Indian Standard, New Delhi.
3. IS 4990-Plywood for concrete shuttering
4. IS 12183-1-1987, Code of practice for plumbing in multi-storeyed buildings (Part 1 water supply), Bureau of Indian Standards, New Delhi, India.
5. National Building Code (NBC 2017)- Plumbing services
6. Uniform Illustrated Plumbing Code – India(IAPMO) 2018, International Association of Plumbing and Mechanical Officials India.
7. International Plumbing Code - 2018, Appendix E, International Code Council, USA. 06 National Building Code of India - 2016, Vol. 2, Part 9, Bureau of Indian Standards, New Delhi, India.

e-Resources

1. **https://digitalskills.iitmpravartak.org.in/course_details.php?courseID=250**
2. **https://onlinecourses.nptel.ac.in/noc21_ar13/preview**

Program:	B. Tech. (Civil Engineering)			Semester :	VII/VIII (Scheme A / B)		
Course:	Formwork and Plumbing Systems Lab (PEC-5 Lab)			Code:	BCI27PE71/ BCI28PE71		
	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
Credits	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge: Building planning, Concrete technology

Course Objectives: This course aims at enabling students,

1. Analyze temporary formwork and efficient and sustainable water supply/drainage system refereeing to codes and standards.

Course Outcomes: After learning the course, the students should be able to:

1. Design a formwork system for basic structural elements considering loads and select appropriate materials along with safety protocols to prevent failure of formwork.
2. Prepare and Design a water supply system for multi storied building and propose prevention of plumbing system failure.
3. Analyze the performance characteristics of formwork and plumbing materials in relation to industry codes to ensure technical and safety compliance.

Detailed Syllabus

Term work consists of following (any four from part A and any four from part B)

PART A:

1. Prepare a detailed report comparing and contrasting minimum three different formwork materials.
2. Conduct a site visit to a construction project to study the formwork system used and write a report.
3. Design of a formwork system for any one component
4. Individual visit to identify minimum three common deficiencies in formwork system. For each deficiency, explain why it is dangerous and propose a safety protocol or modification to prevent it.
5. Prepare A3 size poster on any formwork system highlighting erection and striking process.
6. Study of any 2 National/international codes/guidelines for formwork system

PART B:

1. Collection of at least ten different plumbing components (fixtures, pipes, valves, fittings) and provide description, function, application.
2. Industrial visit to the plumbing system and write a report.
3. Prepare presentation on conventional and modern plumbing system for building.
4. Prepare a simplified plumbing plan layout for a G+2 story building. The layout should show the water supply lines and drainage-waste-vent.
5. Design a water supply system for multi storied building and propose prevention of plumbing system failure.
6. Summarized any two case studies on failure of plumbing system.
7. Study of any 2 National/international codes/guidelines for plumbing system.

Text Books:

1. Formwork And Scaffold Engineering by Kumar Neeraj Jha, Pearson Education, ISBN: 9789356066274
2. Modern Practices in Formwork for Civil Engineering Construction Works, Dr. Janardan Jha & Prof. S. K. Sinha, University Science Press (An Imprint of Laxmi Publications Pvt. Ltd.
3. Formwork for Concrete Structures, Robert L. Peurifoy and Garold D. Oberlender, McGrawhill Publication.
4. Plumbing: Design and Practice, Deolalikar S. G., Tata Mcgraw-Hill Publication.
5. Water Supply and Sanitary Installation (Within Building), Design, Construction and Maintenance Panchdhari A. C., New Age International publishers

Reference Books:

1. Formwork by Michael P. Hurst, Addison-Wesley Longman Ltd; First Edition (June 1, 1983).
2. Formwork for Concrete, Hurd, M.K., Special Publication No.4, American Concrete Institute, Detroit; Fifth edition
3. Design and Construction of Formwork for Concrete Structures by A.E. Wynn, George Philip Manning, Cement & Concrete Association.

4. Plumbing Engineering Design Handbook 2010, American Society of Plumbing Engineers (ASPE)
5. Plumbing, Sanitation and Domestic Engineering" Volume – 1to 4 by G. S. Williams, Mc Graw Hill.
6. Austin C.K., Formwork for Concrete, Cleaver-Hume Press Ltd., London, 1996.

IS Codes:

1. IS 6461: Part V:Reaffirmed 2002; Glossary of terms relating to cement concrete: Formwork for concrete, Bureau of Indian Standard, New Delhi.
2. IS 14687: Falsework for Concrete Structures – guidelines, Bureau of Indian Standard, New Delhi.
3. IS 4990-Plywood for concrete shuttering
4. IS 12183-1-1987, Code of practice for plumbing in multi-storeyed buildings (Part 1 water supply), Bureau of Indian Standards, New Delhi, India.
5. National Building Code (NBC 2017)- Plumbing services
6. Uniform Illustrated Plumbing Code – India(IAPMO) 2018, International Association of Plumbing and Mechanical Officials India.
7. International Plumbing Code - 2018, Appendix E, International Code Council, USA. 06 National Building Code of India - 2016, Vol. 2, Part 9, Bureau of Indian Standards, New Delhi, India.

e-Resources

1. **https://digitalskills.iitmpravartak.org.in/course_details.php?courseID=250**
2. **https://onlinecourses.nptel.ac.in/noc21_ar13/preview**

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A / B)	
Course:	Advanced Construction Techniques (PEC-5)				Code:		BCI27PE72/ BCI28PE72	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge: Building construction,2.Strength of Material 3.Concrete technology, transportation engineering.

Course Objectives:

1. To understand various advanced construction techniques used in substructure and superstructure systems.
2. To provide knowledge of ground improvement, tunneling, and specialized construction methods.
3. To impart understanding of condition assessment, repair, and retrofitting technologies in civil engineering structures.

Course Outcomes: After learning the course, the students should be able to:

1. Decide the suitable techniques for sub structure construction.
2. Select the suitable ground improvement technique as per the field requirements.
3. Analyze the techno-economic feasibility of formwork systems, precast elements, and 3D concrete printing, alongside specialized techniques for rigid pavements and bridge construction
4. Recommend the suitable tunnel construction techniques used in soft and hard ground conditions.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Sub structure construction techniques:** pile driving and boring techniques, Caisson and cofferdam construction techniques, diaphragm wall construction, shoring techniques for deep excavations, Trenchless technology-box pushing and Pipe jacking.	07
2	**Ground improvement techniques:** Vibro-flotation technique, stone column, micro pile as soil reinforcement, soil nailing, grouting in soft and hard strata, dewatering methods: single and double point system. Ground improvement and stabilization in tunnel construction.	07
3	**Superstructure construction techniques:** Formwork systems (Table form, Tunnel form. slip form, Mivan/ aluform system). Pumped concreting systems, Precast construction coordination and joints, 3D concrete printing technology, Rigid pavement construction technique. Bridge construction: Segmental construction using launching girder, incremental launching and balance cantilever.	08
4	**Tunnel construction**: Tunnel alignment, shape, and size. Tunneling in hard ground: Drill & Blast. cut and cover method, Tunneling in soft ground: NATM (New Austrian Tunneling Method), TBM (Tunnel Boring Machine. Tunnel shaft sinking. Tunnel lining: shotcrete & precast segmental lining. Ventilation and safety considerations. Role of AI in tunnel construction	08
	Total	30

Self-directed learning: Diaphragm wall piles, Digital twin technology, use of BIM integration in formwork and construction, Automation in construction, Safety in deep excavation systems. Concreting for tall building and RMC logistics.

Text Books:

1. Construction techniques and practices by Dr.V.Kannan, first edition, V. Kannna publication, 2021.
2.Concrete Structures: Repair, Rehabilitation and Strengthening, Dr. Mohamed A. El-Reedy, 2020
3.Construction Techniques and Practice by V. Sankara Subramaniyan from Lakshmi Publications, 2017
4. Construction Technology, Sankar, S.K. and Saraswati, S., Oxford University Press, New Delhi, 2008.
5. Tunnel Engineering., S.C. Saxena, DhanpatRai& Sons, New Delhi (2015).

Reference Books:

1. Construction Planning, Equipment and methods – Peurifoy- Tata McGraw Hill Publication
2. Modi, P.I., Patel, C.N., Repair and Rehabilitation of Concrete Structures, PHI India, New Delhi, 2016.

3. CPWD Handbook (2011). Repair and Rehabilitation of RCC Buildings.
4. ACI 201.1R-08:American Concrete Institute, Guide for Conducting a Visual Inspection of Concrete in Service
5. ACI RAP-11-American Concrete Institute, Field Guide to Concrete Repair Application Procedures
6. Dyer, Thomas. (2014). Concrete Durability, CRC Press, Taylor & Francis Group, Florida.
7. Introduction to Tunnel Construction (Applied Geotechnics)., David Chapman, Nicole Metje, Alfred Stark and David N. Chapman , CRC Press; 2nd edition (4 December 2017)

E-Resources

1. https://nptel.ac.in/courses/ground improvement techniques
2. https://nptel.ac.in/courses/ Construction methods and equipment management
3. https://archive.nptel.ac.in/courses/105/105/105105213/
4. https://www.cecr.in/

Program:	B. Tech. (Civil Engineering)			Semester:		VII/VIII (Scheme A/B)	
Course:	Advanced Construction Techniques Lab (PEC-5 Lab)			Code:		BCI27PE73/ BCI28PE73	
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Course Objectives : To impart broad knowledge in the area of Construction techniques and retrofitting of structures

Course Outcomes: After learning the course, the students should be able to:

1. Recommend the suitable construction techniques for sub and super structure construction by analyzing site-specific constraints and technical requirements for high-rise or complex projects.
2. Analyze specialized construction methods, including tunneling and precast or 3D concrete printing technology, by comparing their design challenges and operational limitations through case studies or review papers.
3. Select appropriate ground improvement, dewatering or grouting techniques for challenging strata by applying engineering principles to resolve geotechnical and hydrological site conditions.

Detailed Syllabus

Term work consists of assignments and visit report (Any eight of following, field visit is mandatory).

1. Assignment on pile / caisson / cofferdam construction.
2. Assignment on diaphragm wall or no dig techniques
3. Assignment on ground improvement technique
4. Assignment on dewatering or grouting technique
5. Field visit report on formwork (Mivan, Tunnel form, Slip form) or advanced construction technique.
6. Assignment on rigid pavement or bridge construction technique.
7. Assignment on precast/3D concrete printing.
8. Compare different tunnelling methods (Cut & Cover, Drill & Blast, Shield, Immersed Tunnel, Tunnel Jacking) for both hard rock and soft soil conditions. Include suitability, advantages, and limitations.
9. Conduct a case study on an existing tunnel project (local or international). Include design, construction method, challenges faced, and lessons learned.
10. Case study presentation or individual visit to the construction technology related Exhibition and its report
11. Preparation of e-poster on any one of tunnel construction, formwork, prefab or retrofitting system.
12. Write a review on any recent research paper from standard peer-reviewed journal on any topic from syllabus.

Text Books:

1. Construction techniques and practices by Dr.V.Kannan, first edition, V. Kannna publication, 2021.
2. Concrete Structures: Repair, Rehabilitation and Strengthening, Dr. Mohamed A. El-Reedy, 2020
3. Construction Techniques and Practice by V. Sankara Subramaniyan from Lakshmi Publications, 2017
4. Construction Technology, Sankar, S.K. and Saraswati, S., Oxford University Press, New Delhi, 2008.

Reference Books:

1. Construction Planning, Equipment and methods – Peurifoy- Tata McGraw Hill Publication
2. Modi, P.I., Patel, C.N., Repair and Rehabilitation of Concrete Structures, PHI India, New Delhi, 2016.
3. CPWD Handbook (2011). Repair and Rehabilitation of RCC Buildings.
4. ACI 201.1R-08: American Concrete Institute, Guide for Conducting a Visual Inspection of Concrete in Service
5. ACI RAP-11-American Concrete Institute , Field Guide to Concrete Repair Application Procedures
6. Dyer, Thomas. (2014). Concrete Durability, CRC Press, Taylor & Francis Group, Florida.

E-Resources

1. https://nptel.ac.in/courses/ground improvement techniques
2. https://nptel.ac.in/courses/ Construction methods and equipment management
3. https://archive.nptel.ac.in/courses/105/105/105105213/
4. https://www.cecr.in/

Program:	B. Tech. (Civil Engineering)				Semester:		VII/VIII (Scheme A/B)	
Course:	Structural Dynamics (PEC 5)				Code:		BCI27PE74/ BCI28PE74	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge: Engineering Mechanics, Strength of Materials, Structural Analysis and Design of reinforced concrete structures, Elements of Earthquake Engineering

Course Objectives:

1. To introduce the fundamental concepts of structural dynamics.
2. To impart knowledge of mathematical modelling.
3. To obtain solutions for the dynamic response of single degree of freedom systems.
4. To obtain solutions for the dynamic response of multi degree of freedom systems.

Course Outcomes: After learning the course, the students will be able to:

1. Apply the concepts of dynamics of structural systems.
2. Prepare mathematical models for different types of vibration problems.
3. Formulate, and solve the dynamic response of the multi degree of freedom systems.
4. Analyze and interpret the free and forced vibrations response of structural systems.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Single-Degree-of-Freedom System (SDOF):** Single-Degree-of-Freedom System, Analysis models, Equations of motion, Free vibration, Damping, Types of Damping. Logarithmic Decrement.	07
2	**SDOF subjected to harmonic loading:** Undamped and damped harmonic excitation, Bandwidth method, Response to support the motion, the force transmitted to the foundation, Seismic Instrument.	08
3	**Multi-Degree-of-Freedom System:** Selection of DOFs, Formulation of Equation of motion, Structure matrices, Static condensation, Free vibration Eigenvalue problem, Frequencies, Mode Shapes, Determination of natural frequencies and mode shapes, Orthogonality conditions.	08
4	**Structures Modeled with Distributed Properties:** Distributed-Parameter Systems, Partial differential equations of motion, free and forced vibrations, Application to beams in flexure. Application of structural dynamics in real life structures. Introduction of FEM in structural dynamics.	07
	Total	30

Self directed learning: Vibration Isolation Systems in Buildings and Machines, Human-Induced Vibrations in Footbridges and Floors, Response spectrum analysis, Tuned Mass Dampers (TMDs) used in Tall Buildings.

Text Books:

1. Elements of Earthquake Engineering by Jaikrishna, A.R. Chandrashekharan, Brijesh Chandra. Standard Publishers & Distributors, 2nd edition (2019)
2. Dynamics of Structures by Madhujit Mukhopadhyay. Ane Books Pvt Ltd (2015)

Reference Books:

1. Dynamics of structures by R.W. Clough and J. Penxiene. McGraw-Hill Pub, 2nd edition (2015)
2. Structural Dynamics by Roy Craig, Andrew J. Kurdila. John Wiley & Sons, 2nd edition (2006)
3. Dynamics of Structures – Theory & Application to Earthquake Engineering by A.K. Chopra. Prentice Hall Publications, 5th edition (2016)
4. Structural Dynamics – Mario Paz, Young Hoon Kim. Springer, 6th edition (2018)
5. An Applied Introduction to Structural Dynamics by Eric P. Kasper, Garrett J Hall
6. Structural Analysis 10th Edition by Russell Hibbeler (for revision of concepts before the course starts- self reading)
7. Strength of Materials (Beer and Johnston) (For revision of concepts before the course – self reading)

Reference IS Codes: IS 1893 :2025: Criteria for earthquake-resistant design of structures.
e-Resources 1. https://nptel.ac.in/courses/105106151 2. https://courses.degreetutors.com/the-structural-dynamics-course-bundle 3. https://sd-iiith.vlabs.ac.in/Introduction.html

Program:	B. Tech. (Civil Engineering)			Semester :		VII/VIII (Scheme A/B)	
Course:	Structural Dynamics Lab (PEC 5 Lab)			Code:		BCI27PE75/ BCI28PE75	
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge: Engineering Mechanics, Strength of Materials, Structural Analysis and Design of reinforced concrete structures, Elements of Earthquake Engineering

Course Objectives:

1. To inculcate understanding of vibration characteristics in single and multi-degree of freedom systems through assignments.
2. To provide exposure for analyzing free and forced vibration behavior of discrete and continuous systems.

Course Outcomes: After learning the course, the students will be able to:

1. Determine natural frequencies and mode shapes of structures.
2. Analyze vibration response of single & multi-degree systems.

Detailed Syllabus

Lab Assignments based on following content (Any six from eight)

1. Single Degree of Freedom Systems.
2. Multiple Degree of Freedom Systems.
3. Free vibration Eigenvalue problem.
4. Determination of natural frequencies and mode shapes.
5. Distributed- parameter Systems.
6. Free and forced Vibration.
7. Introduction to soft computing tools for dynamic analysis of structures.
8. Validation of frequency/time period calculations done by using soft computing tools.

Text Books:

1. Elements of Earthquake Engineering by Jaikrishna, A.R. Chandrashekharan, Brijesh Chandra. Standard Publishers & Distributors, 2nd edition (2019)
2. Dynamics of Structures by Madhujit Mukhopadhyay. Ane Books Pvt Ltd (2015)

Reference Books:

1. Dynamics of structures by R.W. Clough and J. Penxiene. McGraw-Hill Pub, 2nd edition (2015).
2. Structural Dynamics by Roy Craig, Andrew J. Kurdila. John Wiley & Sons, 2nd edition (2006).
3. Dynamics of Structures – Theory & Application to Earthquake Engineering by A.K. Chopra. Prentice Hall Publications, 5th edition (2016).
4. Structural Dynamics – Mario Paz, Young Hoon Kim. Springer, 6th edition (2018).
5. An Applied Introduction to Structural Dynamics by Eric P. Kasper, Garrett J Hall.
6. Structural Analysis 10th Edition by Russell Hibbeler (for revision of concepts before the course starts- self reading).
7. Strength of Materials (Beer and Johnston) (For revision of concepts before the course – self reading).

Reference IS Codes:

IS 1893 :2025: Criteria for earthquake-resistant design of structures.

E-Resources:

1. https://nptel.ac.in/courses/105106151
2. https://courses.degreetutors.com/the-structural-dynamics-course-bundle
3. https://sd-iiith.vlabs.ac.in/Introduction.html

Program:	B. Tech. (Civil Engineering)				Semester:		VII/VIII (Scheme A/B)	
Course:	Retrofitting & Rehabilitation of Structures (PEC 5)				Code:		BCI27PE76/ BCI28PE76	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge: Engineering Mechanics, Strength of Materials, Concrete Technology, Mechanics of Structures, Structural Analysis, Design of RC Structures, Design of steel structures.

Course Objectives:

1. To understand the basics of repair and retrofitting and the main causes of deterioration in concrete and reinforcement.
2. To learn basic assessment methods and NDT techniques for evaluating structural damage.
3. To learn common repair materials and simple methods for crack repair, patching, grouting, and strengthening concrete structures.
4. To understand basic maintenance needs and common retrofitting methods like jacketing, EB, NSM, and FRP systems.

Course Outcomes: After learning the course, the students should be able to:

1. Identify structural deterioration, understand damage causes, and use basic durability codes for concrete structures.
2. Inspect structures, assess damage, and interpret basic NDT results for condition evaluation.
3. Select the right repair materials and confidently apply simple methods like grouting, shotcreting, and strengthening to restore structures.
4. Suggest practical maintenance and retrofitting solutions using simple methods like jacketing, FRP, EB, and NSM to improve structural safety.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Introduction & Structural Assessment:** Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Damage to Concrete: mechanical actions, chemical attacks, physical actions, fire. Damage to reinforcement: corrosion induced by carbonation of concrete, chloride induced corrosion, corrosion induced by leaching of concrete, corrosion mechanisms of pre-stressed steel. National and International codal provisions for durability considerations, making of durable concrete, selection of materials and quality considerations, good construction management for long-term sustainability.	8
2	**Damage Assessment:** Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, Preliminary assessment – documentation of the general condition of the structure. Detailed surface inspection: mapping of chloride induced corrosion and carbonation induced corrosion, potential mapping and resistivity mapping, cracks, and crack mapping. Determination of concrete properties by non-destructive techniques, corrosion activity, loss of cross section, chloride concentration, carbonation depth, concrete cover, concrete endoscopy and thermal imaging, pull-off and pull-out test.	7
3	**Materials and Methodology of Repairs:** Repair analysis and design, repair materials and their properties, methodologies of crack and patch repair, Polymer modified mortar, Artificial & Natural polymer modified concrete, polymer concrete, injection grouting, shortcreting, joints and sealants, rebar corrosion crack repair. Adhesive like, Epoxy Resin, Special concretes, and mortars, concrete chemicals, special elements for accelerated strength gain. seismic strengthening of existing R C structures, repair, and restoration of heritage structures.	8

4	**Maintenance and Retrofitting Techniques:** Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, procedure & methods. retrofitting of structural members i.e., column and beams by Jacketing technique, externally bonding (ERB) technique, near surface mounted (NSM) technique, retrofitting of structural component using FRP, FRP strengthening system, Statutory legislation, and obligation.	**7**
	Total	**30**

Self-directed learning: Recent research articles on SHM applications, including data-driven and machine learning-based approaches.

Reference Books:

1. Concrete Repair and Maintenance, P. H. Emmons and G M Sabnis, Galgotia Publication.
2. Repairs and Rehabilitation – Compilation from Indian Concrete Journals
3. Management of Deteriorating Concrete Structures, George Somerville, Taylor and Francis, Publication.
4. Concrete Building Pathology, Susan Macdonald, Blackwell Publishing.
5. Durability of Cement and Cement Composites, C. L. Page, M M Page, Wood Head, Publishing.
6. ACI 440.2R-08, Guide for the design and construction of externally bonded FRP systems for strengthening concrete structures, American Concrete Institute.
7. CPWD hand book on Repairs and Rehabilitation of RCC buildings published by DG (Works), CPWD, Government of India (Nirman Bhawan), http://www.cpwd.gov.in/handbook.pdf.
8. Guide to Concrete Repair, Glenn Smoak, US Department of the Interior Bureau of Reclamation, Technical Service Center, http://books.google.co.in 9. Waterproofing Technology – Theory and Practice by M. K. Lakhani.
9. R.T. Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL).

Text Books:

1. Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"-Longman Scientific and Technical.
3. Concrete Structures Repair, Rehabilitation and Retrofitting by J. Bhattacharjee, CBS Publishers & Distributors Pvt. Ltd.
4. Maintenance, Repair, Rehabilitation and Retrofitting of Structures : G., Nandini Devi, WILEY Publication.New Delhi.
5. Repair & Rehabilitation of Concrete Structure by Poonam Modi & Chirag Patel, PHI Publishing, New Delhi.

IS Codes:

1. IS 13935:2009 (Guidelines for repair and seismic strengthening of buildings)
2. IS 15988:2013 (Seismic evaluation and strengthening)
3. IS 13920-2016 (Ductile design and detailing) for seismic retrofitting

e-Resources

1. https://archive.nptel.ac.in/courses/105/105/105105162/
2. https://www.coursera.org/learn/design-basics-of-steel-buildings
3. https://www.classcentral.com/course/youtube-design-of-steel-structures-47758
4. https://unacademy.com/course/complete-course-on-design-of-steel-structures-654/5T9O8774
5. https://www.udemy.com/course/design-of-steel-structures-as-per-is800/?srsltid=AfmBOopTV0PIK31vpvtCEcidno2nGU8ZMwwNJbksL0N5_vUalWjszi3Q&couponCode=ST11MT170325G3

Program:	B. Tech. (Civil Engineering)			Semester:	VII/VIII (Scheme A/B)		
Course:	Retrofitting & Rehabilitation of Structures Lab (PEC 5 Lab)			Code:	BCI27PE77/ BCI28PE77		
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1		2	-	25	25	-	50

Prior Knowledge: Engineering Mechanics, Strength of Materials, Concrete Technology, Mechanics of Structures, Structural Analysis, Design of RC Structures, Design of steel structures.

Course Objectives:

1. To understand structural damage and choose suitable repair or retrofitting methods for RCC and masonry buildings.
2. To learn how to analyze and design rehabilitation solutions using NDT, FRP, jacketing, and basic software tools.
3. To gain practical exposure through case studies, market surveys, and real-world repair and retrofitting practices

Course Outcomes: After learning the course, the students should be able to:

1. Identify structural defects and assess damage using visual checks and NDT & select suitable repair materials and suggest practical retrofit solutions.
2. Use software to perform pushover analysis and recommend seismic upgrades.
3. Study real cases, compare repair options, and design basic FRP/jacketing retrofit schemes with calculations.

Detailed Syllabus

Term work consists of a journal containing the following assignments. Note: Any Six assignments out of seven shall be completed. Term work marks will be based on continuous assessment.

List of Experiments:

1. Study of rehabilitation/retrofitting of RCC/Masonry buildings covering (a) damage assessment by visual inspection and using various techniques including NDT (b) one/two alternatives for rehabilitation/retrofitting (considering strength criteria & serviceability criteria).
2. Assignment on Study of Techniques for Repair & Rehabilitation.
3. Case study of construction and design failures.
4. Market survey on repair materials for structural health monitoring applications
5. Case study of repairing/rehabilitation structures and retrofitting of EQ damage/deficit structure.
6. **Case study report** of a retrofitted bridge deck or industrial building, including NDT data, repair technique selection, and performance evaluation.
7. Presentations / finding engineering applications /preparation of learning material based on the syllabus.

Reference Books:

1. Concrete Repair and Maintenance, P. H. Emmons and G M Sabnis, Galgotia Publication.
2. Repairs and Rehabilitation – Compilation from Indian Concrete Journals
3. Management of Deteriorating Concrete Structures, George Somerville, Taylor and Francis, Publication.
4. Concrete Building Pathology, Susan Macdonald, Blackwell Publishing.
5. Durability of Cement and Cement Composites, C. L. Page, M M Page, Wood Head, Publishing.

6. ACI 440.2R-08, Guide for the design and construction of externally bonded FRP systems for strengthening concrete structures, American Concrete Institute.
7. CPWD hand book on Repairs and Rehabilitation of RCC buildings published by DG (Works), CPWD, Government of India (Nirman Bhawan), http://www.cpwd.gov.in/handbook.pdf.
8. Guide to Concrete Repair, Glenn Smoak, US Department of the Interior Bureau of Reclamation, Technical Service Center, http://books.google.co.in 9. Waterproofing Technology – Theory and Practice by M. K. Lakhani.
9. R.T. Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL).

Text Books:

1. Sidney, M. Johnson, "Deterioration, Maintenance and Repair of Structures"
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"-Longman Scientific and Technical.

IS Codes:

1. IS 13935:2009 (Guidelines for repair and seismic strengthening of buildings)
2. IS 15988:2013 (Seismic evaluation and strengthening)
3. IS 13920-2016 (Ductile design and detailing) for seismic retrofitting

Program:	B. Tech. (Civil Engineering)				Semester :		VII/VIII (Scheme A/B)	
Course:	Advanced Soil Mechanics (PEC 5)				Code:		BCI27PE78/ BCI28PE78	
Credits	Teaching Scheme (Hrs/Week)				Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
2	2	-	-	1	10	10	30	50

Prior Knowledge: Engineering Geology, Geotechnical Engineering, Foundation Engineering, Advanced Foundation Engineering

Course Objectives:

1. To provide students with an understanding of advanced concepts in soil behavior and geoenvironmental issues.
2. To provide students with an understanding of advanced concepts in earthquake geotechnics and offshore geotechnical problems.

Course Outcomes: After learning the course, the students will be able to:

1. Explain the structure, bonding, and properties of clay minerals.
2. Analyze soil and groundwater contamination problems and propose suitable geoenvironmental solutions.
3. Evaluate soil behavior under earthquake loading and **assess** liquefaction potential.
4. Apply geotechnical concepts to offshore and marine soil conditions.

Detailed Syllabus

Unit	Description	Duration (H)
1	**Clay mineralogy and soil structure** Introduction, gravitational and surface forces, primary valence bonds, hydrogen bond, secondary valence bonds , basic structural units of clay minerals, kaolinite mineral, montmorillonite, Illite mineral, electrical charges on clay minerals, base exchange capacity, DDL theory.	07
2	**Geoenvironmental Engineering** Soil contamination and pollutant transport, Landfill design and liner systems, Groundwater contamination and remediation, Use of geosynthetics in waste containment, Sustainability aspects in geoenvironmental projects.	08
3	**Geotechnical Earthquake Engineering** Dynamic soil properties and site characterization, Ground response analysis, Liquefaction and its evaluation, Liquefaction Potential, Seismic design of foundations and retaining structures, Case histories of earthquake-induced failures.	08
4	**Offshore and Marine Geotechnical Engineering** Soil behavior under cyclic and dynamic loading in marine environments, Foundations for offshore structures (piled, caisson, suction), Seabed instability and scouring, Site investigation in offshore areas, Geohazards in marine environments (tsunamis, submarine slides).	07
	Total	30

Self-directed learning: Electrical charges on clay surfaces, Landfill design, Scouring around an offshore pile, Liquefaction potential prediction using ML.

Text Books:

1. Soil Mechanics and Foundation Engineering by K. R. Arora, Standard Publisher, 7th Edition (2019)
2. Soil Mechanics and Foundation Engineering by B. C. Punmia, Laxmi Publications, 16th Edition (2017)

Reference Books:

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A. S. R. Rao, Newage International, 3rd Edition (2016)
2. Soil Mechanics- T.William Lambe--Wiley
3. Principles of Soil Mechanics and Foundation Engineering by V.N.S. Murthy, UBS Publishers (2018)

4. Soil Mechanics & Foundation Engineering by M. Bandhu, Wiley Publications, 3rd Edition (2010)
5. Geotechnical Engineering by Principles & Practices by Donald. P. Coduto, Pearson Education, 2nd Edition (2017)
6. Foundation Analysis and Design by J.E. Bowels, McGraw-Hill book company, 5th Edition (2001)
7. Principles of Geotechnical Engineering by Braja M. Das, Cengage Learning, 8th Edition (2020)
8. Geotechnical Engineering by Shashi K. Gulhati & Manoj Datta, Tata McGraw Hill (2017)
9. Geotechnical Earthquake Engineering by Steven L. Kramer, Pearson Education, 1st Edition (1996).
10. Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies by Hari D. Sharma and Lewis C. W. Yu, Wiley, 1st Edition (2002).

Reference IS Codes:

1. IS 1893 (Part 1, 2016): Criteria for earthquake-resistant design of structures.
2. IS 1498-1970: Classification and identification of soils for general engineering purposes.
3. IS 1892: 2021: Code of practice for subsurface investigation for foundations.
4. IS 2720 (Part series): Methods of test for soils

e-Resources

https://onlinecourses.nptel.ac.in/noc25_ce02/preview

Program:	B. Tech. (Civil Engineering)			Semester :		VII/VIII (Scheme A/B)	
Course:	Advanced Soil Mechanics Lab (PEC 5 Lab)			Code:		BCI27PE79/ BCI28PE79	
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
1	-	2	-	25	-	-	25

Prior Knowledge: Engineering Geology, Geotechnical Engineering, Foundation Engineering, Advanced Foundation Engineering

Course Objectives :

1. To provide students with knowledge of advanced soil mechanics concepts related to clay behavior, geoenvironmental issues, earthquake geotechnics, and offshore engineering.
2. To develop the ability to analyze soil problems through case studies, technical reports, and simplified design exercises based on real-world geotechnical challenges.

Course Outcomes: After learning the course, the students will be able to:

1. Explain clay minerals, Atterberg limits, and pollutant movement in soils through short study reports.
2. Analyze problems like landfill liners, liquefaction, retaining walls, and marine hazards using case studies.
3. Apply soil mechanics concepts to real problems in environment, earthquake, and offshore engineering.

Detailed Syllabus

Lab Assignments

Any Eight assignments out of the following Ten shall be completed.

1. Prepare a technical note on different types of clay minerals (Kaolinite, Montmorillonite, Illite) with their engineering behavior and practical applications.
2. Comparative Study of Atterberg Limits and Activity of Clays.
3. Case study on landfill liner systems in India. Discuss design, construction, and environmental challenges.
4. Prepare a technical report on pollutant transport in soils**.** Include a simple hand-calculation or simulation of contaminant movement using advection-dispersion equation**.**
5. Prepare a review paper on applications of geosynthetics in waste containment and environmental geotechnics**.**
6. Perform a liquefaction potential analysis using SPT data of an earthquake-affected site (data can be provided).
7. Collect information on famous geotechnical failures during earthquakes and prepare a report highlighting causes and lessons learned.
8. Seismic design of a retaining wall using Mononobe-Okabe method.
9. Prepare a report on types of offshore foundations (piled, caisson, suction, gravity-based) with examples of their applications in wind energy and oil exploration.
10. Case study on marine geohazards (tsunamis, submarine slides, seabed instability).

Text Books:

1. Soil Mechanics and Foundation Engineering by K. R. Arora, Standard Publisher, 7th Edition (2019)
2. Soil Mechanics and Foundation Engineering by B. C. Punmia, Laxmi Publications, 16th Edition (2017)

Reference Books:

1. Basic and Applied Soil Mechanics by Gopal Ranjan and A. S. R. Rao, Newage International, 3rd Edition (2016)
2. Soil Mechanics- T.William Lambe--Wiley
3. Principles of Soil Mechanics and Foundation Engineering by V.N.S. Murthy, UBS Publishers (2018)
4. Soil Mechanics & Foundation Engineering by M. Bandhu, Wiley Publications, 3rd Edition (2010)
5. Geotechnical Engineering by Principles & Practices by Donald. P. Coduto, Pearson Education, 2nd Edition (2017)
6. Foundation Analysis and Design by J.E. Bowels, McGraw-Hill book company, 5th Edition (2001)
7. Principles of Geotechnical Engineering by Braja M. Das, Cengage Learning, 8th Edition (2020)

8. Geotechnical Engineering by Shashi K. Gulhati & Manoj Datta, Tata McGraw Hill (2017)
9. Geotechnical Earthquake Engineering by Steven L. Kramer, Pearson Education, 1st Edition (1996).
10. Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies by Hari D. Sharma and Lewis C. W. Yu, Wiley, 1st Edition (2002).

Codes:

1. IS 1893 (Part 1, 2016): Criteria for earthquake-resistant design of structures.
2. IS 1498-1970: Classification and identification of soils for general engineering purposes.
3. IS 1892: 2021: Code of practice for subsurface investigation for foundations.
4. IS 2720 (Part series): Methods of test for soils

e-Resources

1. https://onlinecourses.nptel.ac.in/noc25_ce02/preview

Program:	B. Tech. (Civil Engineering)			Semester:		VII (Scheme A/B)
Course:	Research Methodology			Code:		BCI27EL02/ BCI27EL06
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks		
	Lecture	Practical	Tutorial	TW	OR	Total
4	-	8	-	100	50	150

Prior Knowledge:

1. Fundamentals of Civil Engineering
2. Basics of Research Methodology and Report Writing

Course Objectives: This course aims at enabling students,

1. To introduce students to research methodology and the scientific approach to problem-solving.
2. To develop skills in literature review, data collection, and research planning.
3. To train students in research ethics, report writing, and presentation.
4. To prepare students for undertaking independent project work in Civil Engineering.

Course Outcomes: After learning the course, the students should be able to:

1. Identify and formulate a relevant research problem through critical literature review.
2. Design a structured research plan with clear objectives, methodology, and expected outcomes.
3. Apply appropriate tools for referencing, citation management, and plagiarism detection.
4. Prepare and present a well-structured research proposal with effective communication skills.

Term Work:

The Project report should contain the following. Departmental Project Review Committee may prepare a continuous evaluation sheet of each individual and refer as continuous assessment for term work marks. Project group must comprise of four students.

Detailed Syllabus

1. **Introduction to Research Process**:
   - Definition, purpose, and importance of research in engineering
   - Types of research: Fundamental, Applied, Experimental, Analytical, Descriptive
   - Civil Engineering–specific research domains: Structures, Geotechnics, Transportation, Water Resources, Environmental, Construction Management
   - Identification of research gaps from real-world problems
   - Steps in the research process: Concept → Review → Method → Data → Analysis → Interpretation → Reporting

2. **Formulation of Research Problem:**
   - Understanding the difference between problem, aim, and objectives
   - Techniques for identifying research problems in Civil Engineering
   - Setting objectives (Specific, Measurable, Achievable, Relevant, Time-bound)
   - Defining scope, limitations, and deliverables
   - Writing a problem statement (case examples from CE domains)
   - Feasibility analysis (time, data availability, equipment, resources)

3. **Literature Review**:
   - Purpose and importance of literature survey
   - Identifying quality sources: journals, conferences, standards (IRC, IS codes), government reports
   - Searching databases: Scopus, Web of Science, Google Scholar – keywords, filters, alerts
   - Reading and interpreting research papers (abstract, methods, results, conclusions)
   - Preparing annotated bibliographies
   - Summarizing literature and identifying research gaps

4. **Reference Management:**
   - Need for reference management tools
   - Introduction to Mendeley/Zotero interfaces
   - Importing/organizing research papers
   - Creating folders, tags, and libraries
   - Plagiarism avoidance through proper citation practices

5. **Research Ethics and Plagiarism Check**:
   - Academic integrity and ethical responsibilities
   - Understanding types of plagiarism: self-plagiarism, patchwork, verbatim copying
   - Using plagiarism detection software: Turnitin/Grammarly – demonstration
   - Acceptable similarity index and interpretation of plagiarism reports
   - Ethical data collection: permissions, confidentiality, informed consent

6. **Research Design & Methodology**:
   - Qualitative vs. Quantitative research – definitions and applications
   - Experimental research, field studies, surveys, modeling & simulation
   - Data types: Primary vs. Secondary; qualitative vs. quantitative
   - Data collection tools: sensors, lab instruments, GIS data etc.

7. **Technical Report Writing**:
   - Structure of a technical report: Title, Abstract, Introduction, Methodology, Results, Discussion, Conclusion, References
   - Writing style: clarity, coherence, precision
   - Figures, tables, charts – formatting
   - Formatting and word templates for research reports
   - Common errors in technical writing and how to avoid them

8. **Presentation Skills**:
   - Components of an effective research presentation
   - Designing PPTs: slide structure, visuals, graphs, flow diagrams
   - Storytelling approach for technical presentations
   - Handling Q&A during presentations

ASSESSMENT:

- **Term work:** Continuous assessment based on lab reports and presentations.
- **Oral Examination:** Final evaluation based on research proposal submission and viva.

Course Syllabus

Final Year B Tech Civil Engg.

Semester-VIII/VII

Scheme A/B

Program:	B. Tech. (Civil Engineering)			Semester :		VIII/VII (Scheme A/B)	
Course:	MOOC (PEC 6)			Code:		BCI28PE81/ BCI27PE80	
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	FA		SA	Total
				FA1	FA2		
2	2	-	-	20	30	-	50

Course Objectives:

1. To embed self learning attitude in students.
2. To prepare students for modern tools and techniques.

Course Outcomes: After learning the course, the students will be able to:

1. Build self-learning skills.
2. Discuss the application of modern tools and techniques in civil engineering.

Guidelines for Students:

1. The Massive Open Online Course (MOOC) can be chosen from the platform such as NPTEL/Coursera/ /Udemy etc.in 7th or 8th semester as per curriculum. Student who opted scheme A: and completing MOOC in 7th semester, credit earned through MOOC will be given in 8th semester only. MOOC will be like branch specific program elective course
2. An individual student must obtain prior approval from the project guide and the MOOC coordinator before registration. The student is not permitted to register for a course that has already been learned or for which credits have been earned as part of the B. Tech curriculum.
3. While selecting a course, students may opt for the latest available offerings to acquire advanced knowledge.
4. Total duration of course should be minimum 8 and maximum 12 weeks.
5. Regular assignment submission need to be completed as per the requirement of course.
6. At the end of the MOOC, submission of a hardcopy report of 3–4 pages, along with the certificate of completion, is mandatory.
7. The final examination for this course is mandatory, irrespective of the platform. In cases where a final examination option is not available for the MOOC, evaluation shall be carried out as per the rubrics specified below
8. If a student is unable to complete the MOOC and fails the course as per the prescribed rubrics, the student must enroll in an alternative MOOC and successfully complete it before the Re-SA or the summer term.

Evaluation Guidelines and Rubrics:

1. **Formative Assessment 1 (20 Marks)-** Prepare a presentation on the covered syllabus.

	Good	**Average**	**Poor**
Timely completion, quality of work, understanding of content, assessment and submission of assignments.	16-20	11-15	8-10

2. **Formative Assessment 2 (30 Marks)**

MOOCs report Submission (10 Marks)

The student should summarize learning outcomes in report of 3-4 pages or student may submit good quality paper with some application implemented using the knowledge gained through the course to comply these rubrics:
a. Report/ Paper must be drafted appropriately (LATEX tool but not compulsory) (5 Marks)
b. Content of the report/ paper (5Marks)

If SWAYAM/ NPTEL Course is completed (20 Marks)

a. Appeared for Exam: 05 Marks
b. Performance of Exam: 15 Marks

If Coursera Course is completed
Marks for Certificate: 10 Marks

If Udemy Course is completed
Marks for Certificate: 05 Marks

Link of platforms:

https://nptel.ac.in/courses
https://www.coursera.org/search?query=construction%20management&
https://www.udemy.com/topic/construction/

Program:	B. Tech. (Civil Engineering)			Semester :			VIII/VII (Scheme A/B)
Course:	Internship			Code:			BCI28EL03/ BCI27EL05
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks			
	Lecture	Practical	Tutorial	TW	OR	PR	Total
12	-	24	-	200	50	-	250

Internship General Guideline (Refer separate booklet for assessment process

An internship is an opportunity to gain practical experience in a field of interest, which can also further strengthen career goals. The structured internship proposed has a core objective to expose students to the sites/ fields, allowing them to understand the technical, administrative, economic, and social aspects necessary for the successful completion of the task/project.

The following guidelines are structured for the internship, which are to be strictly followed to earn the academic credits.

1. Internship Duration: For a gain of 1 Credit, 40 Hrs (1 full week) of the Internship is to be completed. The distribution of the credits and marks allocated for the course Internship is presented further in Table.

2. Internship Domains:

. Working for a consultancy/ research project

. Contribution in incubation/innovation/entrepreneurship cell/institutional innovation council/startups cells of the institute

. Learning at departmental lab/tinkering lab/institutional workshop

. Development of new product/business plan/registration of start-up

. Industry/government organisation internship

. In-house product development, intercollegiate, interdepartmental research internship under a research lab/group, micro/small/medium enterprise/online internship

. Research internship under professors, IISC, IIT's, and research organizations

. NGOs or social internships, rural internship

. Development of Physical and/or numerical, mathematical, soft computing model

. Carrying out surveys related to society-related but Engineering problems. For example, a survey of solid waste management in a particular area/town/village, a survey of water supply network in a locality, town, village, etc., a survey of air quality etc.

3. Allocation of the Internship Supervisors:

. **A) Internal Internship Supervisor (IES): The** Internship coordinator of the department will be allocated the IES, which will be an internal faculty member from the department. It is compulsory to report daily to the IES about the daily tasks performed at the site**.**

b) External Internship Supervisor (EIS): EIS will be the person on the site whom the intern (you) will report.

4. Writing of Daily Internship Diary: Students must maintain an Internship Diary. Students should take the sign of the External Internship Supervisor (EIS) after completion of each day's work compulsorily. Students are informed to attach the geotagged photos, site drawings, and calculation sheets in this diary

The internship diary will be evaluated for the assigned marks, and it is mandatory to be submitted. The format of the dairy will be provided by the Department Internship Coordinator.

Program:	B. Tech. (Civil Engineering)			Semester:	VIII/VII (Scheme A/B)	
Course:	Project			Code:	BCI28EL04/ BCI27EL07	
Credits	Teaching Scheme (Hrs/Week)			Evaluation Scheme and Marks		
	Lecture	Practical	Tutorial	TW	OR	Total
4	-	8	-	100	50	150

Prior Knowledge:

1. Fundamentals of Civil Engineering
2. Basics of Research Methodology and Report Writing

Course Objectives: This course aims at enabling students,

1. Identify and analyze technical/practical problems in Civil Engineering.
2. Apply innovative solutions using modern engineering tools.
3. Develop competence in report writing, technical documentation, and presentation.

Course Outcomes: After learning the course, the students should be able to:

1. Formulate and analyze Civil Engineering problems with sound fundamentals.
2. Apply innovative tools/techniques for sustainable solutions.
3. Communicate effectively through technical reports and oral presentations.
4. Demonstrate teamwork, professional ethics, and environmental awareness.

Term Work:

The Project report should contain the following. Departmental Project Review Committee may prepare a continuous evaluation sheet of each individual and refer as continuous assessment for term work marks. Project group must comprise of **four** students.

Detailed Syllabus

Term work consists of:

1. Project Definition & Objectives

- Selection of a relevant Civil Engineering topic
- Problem statement, aim, and measurable objectives
- Understanding relevance, scope, and limitations
- Initial project planning and scheduling

2. Literature Review & Methodology

- Review of recent (last 5 years) research papers and standards
- Identification of research gaps and benchmarking
- Development of methodology: experimental, analytical, or simulation-based
- Tools, materials, data sources, and workflow planning

3. Analysis & Results

- Data collection from experiments, surveys, site visits, or simulations
- Data processing using appropriate engineering tools/software
- Presentation of results through graphs, tables, and charts
- Interpretation and technical discussion of findings

4. Conclusion & Future Scope

- Summary of major outcomes
- Achievement of objectives and technical significance
- Limitations of the study
- Recommendations and possible future enhancements

5. Report & Presentation

- Preparation of technical report as per institute format
- Proper citations and plagiarism compliance
- PPT preparation summarizing project work
- Viva-voce presentation before internal and external examiners

ORAL EXAMINATION:

The students must prepare a presentation on Project work and present in presence of external examiners through a viva-voce examination.

Vision and Mission of the Civil Engineering Department

Vision of the Civil Engineering Department

To establish as a premier civil engineering department in Maharashtra in the coming five years by providing quality education, fostering innovation with ethical values to serve the society.

Mission of the Civil Engineering Department

1. Fostering value-based education to achieve academic excellence with the right attitude and professional ethics.

2. Inculcating a culture of research and innovation, with an aim of serving society in a sustainable manner.

3. Developing skilled civil engineers with an ability to provide solutions to meet national and global challenges in accordance with the needs of the society.

Program Specific Outcomes (PSO) of Civil Engineering Department

1. Graduates in civil Engineering will demonstrate proficiency in practical applications for quality construction work in the domain of Structural Engineering, Water Resources-Environmental Engineering, Geotechnical-Transport and Construction Management.

2. A graduate in Civil Engineering, equipped with the necessary skills and technical knowledge, can become an entrepreneur in the field, capable of identifying business opportunities, developing business plans, managing resources, designing and executing sustainable construction projects for infrastructural development.