K E Socity's

Rajarambapu Institute of Technology, Rajaramnagar

Department of Civil Engineering

Undertaking for Structure & Syllabus Approval

Date: 07/05/2025

To,

Dean Academics,

RIT, Rajaramnagar

Hereby I declare that, I have checked all subject course codes present in a structure and confirmed that no course code is repeated. I have compared the course codes with the database available at controller of examination. Also, I have checked format and content of the structure as well as syllabus.

I assure you that there is no any mistake present in the structure and syllabus.

BOS Secretary

Department of Civil Engineering
R. I. T., Rajaramnagar.

BOS Secretary

RAJARAMBAPU INSTT. OF TECHNOLOGY
RAJARAMNAGAR CIVIL ENGG. DEPT.

BOS Chairman

Department of Civil Engineering
R. I. T., Rajaramnagar.

Head of the Department

B. Tech. in Civil Engineering with Multidisciplinary Minor

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Rajarambapu Institute of Technology, Rajaramnagar

(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)

Curriculum Structure and Evaluation Scheme

To be implemented for 2022-26 Batch

Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev01/2022-26

Class: S. Y. B. Tech **Semester: III**

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min. for passing		Max.	Min. for passing
CE231	Mathematics for Civil Engineer	3	-	-	3	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15			----	----
						ESE	50	40		----	----
CE2214	Building Planning and Design	3	-	-	3	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15			----	----
						ESE	50	40		----	----
CE2074	Surveying	3	-	-	3	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15			----	----
						ESE	50	40		----	----
CE2034	Engineering Mechanics	2	-	-	2	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15			----	----
						ESE	50	40		----	----
SH2174	Environmental Science	1	-	2	2	ISE	50	40	40	----	----
						ESE	50	40		----	----
	Multidisciplinary Minor- I	3	-	-	3	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15			----	----
						ESE	50	40		----	----
CE2234	Building Planning and Drawing Laboratory	-	-	2	1	ISE	----	----		50	50
						ESE	----	----		50	50
CE2114	Surveying Laboratory	-	-	2	1	ISE	----	----		50	50
						ESE	----	----		50	50
CE2134	Engineering Mechanics and Materials Testing Laboratory	-		2	1	ISE	----	----		100	50
CE233	Building Interior Design & Drawing	-	-	2	1	ISE	----	----		100	50
CE2154	Technical Aptitude-I	-	-	2	1	ESE	----	----		100	50
	Professional Skills Development and Foreign Languages	-	-	2	1	ISE	----	----		100	50
	TOTAL	15	-	14	22						
	TOTAL CONTACT HOURS	29									

ISE = In Semester Evaluation, (UT1+UT2) UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Exam

Total Contact Hours/week : 29

Total Credits : 22

Technical Aptitude Courses : Mathematics for Civil Engineer, Surveying, Engineering Mechanics, Building Planning and Design

Note: ISE of the Environmental Science course will be the project on application of technology in Environmental concerns. If student fails in ISE (i.e. project) he /she will not be eligible for ESE of the course. In time table allot 1 hour for theory and 2 hours for Environmental Science -project (Batch wise)

Professional Skills Development and Foreign Languages

Sr. No.	Subject Name		Course Code
1.	Professional Skills Development and Foreign Languages	Professional Leadership Skills	SH2634
2.		Interpersonal Skills	SH2614
3.		Innovation Tools and Methods for Entrepreneurs	SH2694
4.		Personal Effectiveness and Body Language	SH2594
5.		German Language – III	SH2734
6.		Japanese Language – III	SH2714

Note:

1. A student has to complete any two courses out of six choices offered under Choice Based Professional Skills Development Program. A course in each semester will be allocated without any repetition.
2. Foreign Language course selected in F. Y. B. Tech Sem-I will remain the same with next levels in Sem-III & IV. (No new entries in S. Y. B. Tech Sem-III)

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Curriculum Structure and Evaluation Scheme

To be implemented for 2022-26 Batch

Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev01/2022-26

Class: S. Y. B. Tech Semester: IV

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %) Max	Theory (Marks %) Min. for passing	Practical (Marks %) Max	Practical (Marks %) Min.for passing
CE232	Strength of Materials	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE2044	Concrete Technology	2	-	-	2	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE2064	Fluid Mechanics	2	-	-	2	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE234	Water Resources and Irrigation Engineering	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE236	Highway Engineering	2	-	-	2	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
	Modern Indian Language	2	-	-	2	ISE	100	50	---	---
	Multidisciplinary Minor- II	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE2184	Concrete Technology Laboratory	-	-	2	1	ISE	---	----	50	50
						ESE	---	----	50	50
CE2164	Fluid Mechanics Laboratory	-	-	2	1	ISE	---	----	100	50
CE238	Highway Materials Testing Laboratory	-	-	2	1	ISE	---	----	50	50
						ESE	---	----	50	50
CE240	Practical Aspects of Construction Supervision	-	-	2	1	ISE	---	----	100	50
CE2204	Technical Aptitude-II	-	-	2	1	ESE	---	----	100	50
	Professional Skills Development and Foreign Languages	-	-	2	1	ISE	---	----	100	50
	TOTAL	17	-	12	23					
	TOTAL CONTACT HOURS	29								

ISE = In Semester Evaluation, (UT1+UT2) UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam

Total Contact Hours/week : 29

Total Credits : 23

Technical Aptitude Courses : **Strength of Materials, Concrete Technology, Fluid Mechanics, Water Resource and Irrigation Engineering.**

Note: Students are required to undergo industrial / field training of minimum two weeks in the vacation of Semester-IV and its evaluation will be carried out in the Semester-V.

Rajarambapu Institute of Technology Rajaramnagar Dist. Sangli

Sr. No.	Subject Name		Course Code
1	Modern Indian Language	मराठी भाषिक कौशल्यविकास	SH202
2		हिंदी कथा साहित्य एवं प्रयोजमूलक हिंदी	SH204

Sr. No.	Subject Name		Course Code
1.	Professional Skills Development and Foreign Languages	Professional Leadership Skills	SH2634
2.		Interpersonal Skills	SH2614
3.		Innovation Tools and Methods for Entrepreneurs	SH2694
4.		Personal Effectiveness and Body Language	SH2594
5.		German Language – IV	SH2644
6.		Japanese Language – IV	SH2624

Note:

1. A student has to complete any two courses out of six choices offered under Choice Based Professional Skills Development Program. A course in each semester will be allocated without any repetition.
2. Foreign Language course selected in F. Y. B. Tech Sem-I will remain the same with next levels in Sem-III & IV. (No new entries in S. Y. B. Tech Sem-III)

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Curriculum Structure and Evaluation Scheme

To be implemented for 2022-26 Batch

Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev01/2022-26

Class: T. Y. B. Tech Semester: V

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min. for Passing		Max	Min. for passing
CE3014	Design of Steel Structures	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE351	Estimations and Costing	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE353	Mechanics of Structure	2*	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective -I	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Open Elective -I	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Multidisciplinary Minor-III	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Multidisciplinary Minor-IV	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
SH3034	Scholastic Aptitude I	2	-	-	2	ISE	20	40	40	---	----
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE355	Estimations Costing and Valuation Laboratory	-	-	4	2	ISE	---	---		100	50
CE3174	Technical Aptitude-III	-	-	2	1	ESE	---	---		100	50
CE357	Summer Internship	-	-	-	2	ISE	---	---		100	50
	TOTAL	18+1*	-	6	23						
	TOTAL CONTACT HOURS	25									

ISE = In Semester Evaluation, (UT1+UT2) UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Exam

Total Contact Hours/week : **25**

Total Credits : **23**

Technical Aptitude Courses : **Design of Steel Structures, Estimations & Costing, Mechanics of Structure**

Note*: One extra lecture to be allotted in time Table.

Program Elective Course- I

Sr. No.	Course Code	Course Name	Specialization
1	CE359	Legal practice in Construction	Construction Management
2	CE361	Optimization Techniques	
3	CE363	Construction Quality Control	
4	CE365	Advanced Fluid Mechanics	General Engineering
5	CE367	Solid Waste Management	
6	CE369	Public Building Planning and Design	
7	CE371	Engineering Geology	
8	CE373	Matrix Methods of Structural Analysis	Structural Engineering
9	CE375	Earthquake Engineering	

Open Elective – I			
Sr. No	**Course Code**	**Course Name**	**Offered By Department**
1	OE345	Soft Computing	Computer Science & Information Technology
2	OE361	Object Oriented Modeling and Design	
3	OE343	Data Science	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
4	OE347	New Product Design & Development	Mechanical Engineering
5	OE349	Non-Conventional Energy Sources	
6	OE351	Hydrogen & Fuel Cell Technology	
7	OE3044	Renewable Energy Sources	Automobile Engineering
8	OE353	Factory Automation	Mechatronics Engineering
9	OE355	Cyber Physical Systems	
10	OE3104	Network Administration	Computer Science & Engineering
11	OE3064	Environmental Impact Assessment	Civil Engineering
12	OE350	Operations Research	
13	OE341	Energy Auditing and Management	Electrical Engineering
14	OE357	Internet of Things	Electronics & Telecommunication Engineering
15	OE359	Drone Technology	

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Curriculum Structure and Evaluation Scheme

To be implemented for 2022-26 Batch

Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev01/2022-26

Class: T. Y. B. Tech **Semester:** VI

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %) Max	Theory (Marks %) Min. for passing	Practical (Marks %) Max	Practical (Marks %) Min. for passing
CE352	Geotechnical Engineering	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE354	Construction Practices	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE356	Research Methodology	2	-	-	2	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
	Program Elective -II	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
	Open Elective -II	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
	Multidisciplinary Minor- V	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
SH3064	Scholastic Aptitude II	2	-	-	2	ISE	20	40	---	----
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE358	Geotechnical Engineering Laboratory	-	-	2	1	ISE	---	---	50	50
						ESE	---	---	50	50
CE360	Design of Steel Structures Laboratory	-	-	2	1	ISE	---	---	100	50
CE362	Software Laboratory	-	-	2	1	ISE	---	---	100	50
CE3124	Technical Aptitude IV	-	-	2	1	ESE	---	---	100	50
CE3144	Capstone project Phase I	-	-	2	1	ISE	---	---	100	50
	TOTAL	19	-	10	24					
	TOTAL CONTACT HOURS	29								

ISE = In Semester Evaluation, (UT1+UT2) UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam

Total Contact Hours/week : 29

Total Credits : 24

Technical Aptitude Courses : Geotechnical Engineering, Construction Practices, Highway Engineering

Program Elective II Course List

Sr. No.	Course Code	Course Name	Specialization
1	CE364	Construction Equipment Management	Construction Management
2	CE382	Town Planning	
3	CE366	Advanced Hydraulic Engineering	General Engineering
4	CE368	Air Quality Assessment	
5	CE370	Traffic Engineering	
6	CE372	Industrial Waste Management	
7	CE3184	Repair and Rehabilitation of Structures	Structural Engineering
8	CE374	Advanced Structural Analysis	
9	CE376	Composite Materials and Structures	
10	CE378	Finite Element Method	
11	CE380	Fiber Reinforced Concrete	

Open Elective –II			
Sr. No.	Course Code	Course Name	Offered By Department
1	OE3401	Cyber security	Computer Science & Information Technology
2	OE360	Distributed Systems	
3	OE342	Data Mining	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
4	OE3024	Reliability Engineering	Automobile Engineering
5	OE344	Supply Chain Analytics	Mechatronics Engineering
6	OE346	Mobile Robotics	Mechatronics Engineering
7	OE348	Information Technology Foundation Program	Computer Science & Engineering
8	OE3381	Disaster Management	Civil Engineering
9	OE3084	Materials Management	
10	OE358	Plumbing (Water and Sanitation)	
11	OE3182	Industrial Drives	Electrical Engineering
12	OE352	Image Processing	Electronics & Telecommunication Engineering
13	OE354	Fuzzy logic and Neural Network	
14	OE356	Project Management	Mechanical Engineering
15	OE3284	Supply Chain Management	
16	OE3324	Entrepreneurship Development	

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Curriculum Structure and Evaluation Scheme

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Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev01/2022-26

Class: Final Year B. Tech **Semester:** VII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max.	Min. for passing		Max.	Min. for passing
CE4014	Design of Reinforced concrete Elements	3*	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE4034	Construction Management	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE4054	Environmental Engineering	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective -III	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective -IV	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE4074	Design of Reinforced Concrete Structures Laboratory	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
CE4094	Environmental Engineering Laboratory	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
	Program Elective III Laboratory	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
CE4114	Capstone Project Phase II	-	-	6	3	ISE	--	---		50	50
						ESE	--	---		50	50
	TOTAL	14+1*	-	10	20						
	TOTAL CONTACT HOURS	25									

ISE = In Semester Evaluation, (UT1+UT2) UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Exam

Total Contact Hours/week : 25

Total Credits : 20

Note*: One extra lecture to be allotted to the course Design of Reinforced concrete Elements in time Table.

Program Elective Course- III

Sr. No.	Course Code	Course Name	Specialization
1	CE4134	Construction Project Management	Construction Management
2	CE4154	Advanced Concrete Technology	
3	CE481	Environmental Chemistry and Microbiology	General Engineering
4	CE483	Watershed Management and Remote Sensing Applications	
5	CE4174	Rock Mechanics	
6	CE4194	GIS and GPS system	
7	CE485	Structural Health Monitoring	Structural Engineering
8	CE487	Design of Industrial Structures	
9	CE4214	Advanced Structural Design	

Program Elective Course- IV

Sr. No.	Course Code	Course Name	Specialization
1	CE4234	Total Quality Management	Construction Management
2	CE439	Advanced Construction Techniques	
3	CE4254	Environmental Management System	General Engineering
4	CE487	Foundation Engineering	
5	CE4274	Design of Prestressed Concrete structures	Structural Engineering
6	CE489	Advanced Design of Steel Structure	
7	CE491	Structural Design of Foundation	
8	CE4294	Design of bridges	

Program Elective III Laboratory

Sr. No.	Course Code	Course Name	Specialization
1	CE4314	Construction Project Management Laboratory	Construction Management
2	CE4334	Advanced Concrete Technology Laboratory	
3	CE493	Environmental Chemistry and Microbiology Laboratory	General Engineering
4	CE495	Watershed Management and Remote Sensing Applications Laboratory	
5	CE4354	Rock Mechanics Laboratory	
6	CE4374	GIS and GPS system Laboratory	
7	CE497	Structural Health Monitoring Laboratory	Structural Engineering
8	CE499	Design of Industrial Structures Laboratory	
9	CE4394	Advanced Structural Design Laboratory	

Choice based Internship Model
Model I: Industry Internship (II)

Class: Final Year B. Tech — **Semester:** VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %) Max.	Theory (Marks %) Min. for passing		Practical (Marks %) Max.	Practical (Marks %) Min. for passing
OE4382	Finance for Engineers (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
OE4362	Engineering Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
IP4024	Industry Internship & Project	-	-	-	12	ISE	---	----		50	50
						ESE	---	---		50	50
	TOTAL	-	-	-	16						

ISE = In Semester Evaluation, ESE = End Semester Exam

Total Contact Hours/week : --
Total Credits : 16

Note:
1] Weekly Contact hours are not mentioned as student is expected to be in industry regularly for 20 weeks. However, student needs to report to Institute mentors as and when required.
2] For online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.
Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exam will be held at college campus.

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Model II: Research Internship (RI)

Class: Final Year B. Tech **Semester:** VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max.	Min. for passing		Max.	Min. for passing
OE4382	Finance for Engineers (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
OE4362	Engineering Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
RE4044	Research Internship	-	-	-	12	ISE	---	----		50	50
						ESE	---	---		50	50
	TOTAL	-	-	-	16						

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam

Total Contact Hours/week : -
Total Credits : 16

Students who opt for a research internship need to undergo a minimum of one month of research internship in outside research organizations or laboratories.

Note:
1] Weekly Contact hours are not mentioned as student is expected to be in outside research organization regularly for 20 weeks. However, student needs to report to Institute mentors as and when required.
2] For online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exam will be held at college campus.

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Curriculum Structure and Evaluation Scheme

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Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev01/2022-26

Model III: Entrepreneurial Internship (EI)

Class: Final Year B. Tech **Semester:** VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min. for passing		Max	Min. for passing
ED4104	Project Management (Online Course)	2	-	-	2	ISE	25	40	40	-	-
						ESE	75	40		-	-
ED4044	Commercial Aspects of the Project (Online Course)	2	-	-	2	ISE	25	40	40	-	-
						ESE	75	40		-	-
ED4064	Entrepreneurship Development Program (EDP)	-	-	-	1	ISE				100	50
ED4084	Entrepreneurial Internship	-	-	-	11	ISE	-	-	-	50	50
						ESE	-	-	-	50	
	TOTAL	-	-	-	16						

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam

Total Contact Hours/week : -

Total Credits : 16

Students who opt for an entrepreneurial internship need to undergo a one-month internship at an outside reputed organization or firm

Note:

1] Weekly Contact hours are not mentioned as student is expected to be in outside research organization regularly for 20 weeks. However, student needs to report to Institute mentors as and when required.

2] For online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exam will be held at college campus.

3] A one week Entrepreneurship Development Program (EDP) will be conducted after completion of 7th semester and before start of 8th semester.

Multidisciplinary Minor

1. Student should choose any one specialization given by the department and complete all the five courses under the specialization to earn 170 credits.
2. Following are the baskets of multidisciplinary minor courses.

Multidisciplinary Minor Baskets					
MDM Basket Name	**Sr. No.**	**Course Code**	**Course Name**	**Semester**	**Offered by Department**
Automobile Engineering	1	ATMD201	Automobile Systems	III	Automotive Technology
	2	ATMD202	I. C. Engines	IV	
	3	ATMD301	Automotive Safety & Ergonomics	V	
	4	ATMD303	Automobile Engineering Lab.	V	
	5	ATMD302	Electric Vehicles	VI	
Construction Engineering	1	CEMD201	Building Construction and Planning	III	Civil Engineering
	2	CEMD202	Building Estimation and Valuation	IV	
	3	CEMD301	Infrastructure Engineering	V	
	4	CEMD303	Smart Cities and Sustainable Development	V	
	5	CEMD302	Environmental Engineering	VI	
Software Programming	1	CSMD201	Introduction to Data Structures	III	Computer Science & Engineering
	2	CSMD202	Problem solving using JAVA	IV	
	3	CSMD301	Fundamentals of Database Systems	V	
	4	CSMD303	Object-oriented Programming in Python	V	
	5	CSMD302	Artificial Intelligence	VI	
Electrical Power System	1	EEMD201	Electrical Power Generation	III	Electrical Engineering
	2	EEMD202	Power System	IV	

	3	EEMD301	Electrical Machines	V	
	4	EEMD303	Electrical Technology	V	
	5	EEMD302	Smart Grid	VI	
Electronics System Design	1	ECMD201	Electronics Devices and Applications	III	Electronics &Telecommunication Engineering
	2	ECMD202	Electronics Communication Systems	IV	
	3	ECMD301	Advanced Communication Systems	V	
	4	ECMD303	Electronic Product Design	V	
	5	ECMD302	Industrial Electronics	VI	
Software Development	1	CIMD201	Data Structures	III	Computer Science & Information Technology
	2	CIMD202	Computer Algorithms	IV	
	3	CIMD301	Introduction to DBMS	V	
	4	CIMD303	OOP using Java	V	
	5	CIMD302	Software Engineering	VI	
Elements of Mechanical Engineering	1	MEMD201	Materials and Applications	III	Mechanical Engineering
	2	MEMD202	Design and Drawing of Machine Components	IV	
	3	MEMD301	Manufacturing and Assembly Process	V	
	4	MEMD303	Refrigeration and Air Conditioning	V	
	5	MEMD302	Power Plant Engineering	VI	
Mechatronics Engineering	1	MCMD201	Fundamentals of Mechatronics	III	Mechatronics Engineering
	2	MCMD202	Industrial Fluid Power	IV	
	3	MCMD301	Sensor and Instrumentation	V	
	4	MCMD303	Industrial Automation	V	
	5	MCMD302	Industrial Robotics	VI	
Artificial	1	AIMD201	Object Oriented	III	Computer Science &

Intelligence			Programming		Engineering (AI-ML)
	2	AIMD202	Data Structures and Algorithms	IV	
	3	AIMD301	Machine Learning	V	
	4	AIMD303	Business Intelligence	V	
	5	AIMD302	Principles of AI	VI	

B. Tech. in Civil Engineering with Double Minor (Multidisciplinary and Specialization Minor)

B. Tech in Civil Engineering with Double Minor degree

1. It is required to complete SIX courses (each of 3 credits) from ONLINE platform to earn total of 18 credits under Double Minor (DM) certification.
2. Student must complete and earn the credits for all the six courses starting from Second Year First semester (3rd semester) to Final Year Second Semester (8th semester).
3. Basket of the DM courses and respective semester is mentioned in the following table.

Sr. No.	Semester	Course	Code
1	IV	DM – I	YYDMNXXX
2	V	DM – II	YYDMNXXX
3	V	DM – III	YYDMNXXX
4	VI	DM – IV	YYDMNXXX
5	VII	DM – V	YYDMNXXX
6	VIII	DM – VI	YYDMNXXX

4. To select course platform, first preference must be given to NPTEL.
5. Other than NPTEL, courses from COURSERA and UDEMY platforms are allowed to register only in following cases,
    - If timeline of NPTEL course is not in line with timeline of academic calendar.
    - The suitable succeeding course in line with previous course is not available on NPTEL.
    - If any other unavoidable circumstances occurs.
6. Platform and course selection must be as per recommendation of BOS of the department.
7. Student will get the credits of respective DM course in following conditions,
    - In case of course selected from NPTEL platform, student have to complete the timely assignments, PASS the exam and secure the certificate.
    - In case of course selected from COURSERA or UDEMY, student have to secure the certificate and appear for VIVA(oral) exam.
8. While selecting online course, following points must be taken care of,
    - Selected course must be of basic or fundamental level.
    - Contents of the course should not be covered in any of the course offered in regular curriculum or not listed in any elective (open or program elective) or in Multidisciplinary Minor (MDM)
    - Duration of each online course must be of EIGHT weeks for NPTEL and 30+ hours for UDEMY, COURSERA courses.

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B. Tech. in Civil Engineering with Honor and Multidisciplinary Minor

B. Tech in Civil Engineering with Honor and Multidisciplinary Minor degree

1. It is required to complete SIX courses (each of 3 credits) from ONLINE platform to earn total of 18 credits under Honor certification.
2. Student must complete and earn the credits for all the six courses starting from Second Year First semester (3rd semester) to Final Year Second Semester (8th semester).
3. Basket of the Honor courses and respective semester is mentioned in the following table.

Sr. No.	Semester	Course	Code
1	IV	Honor - I	YYHNXXX
2	V	Honor - II	YYHNXXX
3	V	Honor - III	YYHNXXX
4	VI	Honor - IV	YYHNXXX
5	VII	Honor - V	YYHNXXX
6	VIII	Honor - VI	YYHNXXX

4. To select course platform, first preference must be given to NPTEL.
5. Other than NPTEL, courses from COURSERA and UDEMY platforms are allowed to register only in following cases,
    a. If timeline of NPTEL course is not in line with timeline of academic calendar.
    b. The suitable succeeding course in line with previous course is not available on NPTEL.
    c. If any other unavoidable circumstances occurs.
6. Platform and course selection must be as per recommendation of BOS.
7. Student will get the credits of respective Honor course in following conditions,
    a. In case of course selected from NPTEL platform, student have to complete the timely assignments, PASS the exam and secure the certificate.
    b. In case of course selected from COURSERA or UDEMY, student have to secure the certificate and appear for VIVA(oral) exam.
8. While selecting online course, following points must be taken care of,
    a. Selected course must be of advanced level and not basic or fundamental level.
    b. Contents of the course should not be covered in any of the course offered in regular curriculum or not listed in any elective (open or program elective)
    c. Duration of each online course must be of EIGHT weeks for NPTEL and 30+ hours for COURSERA, UDEMY courses.

B. Tech. in Civil Engineering-Honors with Research and Multidisciplinary Minor

Honors with Research and Multidisciplinary Minor

The Student will work on Research Project or Dissertation for 18 Credits in the Fourth Year in respective discipline. The distribution of 18 Credits for Research project in Sem-VII and Sem-VIII is given below. To get B. Tech in Civil Engineering-Honors with Research and Multidisciplinary Minor degree Student need to earn total 188 Credits which consist 170 credits of regular Multidisciplinary Minor courses, 18 Credits of Honor courses and 18 credits of Research courses.

Class: Final Year B. Tech **Semester:** VII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %) Max.	Min. for passing		Practical (Marks %) Max.	Min. for passing
REH401	Intellectual Property Rights (IPR)	-	-	-	2	ISE	50	40	40	---	---
						ESE	50	40		---	---
REH403	Research project (Synopsis) Phase- I	-	-	-	2	ISE				50	50
						ESE				50	50
REH405	Research Specific core course - I (Online NPTEL course)	-	-	-	3	ISE	50	40	40		
						ESE	50	40			
	TOTAL	-	-	-	7						

ISE = In Semester Evaluation, ESE = End Semester Exam

Note: For Evaluation of Online NPTEL course ISE Marks will be marks obtained by students in the assignments given by NPTEL, students who will secure NPTEL certification will be only eligible for ESE of the same course which will be conducted at institute

Class: Final Year B. Tech **Semester:** VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %) Max	Min. for passing		Practical (Marks %) Max	Min. for passing
REH402	Research project phase - II	-	-	-	11	ISE	--	--	-	50	50
						ESE	--	--		50	
	TOTAL	-	-	-	11						

ISE = In Semester Evaluation, ESE = End Semester Exam

B. Tech. in Civil Engineering with Multidisciplinary Minor

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K.E. Society's

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Curriculum Structure and Evaluation Scheme

To be implemented for 2022-26 Batch

Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev02/2022-26

Class: S. Y. B. Tech **Semester:** III

Course Code	Course	Teaching Scheme				Evaluation Scheme				
							Theory (Marks %)		Practical (Marks %)	
		L	T	P	Credits	Scheme	Max	Min. for passing	Max.	Min. for passing
CE231	Mathematics for Civil Engineer	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	---
						ESE	50	40	----	----
CE2214	Building Planning and Design	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
CE2074	Surveying	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
CE2034	Engineering Mechanics	2	-	-	2	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
SH2174	Environmental Science	1	-	2	2	ISE	50	40	----	----
						ESE	50	40	----	----
	Multidisciplinary Minor- I	3	-	-	3	ISE	20	40	----	----
						UT1	15		----	----
						UT2	15		----	----
						ESE	50	40	----	----
CE2234	Building Planning and Drawing Laboratory	-	-	2	1	ISE	----	----	50	50
						ESE	----	----	50	50
CE2114	Surveying Laboratory	-	-	2	1	ISE	----	----	50	50
						ESE	----	----	50	50
CE2134	Engineering Mechanics and Materials Testing Laboratory	-		2	1	ISE	----	----	100	50
CE233	Building Interior Design & Drawing	-	-	2	1	ISE	----	----	100	50
CE2154	Technical Aptitude-I	-	-	2	1	ESE	----	----	100	50
	Professional Skills Development and Foreign Languages	-	-	2	1	ISE	----	----	100	50
	TOTAL	**15**	**-**	**14**	**22**					
	TOTAL CONTACT HOURS	**29**								

ISE = In Semester Evaluation, (UT1+UT2) UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Exam

Total Contact Hours/week : 29

Total Credits : 22

Technical Aptitude Courses : Mathematics for Civil Engineer, Surveying, Engineering Mechanics, Building Planning and Design

Note: ISE of the Environmental Science course will be the project on application of technology in Environmental concerns. If student fails in ISE (i.e. project) he /she will not be eligible for ESE of the course. In time table allot 1 hour for theory and 2 hours for Environmental Science -project (Batch wise)

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Professional Skills Development and Foreign Languages

Sr. No.	Subject Name		Course Code
1.	Professional Skills Development and Foreign Languages	Professional Leadership Skills	SH2634
2.		Interpersonal Skills	SH2614
3.		Innovation Tools and Methods for Entrepreneurs	SH2694
4.		Personal Effectiveness and Body Language	SH2594
5.		German Language – III	SH2734
6.		Japanese Language – III	SH2714

Note:

1. A student has to complete any two courses out of six choices offered under Choice Based Professional Skills Development Program. A course in each semester will be allocated without any repetition.
2. Foreign Language course selected in F. Y. B. Tech Sem-I will remain the same with next levels in Sem-III & IV. (No new entries in S. Y. B. Tech Sem-III)

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Curriculum Structure and Evaluation Scheme

To be implemented for 2022-26 Batch

Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev02/2022-26

Class: S. Y. B. Tech **Semester:** IV

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)	
							Max	Min. for passing	Max	Min.for passing
CE232	Strength of Materials	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE2044	Concrete Technology	2	-	-	2	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE2064	Fluid Mechanics	2	-	-	2	ISE	20	40	---	---
						UT1	15		--	---
						UT2	15		---	---
						ESE	50	40	---	---
CE234	Water Resources and Irrigation Engineering	3	-	-	3	ISE	20	40	---	---
						UT1	15		--	---
						UT2	15		---	---
						ESE	50	40	---	---
CE236	Highway Engineering	2	-	-	2	ISE	20	40	---	---
						UT1	15		--	---
						UT2	15		---	---
						ESE	50	40	---	---
	Modern Indian Language	2	-	-	2	ISE	100	50	---	---
	Multidisciplinary Minor- II	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE2184	Concrete Technology Laboratory	-	-	2	1	ISE	---	----	50	50
						ESE	---	----	50	50
CE2164	Fluid Mechanics Laboratory	-	-	2	1	ISE	---	----	100	50
CE238	Highway Materials Testing Laboratory	-	-	2	1	ISE	---	----	50	50
						ESE	---	----	50	50
CE240	Practical Aspects of Construction Supervision	-	-	2	1	ISE	---	----	100	50
CE2204	Technical Aptitude-II	-	-	2	1	ESE	---	----	100	50
	Professional Skills Development and Foreign Languages	-	-	2	1	ISE	---	----	100	50
	TOTAL	**17**	**-**	**12**	**23**					
	TOTAL CONTACT HOURS	**29**								

ISE = In Semester Evaluation, (UT1+UT2) UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam

Total Contact Hours/week : 29

Total Credits : 23

Technical Aptitude Courses : Strength of Materials, Concrete Technology, Fluid Mechanics, Water Resource and Irrigation Engineering.

Note: Students are required to undergo industrial / field training of minimum two weeks in the vacation of Semester-IV and its evaluation will be carried out in the Semester-V.

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Sr. No.	Subject Name		Course Code
1	Modern Indian Language	मराठी भाषिक कौशल्यविकास	SH202
2		हिंदी कथा साहित्य एवं प्रयोजमूलक हिंदी	SH204

Sr. No.	Subject Name		Course Code
1.	Professional Skills Development and Foreign Languages	Professional Leadership Skills	SH2634
2.		Interpersonal Skills	SH2614
3.		Innovation Tools and Methods for Entrepreneurs	SH2694
4.		Personal Effectiveness and Body Language	SH2594
5.		German Language – IV	SH2644
6.		Japanese Language – IV	SH2624

Note:

1. A student has to complete any two courses out of six choices offered under Choice Based Professional Skills Development Program. A course in each semester will be allocated without any repetition.
2. Foreign Language course selected in F. Y. B. Tech Sem-I will remain the same with next levels in Sem-III & IV. (No new entries in S. Y. B. Tech Sem-III)

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Curriculum Structure and Evaluation Scheme

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Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev02/2022-26

Class: T. Y. B. Tech **Semester:** V

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %) Max	Theory (Marks %) Min. for Passing		Practical (Marks %) Max	Practical (Marks %) Min. for passing
CE3014	Design of Steel Structures	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE351	Estimations and Costing	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE353	Mechanics of Structure	2*	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective -I	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Open Elective -I	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Multidisciplinary Minor-III	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Multidisciplinary Minor-IV	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
SH3034	Scholastic Aptitude I	2	-	-	2	ISE	20	40	40	---	----
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE355	Estimations Costing and Valuation Laboratory	-	-	4	2	ISE	---	---		100	50
CE3174	Technical Aptitude-III	-	-	2	1	ESE	---	---		100	50
CE357	Summer Internship	-	-	-	2	ISE	---	---		100	50
	TOTAL	**18+1***	**-**	**6**	**23**						
	TOTAL CONTACT HOURS	**25**									

ISE = In Semester Evaluation, (UT1+UT2) UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Exam

Total Contact Hours/week : 25

Total Credits : 23

Technical Aptitude Courses : Design of Steel Structures, Estimations & Costing, Mechanics of Structure

Note*: One extra lecture to be allotted in time Table.

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Program Elective Course- I

Sr. No.	Course Code	Course Name	Specialization
1	CE359	Legal practice in Construction	Construction Management
2	CE361	Optimization Techniques	
3	CE363	Construction Quality Control	
4	CE365	Advanced Fluid Mechanics	General Engineering
5	CE367	Solid Waste Management	
6	CE369	Public Building Planning and Design	
7	CE371	Engineering Geology	
8	CE373	Matrix Methods of Structural Analysis	Structural Engineering
9	CE375	Earthquake Engineering	

Open Elective – I			
Sr. No	**Course Code**	**Course Name**	**Offered By Department**
1	OE345	Soft Computing	Computer Science & Information Technology
2	OE361	Object Oriented Modeling and Design	
3	OE343	Data Science	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
4	OE347	New Product Design & Development	Mechanical Engineering
5	OE349	Non-Conventional Energy Sources	
6	OE351	Hydrogen & Fuel Cell Technology	
7	OE3044	Renewable Energy Sources	Automobile Engineering
8	OE353	Factory Automation	Mechatronics Engineering
9	OE355	Cyber Physical Systems	
10	OE3104	Network Administration	Computer Science & Engineering
11	OE3064	Environmental Impact Assessment	Civil Engineering
12	OE350	Operations Research	
13	OE341	Energy Auditing and Management	Electrical Engineering
14	OE357	Internet of Things	Electronics & Telecommunication Engineering
15	OE359	Drone Technology	

Class: T. Y. B. Tech **Semester:** VI

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)	
							Max	Min. for passing	Max	Min. for passing
CE352	Geotechnical Engineering	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE354	Construction Practices	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE356	Research Methodology	2	-	-	2	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
	Program Elective -II	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
	Open Elective -II	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
	Multidisciplinary Minor- V	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
SH3064	Scholastic Aptitude II	2	-	-	2	ISE	20	40	---	----
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE358	Geotechnical Engineering Laboratory	-	-	2	1	ISE	---	---	50	50
						ESE	---	---	50	50
CE360	Design of Steel Structures Laboratory	-	-	2	1	ISE	---	---	100	50
CE362	Software Laboratory	-	-	2	1	ISE	---	---	100	50
CE3124	Technical Aptitude IV	-	-	2	1	ESE	---	---	100	50
CE3144	Capstone project Phase I	-	-	2	1	ISE	---	---	100	50
	TOTAL	**19**	**-**	**10**	**24**					
	TOTAL CONTACT HOURS	**29**								

ISE = In Semester Evaluation, (UT1+UT2) UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam

Total Contact Hours/week : **29**
Total Credits : **24**
Technical Aptitude Courses : **Geotechnical Engineering, Construction Practices, Highway Engineering**

RAJARAMBAPU INSTT. OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

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Program Elective II Course List

Sr. No.	Course Code	Course Name	Specialization
1	CE364	Construction Equipment Management	Construction Management
2	CE382	Town Planning	
3	CE366	Advanced Hydraulic Engineering	General Engineering
4	CE368	Air Quality Assessment	
5	CE370	Traffic Engineering	
6	CE372	Industrial Waste Management	
7	CE3184	Repair and Rehabilitation of Structures	Structural Engineering
8	CE374	Advanced Structural Analysis	
9	CE376	Composite Materials and Structures	
10	CE378	Finite Element Method	
11	CE380	Fiber Reinforced Concrete	

Open Elective –II			
Sr. No.	**Course Code**	**Course Name**	**Offered By Department**
1	OE3401	Cyber security	Computer Science & Information Technology
2	OE360	Distributed Systems	
3	OE342	Data Mining	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
4	OE3024	Reliability Engineering	Automobile Engineering
5	OE344	Supply Chain Analytics	Mechatronics Engineering
6	OE346	Mobile Robotics	Mechatronics Engineering
7	OE348	Information Technology Foundation Program	Computer Science & Engineering
8	OE3381	Disaster Management	Civil Engineering
9	OE3084	Materials Management	
10	OE358	Plumbing (Water and Sanitation)	
11	OE3182	Industrial Drives	Electrical Engineering
12	OE352	Image Processing	Electronics & Telecommunication Engineering
13	OE354	Fuzzy logic and Neural Network	
14	OE356	Project Management	Mechanical Engineering
15	OE3284	Supply Chain Management	
16	OE3324	Entrepreneurship Development	

RAJARAMBAPU INSTT. OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

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Class: Final Year B. Tech **Semester:** VII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max.	Min. for passing		Max.	Min. for passing
CE4014	Design of Reinforced concrete Elements	3*	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE4034	Construction Management	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE4054	Environmental Engineering	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective -III	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective -IV	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE4074	Design of Reinforced Concrete Structures Laboratory	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
CE4094	Environmental Engineering Laboratory	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
	Program Elective III Laboratory	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
CE4114	Capstone Project Phase II	-	-	6	3	ISE	--	---		50	50
						ESE	--	---		50	50
	TOTAL	**14+1***	**-**	**10**	**20**						
	TOTAL CONTACT HOURS	**25**									

ISE = In Semester Evaluation, (UT1+UT2) UT-I = Unit Test-I, UT-II = Unit Test-II, ESE = End Semester Exam

Total Contact Hours/week : 25

Total Credits : 20

Note*: One extra lecture to be allotted to the course Design of Reinforced concrete Elements in time Table.

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Program Elective Course- III

Sr. No.	Course Code	Course Name	Specialization
1	CE4134	Construction Project Management	Construction Management
2	CE4154	Advanced Concrete Technology	
3	CE481	Environmental Chemistry and Microbiology	General Engineering
4	CE483	Watershed Management and Remote Sensing Applications	
5	CE4174	Rock Mechanics	
6	CE4194	GIS and GPS system	
7	CE485	Structural Health Monitoring	Structural Engineering
8	CE441	Design of Industrial Structures	
9	CE4214	Advanced Structural Design	

Program Elective Course- IV

Sr. No.	Course Code	Course Name	Specialization
1	CE4234	Total Quality Management	Construction Management
2	CE439	Advanced Construction Techniques	
3	CE4254	Environmental Management System	General Engineering
4	CE487	Foundation Engineering	
5	CE4274	Design of Prestressed Concrete structures	Structural Engineering
6	CE489	Advanced Design of Steel Structure	
7	CE491	Structural Design of Foundation	
8	CE4294	Design of bridges	

Program Elective III Laboratory

Sr. No.	Course Code	Course Name	Specialization
1	CE4314	Construction Project Management Laboratory	Construction Management
2	CE4334	Advanced Concrete Technology Laboratory	
3	CE493	Environmental Chemistry and Microbiology Laboratory	General Engineering
4	CE495	Watershed Management and Remote Sensing Applications Laboratory	
5	CE4354	Rock Mechanics Laboratory	
6	CE4374	GIS and GPS system Laboratory	
7	CE497	Structural Health Monitoring Laboratory	Structural Engineering
8	CE499	Design of Industrial Structures Laboratory	
9	CE4394	Advanced Structural Design Laboratory	

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Choice based Internship Model
Model I: Industry Internship (II)

Class: Final Year B. Tech **Semester:** VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %) Max.	Min. for passing		Practical (Marks %) Max.	Min. for passing
OE4382	Finance for Engineers (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
OE4362	Engineering Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
IP4024	Industry Internship & Project	-	-	-	12	ISE	---	----		50	50
						ESE	---	---		50	50
	TOTAL	-	-	-	**16**						

ISE = In Semester Evaluation, ESE = End Semester Exam

Total Contact Hours/week : --
Total Credits : **16**

Note:
1] Weekly Contact hours are not mentioned as student is expected to be in industry regularly for 20 weeks. However, student needs to report to Institute mentors as and when required.
2] For online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.
Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exam will be held at college campus.

Model II: Research Internship (RI)

Class: Final Year B. Tech **Semester:** VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max.	Min. for passing		Max.	Min. for passing
OE4382	Finance for Engineers (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
OE4362	Engineering Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
RE4044	Research Internship	-	-	-	12	ISE	---	----		50	50
						ESE	---	---		50	50
	TOTAL	-	-	-	16						

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam

Total Contact Hours/week : -
Total Credits : 16

Students who opt for a research internship need to undergo a minimum of one month of research internship in outside research organizations or laboratories.

Note:
1] Weekly Contact hours are not mentioned as student is expected to be in outside research organization regularly for 20 weeks. However, student needs to report to Institute mentors as and when required.
2] For online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exam will be held at college campus.

Model III: Entrepreneurial Internship (EI)

Class: Final Year B. Tech **Semester:** VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min. for passing		Max	Min. for passing
ED4104	Project Management (Online Course)	2	-	-	2	ISE	25	40	40	-	-
						ESE	75	40		-	-
ED4044	Commercial Aspects of the Project (Online Course)	2	-	-	2	ISE	25	40	40	-	-
						ESE	75	40		-	-
ED4064	Entrepreneurship Development Program (EDP)	-	-	-	1	ISE				100	50
ED4084	Entrepreneurial Internship	-	-	-	11	ISE	-	-	-	50	50
						ESE	-	-	-	50	
	TOTAL	-	-	-	16						

ISE = In Semester Evaluation, UT-I = Unit Test-I, UT-II = Unit Test-II ESE = End Semester Exam

Total Contact Hours/week : -
Total Credits : 16

Students who opt for an entrepreneurial internship need to undergo a one-month internship at an outside reputed organization or firm

Note:

1] Weekly Contact hours are not mentioned as student is expected to be in outside research organization regularly for 20 weeks. However, student needs to report to Institute mentors as and when required.

2] For online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exam will be held at college campus.

3] A one week Entrepreneurship Development Program (EDP) will be conducted after completion of 7th semester and before start of 8th semester.

Multidisciplinary Minor

1. Student should choose any one specialization given by the department and complete all the five courses under the specialization to earn 170 credits.
2. Following are the baskets of multidisciplinary minor courses.

Multidisciplinary Minor Baskets					
MDM Basket Name	**Sr. No.**	**Course Code**	**Course Name**	**Semester**	**Offered by Department**
Automobile Engineering	1	ATMD201	Automobile Systems	III	Automotive Technology
	2	ATMD202	I. C. Engines	IV	
	3	ATMD301	Automotive Safety & Ergonomics	V	
	4	ATMD303	Automobile Engineering Lab.	V	
	5	ATMD302	Electric Vehicles	VI	
Construction Engineering	1	CEMD201	Building Construction and Planning	III	Civil Engineering
	2	CEMD202	Building Estimation and Valuation	IV	
	3	CEMD301	Infrastructure Engineering	V	
	4	CEMD303	Smart Cities and Sustainable Development	V	
	5	CEMD302	Environmental Engineering	VI	
Software Programming	1	CSMD201	Introduction to Data Structures	III	Computer Science & Engineering
	2	CSMD202	Problem solving using JAVA	IV	
	3	CSMD301	Fundamentals of Database Systems	V	
	4	CSMD303	Object-oriented Programming in Python	V	
	5	CSMD302	Artificial Intelligence	VI	
Electrical Power System	1	EEMD201	Electrical Power Generation	III	Electrical Engineering
	2	EEMD202	Power System	IV	

	3	EEMD301	Electrical Machines	V	
	4	EEMD303	Electrical Technology	V	
	5	EEMD302	Smart Grid	VI	
Electronics System Design	1	ECMD201	Electronics Devices and Applications	III	Electronics &Telecommunication Engineering
	2	ECMD202	Electronics Communication Systems	IV	
	3	ECMD301	Advanced Communication Systems	V	
	4	ECMD303	Electronic Product Design	V	
	5	ECMD302	Industrial Electronics	VI	
Software Development	1	CIMD201	Data Structures	III	Computer Science & Information Technology
	2	CIMD202	Computer Algorithms	IV	
	3	CIMD301	Introduction to DBMS	V	
	4	CIMD303	OOP using Java	V	
	5	CIMD302	Software Engineering	VI	
Elements of Mechanical Engineering	1	MEMD201	Materials and Applications	III	Mechanical Engineering
	2	MEMD202	Design and Drawing of Machine Components	IV	
	3	MEMD301	Manufacturing and Assembly Process	V	
	4	MEMD303	Refrigeration and Air Conditioning	V	
	5	MEMD302	Power Plant Engineering	VI	
Mechatronics Engineering	1	MCMD201	Fundamentals of Mechatronics	III	Mechatronics Engineering
	2	MCMD202	Industrial Fluid Power	IV	
	3	MCMD301	Sensor and Instrumentation	V	
	4	MCMD303	Industrial Automation	V	
	5	MCMD302	Industrial Robotics	VI	
Artificial	1	AIMD201	Object Oriented	III	Computer Science &

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Intelligence			Programming		Engineering (AI-ML)
	2	AIMD202	Data Structures and Algorithms	IV	
	3	AIMD301	Machine Learning	V	
	4	AIMD303	Business Intelligence	V	
	5	AIMD302	Principles of AI	VI	

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B. Tech. in Civil Engineering with Double Minor (Multidisciplinary and Specialization Minor)

B. Tech in Civil Engineering with Double Minor degree

1. It is required to complete SIX courses (each of 3 credits) from ONLINE platform to earn total of 18 credits under Double Minor (DM) certification.
2. Student must complete and earn the credits for all the six courses starting from Second Year First semester (3rd semester) to Final Year Second Semester (8th semester).
3. Basket of the DM courses and respective semester is mentioned in the following table.

Sr. No.	Semester	Course	Code
1	IV	DM – I	YYDMNXXX
2	V	DM – II	YYDMNXXX
3	V	DM – III	YYDMNXXX
4	VI	DM – IV	YYDMNXXX
5	VII	DM – V	YYDMNXXX
6	VIII	DM – VI	YYDMNXXX

4. To select course platform, first preference must be given to NPTEL.
5. Other than NPTEL, courses from COURSERA and UDEMY platforms are allowed to register only in following cases,
    - If timeline of NPTEL course is not in line with timeline of academic calendar.
    - The suitable succeeding course in line with previous course is not available on NPTEL.
    - If any other unavoidable circumstances occurs.
6. Platform and course selection must be as per recommendation of BOS of the department.
7. Student will get the credits of respective DM course in following conditions,
    - In case of course selected from NPTEL platform, student have to complete the timely assignments, PASS the exam and secure the certificate.
    - In case of course selected from COURSERA or UDEMY, student have to secure the certificate and appear for VIVA(oral) exam.
8. While selecting online course, following points must be taken care of,
    - Selected course must be of basic or fundamental level.
    - Contents of the course should not be covered in any of the course offered in regular curriculum or not listed in any elective (open or program elective) or in Multidisciplinary Minor (MDM)
    - Duration of each online course must be of EIGHT weeks for NPTEL and 30+ hours for UDEMY, COURSERA courses.

B. Tech. in Civil Engineering with Honor and Multidisciplinary Minor

B. Tech in Civil Engineering with Honor and Multidisciplinary Minor degree

1. It is required to complete SIX courses (each of 3 credits) from ONLINE platform to earn total of 18 credits under Honor certification.
2. Student must complete and earn the credits for all the six courses starting from Second Year First semester (3rd semester) to Final Year Second Semester (8th semester).
3. Basket of the Honor courses and respective semester is mentioned in the following table.

Sr. No.	Semester	Course	Code
1	IV	Honor - I	YYHNXXX
2	V	Honor - II	YYHNXXX
3	V	Honor - III	YYHNXXX
4	VI	Honor - IV	YYHNXXX
5	VII	Honor - V	YYHNXXX
6	VIII	Honor - VI	YYHNXXX

4. To select course platform, first preference must be given to NPTEL.
5. Other than NPTEL, courses from COURSERA and UDEMY platforms are allowed to register only in following cases,
    a. If timeline of NPTEL course is not in line with timeline of academic calendar.
    b. The suitable succeeding course in line with previous course is not available on NPTEL.
    c. If any other unavoidable circumstances occurs.
6. Platform and course selection must be as per recommendation of BOS.
7. Student will get the credits of respective Honor course in following conditions,
    a. In case of course selected from NPTEL platform, student have to complete the timely assignments, PASS the exam and secure the certificate.
    b. In case of course selected from COURSERA or UDEMY, student have to secure the certificate and appear for VIVA(oral) exam.
8. While selecting online course, following points must be taken care of,
    a. Selected course must be of advanced level and not basic or fundamental level.
    b. Contents of the course should not be covered in any of the course offered in regular curriculum or not listed in any elective (open or program elective)
    c. Duration of each online course must be of EIGHT weeks for NPTEL and 30+ hours for COURSERA, UDEMY courses.

B. Tech. in Civil Engineering-Honors with Research and Multidisciplinary Minor

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Honors with Research and Multidisciplinary Minor

The Student will work on Research Project or Dissertation for 18 Credits in the Fourth Year in respective discipline. The distribution of 18 Credits for Research project in Sem-VII and Sem-VIII is given below. To get B. Tech in Civil Engineering-Honors with Research and Multidisciplinary Minor degree Student need to earn total 188 Credits which consist 170 credits of regular Multidisciplinary Minor courses, 18 Credits of Honor courses and 18 credits of Research courses.

Class: Final Year B. Tech **Semester:** VII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %) Max.	Min. for passing		Practical (Marks %) Max.	Min. for passing
REH401	Intellectual Property Rights (IPR)	-	-	-	2	ISE	50	40	40	---	---
						ESE	50	40		---	---
REH403	Research project (Synopsis) Phase- I	-	-	-	2	ISE				50	50
						ESE				50	50
REH405	Research Specific core course - I (Online NPTEL course)	-	-	-	3	ISE	50	40	40		
						ESE	50	40			
	TOTAL	-	-	-	7						

ISE = In Semester Evaluation, ESE = End Semester Exam

Note: For Evaluation of Online NPTEL course ISE Marks will be marks obtained by students in the assignments given by NPTEL, students who will secure NPTEL certification will be only eligible for ESE of the same course which will be conducted at institute

Class: Final Year B. Tech **Semester:** VIII

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %) Max	Min. for passing		Practical (Marks %) Max	Min. for passing
REH402	Research project phase - II	-	-	-	11	ISE	--	--	-	50	50
						ESE	--	--		50	
	TOTAL	-	-	-	11						

ISE = In Semester Evaluation, ESE = End Semester Exam

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K.E. Society's
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(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Final Year B. Tech. Syllabus
To be implemented for 2022-26 Batch
Department of Civil Engineering

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE4014**	Course Name: **Design of Reinforced Concrete Elements**

L	T	P	Credits
3	-	-	3

Course Description:
Design of Reinforced Concrete Elements is a core course in the seventh semester of the B. Tech. Civil Engineering program, crucial for understanding the design principles of reinforced concrete structures. This course equips students with the knowledge and skills required to analyze and design key structural elements such as beams, slabs, columns, staircases, and isolated pad footings using the Limit State Method, guided by IS 456:2000. The significance of this course lies in its application to real-world civil engineering projects, where reinforced concrete is a fundamental construction material. By mastering these design techniques, students can ensure the structural integrity and safety of various civil engineering structures, preparing them for professional roles in structural design and construction

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Analyze R.C.C. beams and columns using the Limit State Method.
2. Design R.C.C. beams, slab, staircase, using Limit State Method of design.
3. Design R.C.C. columns, isolated pad footing using Limit State Method of design.

Prerequisite: Structural Analysis.

Course Content		
Unit No.	**Description**	**Hrs.**
01	**Design philosophies, LSM:** Design philosophies. Limit State Method: Limit State of Collapse, Serviceability, Analysis and design of singly reinforced beams.	**06**
02	**Doubly reinforced beams and flanged sections:** Analysis and design of doubly reinforced rectangular section. Properties of flanged sections. Analysis and design of flanged sections.	**06**
03	**Design of slab and Stair:** Design of one-way, two-way slabs, Design of Dog-legged staircase.	**06**

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04	**Shear, bond and torsion in beams:** Shear in beams, Cracks, Modes of failure, Critical sections for shear, Design for Shear reinforcement. Types of bonds, curtailment in bars. Detailing of reinforcement, Analysis and design of beams in torsion.	**06**
05	**Design of column:** Analysis and design of short columns, slenderness limit and eccentricity, uniaxial and biaxial bending, interaction diagrams, column with helical reinforcement.	**06**
06	**Design of footing:** Design of isolated pad footings, pressure distribution, check for one way and two-way shears.	**06**

References:

Codes of Practice:

- IS:456- (2000): Plain and Reinforced Concrete - Code of Practice, B.I.S. New Delhi
- SP 16:1980 Design Aids for Reinforced Concrete to IS 456, B.I.S. New Delhi.
- IS:875- (1987): Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures (Part 1 and Part 2).

Text Books:

- Punmia B. C., Jain A. K. "Limit State Design of Reinforced Concrete (As per IS 456:2000)", Laxmi Publications Pvt. Ltd.
- Bhavikatti S. S., "Advance R.C.C. Design", New Age International Publishers.
- Shah M. G. and Kale C. M., "R.C.C. Theory and Design", Trinity Press, New Delhi.

Reference Books:

- Karve S. R. and Shah V. L., "Illustrated Design of Reinforced Concrete Buildings", Assorted Editorial Publications.
- Karve S. R. and Shah V. L., "Handbook of Reinforced Concrete Design (as per IS: 456 - 2000)", Structures Publications.
- Pillai S. U. and Menon D., "Reinforced Concrete Design", McGraw Hill Education (India) Pvt. Ltd.
- Bhatt P., Mac Ginley T. J. Choo B. S., "Reinforced Concrete Design Theory and Examples", CRC Press.

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Final Year B. Tech. Syllabus
To be implemented for 2022-26 Batch
Department of Civil Engineering

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4034**	Course Name: **Construction Management**

L	T	P	Credits
2	**-**	**-**	**2**

Course Description:
Technology focuses on material aspects, while management encompasses both material resources and human factors. Planning is a crucial phase in construction management. Effective management boosts productivity by integrating technological innovations. Construction management is a fundamental course in civil engineering, providing valuable insights into the management of construction projects. It covers topics such as construction management tools, resource allocation, and resource leveling

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Discuss the functions & principles of management.
2. Analyse network diagram for civil engineering projects by using CPM and or PDM.
3. Apply various project monitoring and controlling methods for construction projects.
4. Apply various techniques for inventory control.

Prerequisite: Basic knowledge of construction activities

Course Content

Unit No.	Description	Hrs
01	**Functions & Principles of Management**: Functions of Management, Planning, Organizing, Staffing, Directing, Coordination, Communication, Motivation and Controlling. Principles of management by Henry Fayol, Levels of management, Organizations-elements, types and characteristics	04
02	**Project Planning & Management:** Project, categories of Projects, Objectives & importance of Project management, Agencies, Phases; Work Breakdown Structure, Project Planning-Bar Chart, Milestone Chart, Critical Path Method,	04
03	**Project Scheduling:** Development of CPM Network – Time Estimates, Floats, Critical Path, Network Compression.	04
04	**Monitoring & Controlling techniques:** Network Updating, Resource allocation – smoothing and leveling,	04
05	**Precedence Networking method:** Development of Precedence Network, Network analysis by precedence diagramming method, Introduction to Computer based Project Management	04

06	**Material planning & Site Layout:** Material Management – Objectives, Functions, Inventory Control- Necessity, Techniques Such as ABC, EOQ Analysis, Safety Stocks. Site Layout and Planning, Factor affecting site layout.	04

References:

Text Books:

- Punmia B. C., Khandelwal K. K, "Project Planning & Control with PERT & CPM", Laxmi Publications Pvt Ltd.
- Srinath L.S., "PERT and CPM: Principles and Applications" Publisher Affiliated East-West Press Private Limited, New Delhi
- Seetharaman S., "Construction Engineering and Management" Publisher Umesh Publication

Reference Books:

- Chitkara K. K., "Construction Project Management-Planning, Scheduling and Controlling", Tata McGraw Hill Publishing Company, New Delhi.
- Sengupta B. and Guha H. "Construction Management and Planning", McGraw Hill Education (India).
- Chandra Parsanna, "Projects: Planning, Analysis, Selection, Financing, Implementation and Review", McGraw-Hill Education (India).

Class: Final **Year B. Tech. Civil**	Semester: **VII**
Course Code **: CE4054**	Course Name: **Environmental Engineering**

L	T	P	Credits
3	**-**	**-**	**3**

Course Description:

Environmental Engineering course offered as core course in 7th semester, which focuses on water supply engineering and wastewater treatment, solid waste management and air pollution. The course enables students to work as a consultant or contractor for infrastructure projects related to water supply and waste management projects. This course intends to build the competency in the students to identify water source, to check water quality, to design of water supply scheme and wastewater treatment plant. In addition, this course enables student to control environmental degradation by using AI tools.

Course Learning Outcomes:

After successfully completion of this course, student will able to:

1. Explain importance water and wastewater analysis for various parameters.
2. Discuss impact of pollution on man, animal and plants.
3. Prepare layout of water and wastewater treatment process.
4. Design Water and Wastewater Treatment Plant.
5. Apply AI tools for assessment of impact of humans on environment.

Prerequisite: Basic knowledge of Environmental Science.

Course Content

Unit No.	Description	Hrs
01	**Introduction to Environmental Engineering** Introduction to Water Supply Engineering (WSE), Sources of Water and quality issues, water quality requirements for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design.	06
02	**Water Treatment Process** Layout of Water Treatment Plant, Aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion	06

	exchange, membrane processes, design problems on water treatment process, application of SCADA for water treatment plant	
03	**Sewage and Storm Water Collection system** Domestic and Storm water, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water-Quantification, and design of Storm water; Sewage and Sludge, Pollution due to improper disposal of sewage,	06
04	**Wastewater Treatment Process** Layout of Sewage Treatment Plant, wastewater treatment-Physical, chemical and biological treatment,, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes, design problems on components of wastewater treatment, Applications of SCADA for STP operations.	06
05	**Solid Waste Management** Solid waste, physical and chemical composition of solid waste, Functional elements of solid waste, Treatment and disposal of solid waste and Integrated solid waste management, application of remote sensing and GIS for SWM	06
06	**Air Pollution and Control** Air pollution, effects of air pollution on man material and vegetation, Metrological aspects of air pollution, Control of air pollution, Vehicular pollution, Global issues of environment viz. Global warming, acid rain, ozone layer depletion, Applications of AI tools for control of air pollution	06

References:

Text Books:

- Punmia B. C. "Water Supply Engineering" Lakshmi Publications Pvt. Ltd. New Delhi
- Punmia B. C."Wastewater Treatment and Reuse" Lakshmi Publications Pvt. Ltd. New Delhi
- Modi P. N. "Water Supply Engineering" Standard Book House, New Delhi
- Modi P. N. "Wastewater Treatment and Reuse" Standard Book House, New Delhi
- Rao M. N. & Datta A. K. "Wastewater Treatment" Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.

Reference Books:

- Metcalf and Eddy, "Wastewater Engineering: Treatment & Reuse" Tata McGraw Hill Publication.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code **: CE4134**	Course Name: **PE-III Construction Project Management**

L	T	P	Credits
3	**-**	**-**	**3**

Course Description:

Students will gain expertise in all key project management phases, with a focus on how to manage time, cost, quality, and resources across the entire project lifecycle. It encompasses theory and practical application of concepts in project management life cycle process. Human resource management is also incorporated in the last unit. Students will gain expertise in all key project management phases, with a focus on how to effectively manage time, cost, quality, and resources across the entire project lifecycle. It focuses on the processes, tools, and techniques essential for successfully managing construction projects within scope, budget, time, and quality constraints.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Discuss the concepts of project management, including the project life cycle.
2. Perform project feasibility studies.
3. Carry out project scheduling by using various tools.
4. Apply monitoring and control techniques using project management tools to track performance against time and cost baselines during project execution
5. Plan and Manage Project Teams and Communication

Prerequisite: Possess basic knowledge of construction activities.

Course Content

Unit No.	Description	Hrs
01	**Introduction:** Need for Project Management, Project Management Knowledge Areas and Processes, The Project Life Cycle, The Project Manager (PM), Phases of Project Management Life Cycle, Project Management Processes, Impact of Delays in Project Completions, Essentials of Project Management Philosophy, Project Management Principles and leadership.	06
02	**Project Identification Process:** Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point, SWOT analysis.	06

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03	**Project Planning:** Introduction, Project Planning, Need of Project Planning, Project Life Cycle, Roles, Responsibility and Team Work, Project Planning Process, Work Breakdown Structure (WBS).	06
04	**Project Execution:** Introduction, Project Execution, Project Control Process, Purpose of Project Execution and Control, Baseline management, Monitoring of project with respect to time and cost.	06
05	**Project Close-out:** Introduction, Project Close-out, Steps for Closing the Project, Project Termination, Project Follow-up, project documentation.	06
06	**Planning human resources:** Acquire, develop and manage project team. Planning project communications Manage and control communications, Project Organization- Project Organization chart, factors in designing a project structure, types of project organizations structures	06

References:

Text Books:

- Edward F, James A, Finch S, "Engineering Management", Pearson Education India,
- Davar R, "Principles of Management", Progressive Corporation Pvt Limited,
- Punmia B, Khandelwal K, "Project Planning and Control With PERT and CPM", Laxmi,
- Chitkara K, "Construction Project Management", Mc Graw Hill Publications,

Reference Books:

- Gupta P, Hira D, "Operations Research", S Chand Publication,
- Clifford F., Erik W., Desai G, "Project Management The Managerial Process", Mcgraw Hill Publications,
- Prasanna C., "Projects: Planning, Analysis, Selection, Fin. Implementation & Review", Tata McGraw Hill.
- Pilcher R, "Project Cost Control in Construction", Wiley-Blackwell,
- Khanna O, "Industrial management", Dhanpat Rai Publication.

Class: **Final Year B. Tech. Civil**	Semester: **VII**	L	T	P	Credits
Course Code : **CE4154**	Course Name: **PE-III Advanced Concrete Technology**	**3**	**-**	**-**	**3**

Course Description:

This course aims to inspire students by thoroughly exploring concrete behavior. It involves analyzing the properties and mechanisms of concrete at both microscopic and macroscopic levels. The curriculum includes investigations into how admixtures affect concrete, focusing on rheology and volume changes in fresh and hardened states. Additionally, the course covers specifications, mix-proportioning criteria, concrete properties, and special-purpose concrete applications.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Evaluate concrete quality based on the microstructural properties.
2. Recommend an appropriate binder and or admixture for given concreting applications.
3. Examine the mechanisms affecting the properties of fresh and hardened concrete.
4. Choose and explain appropriate testing method for fresh and hardened concrete based on a specific scenario and requirements.
5. Select a specialized concrete type for a specific concreting project.

Prerequisite: Possess basic knowledge of concrete technology

Course Content

Unit No.	Description	Hrs
01	**Microstructural properties of concrete:** Microstructure of the Aggregate Phase, Hydrated Cement Paste, Hydraulic and Non-hydraulic Cements, Chemistry of gypsum and lime cements, Solids and Voids in the hydrated cement paste, Microstructure-property relationships in the hydrated cement paste, Interfacial Transition Zone in Concrete.	06
02	**Chemical and Mineral Admixtures** Classifications, Mechanisms of action, Applications, Superplasticizers Set-Controlling Chemicals, Nomenclature and Composition, Applications. Mineral Admixtures, Significance, Classification, Natural Pozzolanic	06

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	Materials, Byproduct Materials, Mechanism of action, Applications. As per IS-9103: 1999.	
03	**Rheology of Concrete:** Concept, factors affecting rheology, rheological properties of concrete, basic rheological models, measurement of rheological properties.	06
04	**Dimensional Stability:** Types of cracks, deformations and their Significance, Elastic Behavior, stress-strain relationship, Shrinkage of concrete, Thermal Properties of Concrete, Extensibility and Cracking.	06
05	**Testing of Hardened Concrete:** Testing of hardened concrete – compression, tension, flexure; Failure Modes in Concrete, Tensile strength of mass concrete, Creep, NDT.	06
06	**Properties and Applications of Special Purpose Concretes** Specifications, Mix-proportioning criteria, Properties and Applications of Self-Compacting Concrete, High Strength Concrete, Fiber Reinforced Concrete, Concrete Containing Polymers, Structural Lightweight Concrete, Heavyweight Concrete for Radiation Shielding, Mass Concrete, Roller-Compacted Concrete, 3D Printed Concrete.	06

References:

Text Books:

- Shetty, M.S., Concrete Technology, S. Chand & Company Ltd., New Delhi
- Santhakumar, A.R., Concrete Technology, Oxford University Press

Reference Books:

- Mehta, P. K. and Monteiro, P.J. M., Concrete Microstructure, Properties and Materials, Third Edition, Mc Graw Hill Publications, NY.
- Irving Kett, Engineered Concrete- Mix Design and Test Methods, Second Edition, CRC Press Taylor & Francis Group.
- Newman J, Choo B. S, Advanced Concrete Technology, Butterworth-Heinemann, Elsevier Ltd.

Codes of Practice:

- Bureau of Indian Standards IS 456: 2000. Indian standard code of practice for plain and reinforced concrete. New Delhi, BIS.
- Bureau of Indian Standards IS 1199: 1959. Indian standard code of methods of sampling and analysis of concrete. New Delhi, BIS.
- Bureau of Indian Standard New Delhi, BIS, IS 456: 2000. Indian standard code of

practice for plain and reinforced concrete, 2000

- Bureau of Indian Standard New Delhi, BIS, IS 1199: 1959. Indian standard code of methods of sampling and analysis of concrete.
- Bureau of Indian Standards IS 9103: 1999. Indian standard code for chemical and air-entraining admixtures in concrete
- Bureau of Indian Standards IS: 10262-2019. Indian standard code of practice for recommended Guidelines of Concrete Mix Design plain and reinforced concrete. New Delhi, BIS.
- Bureau of Indian Standard New Delhi, BIS, IS: 383-1970. Indian standard specification for coarse and fine aggregates from natural sources for , 1970, Bureau of Indian Standard New Delhi, BIS, 1970
- Handbook on Concrete Mixes SP23:1982, 2001.
- ACI 211.1-91.

Class: **Final Year B. Tech. Civil**	Semester-**VII**
Course Code: **CE481**	Course Name: **PE-III Environmental Chemistry and Microbiology**

L	T	P	Credits
3	--	--	3

Course Description:
Environmental chemistry and microbiology course offered as program elective course in 7th semester, which focuses on environmental chemistry and microbiology. The course enables students to work as a consultant or contractor for infrastructure projects related to water supply and waste management projects. This course intends to build the competency in the students to analysis water and wastewater treatment

Course Learning Outcomes:
After successful completion of the course, students will be able to

1. Explain the basic concepts of environmental chemistry and microbiology of water and wastewater.
2. Summarize environmental significance of organic compounds and microorganisms.
3. Apply instrumental and microbiological methods for water and wastewater analysis.

Prerequisite:
Basic knowledge of mathematics and environmental science

Course Content

Unit No.	Description	Hrs
01	**Introduction to General Chemistry and Physical Chemistry** **General chemistry:** Nomenclature, Valency, Oxidation-reduction equations, Ionization, Solubility Product, Common ion effect. **Physical chemistry:** Enthalpy, Entropy, Vapour pressure	06
02	**Introduction to Organic Chemistry and Biochemistry** **Organic chemistry:** Environmental significance of different organic compounds viz. Aliphatic Compounds: Alcohols, Aldehydes and Ketones, Acids, Esters, Ethers, Halogenated aliphatic compounds, Compounds containing nitrogen. Aromatic Compounds: Hydrocarbons, Phenols, Alcohols, Aldehydes, Ketones and Acids, Compounds containing nitrogen, Heterocyclic compounds, Dyes, Detergents and Pesticides.	06

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03	**Instrumental Methods** UV- visible, atomic absorption spectroscopy, flame photometry with reference to principle, instrumentation, calibration, working and applications in environmental analysis. Chromatography and its types. Mass spectroscopy and Gas chromatography with reference to principle, instrumentation, calibration, working and applications in environmental analysis.	**06**
04	**Introduction to Biochemistry** Biochemistry of carbohydrates and Proteins, General biochemical pathways.	**06**
05	**Introduction to Environmental Microbiology** Groups of microorganisms, Major characteristics of microorganisms, Microbial classification, nomenclature and identification, Cell elements and composition, Cell and its composition, Cytoplasmic membrane, Prokaryotic cell division, Growth curve of bacteria, Enzymes and their regulation, Control of microorganisms by physical and chemical agents.	**06**
06	**Water, Wastewater and Solid Waste Treatment using Microbiome** Drinking water microbiology, Drinking water microbiome and treatment Bioremediation and wastewater microbiology, Bioremediation examples, Enhanced metal recovery. Solid waste microbiology, Landfills, Leachate anaerobic degradation phases.	**06**

References:

Text Books:

- Sawyer C.N. and McCarty P.L., "Chemistry for Environmental Engineers", Tata McGraw-Hill Publishing Company Limited.
- Holler F. J. and Crouch S. R., "Skoog and West's Fundamentals of analytical Chemistry", Cengage Learning.
- Mohapatra P. K., "Textbook of Environmental Microbiology", I. K. International Publishing House Pvt. Ltd.,

Reference Books:

- VanLoon G. W. and Duffy S. J., "Environmental Chemistry: A Global Perspective", Oxford University Press, Indian Edition
- Pelczar Jr., M. J. E. C. S. Krieg, R. Noel., and Pelczar M. F., "Microbiology", Tata McGraw Hill Publishing Company Limited
- Madigan, M., Bender K. S., Buckley D.H., Sattley W. M., and Stahl D.A., "Brock Biology of Microorganisms

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE483**	Course Name: **PE-III Watershed Management and Remote Sensing Applications**

L	T	P	Credits
3	-	-	3

Course Description:

This course introduces the fundamentals of GIS and GPS, covering GIS elements, coordinate systems, data models, and spatial data accuracy. It explores Web-GIS applications like e-Government, e-Business, and mobile GIS. The GPS module includes satellite motions, coordinate systems, and data processing. Students will apply these technologies to real-world problems such as resource mapping, watershed management, and sustainable development.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Understand the philosophy, concepts, and characterization of watersheds
2. Analyze the role of Remote Sensing, GPS, and GIS in watershed planning and sustainable management.
3. Apply knowledge of watershed characteristics, including size, slope, drainage, and land use for hydrological assessments.
4. Evaluate water resources management strategies for flood and drought assessment,
5. Utilize Remote Sensing techniques for crop identification, yield modeling, and water management in agricultural command areas.
6. Develop an integrated approach for sustainable watershed management using Remote Sensing, GIS, and case studies.

Prerequisite: Engineering Mathematics, Fluid Mechanics, Water Resources, and Irrigation Engineering

Course Content

Unit No.	Description	Hrs
01	**Introduction to Watershed management:** Watershed management- introduction, philosophy and concept of watershed, objectives of Watershed management program, Types of Watershed models,	05

	Watershed characterization and mapping, Runoff estimates from watersheds & GIS database for watershed management	
02	**Watershed Characteristics:** River basins in India, Watershed hydrology, Classification of the watershed, Size, shape, physiography, slope, climate, drainage, land use, vegetation, geology and soils, hydrology and hydrogeology, socioeconomic characteristics, Linear aspects of channel systems - Aerial aspects of drainage basins.	**05**
03	**Fundamentals of Remote sensing:** Fundamentals – physics of remote sensing – electromagnetic radiation, interaction of Electromagnetic Radiation with atmosphere, earth surface, soils, water and vegetation. Data acquisition- photographic system and imaging systems, single vertical photographs, visible and near infrared imagery, photo interpretation, visual analysis, spectral properties of water, photogrammetry, stereoscopic viewing,	**08**
04	**Remote Sensing applications:** Scope of Remote Sensing applications - potentials and limitations, Resource mapping and integrated information for sustainable development, Resource evaluation- Soils, minerals forest and agriculture, aapplication to water resources mapping, Watershed management – satellite data, geo-coding, GPS and GIS utilities, classification using imageries, applications in water resources and watershed management case studies.	**08**
05	**Water Resources Management:** Land use Land cover mapping, Watershed Mapping and Management for sustainable development, Flood and Drought impact assessment and monitoring, Identification of suitable sites for ground water & artificial recharge structures, Reservoir sedimentation, Surface and Ground Water Pollution mapping and analysis.	**05**
06	**Agricultural Assessment:** Principles of crop identification and area estimation, sampling techniques, vegetation indices and crop yield modeling using Remote Sensing. Water	**05**

	management in command areas - monitoring, assessing crop water availability, demand and utilization pattern through Remote Sensing. Crop stress assessment and monitoring - droughts and floods. General concept of water resource assessment and irrigation water management and water logging.	

References:

Reference Books:

- Bhave, P.R., and Gupta R., "Analysis of Water Distribution Networks", Alpha Science International Ltd.
- Vir Singh, R., Watershed Planning and Management, Yash Publishing House, Bikaner,

Text Books:

- Chow, V. T., Maidment, D. R., and Mays, L. W., "Applied Hydrology", McGraw Hill International editions, New Delhi.
- Kennedy, Michael. Introducing geographic information systems with ARCGIS: a workbook approach to learning GIS. John Wiley & Sons.
- Wong, D. Statistical Analysis of Geographic Information with ArcView GIS and ArcGIS.
- Kennedy, Michael. Introducing geographic information systems with ArcGIS. John Wiley & Sons.
- Subramanya, K., "Engineering Hydrology", Fourth Edition, Tata McGraw-Hill Publishing company Ltd., New Delhi,
- Rossmiller,R.L., "Storm water design for sustainable development", Mc.Graw-Hill Education,
- Ojha, C. S. P., Bhunya, P., and Berndtsson, P., "Engineering Hydrology", Oxford University Press, Noida,
- Raghunath, H. M., "Hydrology Principles, Analysis and Design", New Age International Pvt. Ltd., New Delhi.

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4174**	Course Name: **PE-III Rock Mechanics**

L	T	P	Credits
3	-	-	3

Course Description:

This course introduces the theory of rock mechanics and its applications in mine construction and operation. This course presents the fundamental concepts of stress in isotropic and anisotropic rocks and conduct stress analyses using data collected in the laboratory and the field. Rock mass structures and classification schemes are introduced, and students learn how these govern rock slope stability and underground rock excavation methods in a given stress environment. Rock control and support systems utilized in underground and surface excavations and their related safety requirements are discussed.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Identify types of rocks based on preliminary geological investigation.
2. Analyze the theory of in-situ induced stresses in a rock mass and structurally controlled failure.
3. Classify the rock based on stress strain failure.
4. Analyze the rock slope stability and rock-fall hazards.
5. Determine settlement and bearing capacity of rock foundation.
6. Apply the concepts of rock mechanics to solve problems which occurs during underground construction

Prerequisite: Basic knowledge of Mathematics and Geotechnical Engineering etc.

Course Content

Unit No.	Description	Hrs
01	**Introduction to Geology and Rock Mechanics:** Definition, Importance, History of Rock Mechanics, Rock types- Igneous, Metamorphic, Sedimentary. Preliminary geological investigations, Core drilling, core logging. Distribution of rocks – Archean Rocks, Cuddapah Rocks, Vindhyan Rocks, Palaeozoick Rocks, Mesozoic rocks, Gondwana Rocks, Deccan Traps, Steriographic presentation of Geological data	06
02	**Strength, Modulus and Stress Strain Behavior of Rocks:** Factors influencing rock behavior, Strength criteria for Isotropic Intact Rocks,	06

	Modulus of Isotropic Intact Rocks, Compressive strength of rocks. Stress Strain models – Elastic model, Elasto plastic model, Visco elastic model.	
03	**Engineering Classification of Rock:** RQD, RMR system, Terzaghi's rock load classification, Deere Miller, CMR Sand RSR System. Classification based on strength and modulus, Classification based on strength and failure strain, rock discontinuity qualitative description.	06
04	**Stability of Rock Slopes:** Modes of failure – Rotational, Plane and wedge failures, Plane failure method of Analysis, Wedge method of Analysis, Toppling failure, Protection against slope failure.	06
05	**Rock Foundation:** Estimation of Bearing Capacity – Intact, Fractured rocks, Stress distribution in rocks, Factor of Safety, Sliding stability of dam foundation, Settlement in rocks, Bearing capacity of piles in rock, Measures for strengthening rock mass – Concrete shear keys, Bored concrete piles, Tensioned cable anchors, concrete block at toe	06
06	**Applications of Rock Investigation** Blasting and underground open excavation, Mining and other Engineering applications, criteria for design of underground excavations, tubular excavations, pillars and ribs support multiple excavations. Structural defects in Rock masses, their improvement by rock bolting, grouting and other methods. Rock Reinforcement Rock grouting	06

References:

Text Books –

- Jaeger, J.C., Cook, N.G.W., Zimmerman, R.W., "Fundamentals of Rock Mechanics", Blackwell Publishing.
- Mogi Kiyoo, "Experimental Rock Mechanics", Published by Taylor & Francis.
- Hudson, J.A. and Harrison, "Engineering Rock Mechanics – An Introduction to Principles", J.P., Pergamon.
- Obert and Duvall, "Rock Mechanics and Design of Structures", John Willey & Sons.
- Stag and Zienkiewez, "Rock Mechanics in Engineering Practice, John Willey & Sons
- T. Ramamurthy, "Engineering in Rocks", PHI Learning Pvt. Ltd.

References Books: -

- Murthy V.N.S., Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
- Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics- New Age International (P) Ltd., Newe Delhi.
- P. Purushottam Raj. 'Geotechnical Engineering' Tata Mcgraw Hill Company Ltd. New Delhi.
- K. Terzaghi, R. B. Peck, G. Mesri 'Soil mechanics', John Willey and Sons publication, New- York.

Class: **Final Year B. Tech Civil**	Semester: **VII**	L	T	P	Credits
Course Code: **CE4194**	Course name: **PE-III GIS and GPS System**	**3**	**-**	**-**	**3**

Course Description:
Geographic Information Systems (GIS) and Global Positioning System (GPS) is an emerging sub-engineering branch that comes under the branch of civil engineering. India is a developing country and application of GIS in the field of irrigation and hydraulic structures is a current need. In this course the study is based on the aim of application of GIS and GPS to solve complex engineering problems with the help of real-world data. Through this course students will be acquainted with the basic concept of GIS and GPS, application to irrigation hydraulic structures and disasters management plan

Course Learning Outcomes:
After completion of course, student will be able to:
1. Explain fundamentals of GIS and GPS,
2. Explain the principles of the Global Positioning System (GPS), including satellite motions and NAV messages.
3. Evaluate spatial data accuracy, identify errors, and perform topological and non-topological editing.
4. Analyze GPS data using mathematical models and processing methods for various geodetic and geospatial applications.

Prerequisite: Surveying, Water Resources and Irrigation Engineering

Course Content		
Unit No.	**Description**	**Hrs**
01	**Introduction to GIS** Elements of GIS, Application of GIS, types of GIS modules, Integration of GIS, Web Mapping, Geosocial Data Exploration, Concepts and Practice, Types of Map Projections, Commonly Used Map Projections, Projected Coordinate Systems.	**06**
02	**Vector and Raster Data model** Representation of Spatial Features, Topology, Geo-relational Data Model, Object-Based Data Model, Representation of Composite Features, Elements of the Raster Data Model, Raster Data Structure, Digital Elevation Models, Data Conversion and Integration	**06**

03	**GIS Data Acquisition** Existing GIS Data, Spatial Data Infrastructure, and Geoportal, U.S. Geological Survey, Data Formats for USGS Products, National Aeronautics and Space Administration, U.S. Census Bureau, Natural Resources Conservation Service, Metadata, conversion of existing data, creation of raster and vector data set.	
04	**Spatial Data Accuracy and Quality** Commonly used map projection and their significance, Gird systems, Digital database in GIS, location errors, Spatial Data Accuracy Standards, Topological Errors, Topological Editing, Non-topological Editing, Other Editing Operations,	06
05	**Principles of Global Positioning System** Coordinate and time systems: Definition of global and local coordinate systems, Relationship between satellite and conventional geodetic systems, Satellite orbital motions; Description of motions, Forces acting on the satellites, Satellite NAV messages, GPS observables; Pseudo ranges, Format of data (RINEX)	06
06	**Application of GPS** GPS system elements, GPS satellite constellation and signals, Propagation medium, Mathematical model of GPS observables, Methods of processing GPS data, and examples of GPS data analysis along with other space geodetic data	06

References:

Text Books:

- McHaffie, Patrick, Sungsoon Hwang, and Cassie Follett. "GIS: An Introduction to Mapping Technologies, CRC Press.
- Bolstad, Paul, "GIS fundamentals: A first text on geographic information systems" Eider (Press Minnesota).
- Campbell, J. E., & Shin, M, "Essentials of geographic information systems"
- Lo, C.P. and Yeung, Albert K.W., "Concepts and Techniques of Geographic Information Systems", Prentice Hall.

Reference Books:

- Kang-tsung Chang, "Introduction to Geographic Information Systems" Tata MC Graw Hill, New Delhi.
- C.P.Lo and Albert K.W. Yeung "Concepts and Techniques of Geographic information Systems" Prentice Hall of India, New Delhi
- Magwire, D.J. Goodchild, M.F. and Rhind, D.M., "Geographical Information Systems: Principles and Applications", Longman Group, U.K.
- Laurini, Robert and Dierk Thompson, "Fundamentals of Spatial Information Systems", Academics Press, ISBN 0-12-438380-7.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE485**	Course Name: **PE-III Structural Health Monitoring**

L	T	P	Credits
3	-	-	3

Course Description:

Structural Health Monitoring (SHM) focuses on the assessment, evaluation, and diagnosis of structural systems to ensure their safety, reliability, and long-term performance. The course provides a comprehensive understanding of SHM techniques, covering both fundamental concepts and advanced applications. Emphasis is placed on risk and reliability assessment, along with practical insights through case studies, particularly for critical infrastructure such as bridges, dams, and offshore structures.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Discuss the concept and various components of SHM
2. Identify suitable Sensors and Instruments required in SHM for in-service performance of structures.
3. Assess the health of structures using different techniques of SHM
4. Design the sensor layouts of SHM for the civil engineering structures

Prerequisite: Building Materials, Concrete Technology, RCC Structures, Steel Structures.

Course Content

Unit No.	Description	Hrs
01	**Introduction of Structural Health Monitoring:** Factors affecting the health of structures, NDT Non-Destructive Evaluations-Thermography (Infrared Testing), Acoustic Emission Testing, Electromagnetic Methods, Laser Scanning and LiDAR (Light Detection and Ranging), Fiber Optic and Sensor-based Testing, Necessity of Structural Health Monitoring (SHM), Definition and Concept of SHM, Comparison of SHM with NDT, Challenges in SHM	06
02	**Components of SHM Process:** Structure, sensors, Data acquisition systems, Data transfer and storage mechanism, Data management, Data interpretation and diagnosis-System Identification, Structural model update, Structural condition assessment.	04
03	**Sensor Technologies and Instrumentation for SHM:** Basics of sensor	07

	technology and their role in structural monitoring, Sensor characteristics: Sensitivity, accuracy, precision, and calibration, Characteristics and Working Principles of Various Types of Sensors - Strain Sensors, Displacement and Deformation Sensors, Acceleration and Vibration Sensors, Environmental and Corrosion Sensors, Data Acquisition Systems-Types, Hardware and its components.	
04	**Static and Dynamic Field-Testing Methods of SHM:** Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement. Dynamic Field-Testing Methods: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring, Long term SHM, requirement for long term SHM	**07**
05	**Vibration Based SHM Techniques:** Use and Demonstration of Dynamic Properties of Structures for Damage Detection and SHM, Ambient Vibration Test, Forced Vibration test, Acoustic Emission Technique, Electromechanical Impedance Technique, Wave Propagation Based Techniques, Fiber Optics Based Techniques, Remote & Wireless SHM Techniques.	**07**
06	**Applications of SHM:** Applications of SHM on bridges and buildings structures.	**05**

References –

Text Books:

- Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, "Structural Health Monitoring", John Wiley and Sons.
- Douglas E Adams, "Health Monitoring of Structural Materials and Components, Methods with Applications", John Wiley and Sons

Reference Books:

- J. P. Ou, H. Li and Z. D. Duan, "Structural Health Monitoring and Intelligent Infrastructure", Vol1, Taylor and Francis Group, London.
- Victor Giurglutiu, "Structural Health Monitoring with Wafer Active Sensors", Academic Press Inc.

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE441**	Course Name: **PE-III Design of Industrial Structures**

L	T	P	Credits
3	**-**	**-**	**3**

Course Description:
The "Design of Industrial Buildings" course offers an in-depth exploration of the fundamental and advanced concepts involved in the design and analysis of various types of industrial structures. This course is tailored to equip students with the essential skills and knowledge required to proficiently design and assess steel industrial buildings, transmission towers, water tanks, and truss bridges. Students will gain a robust understanding of structural integrity, material efficiency, and safety considerations essential for industrial construction.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Explain various elements involved in the design of industrial building.
2. Design beam-column subjected to combined axial-bending.
3. Design open web castellated beam with various shaped openings.
4. Design the transmission line tower, steel bridges and waters tanks subjected various loads.

Prerequisite: Students should possess basics of Structural Analysis and Design of Steel Structures,

Course Content

Unit No.	Description	Hrs
01	**Industrial buildings:** Structural framing, knee bracing of columns, design of purlins, girts and eave strut, plane trusses, open web steel joists.	06
02	**Design of beam-columns:** Introduction, general behavior of beam-columns, elastic lateral-torsional buckling of beam columns, interaction between beam-column and structure, design of beam columns, beam-columns subjected to tension and bending, crane columns.	06
03	**Design of Open web sections:** Open web sections, application area, mechanical behavior of beams with web openings, Design of Castellated beams with trapezoidal openings.	06
04	**Transmission Tower**	06

	Introduction, Material Properties, Clearances and Tower Configurations, Factors of Safety and Load, Tower Design	
05	**Design of bridges:** Introduction, classification of steel bridges, loads and load combinations, analysis of truss girder bridges, design of truss bridges.	**06**
06	**Steel water tanks** Design of steel water tank, bottom plates, joints, ring girder, design of staging and foundation.	**06**

References:

Codes of Practice:

- IS: 800 (2007) General Construction in Steel - Code of Practice, Bureau of Indian Standards.
- IS: 875 (Part 3) (2015), Wind Loads on Buildings and Structures, Bureau of Indian Standards.
- Hand Book No. 1 (SP 16) or Steel Table, (1964), Handbook for Structural Engineers, Bureau of Indian Standards.

Textbooks:

- Duggal S. K., "Design of Steel Structures", Tata Mc-GrawHill publishing company Ltd.
- Dayaratnam, "Design of Steel Structures", Wheeler Publishing.

Reference Books:

- Subramanian N., "Design of Steel Structures", Oxford University Press.
- Sairam K. S., "Design of Steel Structures", Pearson publication.
- Shiyekar M. R., "Limit State Design in Structural Steel", PHI Learning.

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To be implemented for 2022-26 Batch
Department of Civil Engineering

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE4214**	Course Name: **PE-III Advanced Structural Design**

L	T	P	Credits
3	-	-	3

Course Description:

This course delves into concepts of reinforced concrete design, focusing on flat slabs, combined footings, raft and pile foundations, retaining walls, and overhead water tanks. Students will engage in the design and detailing of these structural elements, considering practical applications and adherence to various Indian Standard codes. The course emphasizes structural stability, safety, and serviceability, providing learners with the skills necessary to address real-world challenges in structural engineering. By the end of the course, students will gain expertise in designing complex structures and be prepared for upcoming engineering roles.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Design reinforced concrete flat slab, combined footing, raft footing and pile foundation.
2. Design cantilever and counterfort retaining wall.
3. Design overhead circular water tank with flat base.

Prerequisite: Design of Reinforced Concrete Structures, Theory of Structures.

Course Content

Unit No.	Description	Hrs.
01	**Flat slab:** Introduction, methods of analysis of flat slab, design of flat slab, detailing of reinforcement.	6
02	**Combined Footing:** Introduction, Design of rectangular and trapezoidal combined footing, detailing of reinforcement.	6
03	**Raft footing:** Introduction, Analysis of raft footing, Design of raft footing, Introduction to pile	6

	raft footing, detailing of reinforcement.	
04	**Pile foundation:** Introduction to pile foundations, structural design of reinforced concrete piles, design of pile cap up to four piles group. Detailing of reinforcement.	6
05	**Cantilever and counter fort retaining walls:** Introduction, classification, stability requirements of retaining wall, design of cantilever and counterfort retaining wall, detailing of reinforcement.	6
06	**Overhead water tanks:** Analysis and design of overhead circular water tanks with flat bottom, spherical and conical tank roofs, and ring beams. Detailing of reinforcement in the components of overhead water tank.	6

References:

Codes of Practice:

- IS 456 (2000): Plain and Reinforced Concrete - Code of Practice, B.I.S. New Delhi
- SP 16:1980 Design Aids for Reinforced Concrete to IS 456, B.I.S. New Delhi.

Text Books:

- Punmia B. C., Jain A. K. "Limit State Design of Reinforced Concrete (As per IS 456:2000)", Laxmi Publications Pvt. Ltd.
- Bhavikatti S. S., "Advance R.C.C. Design", New Age International Publishers.
- Shah M. G. and Kale C. M., "R.C.C. Theory and Design", Trinity Press, New Delhi.

Reference Books:

- Karve S. R. and Shah V. L., "Illustrated Design of Reinforced Concrete Buildings", Assorted Editorial Publications.
- Karve S. R. and Shah V. L., "Handbook of Reinforced Concrete Design (as per IS: 456 - 2000)", Structures Publications.
- Pillai S. U. and Menon D., "Reinforced Concrete Design", McGraw Hill Education (India) Pvt. Ltd.
- Bhatt P., Mac Ginley T. J. Choo B. S., "Reinforced Concrete Design Theory and Examples", CRC Press.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4234**	Course Name: **PE-IV Total Quality Management**

L	T	P	Credits
3	-	-	3

Course Description:

Today managers of various organizations have overhauled the structure of their organization, changed their organization climates and redirected their products/ service quality programs toward becoming global quality leaders, through an effort that is known as "Total Quality Management"(TQM). The growing importance of quality management has emphasized the need for the study of principles and techniques of total quality management both by students and also by practicing managers in the manufacturing and service industries.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Apply TQM frameworks and quality dimensions to assess customer satisfaction, ensuring continuous improvement in construction projects.
2. Evaluate leadership approaches, strategic quality planning, and employee involvement techniques to optimize organizational efficiency and quality performance.
3. Apply appropriate SPC techniques by selecting and implementing control to monitor and improve process stability and quality performance.
4. Analyze and implement different methodologies, tools and techniques to improve organizational quality.
5. Analyze the principles, requirements, and implementation processes of ISO 9000 and ISO 14000 series standards to develop effective quality and environmental management systems.

Prerequisite: Possess basic knowledge of Construction Management.

Course Content

Unit No.	Description	Hrs.
01	**Introduction to TQM:** Introduction, Need for quality, Evolution of quality, Dimensions of product and service quality, Basic concepts of TQM, TQM Framework, Contributions of Deming, Juran and Crosby, Barriers to TQM, Customer focus, Customer orientation, Customer satisfaction, Customer complaints, Customer retention, Need of TQM in construction sector.	06

02	**Principles and Philosophies of Quality Management:** Leadership – Quality Statements, Strategic quality planning, Quality Councils Employee involvement, Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal, Continuous process improvement, PDCA cycle, 5S, Kaizen, Supplier Partnering, Supplier selection, Supplier Rating.	06
03	**Statistical Process Control:** Meaning and significance of statistical process control (SPC), Control charts for variables, Central Limit theorem, Constructing X-R chart, X-S chart, Control charts for attributes 'p' chart, 'np' chart, 'c' chart and 'u' chart, Control chart selection, Implementation of statistical process control.	06
04	**Tools for Quality Management:** Quality functions development (QFD) Benefits, House of quality (HOQ), building a HOQ, Seven old and new management tools of quality assurance, Concepts of Quality circle, Japanese 5S principles and 8D methodology.	06
05	**Techniques used in TQM:** Just-In-Time systems, Benchmarking, Supply Chain Management, Failure mode effect analysis (FMEA), FMEA stages, design, process and documentation, Taguchi quality loss function, Six Sigma- Features of six sigma, Goals of six sigma, DMAIC, Six Sigma implementation.	06
06	**Quality Systems:** Introduction to ISO 9000 series, Benefits of ISO Registration, ISO 9000 Series of Standards, Requirements, Implementation, Documentation, Internal Audits, Registration. Introduction to ISO 14000 Series Standards, Concepts of ISO 14001, Requirements of ISO 14001, Benefits of EMS.	06

References:

Codes of Practice:

- ISO 9001:2015: Quality Management Systems - Requirements
- ISO 9000:2015: Quality Management Systems - Fundamentals and Vocabulary (definitions)
- ISO 9004:2018: Quality Management - Quality of an Organization - Guidance to Achieve Sustained Success (continuous improvement)
- ISO 14000 (series):2015, Environmental management systems

Text Books:

- K. Shridhara Bhat, "Total Quality Management- Text & Cases", Himalaya Publishing House.
- Shankar D. Bagade, "Total Quality Management", Himalaya Publishing House.
- B. L. Hanson & P. M. Ghare. "Quality Control & Application", Prentice Hall of India.
- Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd..
- Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India) Pvt. Ltd.

Reference Books:

- R. E. Stean, The Theory of Constraints: Applications in Quality Manufacturing, CRC Press Inc.
- D. H. Besterfield, G. H. Besterfield, and H. Urdhwareshe, Total Quality Management, Pearson.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE439**	Course Name: **PE-IV Advanced Construction Techniques**

L	T	P	Credits
3	**-**	**-**	**3**

Course Description:

Construction Technology is a fundamental aspect of civil engineering that significantly influences the field's development. This course aims to provide application-oriented knowledge in the various construction technologies employed in the creation and maintenance of civil engineering infrastructure.

Course Learning Outcomes:

After completing the course, the student should be able to: -

1. Outline the processes and required documentation for construction projects.
2. Justify the application of construction techniques for a specific task within the project context.
3. Select a construction technique for a given construction work.
4. Develop method statements for construction techniques.
5. Justify the importance of safety requirements and management practices in construction projects

Prerequisite: Nil

Course Content

Unit No.	Description	Hrs
01	**Fundamentals of Construction Technology** Construction activities, Process, Workers, Estimation and Schedule. Construction documentation & records. Codes & regulation.	04
02	**Construction of High-rise Structures** Foundation, Structural System, Life Safety System, vertical transportation, MEP services, Construction & Processes.	06
03	**Cofferdam & Caissons** General Considerations, Bracing, Excavation, bottom seal. Difficulties in cofferdam construction. Slurry Wall cofferdams, Cellular Cofferdam. Box Caisson:-Site & Foundation preparation, fabrication, launching and deployment, setting, concreting. Open Caisson:-Cutting, Sitting, Sinking. Pneumatic caissons.	08

04	**Underwater Construction & Trenchless Technology** Problems encountered in excavation, Under water drilling & blasting, Grouting Soft and hard soil Trenchless Technology:-Definition, Method & application	06
05	**Mechanized Construction** Introduction, fundamental & Mechanization for plants, tolls, earthwork, transportation, movement & handling. Mechanization in concrete mixers and pumps. 3D Printed Concreting.	06
06	**Construction Safety** Basic principles of safety, Housekeeping, Personal Safety. Fire Protection, Electrical Safety Mechanical handily & transportation Safety in Excavation, Blasting, formwork concrete. First Aid and Accidents	06

References:

Text Book:

- Sarkar, S. K. and Saraswati S., "Construction Technology", Oxford University press.
- Peurifoy, R.L., "Construction Planning Equipment and Method", Co. Inc. International student edition.

Reference Books:

- Brien, J.J.J., A. Havers and F.W.Stubbs, Jr., "Standard Handbook of Heavy Construction", McGraw-Hill Book Co.
- Chudley, R., "Construction Technology (Vol. IV)" Longman Group Limited.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4254**	Course Name: **PE-IV Environmental Management System**

L	T	P	Credits
3	-	-	3

Course Description:

An Environmental Management System (EMS) offered as an elective course in VII semester. This course is a set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency. This course provides information and resources related to EMS for small businesses and private industry. The course consists of progress in developing and maintaining an environmental management system at each of its offices, labs, and other facility operations, focusing on the reduction of the agency's environmental footprint.

Course Learning Outcomes:

After completing the course, the student should be able to: -

1. Describe an environmental policy for an organization.
2. Develop environmental treatment and monitor system.
3. Analyze a life cycle assessment for a selected product or service.
4. Apply standard environmental, health and safety auditing principles and practices to environmental management systems.

Prerequisite: Basic knowledge of Environmental Engineering

Course Content

Unit No.	Description	Hrs
01	**Introduction to EMS & Global Environmental Challenges**: Modern climate change, climate projections, biosphere, soil and sustainability, biodiversity and ecosystem functions, physical resources: water, pollution, minerals, environmental and resource economics, modern environmental management	06
02	**Environment Management:** Principles of Environmental Management, Ecosystem Concepts, Environmental Concerns in India, Policy and Legal Aspects of EM, Introduction to Environmental Policies, Environmental Laws and Legislations.	06
03	**Environmental Legislation:** Role of MPCB, CPCB, MOEF in Environmental legislation, IS14000, Environmental Impact assessment	06

04	**Impact Assessment**: Impact Prediction, Evaluation and Mitigation, Forecasting Environmental Changes, Strategic Environmental Assessment (SEA), Environmental Clearance Procedure in India and EIA	06
05	**Air Quality Management** :Waste Audits and Pollution Prevention Assessments, Elements of Audit Process, EA in Industrial Projects, Liability Audits and Site Assessment, EMS Standards: ISO 14000, Implementation of EMS Conforming to ISO 14001, Environmental management techniques, Application of Remote Sensing and GIS in EM.	06
06	**Sustainable Environment System** : systems of waste management, sustainable energy systems, sustainable infrastructure, embodied energy, life cycle, sustainable materials and construction, problem solving and tools of sustainability	06

References:

Text Books:

- Peavy, H.s, Rowe, D.R, Tchobanoglous, G. "Environmental Engineering", Mc-Graw - Hill International Editions, New York.
- MetCalf and Eddy, "Wastewater Engineering, Treatment, Disposal and Reuse", Tata McGraw-Hill, New Delhi.

Reference Books:

- Richard D. Morgenstern, "New Approaches on Energy and the Environment: Policy Advice for the President".
- Gary C. Young, "Municipal Solid Waste to Energy Conversion Processes: Economic, Technical, and Renewable Comparisons", John Wiley & Sons
- Jazmin Seijas Nogarida, "Green Management and Green Technologies: Exploring the Causal Relationship"

Class: **Final Year B. Tech. Civil**	Semester-**VII**
Course Code: **CE487**	Course Name: **PE-IV Foundation Engineering**

L	T	P	Credits
3	--	--	3

Course Description:
In this course, the civil engineer has many diverse and important encounters with soil. It uses soil as a foundation to support structures and embankments. Nearly every civil engineering structure like building, bridge, highway, tunnel, wall, tower, canal or dam founded in or on the surface of earth. To perform satisfactorily each structure must have a proper foundation.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Investigate soil using different soil exploration methods.
2. Design shallow and deep foundation on different types of soil.
3. Analyze stability of slope using various slope stability analysis techniques.
4. Compute lateral earth pressure for different conditions of soil.
5. Compute stress distribution in soil using different theories.

Prerequisite:
Basic knowledge of mathematics, fluid mechanics and Geotechnical Engineering etc.

Course Content

Unit No.	Description	Hrs.
1.	**Subsurface Exploration**: Importance of exploration program, Exploration Methods, Geophysical methods, Types of samples, Sampler characteristics, Core barrels, Core boxes, core recovery, RQD. Number and depth of borings, soil exploration report.	06
2.	**Shallow Foundation:** Definition, types and there selection. Assumptions and limitations of rigid design analysis. Design of isolated, combined, strap footing (rigid analysis), Raft foundation (elastic analysis,), concept of floating foundation.	06
3.	**Pile Foundation:** Pile classification, Carrying capacity of pile, static and dynamic methods, pile load test, group action, Rigid block method, Negative skin friction, Settlement of single and group	06

	of piles, introduction to well foundation.	
4.	**Lateral Earth Pressure:** Earth pressure on vertical wall, earth pressure at rest, Rankine"s theory, lateral earth pressure due to submerged backfill, backfill with uniform surcharge, backfill with sloping surface, Coulomb's theory.	**06**
5.	**Stability of Earth Slopes:** Slope classification, slope failure, modes of failure. Infinite slope in cohesive and cohesion less soil, Taylor's stability number, Friction circle method, Landslides.	**06**
6.	**Stress Distribution in Soil:** Boussinesq theory- point load, pressure distribution due to line load, strip load, pressure bulb, Westergaard's theory, contact pressure, approximate stress distribution method.	**06**

References –

- K. R. Arora 'Soil mechanics and Foundation engineering' Standard Publishers Distributers-Delhi.
- B. C. Punmia, A. K. Jain, A. K. Jain 'Soil mechanics and Foundation engineering' Laxmi Publications Pvt. Ltd.
- A. Singh 'soil mechanics in theory and practice' by Asian Publishing House, Bombay.
- T. N. Ramamurthy, T. G. Sitharam, 'Geotechnical Engineering' by S Chand Publications, New Delhi.

References Books: -

- Murthy V. N. S., Soil Mechanics and Foundation Engineering, UBS Publishers and Distributors, New Delhi.
- Gopal Ranjan and Rao A. S. R., Basic and Applied Soil Mechanics- New Age International (P) Ltd., Newe Delhi.
- P. Purushottam Raj. 'Geotechnical Engineering' Tata Mcgraw Hill Company Ltd. New Delhi.
- K. Terzaghi, R. B. Peck, G. Mesri 'Soil mechanics', John Willey and Sons publication, New- York.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4274**	Course Name: **PE IV Design of Prestressed Concrete Structures**

L	T	P	Credits
3	-	-	3

Course Description:

Design of Pre-Stressed Concrete Structures is offered as Program Elective course in 7th semester of Civil Engineering undergraduate program focuses on the concept of pre-stressed concrete, analysis of prestress sections using stress concept, strength concept and load balancing concept, systems of pre stressing, losses and design of various components like beams, end blocks etc. This course helps the students to analyze and design the pre-Stressed concrete members.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Explain the concept and importance of pre-stressing.
2. Analyse the pre-stressed concrete sections for flexure and shear.
3. Calculate the losses in pre-stressed concrete members.
4. Design the pre-stressed concrete beams.
5. Design an end block for pre-stressed members.

Prerequisite: Reinforced Concrete Structures, Strength of materials, Concrete Technology.

Course Content

Unit No.	Description	Hrs
01	**Introduction, Prestressing Systems and Material Properties:** Basic concept, definitions, advantages of prestressing, limitations of prestressing, types of prestressing, materials used and their properties, pre-stressing systems and devices.	06
02	**Analysis of pre-stressed concrete sections for flexure:** Analysis of pre-stress concrete elements - Stress concept, Strength concept and Load balancing concept. Cracking moment, kern points, pressure line, Analysis for ultimate strength, variation of stress in steel, choice and efficiency of sections.	06
03	**Losses in Prestress:** Introduction to losses of pre-tensioning and post-tensioning concrete, immediate and time dependent losses, Loss due to elastic deformation of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip.	06
04	**Analysis of pre-stressed concrete sections for shear:**	06

	Shear and principal stresses, mechanism of shear resistance in prestress concrete beams, ultimate shear resistance of pre-stress concrete members, pre-stress concrete members in torsion, behaviour and failure of pre-stress concrete members under torsion, I. S. 1343-1980 code recommendations.	
05	**Design of pre-stressed concrete sections:** Design of sections for flexure, axial tension, compression, bending, shear and torsion.	**06**
06	**Design of End Blocks:** Methods of End block design, End zone stresses in pre-stressed concrete members, Pretension transfer bond, transmission length, and end block of post-tensioned members.	**06**

References:

Codes of Practice:

- Bureau of Indian Standards IS 1343: 2012. Indian standard code of practice for Prestressed Concrete - Code of Practice. New Delhi, BIS.
- Bureau of Indian Standards IS 456: 2000. Indian standard code of practice for plain and reinforced concrete. New Delhi, BIS.

Text Books:

- N. Krishna Raju, "Prestressed Concrete", McGraw Hill Education.
- Sinha. N. C. and Roy. S. K., "Fundamentals of Prestressed Concrete", S. Chand & Company Pvt. Ltd., New Delhi.

Reference Books:

- Lin, T.Y. and Burns, "Design of Prestressed Concrete Structures", N.H, John Wiley and Sons.
- S. Ramamrutham, "Design of Reinforced Concrete Structures", Dhanpat Rai Publishing Company.
- N. Rajaopalan, "Prestressed Concrete", Alpha Science International Ltd.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE489**	Course Name: **PE-IV Advanced design of steel structure**

L	T	P	Credits
3	-	-	3

Course Description:

This course deals with the design of advanced steel structures. Advanced design of steel structures courses covers the topics such as the welded, bolted and riveted connections, design methods, and stability analysis. It also includes the design of steel structures for specific loads and conditions for column and beams. The last two units includes design of industrial shea with advanced steel structural members.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Analysis and design of welded, bolted and riveted connection.
2. Design of column and flexural members.
3. Design an industrial building with plate girder.

Prerequisite: Design of RCC structures

Course Content

Unit No.	Description	Hrs.
01	**Connections** Bolted – bearing type, HSFG for seismic purpose, riveted connections, Welded: types of electrodes. Connection design for tension, compression, flexural, flexural shear.	06
02	**Plastic Design** Introduction – Plastic Theory – Plastic neutral Axis plastic moment, Elastic & Plastic Section moduli shape factors plastic Hinge – Fundamental condition conditions in plastic analysis, methods of plastic analysis – collapse load – simply supported, propped cantilever beam, fixed beams continuous beams, portal frame single bay single storey portal frame at different level subjected to vertical and horizontal loads.	06
03	**Eccentric and Moment Connections:** Introduction – Beams – Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed Connections –Bolted Seat Connections – Bolted Bracket Connections. Bolted Moment Connections – Welded Framed Connections- Welded Bracket Connections – Moment Resistant Connections.	06
04	**Design of Beams**	06

	Laterally supported and unsupported Beams – Design of laterally supported beams - Bending and shear strength/buckling – Built-up sections - Beam splice	
05	**Analysis and Design of Industrial Buildings:** Types of roof trusses - Loads on trusses – Wind loads - Purlin design –Truss design. Design of welded Gantry girder, (Introduction to Pre-engineered metal buildings)	06
06	**Design of welded plate girders :** Elements – Economical depth – Design of main section – Connections between web and flange – Design of stiffeners - Bearing stiffener– Intermediate stiffeners – Design of web splice and flange splice.	06

References:

Codes of Practice:

- IS: 800, (2007) General Construction in Steel - Code of Practice, Bureau of Indian Standards.
- IS: 875 (Part 3), (2015), Wind Loads on Buildings and Structures, Bureau of Indian Standards.
- Hand Book No. 1 (SP 16) or Steel Table, (1964), Handbook for Structural Engineers, Bureau of Indian Standards.

Text Book:

- Victor D. J., Essentials of Bridge Engineering, TATA McGraw Hill Publisher, Delhi,
- Jagdish & Jayram, , Design of Bridge Engineering, Patrice Hall of India (P) Ltd, New Delhi.,
- Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Reinforced Concrete Structures", Laxmi Publications.
- Dr V. K. RAINA, "Concrete Bridge Practice, Analysis, Design and Economics"., Tata McGraw- Hills Publishing Company Limited.
- S. Ponnuswamy, "Bridge Engineering", Tata McGraw-Hills Publishing Company Limited.
- N. Krishna Raju, "Design of Bridges", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Reference Books:

- J Jain and Jaikrishna, "Plain and Reinforced Concrete", Vol.2, New Chand Brothers.
- Standard specifications and code of practice for road bridges, IRC section I,II, III and IV.
- The Concrete Association of India, "Concrete Bridges",

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code **: CE491**	Course Name: **PE IV Structural Design of Foundation**

L	T	P	Credits
3	-	-	3

Course Description:

The first module focuses on various concepts and introductory information about different foundations. The design concepts of different types of foundations such as raft, pile and machine foundations. It also includes software applications. The idea behind these is the theory & numerical analysis, visit to site, model study & studying various practical and equipment related. This course intends to build the competency in the student to identify various needs of construction industry.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Explain various types of foundations and their design procedures.
2. Design different types of foundation.

Prerequisite: Soil mechanics and Design of structures

Course Content

Unit No.	Description	Hrs
01	**Introduction:** Bearing capacity of shallow foundation, design criteria, factors affecting bearing capacity, factors influencing selection of depth of foundation, modes of shear failures, types of shallow foundations, contact pressure under rigid and flexible footings, Terzaghi's, Meyerhof, Hansen's bearing capacity theories, IS code method	06
02	**Shallow Foundation:** Introduction to types of foundations, design of isolated footing, continuous footing and combined footing. RCC Design of shallow foundation; principles of design of footing, design of isolated footings and strip footing.	06
03	**Raft Foundation:** Design of Combined Footing and Raft Foundations	06
04	**Deep Foundation:** Design of deep foundation- RCC Design of pile foundation and pile cap.	06
05	**Machine Foundation:** Types of Machine Foundations General Requirements of Machine Foundations and Design Criteria, Dynamic Loads, Physical	06

	Modeling and Response Analysis, Analysis by Lysmer and Richart, General Analysis of Machine-Foundation-Soil Systems Using Analog Models, General Equations of Motion, Methods of Solution Framed Foundation	
06	**Foundations for special structures:** Design of foundations for seashore structures and elastic foundations.	**06**

References:

Codes of Practice:

- Bureau of Indian Standards IS 1343: 2012. Indian standard code of practice for Prestressed Concrete - Code of Practice. New Delhi, BIS.
- Bureau of Indian Standards IS 456: 2000. Indian standard code of practice for plain and reinforced concrete. New Delhi, BIS.

Text Books:

- Winterkorn H.F. & Fang H.Y, "Foundation Engineering Hand Book", Van Nostand Reinhold Company.
- B.J. Kasmalkar,"Foundation Engineering", Pune Vidyarthi Griha Prakashan.
- Naik N.V, "Foundation Design Manual", Dhanpat Rai and sons.

Reference Books:

- J.E. Bowles, "Foundation Analysis and Design"Tata McGraw Hill BookCompany. Poulos, H.G. and Davis, E.H.Pile Foundation Analysis and Design",John Wiley and Sons, New York.
- Mohan, Dinesh, "Pile Foundations", Oxford & IBH Pub. Co. Pvt. Ltd., Delhi.
- Swami Saran, "Soil Dynamics and machine foundation", Galgotia Publications Pvt. Ltd., New Delhi.
- Teng W. C., "Foundation Design", Prentice Hall of India Pvt. Ltd., New Delhi

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4294**	Course Name: **PE-IV Design of Bridges**

L	T	P	Credits
3	-	-	3

Course Description:

This course deals with the fundamentals in bridge engineering; including the analysis and design of superstructure and substructure of bridge. This course "Design of bridges" goes deeper into the various aspects of bridge engineering along with bringing out the advanced theories for design and analysis. It includes six topics which covers overall analysis of bridge components including design of super-structure, sub-structure, foundation, and bearings.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Design the short span bridges i.e. culverts and pipe culvert
2. Design Box culvert, deck slab and T beam bridges i.e. long span bridges
3. Design end bearings for bridges.

Prerequisite: Design of RCC structures

Course Content

Unit No.	Description	Hrs
01	**Introduction to bridges** Introduction to bridges, Classification, Importance of bridges, Components of bridges, Investigation for Bridges, Bridge hydrology- computation of discharge, linear waterway, economic span, afflux, scour depth, Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Effective width, Introduction to methods as per I.R.C.	06
02	**Design Considerations** for culvert Standard specification for Road Bridges. I.R.C. bridge code, width of carriage way, clearances, loads to be considered i.e. D.L., L.L., Impact load, wind load, Earthquake load, Longitudinal force, Centrifugal force, buoyancy, Earth pressure, water current force, thermal force etc. General design considerations for R.C.C. bridges	06
03	**Short span bridges** Design of slab for culvert, Design criteria for Box culvert (Single vent only) & Pipe culverts.	06
04	**Design of sub structure** Pigeaud's theory, Courbon's theory, calculation of dead load BM and SF,	06

	calculation of live load B M & S F using IRC loading. Design of reinforced concrete deck slab, Design of T beam bridges (up to three girders only), structural design of cross girder.	
05	**Design of sub structure** Design of Abutments, Piers, Approach slab, Design process of bridge foundations – pile and well	06
06	**Bearings** Different types of bridge Bearing and expansion joints – forces on bearings – Types of bearings, design of unreinforced elastomeric bearings, expansion joints.	06

References:
Text Book:

- Victor D. J., Essentials of Bridge Engineering, TATA McGraw Hill Publisher, Delhi,
- Jagdish & Jayram, , Design of Bridge Engineering, Patrice Hall of India (P) Ltd, New Delhi.,
- Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Reinforced Concrete Structures", Laxmi Publications.
- Dr V. K. RAINA, "Concrete Bridge Practice, Analysis, Design and Economics"., Tata McGraw- Hills Publishing Company Limited.
- S. Ponnuswamy, "Bridge Engineering", Tata McGraw-Hills Publishing Company Limited.
- N. Krishna Raju, "Design of Bridges", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

Codes:

- IRC Codes – IRC: 5, IRC: 6, IRC: 18, IRC: 21, IRC: 45, IRC: 78, IRC: 83.

Reference Books:

- J Jain and Jaikrishna, "Plain and Reinforced Concrete", Vol.2, New Chand Brothers.
- Standard specifications and code of practice for road bridges, IRC section I,II, III and IV.
- The Concrete Association of India, "Concrete Bridges",

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code **: CE4074**	Course Name: **Design of Reinforced Concrete Structures Laboratory**

L	T	P	Credits
	-	**2**	**1**

Course Description:

The laboratory course Design of Reinforced Concrete structures is offered at the 7th semester of Civil Engineering undergraduate programme. Since last five decades concrete has emerged as a versatile construction material and hence is being used for constructing almost all types of civil engineering structures. Every civil engineer must have sufficient knowledge of the design of Reinforced Concrete structures. This course deals with design of a two storied building manually and using software.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Determine primary and combination design loads on building referring appropriate standards and handbooks.
2. Design a two storied building manually and using standard software.
3. Prepare structural drawings of slab, beam, stair, column and footing.

Prerequisite: Design of Reinforced Concrete Structures, STAAD Pro.

Course Content		
Expt. No.	**Description**	**Hrs**
1	Introduction to software.	2
2	Design of a two-storied building using appropriate software.	6
3	Manual design of R. C. slab panels of the building.	4
4	Manual design of R. C. beams.	6
5	Manual design of R. C. Columns and footing.	6

References:

Codes of Practice:

- IS:456- (2000): Plain and Reinforced Concrete - Code of Practice, B.I.S. New Delhi
- SP 16:1980 Design Aids for Reinforced Concrete to IS 456, B.I.S. New Delhi.
- IS:875- (1987): Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures (Part 1 and Part 2).

Text Books:

- Punmia B. C., Jain A. K. "Limit State Design of Reinforced Concrete (As per IS 456:2000)", Laxmi Publications Pvt. Ltd.
- Bhavikatti S. S., "Advance R.C.C. Design", New Age International Publishers.
- Shah M. G. and Kale C. M., "R.C.C. Theory and Design", Trinity Press, New Delhi.

Reference Books:

- Karve S. R. and Shah V. L., "Illustrated Design of Reinforced Concrete Buildings", Assorted Editorial Publications.
- Karve S. R. and Shah V. L., "Handbook of Reinforced Concrete Design (as per IS: 456 - 2000)", Structures Publications.
- Pillai S. U. and Menon D., "Reinforced Concrete Design", McGraw Hill Education (India) Pvt. Ltd.
- Bhatt P., Mac Ginley T. J. Choo B. S., "Reinforced Concrete Design Theory and Examples", CRC Press.

Class: **Final Year B. Tech. Civil**	Semester-**VII**
Course Code: **CE4094**	Course Name: **Environmental Engineering Laboratory**

L	T	P	Credits
--	--	2	1

Course Description:
The purpose of this laboratory course is to facilitate high-level research and development work within the field of water, wastewater, solid waste management and air pollution with emphasis on environmental engineering Laboratory testing, field testing and monitoring.
The laboratory course deals with the use of standard and advanced Environmental Engineering laboratory testing equipment which facilitates water, wastewater and air pollution etc.

Course Learning Outcomes:
After successful completion of the course, students will be able to
1. Analyze water and wastewater for different parameters
2. Prepare layout of Water and wastewater treatment plant.
3. Design water and wastewater treatment plant

Prerequisite:
Basic knowledge of mathematics and environmental science

Course Content		
Expt. No.	**Description**	**Hrs.**
1.	Determination of pH of water and wastewater	**02**
2.	Determination of acidity and alkalinity of water & wastewater	**02**
3.	Determination of Chloride Content of water & wastewater	**02**
4.	Determination of Turbidity of water & wastewater	**02**
5.	Determination of Dissolved Oxygen of water & wastewater	**02**
6.	Determination of Biochemical Oxygen of water & wastewater	**02**
7.	Determination of Chemical Oxygen Demand of water & wastewater	**02**
8.	Determination of Hardness of water & wastewater	**02**
9.	Determination of Solid Content of a water & wastewater	**02**
10.	Demonstration of High volume sampler	**02**
11.	Prepare layout of water and wastewater treatment plant	**02**
12.	Design water and wastewater treatment plant	**02**

References:

Text Books:

- Punmia B. C. "Water Supply Engineering" Lakshmi Publications Pvt. Ltd. New Delhi
- Punmia B. C."Wastewater Treatment and Reuse" Lakshmi Publications Pvt. Ltd. New Delhi
- Modi P. N. "Water Supply Engineering" Standard Book House, New Delhi
- Modi P. N. "Wastewater Treatment and Reuse" Standard Book House, New Delhi
- Rao M. N. & Datta A. K. "Wastewater Treatment" Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.

Reference Books:

- Metcalf and Eddy, "Wastewater Engineering: Treatment & Reuse" Tata McGraw Hill Publication.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code **: CE4314**	Course Name: **PE-III Construction Project Management Laboratory**

L	T	P	Credits
-	-	**2**	**1**

Course Description:

This course addresses the hands on concepts in project management related practical application of projects charter, scheduling, cost planning and human resource management. The course helps to from a management perspective, the project manager in particular with a basic exposure to the tasks and challenges which affect most projects. Course also includes use of software for the project resource planning

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Develop a project charter for a construction project.
2. Analyze feasibility of project.
3. Determine optimum time and optimum cost of project through network compression.
4. Plan resources required for execution of the project.

Prerequisite: Possess basic knowledge of construction activities

Course Content

Expt No.	Description	Hrs
01	Develop a project charter for a construction project.	04
02	Analyze feasibility of project.	06
03	Schedule a project using Primavera P6/ MS project software	06
04	Determine optimum time and optimum cost of project through network compression.	04
05	Plan resources required for execution of the project.	02
06	Industrial Visit for Site Layout and Report	02

References:

Text Books:

- Edward F, James A, Finch S, "Engineering Management", Pearson Education India,
- Davar R, "Principles of Management", Progressive Corporation Pvt Limited,

- Punmia B, Khandelwal K, "Project Planning and Control With PERT And CPM", Laxmi,
- Chitkara K, "Construction Project Management", Mc Graw Hill Publications,

Reference Books:

- Gupta P, Hira D, "Operations Research", S Chand Publication,
- Clifford F., Erik W., Desai G, "Project Management The Managerial Process", Mcgraw Hill Publications,
- Prasanna C., "Projects: Planning, Analysis, Selection, Fin. Implementation & Review", Tata McGraw Hill.
- Pilcher R, "Project Cost Control in Construction", Wiley-Blackwell,
- Khanna O, "Industrial management", Dhanpat Rai Publication.

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Class: **Final Year B. Tech. Civil**	Semester: **VII**	L	T	P	Credits
Course Code: **CE4334**	Course Name: **PE-III Advanced Concrete Technology Laboratory**	-	-	**2**	**1**

Course Description:

This laboratory course is designed to enable students to conduct experimental investigations on concrete. The course content includes experimental studies on various properties of concrete, focusing on microstructure, flowability, the use of admixtures, as well as corrosion and durability. Additionally, the laboratory exercises involve site visits and the preparation of reports. This laboratory course is structured to facilitate students in conducting experimental investigations on concrete. The content encompasses an array of experimental studies that examine the properties of concrete, specifically focusing on microstructure, flowability, the utilization of admixtures, as well as aspects of corrosion and durability. Furthermore, the laboratory exercises include site visits and the preparation of comprehensive reports.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Examine SEM and XRD data for concrete.
2. Analyze the impact of admixture dosage on the properties of concrete.
3. Evaluate the workability characteristics of flowable concretes.
4. Assess the quality of concrete based on data collected during the condition assessment of concrete structures.
5. Design mixes for special concretes following the standard codes of practices/ handbooks.

Prerequisite: Possess basic knowledge of concrete technology laboratory

Laboratory Course Content

Unit No.	Description	Hrs
01	Introduction to microstructural characterization of concrete 1. Study of SEM micrographs 2. Study of XRD data	**04**
02	Mini Project: Examine the effect of admixture dosage on concrete properties 1. Fresh concrete 2. Hardened concrete	**06**
03	Mini Project: Mix design of special concrete following the standard/ existing guidelines (minimum one type)	**06**

04	Condition assessment of RCC structure report preparation.	**04**
06	Visit a construction site and write a visit report. (Visits are preferred to cement manufacturing plants, RMC plants, high-rise construction, and bridge construction sites)	**04**

References:

Text Books:

- Shetty, M.S. , Concrete Technology, S. Chand & Company Ltd., New Delhi
- Santhakumar, A.R. , Concrete Technology, Oxford University Press

Reference Books:

- Mehta, P. K. and Monteiro, P.J. M., Concrete Microstructure, Properties and Materials., Third Edition, Mc Graw Hill Publications, NY.
- Irving Kett, Engineered Concrete- Mix Design and Test Methods, Second Edition, CRC Press Taylor & Francis Group.
- Newman J, Choo B. S, Advanced Concrete Technology, Butterworth-Heinemann, Elsevier Ltd.

Codes of Practice:

- Bureau of Indian Standards IS 456: 2000. Indian standard code of practice for plain and reinforced concrete. New Delhi, BIS.
- Bureau of Indian Standards IS 1199: 1959. Indian standard code of methods of sampling and analysis of concrete. New Delhi, BIS.
- Bureau of Indian Standard New Delhi, BIS, IS 456: 2000. Indian standard code of practice for plain and reinforced concrete, 2000
- Bureau of Indian Standard New Delhi, BIS, IS 1199: 1959. Indian standard code of methods of sampling and analysis of concrete
- Handbook on Concrete Mixes SP 23: 1982, 2001.
- Bureau of Indian Standards IS 9103: 1999. Indian standard code for chemical and air-entraining admixtures in concrete.
- Bureau of Indian Standards IS: 10262-2019. Indian standard code of practice for recommended Guidelines of Concrete Mix Design plain and reinforced concrete. New Delhi, BIS.
- ACI 211.1-91.
- Bureau of Indian Standard New Delhi, BIS, IS: 383-1970. Indian standard specification for coarse and fine aggregates from natural sources for , 1970, Bureau of Indian Standard New Delhi, BIS, 1970

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE493**	Course Name: **PE-III Environmental Chemistry and Microbiology laboratory**

L	T	P	Credits
-	-	**2**	**1**

Course Description:
Environmental chemistry and microbiology laboratory course offered as program elective course in 7th semester, which focuses on environmental chemistry and microbiology. The course enables students to work as a consultant or contractor for infrastructure projects related to water supply and waste management projects. This course intends to build the competency in the students to analysis water and wastewater for design of WTP and STP

Course Learning Outcomes:
After successfully completing the course, student will able to:
1. Apply physical, bio-chemical and advanced instrument method for water and wastewater analysis.
2. Analyze data acquired from experiment.

Prerequisite: Basic knowledge of Environmental Science.

Course Content

Unit No.	Description	Hrs
01	Review of basic experiments: pH, acidity, alkalinity, electricity, hardness and chloride	02
02	Determination of solid Content present	02
03	Determination of B.O.D. of wastewater	02
04	Determination of C.O.D. of wastewater	02
05	Determination of Total Kjeldhal Nitrogen(TKN) of wastewater	02
06	Determination of fluoride content of water	02
07	Determination Most Probable Number of water	02
08	Demonstration of High Volume Sampler	02
09	Demonstration of UV Spectrometer	02
10	Demonstration of flame photometer	02
11	Visit to water Treatment plant for understanding water treatment processes	02
12	Visit to Sewage Treatment plant for understanding sewage treatment processes	02

References

Text Books:

- Sawyer C.N. and McCarty P.L., "Chemistry for Environmental Engineers", Tata McGraw-Hill Publishing Company Limited
- Mohapatra P. K., "Textbook of Environmental Microbiology", I. K. International Publishing House Pvt. Ltd

Reference Books

- VanLoon G. W. and Duffy S. J., "Environmental Chemistry: A Global Perspective", Oxford University Press, Indian Edition.
- Pelczar Jr., M. J. E. C. S. Krieg, R. Noel., and Pelczar M. F., "Microbiology", Tata McGraw Hill Publishing Company Limited
- American Public Health Association (APHA), "Standard Methods for the Examination of Water and Wastewater",
- Metcalf and Eddy "Wastewater Engineering Treatment and Reuse", Tata McGraw Hill Publication

Class: **Final Year B. Tech. Civil**	Semester: **VI**	L	T	P	Credits
Course Code: **CE495**	Course Name: **PE-III Watershed Management and Remote Sensing Applications Laboratory**	-	-	**2**	**1**

Course Description:

Geographic Information Systems (GIS) is an emerging sub-engineering branch that comes under the branch of civil engineering. India is a developing country and application of GIS in the field of irrigation and hydraulic structures is a current need. In this course the study is based on the aim of application of GIS to solve complex engineering problems with the help of real-world data. Through this course students will be acquainted with the basic concept of GIS, application to irrigation hydraulic structures and disasters management plan.

Course Learning Outcomes:

After completion of course, student will be able to:

1. Explain use of different data formats used in GIS.
2. Describe types of data used in GIS.
3. Discuss the data editing operations.
4. Apply GIS techniques in Disaster Management.

Prerequisite: Engineering Mathematics, Fluid Mechanics, Water Resources, and Irrigation Engineering

Course Content

Expt. No.	Name of Experiment	Hrs
1	Overview of ArcGIS or QGIS tools and modules	02
2	Working with Projections	02
3	Toposheet and Image Registration	02
4	Digitization of map data and making map layout	02
5	Data query: Spatial and Attribute.	02
6	Animating Time Series Data and Interpolating Point Data	02

7	Travel Time Analysis with vehicle movement and Service Area Analysis using Open route service	**02**
8	Data Formats in ArcGIS Pro: Import of Data, Shapefile, Feature Class, Geodatabase, Data Frames, Labeling Features.	**02**
9	Vector Data: Creating New Features, Editing Functions, Digitization, Errors and Creation of Topology.	**02**
10	Import and Create 3D Model in ArcGIS Pro	**02**
11	Calculation of Vegetation and Water Indices, Slope and Contour, Network Analysis.	**04**

References:

Text Books:

- P. Fu, J Sun, Web GIS principles and applications, ESRI Press.
- V Pessina , F Meroni , A web GIS tool for seismic hazard scenarios and risk analysis Geomatics Canada Web Site.
- Pandey, Dhirendra. Int. Conference on Advances in Engineering & Technology - AET - 2013 - ISBN- 978 - 81 -927082-1-7.
- Joseph, G. Fundamentals of Remote Sensing. Universities Press (India) Pvt. Ltd, Hyderabad, India.
- Lillesand, T. M., Ralph, K. W. & Chipman, J. Remote Sensing and Image Interpretation (6th ed.), John Wiley.
- Sabins, F. F. Remote Sensing Principles and Interpretation. Waveland Pr. Inc.

Reference Books:

- American National Standards Institute. ANSI/X3/SPARC Study Group on Data Base Management Systems; Interim Report. FDT (Bulletin of ACM SIGMOD)
- Dangermond and Dangermod "A Classification of Software Components Commonly used in Geographic Information Systems." In Proceedings of the U.S.-Australia Workshop on the Design and Implementation of Computer-Based Geographic Information Systems, 70–91. Honolulu, HI.
- White, D. "Display of Pixel Loss and Replication in Reprojecting Raster Data from the Sinusoidal Projection." Geocarto International 21 (2): 19–22.

Class: **Final Year B. Tech. Civil**	Semester-**VIII**
Course Code: **CE4354**	Course Name: **PE-III Rock Mechanics Laboratory**

L	T	P	Credits
--	--	2	1

Course Description: The design and analyses of any rock engineering project for civil or mining applications require careful mechanical characterization of the host rock. For this purpose, on-site drilling of rock cores and rock samples are prepared for laboratory testing. These samples then go through various standard rock mechanics testing procedures to determine several physical and mechanical properties. These properties are typically used for design purposes.

Course Outcomes:

After successfully completing the course, student will able to:

1. Determine the physical and mechanical properties of rock.
2. Classify types of rock based on observations and laboratory testing.
3. Prepare the site investigation report.

Prerequisites: Basic knowledge of Mathematics and Geotechnical Engineering etc.

Course Content		
Exp. No.	**Name of Experiment**	**Hrs.**
1.	Introduction and Identification of Different Types of Rock	2
2.	Determination of Core Recovery and RQD of Rock Sample	2
3.	Determination of Moisture Content and Porosity of Rock Sample	2
4.	Unconfined Compressive Strength Test	2
5.	Point Load Strength Index Test	2
6.	Brazilian Tensile Strength Test	2
7.	Direct Shear Test on Rock Sample	2
8.	Permeability of Rock Sample	2

9.	Triaxial Test on Rock Sample	**2**
10.	Taking Borelog on Site- Site Experiment	**2**
11.	Site Investigation Report	**2**

References –

- Jaeger, J.C., Cook, N.G.W., Zimmerman, R.W., "Fundamentals of Rock Mechanics", Blackwell Publishing.
- Mogi Kiyoo, "Experimental Rock Mechanics", Taylor & Francis.
- Hudson, J.A. and Harrison, "Engineering Rock Mechanics – An Introduction to Principles", J.P., Pergamon.
- Obert and Duvall, "Rock Mechanics and Design of Structures", John Willey & Sons.
- Stag and Zienkiewez, "Rock Mechanics in Engineering Practice, John Willey & Sons
- T. Ramamurthy, "Engineering in Rocks", PHI Learning Pvt. Ltd.

Class: **Final Year B. Tech Civil**	Semester: **VII**
Course Code: **CE4374**	Course Name: **PE-III GIS and GPS System Laboratory**

L	T	P	Credits
-	-	**2**	**1**

Course Description:
Geographic Information Systems (GIS) is an emerging sub-engineering branch that comes under the branch of civil engineering. India is a developing country and application of GIS in the field of irrigation and hydraulic structures is a current need. In this course the study is based on the aim of application of GIS to solve complex engineering problems with the help of real-world data. Through this course students will be acquainted with the basic concept of GIS, application to irrigation hydraulic structures and disasters management plan.

Course Learning Outcomes:
After completion of course, student will be able to:
1. Explain use of different data formats used in GIS and GPS.
2. Describe types of data used in GIS.
3. Discuss the data editing operations in GIS and GPS.
4. Apply GIS and GPS techniques in Disaster Management.

Prerequisite: Environmental Science, Irrigation Hydraulic engineering, Engineering Mathematics, Surveying, Water Resources Engineering,

Course Content

Expt. No.	Name of Experiment	Hrs
1	GPS: Basic functions, Waypoint demarcation, and Area Calculation through GPS	02
2	GPS: Transfer data in GIS software	02
3	Web GIS Applications with App Builder	02
4	Spatial Analysis in ArcGIS Online	02

5	WebGIS and 3D Visualization	**02**
6	Digitization of Map Data and WMS Data	**02**
7	Data query: Spatial and Attribute.	**02**
8	Interpolating Point Data	**02**
9	Service Area Analysis using Open route service	**02**
10	Working with Google Earth.	**02**
11	Making a Map Layout.	**04**

References:

Text Books:

- P. Fu, J Sun, Web GIS principles and applications, ESRI Press.
- V Pessina , F Meroni , A web GIS tool for seismic hazard scenarios and risk analysis Geomatics Canada Web Site.
- Pandey, Dhirendra. Int. Conference on Advances in Engineering & Technology - AET - 2013 - ISBN- 978 - 81 -927082-1-7.
- Joseph, G. Fundamentals of Remote Sensing. Universities Press (India) Pvt. Ltd, Hyderabad, India.
- Lillesand, T. M., Ralph, K. W. & Chipman, J. Remote Sensing and Image Interpretation (6th ed.), John Wiley.
- Sabins, F. F. Remote Sensing Principles and Interpretation. Waveland Pr. Inc.

Reference Books:

- American National Standards Institute. ANSI/X3/SPARC Study Group on Data Base Management Systems; Interim Report. FDT (Bulletin of ACM SIGMOD)
- Dangermond and Dangermod "A Classification of Software Components Commonly used in Geographic Information Systems." In Proceedings of the U.S.-Australia Workshop on the Design and Implementation of Computer-Based Geographic Information Systems, 70–91. Honolulu, HI.
- White, D. "Display of Pixel Loss and Replication in Reprojecting Raster Data from the Sinusoidal Projection." Geocarto International 21 (2): 19–22.

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE497**	Course Name: **PE-III Structural Health Monitoring Laboratory**

L	T	P	Credits
	-	2	1

Course Description: This lab enables students to explore various methods for detecting, diagnosing, and predicting structural issues, focusing on real-time monitoring and assessment. The laboratory provides practical exposure to tools like sensors, data acquisition systems, and analytical software.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Select appropriate sensors for SHM based on structural characteristics and monitoring requirements.
2. Testing structural elements using strain gauges and LVDTs to accurately measure low deflections under various loading conditions

Prerequisite: Building Materials, Concrete Technology, RCC Structures, Steel Structures.

Course Content		
Expt. No.	**Description**	**Hrs.**
01	Introduction to various sensor types for SHM	**02**
02	Characteristics verification of different types of sensors on SHM	**02**
03	Demonstration of vibration-based SHM Using Accelerometers	**02**
04	Testing of structural element for determination of low deflections using strain gauges	**02**
05	Testing of structural element for determination of low deflections using LVDT	**02**
06	Visit to a civil engineering structure installed with SHM system	**02**

References –
Text Books:

- Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, "Structural Health Monitoring", John Wiley and Sons.
- Douglas E Adams, "Health Monitoring of Structural Materials and Components, Methods with Applications", John Wiley and Sons

Reference Books:

- J. P. Ou, H. Li and Z. D. Duan, "Structural Health Monitoring and Intelligent Infrastructure", Vol1, Taylor and Francis Group, London.
- Victor Giurglutiu, "Structural Health Monitoring with Wafer Active Sensors", Academic Press Inc.

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE499**	Course Name: **PE-III Design of Industrial Structures Laboratory**

L	T	P	Credits
-	-	**2**	**1**

Course Description: This laboratory course aims to provide students with hands-on experience in designing and analyzing various industrial structures using advanced software tools. Through practical exercises and projects, students will develop the skills necessary to create detailed structural designs and drawings for beam-columns, castellated beams, transmission towers, and water tanks

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Design beam-columns, castellated beam, transmission tower and water tank using appropriate software.
2. Prepare detailed structural drawings of beam-columns, castellated beam, transmission tower and water tank

Prerequisite: Students should possess basics of Structural Analysis and Design of Steel Structures and STAAD Pro software.

Course Content

Unit No.	Description	Lab Hrs
01	Design and drawing of beam-columns using STAAD Pro software.	06
02	Desing of castellated beam and validation of stresses using ABAQUS	06
03	Design and drawing of transmission line tower using STAAD Pro software	06
04	Design and drawing of water tank using STAAD Pro software	06

References:
Codes of Practice:
- IS: 800 (2007) General Construction in Steel-Code of Practice, BIS.
- IS: 875 (Part 3) (2015), Wind Loads on Buildings and Structures, BIS.

Textbooks:
- Duggal S. K., "Design of Steel Structures", Tata Mc-GrawHill publishing company Ltd.
- Dayaratnam, "Design of Steel Structures", Wheeler Publishing.

Reference Books:
- Subramanian N., "Design of Steel Structures", Oxford University Press.
- Sairam K. S., "Design of Steel Structures", Pearson publication.
- Shiyekar M. R., "Limit State Design in Structural Steel", PHI Learning.

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE4394**	Course Name: **PE-III Advanced Structural Design Laboratory**

L	T	P	Credits
	-	**2**	**1**

Course Description:

This course delves into concepts of reinforced concrete design, focusing on flat slabs, combined footings, raft and pile foundations, retaining walls, and overhead water tanks. Students will engage in the design and detailing of these structural elements, considering practical applications and adherence to various Indian Standard codes. The course emphasizes structural stability, safety, and serviceability, providing learners with the skills necessary to address real-world challenges in structural engineering. By the end of the course, students will gain expertise in designing complex structures and be prepared for upcoming engineering roles.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Design reinforced concrete flat slab, combined footing, raft footing, pile foundation using appropriate software.
2. Design retaining wall and elevated circular water tank using appropriate software.
3. Prepare structural drawings of flat slab, combined footing, raft footing, pile foundation, retaining wall and elevated circular water tank.

Prerequisite: Design of Reinforced Concrete Structures, STAAD Pro.

Course Content		
Expt. No.	**Name of Experiment**	**Hrs.**
The students are expected to complete any four design projects from the list below.		
01	Design of Flat slab using appropriate software.	04
02	Design of combined footing using appropriate software.	04

03	Design of raft footing using appropriate software.	04
04	Design of pile foundation using appropriate software.	04
05	Design of retaining wall using appropriate software.	04
06	Design of elevated circular water tank using standard software.	04

References:

Codes of Practice:

- IS 456 (2000): Plain and Reinforced Concrete - Code of Practice, B.I.S. New Delhi
- SP 16:1980 Design Aids for Reinforced Concrete to IS 456, B.I.S. New Delhi.
- I.S. 875 (1987): Code of Practice for Design Loads (Other than Earthquake) For Buildings and Structures (Part 1 and Part 2).

Text Books:

- Punmia B. C., Jain A. K. "Limit State Design of Reinforced Concrete (As per IS 456:2000)", Laxmi Publications Pvt. Ltd.
- Bhavikatti S. S., "Advance R.C.C. Design", New Age International Publishers.
- Shah M. G. and Kale C. M., "R.C.C. Theory and Design", Trinity Press, New Delhi.

Reference Books:

- Karve S. R. and Shah V. L., "Illustrated Design of Reinforced Concrete Buildings", Assorted Editorial Publications.
- Karve S. R. and Shah V. L., "Handbook of Reinforced Concrete Design (as per IS: 456 - 2000)", Structures Publications.
- Pillai S. U. and Menon D., "Reinforced Concrete Design", McGraw Hill Education (India) Pvt. Ltd.
- Bhatt P., Mac Ginley T. J. Choo B. S., "Reinforced Concrete Design Theory and Examples", CRC Press.

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE4114**	Course Name: **Capstone Project Phase-II**

L	T	P	Credits
-	-	-	**3**

Course Description:

The project undertaken by students needs to be completed during this semester. Here students undergoes the work of Capstone Project finalized during previous semester. At the end of this, students will be able to finish their project work.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Analyze the primary/secondary data to solve problems.
2. Interpret results of experimentation/questionnaire survey/ data analysis.
3. Perform project work in team.
4. Apply the tools/techniques/ knowledge to arrive at a conclusion.
5. Develop oral and written presentation skills.

Prerequisite: Basics of civil engineering courses.

Course Content

Unit No.	Description	Hrs
01	In Capstone Project Phase-II, students need to undergo the remaining work of projects in team and should achieve all the objectives stated in the synopsis during the previous semester. Students should collect all the primary/secondary data and analyze the same to solve the problem. Progress presentations for the Capstone Project- II, will be held during this semester. Students need to complete the objectives of the project and present the work before a panel of experts along with supervisors from the civil engineering department. In-semester evaluation consists of presentation of work done before panel of experts.	**48**

Class:-**Final Year B. Tech.**	Semester- **VII**
Course Code : REH401	Course Name : Intellectual Property Rights

L	T	P	Credits
-	-	-	2

Course Description:
This course provides a comprehensive introduction to the principles and practices of Intellectual Property Rights (IPR) with a focus on their application in the fields of science, technology, and engineering. Students will explore the various forms of intellectual property, including patents, copyrights, trademarks, trade secrets, and industrial designs, and understand their legal, economic, and ethical implications. The course covers the process of securing and enforcing IP rights, the role of international agreements and organizations, and the challenges posed by emerging technologies. Through case studies, practical exercises, and discussions, students will gain the knowledge and skills necessary to protect and manage intellectual property in a globalized and innovation-driven world.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Explain the basic concepts and importance of Intellectual Property Rights.
2. Identify different types of intellectual property and their relevance in the technology sector.
3. Analyze the legal aspects of IPR and its implications for innovation and business.
4. Apply IPR principles to protect inventions, designs, and creative works.
5. Evaluate the ethical and societal impact of IPR in a global context..

Prerequisite:
Write prerequisite required to study this course.

Course Content

Unit No	Description	Hrs
1	**Introduction to Intellectual Property Rights:** Definition and importance of Intellectual Property (IP); Historical evolution of IPR; Types of Intellectual Property: Patents, Copyrights, Trademarks, Trade Secrets, Industrial Designs, Geographical Indications; Role of IPR in innovation and economic development; Overview of global IPR systems (WIPO, WTO, TRIPS Agreement)	

2	**Patents:** Concept of patents and patentability criteria (novelty, inventive step, industrial applicability); Types of patents: Utility, Design, and Plant Patents; Patent application process: Filing, examination, and grant; Patent infringement and enforcement; Case studies on patent disputes in technology sectors; Introduction to Patent Cooperation Treaty (PCT) and international patent filing	
3	**Copyrights and Related Rights:** Concept of copyright and its scope; Subject matter of copyright: Literary, artistic, musical, and software works; Rights of copyright holders and limitations (fair use, public domain); Copyright registration and enforcement; Digital rights management and challenges in the digital era; Case studies on copyright infringement in software and media	
4	**Trademarks and Industrial Designs:** Concept of trademarks and their importance in branding; Types of trademarks: Word marks, logos, service marks, collective marks; Trademark registration process and infringement; Concept of industrial designs and their protection; Design registration and enforcement; Case studies on trademark and design disputes	
5	**Trade Secrets and Geographical Indications:** Concept of trade secrets and their protection; Legal framework for trade secrets (e.g., NDAs, confidentiality agreements); Geographical Indications (GIs): Concept and significance; Protection of GIs and their role in promoting local products; Case studies on trade secret theft and GI disputes	
6	**IPR Management, Ethics, and Global Perspectives:** IPR management in technology transfer and commercialization; Licensing and assignment of IP rights; IPR in open innovation and collaborative research; Ethical issues in IPR: Biopiracy, patenting life forms, and access to medicines; Global IPR trends and challenges: Counterfeiting, piracy, and cross-border enforcement; Role of IPR in startups and entrepreneurship; Future of IPR in emerging technologies (AI, blockchain, biotechnology)	

References -
Text Books:

- Roger E. Schechter, John R. Thomas, "Intellectual Property: The Law of Copyrights, Patents, and Trademarks", West Academic Publishing
- David Bainbridge, "Introduction to Intellectual Property", Oxford University Press

Reference Books:

- Robert Merges, John Duffy, "Patent Law and Policy: Cases and Materials", LexisNexis
- David Wright, "Intellectual Property Rights: A Practical Guide for Engineers", Wiley

Note: - Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments as per schedule.

Class:-**Final Year B. Tech.**	Semester- **VII**
Course Code : REH403	Course Name : Research Project (Synopsis) Phase 1

L	T	P	Credits
-	-	-	**2**

Course Description:

This course is designed to guide B. Tech. students through the initial phase of their research project, focusing on the development of a comprehensive research synopsis. Students will be introduced to the fundamentals of research methodology, including problem identification, literature review, research design, and ethical considerations. The course emphasizes the formulation of clear research questions, the selection of appropriate methodologies, and the preparation of a well-structured research proposal. Through mentoring sessions, students will learn to conduct systematic literature reviews, design research frameworks, and present their synopsis/proposal effectively. The course aims to equip students with the skills necessary to plan, propose, and defend their research projects, setting a strong foundation for the successful execution of their research in Phase 2.

The evaluation process is designed to assess students' understanding and application of research concepts. It includes in Semester Evaluation (ISE - 50%) and End-Semester Evaluation (ESE - 50%) comprises presentation sessions.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Demonstrate an understanding of research methodology and project planning.
2. Identify a research problem with clear objectives and questions.
3. Conduct a systematic literature review using appropriate sources and tools.
4. Develop a research synopsis with a well-defined methodology and expected outcomes.
5. Present research synopsis/proposal effectively.

Class:-**Final Year B. Tech.**	Semester- **VII**
Course Code : REH405	Course Name : Research-Specific Core Course-1 (Online NPTEL Course)

L	T	P	Credits
-	-	-	3

Course Description:

Student can opt for online certification course and produce certificate.

- The student should select the course in consultation with mentor on NPTEL platform related to project area.
- The course should be minimum 25 hours' duration and should have certification facility.

Student should complete course and get certificate. The certificate copy should be submitted to mentor. The evaluation process is designed to assess students' understanding of core concepts related to project area. It includes in Semester Evaluation (ISE - 50%) and End-Semester Evaluation (ESE - 50%) comprises presentation sessions.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Explain the key concepts and insights gained from the NPTEL course
2. Apply concepts, tools, and methodologies learned from the NPTEL course into their ongoing research project
3. Analyze research-specific problems using the knowledge acquired from the online course.
4. Identify the real life applications and practices of courses studied

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Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : OE4382	Course Name : Finance for Engineers (Online Course)

L	T	P	Credits
2	-	--	2

Course Description:
In today's workplace, it is nearly impossible for an engineer to perform without considering the financial impact of every action on the organization's bottom line. Engineers need to be aware of issues such as cost reduction and capital investment and how their decisions can affect the financial statements. This course introduces basic financial management to engineers and technical personnel who need this knowledge to manage a profit center effectively. The course aims at providing students with an in-depth coverage of the various aspects of financial management.
It covers the assessing the financial health of the organization through ratio and cash flow analysis, sources of long term as well as short term finance. Decisions concern with financing, working capital and long term investment. Class will focus on both the academic theories underlying the management of funds and the practical aspects of financial management.

Course Learning Outcomes:
After successful completion of this course, students will be able to,
1. Discuss the fundamental aspects of accounting and finance.
2. Apply theoretical knowledge and information for preparing various financial statements.
3. Analyze the financial information for solving managerial problems.
4. Evaluate financial performance of the organization for effective decision making.

Prerequisite:
Basics of Mathematics

Course Contents

Unit No	Description	Hrs
1.	**Finance Terminologies & Financial Statement:** Key terms of Accounting and Finance, Accounting Principles underlying Preparation of Financial Statements	4
2.	**Analyzing Health of a Firm:** Techniques of Analyzing Health of a Firm, Classification of Ratios – Liquidity, Leverage, Activity, Profitability, Analysis of Cash Flows	4

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3.	**The Management of Working Capital:** Need of Working Capital, Operating Cycle of Working Capital, Determinants of Working Capital, Preparation of Working capital statement	4
4.	**Investment Decision Rules:** Investment Decision Rules, Evaluation Criteria for Investment Decision: Payback, ARR, NPV, PI & IRR, Decision Tree Analysis	4
5.	**Long Term Financing:** Long Term Financing: Shares, Debentures, Loan capital, foreign capital, FDI, Euro issues & external borrowings, Venture capital financing.	4
6.	**Financing Decisions and Cost of Capital:** Risk & Return, Cost of Capital, Cost of Equity, Cost of Debt, Weighted Average Cost of Capital	4

References -
Reference Books:

- Paul Kimmel, J. Weygandt, D. Kieso, Financial Accounting
- S.N. Maheshwari & S.K. Maheshwari, Problems & Solutions in Advanced Accountancy, Vikas Publishing House Pvt. Ltd., New Delhi
- M.C. Shukla, T.C. Grewal & S. C. Gupta, Advanced Accounts, S. Chand
- M. Y. Khan & P. K. Jain, Financial Management, Tata McGraw-Hill Publishing Company Limited, New Delhi
- Prasanna Chandra, Financial Management, Tata McGraw-Hill Publishing Company Limited.

Note: - Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.
Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam.
Final exam will be held at college campus.

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Class:-**Final Year B. Tech.**	Semester- **VIII**
Course Code : OE4362	Course Name : Engineering Management & Economics

L	T	P	Credits
2	-	-	2

Course Description:
Engineering management is the integration of management principles with engineering practices. It is a specialized field that focuses on effectively leading engineering teams and managing technical projects. This course is structured into two key modules: Engineering Management and Engineering Economics. The first module is centered on building the managerial skills necessary to guide, mentor, and inspire technical professionals in their engineering roles. The second module delves into engineering economics, a vital area for engineering firms to maintain their competitive advantage and market presence, focusing on economic decision-making.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Develop administrative, organizational, and planning skills to effectively manage and execute engineering projects.
2. Create bar charts and milestone charts to track and manage project progress.
3. Analyze profit and cost data, conducting economic evaluations to make informed, optimal decisions.
4. Calculate depreciation using various methods.

Prerequisite: Basics of Mathematics

Course Content

Unit No	Description	Hrs
1	**Managerial skills** Theories of Management Principles of Management (by Henry Fayol), Functions of Management, Planning, Organizing, Staffing, Directing, Co-Ordination, Communication, Motivation and Controlling	04
2	**Organizational skills** Levels of management, Organizations-elements, types and characteristics of organization, Management by Objectives (MBO)	04
3	**Planning Tools** Methods of scientific management- Critical Path Method (CPM), Programme Evaluation & Review Techniques (PERT), Network Crashing, Bar Chart, Mile-Stone chart, Gant Chart	04

4	**Methods of Economic Analysis** Economic equivalence, Methods of comparison of alternatives- Present Worth Method, Rate of Return method, Benefit-Cost ratio method	**04**
5	**Make or Buy Decision** Approaches of make or buy decision-Simple cost analysis, Economic analysis, break-even analysis, Payback analysis	**04**
6	**Depreciation** Methods of Depreciation- Straight line method, Declining balance depreciation, Sum of years digits method, sinking fund method, service output method	**04**

References -

Text Books:

- Gilbert Daniel R, Freeman R. Edward and Stoner James A. F, "Management" Pearson Education.
- Harold Kerzner, "Project Management- A system approach to planning, scheduling and controlling", John Wiley & Sons Inc.
- Punmia B. C. and Khandelwal K. K, "Project Planning, Scheduling and controlling with PERT and CPM", Laxmi Publications Pvt. Ltd.
- Paneerselvam R, "Engineering Economics", Prentice Hall India Learning Private Limited.

Reference Books:

- Cannice Mark V, Koontz Harold and Weihrich Heinz, "Management", McGraw Hill Education (I) Pvt. Ltd.
- Blank Leland and Tarquin Anthony, "Basics of Engineering Economy", Tata McGraw-Hill.
- Mithani D. M, "Managerial Economics- Theory & Applications", Himalaya Publishing House-New Delhi.

Note:- Being online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments as per schedule.

Weightage: 25% weightage for unit wise assignments + 75% weightage for final examination.

Final exam will be held at college campus.

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Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : IP4024	Course Name : Industry Internship & Project

L	T	P	Credits
-	-	--	**12**

Course Description:
Internship is designed to expand the depth and breadth of academic learning of students in their particular areas of study. It is an opportunity for students to receive experience in applying theories learned from the classroom to specific experiences with the community and work world. An internship can also heighten awareness of community issues, motivate students to create opportunities, embrace new ideas, and give direction to positive change. A successful internship can give valuable information in making decisions about the direction of future studies or employment. An internship is an opportunity not only to use and develop industry-related knowledge and skills, but also to enhance some of the skills that are transferable to any professional work setting. Students from Final year B.Tech are eligible to do this internship. Selected candidates by college will be permitted for internship of minimum 20 weeks in 8th semester. During this Internship, it is expected that students should identify the problems arising in the industry related to Engineering, and they have to give the solution to the company.

Course Learning Outcomes:

1. **Internship**
   After the successful completion of the IIP- II the student should be able to
   1. Examine the functioning of the company on the terms of inputs, transformation process and the outputs (products and services)
   2. Develop an attitude to adjust with the company culture, work norms, code of conduct.
   3. Recognize and follow the safety norms, Code of conduct.
   4. Demonstrate the ability to observe, analyse and document the details as per the industry practices.
   5. Interpret the processes, systems and procedures and to relate to the theoretical concepts- studies.
   6. Develop the leadership abilities, communication.
   7. Demonstrate project management and finance sense
2. **Project**
   After the successful completion of the project, the student should be able to;

1. Identify the project/problem in the domain of a program relevant for the company.
2. Compile the information to the pertaining to the problem identified.
3. Analyse the information using the statistical tools/ techniques.
4. develop the feasible solution for given problem.
5. Analyse the impact of the project on the performance of company/department.

Course Content

I. Internship :

During Internship, Students should follow guidelines given below.

1. After joining the industry students should learn all the departments and their workings. Furthermore, student should understand how each department of industry is interlinked with one another.
2. Student should correlate the theoretical aspects learned in academics with industry practices.
3. Students should gain a knowledge of new technologies which industry follows.
4. Students should follow the professional codes and ethics.
5. Students should follow all rules and regulations of industry. Special care should be taken regarding safety.

- **Work Diary:**
  Work Diary will be provided to each student, which contains details regarding internship, do's and don'ts and evaluation scheme. Student is required to write the Diary regularly and get it signed by the industry guide periodically. During the visit of Mentor, assigned to the student should be able to go through the Diary to access the work done and write the remarks/ instruction. At the end of internship, student should submit the duly completed diary to the department.

- **Duration:**
  The internship duration is of one complete semester (approximately 20 weeks) between 1st January to 30th May of the respective academic year. Biometric attendance on working days is compulsory.

II. Project :

Students should select technical problems occurring within the industry as a project in consult with industry & Institute mentors.

- **Evaluation**

Faculty Mentor will be assigned to each student by the Institute who will monitor the progress of internship and project and help the student to sort-out any issues/ problems arising. Mentor of student from college will visit the industry as per the schedule given below.

Sr.No.	Evaluation	Period
1.	At the beginning of the program for orienting Students to the company and finalize the project	During 2nd Week
2.	Review-I (ISE-1)	During10thweek
3.	Review-II (ISE-2)	During15thweek
4.	Review-III (ESE)	During20thweek

*Review-III is end semester examination (ESE), which will be conducted at institute.

*During ESE, students should submit, Project & internship report, Work diary, Internship & project completion certificate issued by industry etc. to respective departments.

Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : RE4044	Course Name : Research Internship

L	T	P	Credits
-	-	-	**12**

Course Description:
Research experience for undergraduates is important not only for conducting research on a topic that has an impact on a current research activity, but also as a tool to enhance undergraduate education. For the engineering technology students, research experiences allow them to carry out in-depth study of engineering concepts, while emphasizing hands-on experiences and practical applications. Participating in research projects strengthens the student's resume, and fulfills the requirements of present day employers, who demand sound engineering skills in their employees.

Course Learning Outcomes:
After completion of this course, the student will be able to,

1. Investigate the technical literature.
2. Recognize and evaluate theories, practices, and/or research on a chosen topic by conducting a thorough literature review and submitting a written integrative, critical summary of the current literature.
3. Design a research problem and develop a methodology.
4. Develop and implement an advanced original research or creative project.
5. Develop the ability to explain the conceptual viability of the project and describe the major components involved.
6. Develop advanced discipline-relevant skills and competencies.
7. Write a research report and paper.

Course Content

Students should carefully discuss with their research advisor about time expectations to complete the research project.

Degree to which students meet expectations: The following is a minimum set of expectations for every student enrolled for this course for credit:
i) perform a background literature search and review,
ii.) Develop a project plan,
iii.) Perform experimental work or applied experimental work,

iv.) Write and present a research report.
iv) Write and submit research paper to any reputed journal/international conference.

- **To submit or publish the research paper in any reputed journal/international conference is a necessary criteria to become eligible for End semester Examination (ESE).**

Quality of the final report and oral presentation: The research advisor will provide clear expectations of the desired format, content, and deadlines of the final report. The research advisors will grade the final report.

Attendance: In order to provide the measure of performance, the research advisor is expected to complete a two mid-term evaluation with the student, accompanied by recommendations for improvement for the remainder of the term. The mid-term evaluation with the student should be accompanied by a one-on-one meeting between the research advisor and the student.

Absences and Make-up Work: Requirements for attendance is as per RR of the Institute

- **Evaluation**

Faculty guide will be assigned to each student by the Institute who will monitor the progress of research project and help the student to sort-out any issues/ problems arising. Schedule of evaluation will be as given below.

Sr.No.	Evaluation	Period
1.	Review-I (ISE-1)	During10thweek
2.	Review-II (ISE-2)	During15thweek
3.	Review-III (ESE)	During20thweek

*Review-III is end semester examination (ESE).

*During ESE, students should submit research Project report, proof of submission of research paper to reputed journal/international conference to respective departments.

*If student is doing research project in outside organization (Research Lab/ institutes), he/she should submit project completion certificate given by outside organization.

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Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : ED4104	Course Name : Project Management

L	T	P	Credits
2	-	--	2

Course Description:
To improve and update knowledge of new entrepreneurs in the areas of project preparation & appraisal techniques; decision-making process in the sector of industrial, infrastructure & sustainable opportunities that would lead to improved viability, returns and effective investment decisions. Writing a business plan which can gain interest of the fund providers like venture capitalists and other sources of funding.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1 Develop a Comprehensive Business Plan for selected business
2.Evaluate Project Viability Through Financial Appraisal
3.Analyze the Environmental and Technical Aspects of a Project
4.Apply Project Management Techniques
5.Assess the Commercial Feasibility of a Business Opportunity

Prerequisite:
General knowledge of economics & clear concept about own business model.

Course Content

Unit No	Description	Hrs
1.	**Project appraisal** -Project Development Cycle, Preparation of feasibility studies, project formulation, screening for pre-feasibility studies, stages of feasibility report preparation, Project Analysis including Market Analysis, Technical Analysis & Financial Analysis, Various analytical techniques and integrating the data gathered into a full-fledged business plan.	04
2.	**Project Analysis**-Environmental Analysis, Risk Analysis, Infrastructure Development & Financing, Risk Management, Risk identification, Qualitative risk analysis, Quantitative risk analysis, Risk planning and control,National Cost-Benefit Analysis, Financing Sustainable Opportunities. Sustainability and Green Business Practices	04
3.	**Business Plan:** What is business plan, Entrepreneurial opportunities and Business Plan. Preparing business plan. (Practical Exercises on preparation of business plan) Components of Business Plan, Executive summary, other components. Project report contents.	04

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4.	**Commercial Appraisal:** Economic feasibility and commercial viability, market analysis, Market Research, Industry Analysis, Competitor analysis, defining the target market, market segmentation, market positioning, building a marketing plan, market strategy.	**04**
5.	**Technical Appraisal:** Operation and Production Plan: Types of production systems, Product design and analysis, New product development, location and layout decisions, project layout, plant and technology choices, product specification and customer needs, production planning and control, Commercializing Technologies	**04**
6.	**Financial Appraisal:** pro forma income statements, financial projections, working capital requirement, funds flow and Cash flow statements; Ratio Analysis. **Project Management Techniques**: Identifying organizational structures Estimating costs and budgeting Using critical path project management tools (WBS, Gantt chart, Project Network Diagram) Establishing the critical path Tracking project milestones Using the program evaluation and review technique (PERT tool) Using process improvement tools (Fishbone, SIPOC) Managing time Controlling quality	**04**

References -

Text Books:

- Dwivedi, A.K.: Industrial Project and Entrepreneurship Development, Vikas Publishing House

Reference Books:

- Bangs Jr., D.H., *The Business Planning Guide,* Dearborn Publishing Co.
- Katz, J.A. and Green, R.P., Entrepreneurial Small Business, McGraw Hill
- Mullins, J. and Komisar R., Getting to Plan B, Harvard Business Press
- O'Donnell, M., The Business Plan: Step by Step, UND Center for Innovation.
- Scarborough, N.M. and Zimmerer, T.W., Effective Small Business Management, Pearson
- Pickle, H.B.and Abrahamson, R.L., Small Business Management, Wiley
- Desai, V., Dynamics of Entrepreneurial Development & Management, Himalaya Publishing
- Kao, J., Creativity & Entrepreneurship, Prentice Hall
- Singh, Narendra, Project Management & Control, Himalaya Publications

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Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : ED4044	Course Name : Commercial Aspects of the Project

L	T	P	Credits
2	-	--	2

Course Description:
To familiarize students with accounting, mechanics of preparation of financial statements, understanding corporate financial statements, their analysis and interpretation.
The objectives of the course are to build the skills, frameworks and knowledge in entrepreneurial finance. Students will study the financing of small and medium sized businesses & Financial management from the perspective of both the entrepreneur and investors.
This course will also give overall understanding of marketing management which will help them in developing their own marketing decisions & in understanding the importance of market survey techniques. It will help them in conducting suitable market survey for their own selected products.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Interpret basic Accounting and Financial Terminologies.
2. Prepare & analyze financial statements.
3. Apply basic principles of marketing.
4. Apply knowledge of marketing mix for any organization.

Prerequisite:
General knowledge of economics & clear concept about own business model

Course Content

Unit No	Description	Hrs
1.	**Accounting Terminologies:** Meaning, nature, functions, types of accounting; generally accepted accounting concepts, principles and conventions; double entry system. Accounting Records: Fundamentals of record keeping, the accounting process, Computer-based accounting systems. Accounting cycle.	04
2.	**Financial Management** – Definition, nature, objectives, functions and scope of financial management, Preparation of financial plan – its objectives, essential features, consideration in formulating financial plan	04

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3.	**Financial Statements:** Balance sheet: assets, liabilities. Income statement: concept of income, concept of expenses, concept of gain and losses. Components of the income statement. Cash flow statements: purpose, components, concept, Process.	04
4.	**Nature & Scope of Marketing** – Evolution, core marketing concepts, selling concept, marketing concept, Holistic marketing concept, portfolio approach-BCG matrix. Marketing Research- Concept & practice, Steps in Marketing Research.	04
5.	**Marketing Environment and STP:** Demographic, economic, political, legal, socio cultural, technological environment (Indian context); environmental scanning to discover marketing opportunities, Segmentation, Targeting and Positioning, difference between segmentation, targeting and positioning.	04
6.	**Marketing Mix: Product, Price, Promotion and Place.** **Product Decisions:** Concept of Product, Levels of Product, Product Mix Decisions, Product Line Decisions, Individual Product Decisions, Branding, Product Life-cycle - Stages. **Pricing Decisions:** Meaning, Factors influencing Pricing Decisions, Methods of Pricing **Place Decisions:** Meaning, Channels of Distribution **Promotion Decisions:** Elements of Promotion Mix, Advertising, Publicity, Sales Promotion, Personal Selling, Direct Marketing and Public Relations,	04

References -

Text Books:

- Maheshwari, S.N. and Maheshwari, S.K., Financial Accounting, Vikas Publishing House
- Leach C.J. and Melicher, R.W. Entrepreneurial Finance, Thomson.
- For B2C = Kotler, P., Keller, K.L., Koshy, A. and Jha, M.: Marketing Management, Pearson
- For B2B = Sarin, S. Strategic Brand Management for B2B Markets, Sage

Reference Books:

- Ghosh, T.P., Financial Accounting for Managers, Tax-mann Allied Services
- Gupta, A., Financial Accounting for Management, Prentice Hall
- Jain, S.P. and Narang, K.L., Advanced Accountancy, Kalyani Publishers.
- Smith, J.K., Smith, R.L. and Bliss, R.T., Entrepreneurial Finance, Stanford University

Press

- Smith, J.K. and Smith, R.L., Entrepreneurial Finance, Wiley.
- Rogers, S., Entrepreneurial Finance, McGraw Hill.
- Chandra, P., Financial Management, McGraw Hill.
- Kotler P. & Armstrong, G., Principles of Marketing, Pearson

Note:

- Lectures of this theory course will be conducted through online mode.
- Recorded videos will be made available to students on MOODLE platform.
- Faculty will upload three lectures per week and links will be shared on every Monday.
- Students need to appear in Unit Test-1, Unit Test-2 and ESE in college campus as per the regular practice.
- Faculty of concerned course will take the decision regarding modes of In-Semester Evaluation (ISE).

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Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : ED4064	Course Name : Entrepreneurship Development Program (EDP)

L	T	P	Credits
-	-	--	1

Course Description:
Student will attend short term intensive EDP program organized either in house or by any authorized agency approved by CIIED.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Apply knowledge of engineering, economics, marketing and finance for formulation of business plan, starting & managing new business.

Prerequisite: General knowledge of business & clear concept about own business model.

Course Content:

1 Student will undergo training programs organized by CIIED.

Programs on marketing, Finance management, project report preparation by professional agencies. Students are required to apply this knowledge for preparing final project report.

2. Student will complete online certification course- **Entrepreneurial & Employability Skill Development Program** by Singapore polytechnic in association with Jugad Funda & Shivaji University, Kolhapur or any other approved agencies.

Evaluation- ISE **50** marks by mentor for-

1. Completion of online certification course- **Entrepreneurial & Employability Skill Development Program** by Singapore polytechnic in association with Jugad Funda & Shivaji University, Kolhapur or any approved agencies.

2. Active participation in programs by completing various activities/assignments in program.

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Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : ED4084	Course Name: Entrepreneurial Internship

L	T	P	Credits
-	-	-	**11**

Course Description:
Student will prepare technically feasible and economically viable detailed project report including market survey.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Apply knowledge of engineering, economics, marketing and finance for preparation of project report.
2. Make commercial, technical and financial appraisal of project.

Course Content

Student will start working on collection of data required for business plan. During semester he may require to visit various support organizations, similar industries , suppliers of raw materials, machinery, special service providers. He has to conduct market survey. For this student can go out of campus with prior permission of mentor. Mentor should maintain this record .Students are required to work independently by taking guidance from mentor/Head CIIED/faculty on expert panel of CIIED.

Product prototype & execution of business operation is must & it should be validated by Departmental ED committee.

Continuous efforts taken by student should be observed by mentor for ISE evaluation. At the end of semester detailed project report will be presented before Expert committee for ISE evaluation of 100 marks.

Then student will appear for ESE. Project report evaluation &assessment will be done by a panel of experts appointed by COE.

Evaluation	Weightage	Particulars	converted Marks
ISE	10%	Preliminary project report	10
	20%	Market Survey	20
	20%	Completion of Legal Aspects	20
	50%	Final Report	50
ESE	100%	ESE -Final Report	100

RAJARAMBAPU INSTT. OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Final Year B. Tech. Syllabus
To be implemented for 2022-26 Batch
Department of Civil Engineering

Class:-**Final Year B. Tech.**	Semester- **VIII**
Course Code : REH402	Course Name : Research Project Phase II

L	T	P	Credits
-	-	-	**11**

Course Description:
This course is designed to guide B. Tech. students through the execution and reporting phase of their research project, building on the foundation laid in Phase 1. Students will implement the research plan outlined in their synopsis, focusing on data collection, experimentation, analysis, and interpretation. The course emphasizes the application of research methodologies, tools, and techniques to address the research problem effectively. Through regular mentoring sessions, students will refine their research approach, troubleshoot challenges, and ensure adherence to ethical guidelines. The course also focuses on the preparation of a detailed research report and the presentation of findings.
The evaluation process is designed to assess students' ability to execute their research plan and communicate their results effectively. It includes In-Semester Evaluation (ISE - 50%) and End-Semester Evaluation (ESE - 50%), comprising progress reviews, report submissions, and final presentations.

Course Learning Outcomes:
After successful completion of the course, students will be able to,

1. Apply appropriate analytical tools and techniques to process and interpret research.
2. Identify and address challenges encountered during the research process.
3. Prepare a comprehensive research report detailing the objectives, methodology, findings, and conclusions.
4. Communicate research outcomes effectively through written and oral presentations.
5. Demonstrate ethical guidelines and standards throughout the research process.

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