K.E. Society's

Rajarambapu Institute of Technology, Sakharale

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

Curriculum Structure and Evaluation Scheme

With effective from 2020-21 [2020-24 & 2021-25 Batch]

Department of Civil Engineering

Rev: CE/RIT/02/2020-24

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 %
CE2033	Engineering Mechanics	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE2053	Strength of Material	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE2193	Professional Ethics, Values & Code of Conduct	2	-	-	2	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE2213	Building Planning and Design	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE2073	Surveying	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
SH2173	Environmental Science	1*	-	-	1	ISE	50	40	40	-	-
						ESE	50	40		-	-
CE2233	Building Planning and Design Laboratory	-	-	4	2	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE2113	Surveying Laboratory	-	-	2	1	ISE	-	-	--	50	50
						ESE	-	-	--	50	50
CE2133	Strength of Materials Laboratory	-	-	2	1	ISE	-	-	--	100	50
CE2153	Technical Aptitude-I	-	-	2	1	ISE	-	-	--	50	50
						ESE	-	-	--	50	50
CE2173	Engineering Mechanics Laboratory	-	-	2	1	ISE	-	-	--	100	50
SH2603	Environmental Science Project	-	-	2	1	ISE	-	-	--	100	50
	Open Elective –II Professional Skills Development & Foreign Languages Programme I	-	-	2	1	ISE	-	-	--	60	50
						ESE	-	-	--	40	50
	TOTAL	**15**	**0**	**16**	**23**	-	-	-	-	-	-

ISE = In Semester Evaluation, UT-1 = Unit Test-1, UT-2 = Unit Test-2 & ESE = End Semester Examination

Total Contact Hours/week : 31

Total Credits : 23

Notes: *One extra lecture to be allotted to Environment Science in Time Table.

**Internship will be carried out after completion of semester III for 4 Weeks. The evaluation will be done at the end of semester IV.

Courses for Technical Aptitude-I: Engg. Mechanics, Strength of Materials, Surveying, Building Planning and Design.

Open Elective –II

List of Professional Skills Development & Foreign Languages Programme I

Sr. No.	Subject Name		Course Code
1.	Professional Skills Development & Foreign Languages Programme I	Professional Leadership Skills	**SH2633**
2.		Interpersonal Skills ('Jeevanvidya for Work Life Balance')	**SH2613**
3.		Innovation Tools and Methods for Entrepreneurs	**SH2693**
4.		Personal Effectiveness & Body Language	**SH2593**
5.		German Language – Basic Level	**SH2733**
6.		Japanese Language – Level III	**SH2713**

Note:

1. A student has to complete any two courses out of six choices offered under Choice Based Soft Skills Programme. A course in each semester will be allocated without any repetition.

2. The students who have completed 'German Language Lab' or 'Japanese Language Lab' in F.Y. B. Tech should not give their choice for 'German Language – Basic Level' and 'Japanese Language – Basic Level'. Such students may give their choices for 'German Language – Advanced Level' and 'Japanese Language – Advanced Level' (batch size 40 each) in the S.Y. B. Tech Sem-IV only.

3. The students who will select and will successfully complete 'German Language – Basic Level' and 'Japanese Language –Level III' in S.Y. B. Tech Sem-III will by default (mandatorily) appear for Advance Levels of said courses in Semester-IV.

K.E. Society's

Rajarambapu Institute of Technology, Sakharale

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Curriculum Structure and Evaluation Scheme

With effective from 2020-21 [2020-24 & 2021-25 Batch]

Department of Civil Engineering

Rev: CE/RIT/02/2020-24

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%
SH2063	Engineering Mathematics III	3	1	-	4	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2043	Concrete Technology	3	-	-	3	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2063	Fluid Mechanics	3	-	-	3	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2083	Mechanics of Structures	3	-	-	3	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2123	Applications of Programming Language in Civil Engineering	-	-	2	1	ISE	-	-	50	50
						ESE	-	-	50	50
CE2143	Engineering Geology Laboratory	-	-	2	1	ISE	-	-	100	50
CE2163	Fluid Mechanics Laboratory	-	-	2	1	ISE	-	-	100	50
CE2183	Concrete Technology Laboratory	-	-	2	1	ISE	-	-	50	50
						ESE	-	-	50	50
CE2203	Technical Aptitude-II	-	-	2	1	ISE	-	-	50	50
						ESE	-	-	50	50
	Open Elective –III Professional Skills Development & Foreign Languages Programme II	-	-	2	1	ISE	-	-	60	50
						ESE	-	-	40	50
CE2223	Internship	**	-	-	2	ISE	-	-	100	50
	TOTAL	**12**	**1**	**12**	**21**	-	-	-	-	-

ISE = In Semester Evaluation, UT-1 = Unit Test-1, UT-2 = Unit Test-2 & ESE = End Semester Examination

Total Contact Hours/week : 25

Total Credits : 21

**Internship will be carried out after completion of semester III for 4 Weeks. The evaluation will be done at the end of semester IV.

Courses for Technical Aptitude-II: Engineering Mathematics III, Mechanics of Structures, Fluid Mechanics, Concrete Technology

Open Elective –III

List of Professional Skills Development & Foreign Languages Programme II

Sr. No.	Subject Name		Course Code
1.	Professional Skills Development & Foreign Languages Programme II	Professional Leadership Skills	SH2633
2.		Interpersonal Skills ('Jeevanvidya for Work Life Balance')	SH2613
3.		Innovation Tools and Methods for Entrepreneurs	SH2693
4.		Personal Effectiveness & Body Language	SH2593
5.		German Language – Advanced Level	SH2643
6.		Japanese Language – Level IV	SH2623

Note:

1. A student has to complete any two courses out of six choices offered under Choice Based Soft Skills Programme. A course in each semester will be allocated without any repetition.

2. The students who have completed 'German Language Lab' or 'Japanese Language Lab' in F.Y. B.Tech should not give their choice for 'German Language – Basic Level' and 'Japanese Language – Basic Level'. Such students may give their choices for 'German Language – Advanced Level' and 'Japanese Language – Advanced Level' (batch sizes 40 each) in the S.Y. B. Tech. Sem-IV only.

3. The students who will select and will successfully complete 'German Language – Basic Level' and 'Japanese Language –Level III' in S.Y. B.Tech Sem-III will by default (mandatorily) appear for Advance Levels of said courses in Semester-IV.

K.E. Society's
Rajarambapu Institute of Technology, Sakharale
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
With effective from 2020-21 [2020-24 & 2021-25 Batch]
Department of Civil Engineering

Rev: CE/RIT/02/2020-24

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%
CE3013	Design of Steel Structures	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3033	Geotechnical Engineering	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3053	Irrigation and Hydraulic Structures	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3073	Environmental Engineering	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3093	Transportation Engineering	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
	Program Elective - I	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3113	Geotechnical Engineering Laboratory	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE3133	Environmental Engineering Laboratory	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE3153	Transportation Engineering Laboratory	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
SH3033	Scholastic Aptitude -I	2*	-	-	2	ISE	20	40	40	-	-
						UT1	15				
						UT2	15				
						ESE	50	40			
CE3173	Technical Aptitude-III	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
SH3011	Indian Constitution	2	-	-	Audit	ISE	100	50	(P/N)	-	-
	TOTAL	**22**	**0**	**08**	**24**	-	-	-	-	-	-

ISE = In Semester Evaluation, UT-1 = Unit Test-1, UT-2 = Unit Test-2 & ESE = End Semester Examination

Total Contact Hours/week : 30
Total Credits : 24

Courses for Technical Aptitude-III: Design of steel Structures, Geotechnical Engineering, Environmental Engineering, Transportation Engineering, Irrigation and Hydraulic Structures

Note:
* One extra lecture will be allotted in the time table.

List of Program Elective-PE I

Sr. No.	Course Code	Domain	Course
1	CE3193	Structural Engineering	Structural Analysis
2	CE3213		Composite Materials
3	CE3233	Construction Management	Construction Safety Management
4	CE3253		Construction Techniques
5	CE3273	General Civil Engineering (Environmental, Geotechnical, Transportation etc.)	Advanced Water Treatment
6	CE3293		Tunnel Docks and Harbors Engineering
7	CE3313		Urban Transportation Systems

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Curriculum Structure and Evaluation Scheme

With effective from 2020-21 [2020-24 & 2021-25 Batch]

Department of Civil Engineering

Rev: CE/RIT/02/2020-24

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
							Theory (Marks)			Practical (Marks)	
		L	T	P	Credits	Scheme	Max.	Min. for passing %		Max.	Min. for passing%
CE3023	Theory of Structures	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3043	Estimation & Contracts	2	-	-	2	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3063	Construction Management	3	-	-	3	ISE	20	40	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 -IV	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
SH3021	Biology for Engineers	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3083	Estimation & Contracts Laboratory	-	-	4	2	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE3103	Design of Steel Structures Laboratory	-	-	2	1	ISE	-	-		50	50
						ESE	-	-		50	50
CE3123	Technical Aptitude-IV	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE3143	Capstone Project Phase-I	-	-	2	2	ISE	-	-	-	100	50
SH304	Psychology for Engineers	1*	-	-	1	ISE	50	40	40	-	-
						ESE	50	40		-	-
SH3063	Scholastic Aptitude II	2*	-	-	2	ISE	20	40	40	-	-
						UT1	15				
						UT2	15				
						ESE	50	40			
	TOTAL	**20**	**00**	**12**	**26**	-	-	-	-	-	-

ISE = In Semester Evaluation, UT-1 = Unit Test-1, UT-2 = Unit Test-2 & ESE = End Semester Examination

Total Contact Hours/week : 32

Total Credits : 26

Courses for Technical Aptitude-IV: Theory of Structures, Estimation & Costing, Construction Management

Note:

* One extra lecture will be allotted in the time table.

List of Program Elective PE– II

Sr. No.	Course Code	Domain	Course
1	CE3163	Structural Engineering	Design of Industrial Structures
2	CE3183		Repair and Rehabilitation of Structures
3	CE3203	Construction Management	Construction Economics and Finance
4	CE3243	General Civil Engineering (Environmental, Geotechnical, Transportation etc.)	Air Quality Monitoring and Modeling
5	CE3263		Railway and Airport Engineering
6	CE3283		Foundation Engineering
7	CE3303		Advanced Wastewater Engineering

Open Elective-IV

Sr. No.	Branch	Course Code	Open Elective-IV Courses
1	Automobile	OE3023	Reliability Engineering
2	Automobile	OE3043	Renewable Energy Sources
3	Civil	OE3063	Environmental Impact Assessment
4	Civil	OE3083	Material Management.
5	Computer	OE3103	Network Administration
6	Computer	OE3123	Information Technology Foundation Program
7	E&TC	OE3143	Mechatronics
8	Electrical	OE3163	Engineering Materials
9	Electrical	OE3181	Industrial Drives
10	CS&IT	OE336	Neural Network and Deep learning
11	CS&IT	OE3221	Cyber Forensics
12	MBA	OE3243	Marketing for Engineers
13	Mechanical	OE3263	Aircraft Systems
14	Mechanical	OE3283	Supply Chain Management
15	Mechanical	OE3301	New Product Design and Development
16	Mechanical	OE3323	Entrepreneurship Development
17	Mechanical	OE3341	Research Methodology
18	Civil	OE338	Disaster Management
19	CE&IT	OE340	Cyber Security

Rev: CE/RIT/02/2020-24

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 %
CE4013	Design of Reinforced Concrete Structures	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE4033	Construction Equipment and Methods	2	-	-	2	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE4473	Earthquake Engineering	2	-	-	2	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
	Program Elective PE– 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		-	-
	Program Elective -V	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
	Program Elective -IV Lab	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE4053	Design of Concrete Structures Laboratory	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE4493	Capstone Project Phase-II	-	-	4	4	ISE	-	-	-	100	50
						ESE	-	-	-	100	50
CE4073	Employment Enhancement Skills (Software in Civil Engg.)	-	-	2	1	ISE	-	-	-	100	50
	TOTAL	**16**	**0**	**14**	**23**	-	-	-	-	-	-

ISE = In Semester Evaluation, UT-1 = Unit Test-1, UT-2 = Unit Test-2 & ESE = End Semester Examination

Total Contact Hours/week : 30

Total Credits : 23

#Internal Practical Oral Examinations to be conducted

K.E.S. Rajarambapu Institute of Technology Rajaramnagar Affiliated to Shivaji University, Kolhapur 415 414 Dist. Sangli M.S.

RAJARAMBAPU INSTT. OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

List of Program Elective PE– III

Sr. No.	Course Code	Domain	Course
1	CE4353	Structural Engineering	Design of Bridges
2	CE4373		Design of Formwork
3	CE4393	Construction Management	Advanced Construction Equipment
4	CE4413	General Civil Engineering (Environmental, Geotechnical, Transportation etc.)	Environmental Management System
5	CE4433		Geographical Information System (GIS)
6	CE4453		Metro Rail Technology

List of Program Elective (PE) - IV

Sr. No.	Course Code	Domain	Course
1	CE4093	Structural Engineering	Advanced Structural Design
2	CE4113		Pre-stressed Concrete structures
3	CE4133	Construction Management	Project Management
4	CE4153	General Civil Engineering (Environmental, Geotechnical, Transportation etc.)	Rock Mechanics
5	CE4173		Industrial Waste Management
6	CE4193		Pavement Analysis and Design
7	CE4513		Advanced Concrete Technology

List of Program Elective (PE) - IV Lab

Sr. No.	Course Code	Domain	Course
1	CE4213	Structural Engineering	Advanced Structural Design Lab
2	CE4233		Pre-stressed Concrete structures Lab
3	CE4253	Construction Management	Project Management Lab
4	CE4273	General Civil Engineering (Environmental, Geotechnical, Transportation etc.)	Rock Mechanics Lab
5	CE4293		Industrial Waste Management Lab
6	CE4313		Pavement Analysis and Design Lab
7	CE4333		Advanced Concrete Technology Lab

RAJARAMBAPU INSTT. OF TECHNOLOGY * RAJARAMNAGAR CIVIL ENGG. DEPT.

K.E.S.Rajarambapu Institute of Technology * Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

List of Program Elective–V

Sr. No.	Course Code	Domain	Course
1	CE4533	Structural Engineering	Advanced Structural Analysis
2	CE4553		Finite Element Analysis
3	CE4573		Matrix Method of Structural Analysis
4	CE4593	Construction Management	Construction Resource Planning and Management
5	CE4613		Total Quality Management
6	CE4633	General Civil Engineering (Environmental, Geotechnical, Transportation etc.)	Air Pollution and Control
7	CE4653		Fundamentals of Urban and Regional Planning
8	CE4673		Solid and Hazardous Waste management
9	CE4693		Photogrammetry Surveying
10	CE4713		Geo-informatics for Engineering
11	CE4733		Docks, Harbors and Airport Engineering

Track I: Industry Internship & Projects (IIP)

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
							Theory (Marks)			Practical (Marks)	
		L	T	P	Credits	Scheme	Max.	Min. for passing%		Max.	Min. for passing%
OE4381	Finance for Engineers	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
OE4361	Engineering Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
IP4023	Internship & Project	-	-	-	8	ISE	---	---		50	50
						ESE	---	---		50	50
	TOTAL	**04**	**-**	**-**	**12**						

ISE = In Semester Evaluation, ESE = End Semester Examination

Total Contact Hours/week : 04
Total Credits : 12

Notes:

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.

Track II: Undergraduate Research Experience (URE)

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
							Theory (Marks)			Practical (Marks)	
		L	T	P	Credits	Scheme	Max.	Min. for passing%		Max.	Min. for passing%
OE4381	Finance for Engineers (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
OE4361	Engineering Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
RE4043	Research Project	-	-	8	8	ISE	---	---		50	50
						ESE	---	---		50	50
	TOTAL	**04**	**-**	**08**	**12**						

ISE = In Semester Evaluation, ESE = End Semester Examination

Total Contact Hours/week : 12
Total Credits : 12

Note:
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.

Track III: Entrepreneurship Development (ED)

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

Course Code	Course	Teaching Scheme			Credits	Evaluation Scheme					
						Scheme	Theory (Marks)			Practical (Marks)	
		L	T	P			Max	Min. for passing%		Max	Min. for passing%
ED4103	Project Management	2*	-	-	2	ISE	20	40	40	-	-
						UT1	15				
						UT2	15				
						ESE	50	40			
ED4043	Commercial Aspects of the Project	2*	-	-	2	ISE	20	40	40	-	-
						UT1	15				
						UT2	15				
						ESE	50	40			
ED4063	Entrepreneurship Development Program (EDP)	-	-	-	1	ISE	-	-	-	100	50
ED4083	Entrepreneurship Development Project	-	-	7	7	ISE	-	-	-	50	50
						ESE				50	
Total		**04**	**-**	**07**	**12**						

ISE = In Semester Evaluation, UT-1 = Unit Test-1, UT-2 = Unit Test-2 ESE = End Semester Examination

Total Contact Hours/week : 11
Total Credits : 12

Note:
*One extra lecture to be allotted to Project Management and Commercial Aspects of the Project course in time table.

K.E. Society's
Rajarambapu Institute of Technology, Sakharale
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
S. Y. B. Tech. Civil Engineering Syllabus
To be implemented from 2021-22
Department of Civil Engineering

Class: - **S.Y. B. Tech. Civil Engineering**	Semester-**III**
Course Code:**CE2033**	Course Name: **Engineering Mechanics**

L	T	P	Credits
3	---	--	3

Course Description:
Engineering Mechanics focuses on the statics, dynamics and analysis. The course helps the students to understand facts, concepts, principles and techniques of scientific investigation in the field of engineering. Irrespective of branches of engineering, it develops the thinking, analytical ability and imaginative skill of students.

Engineering Mechanics is an introductory course which supports a study of many other advanced courses like Strength of Materials, Theory of Machines, Fluid Mechanics, Design of Structures etc., which apply engineering concepts in manufacturing automobiles, aircrafts, electric motors, robots, construction of roadways, railways, bridges, satellites, etc.

Course Outcomes:
After successful completion of the course, student will be able to,
1. Apply conditions of equilibrium to solve real life problems.
2. Determine Centroid & Moment of Inertia of the geometrical plane lamina.
3. Apply fundamental concepts of Kinematics and Kinetics to solve engineering problems.

Prerequisite:
Engineering Mathematics, Engineering Physics.

COURSE CONTENT

Unit No.	Details of Content	Hrs.
1.	**Fundamentals of Mechanics and Force Systems:** Fundamental principles of Mechanics: Force and classification of force systems. Law of forces, resolution of forces, Moment of a force, couple and its properties, Varignon's theorem, principle of transmissibility of force. Resultant of force system- parallel, concurrent and non-concurrent coplanar forces.	6
2.	**Equilibrium of Force Systems:** Free body diagram, conditions of equilibrium, types of loads, types of beams, types of supports and reactions. Analysis of simple and compound beams. Lami's theorem, Concept of virtual work.	6
3.	**Friction and Analysis of Plane Trusses** **a) Friction:** Introduction to Laws of friction, Surface friction for bodies on horizontal and inclined planes, Application to problems involving block friction, ladder friction. **b) Analysis of plane trusses:**	6

	Method of joints and Method of sections.	
4.	**Centroid & Moment of Inertia:** Centroid of plane and composite figures, parallel axis and perpendicular axis theorems, radius of gyration, polar MI, Moment of Inertia of plane and composite figures.	6
5.	**Kinematics:** Introduction to dynamics and basic concepts, types of motion, rectilinear motion, equations for rectilinear motion, motion with uniform and variable acceleration, motion curves, motion under gravity, VT diagram, circular motion, normal and tangential components. Projectile motion.	6
6.	**Kinetics:** Newton's second law of motion, D' Alembert's Principle and concept of dynamic equilibrium, application to problems on horizontal plane, inclined plane, Energy and Momentum Methods for particle: work -energy principle, concepts of impulse, linear momentum, conservation of momentum, impulse momentum principle, direct central impact, oblique impact, coefficient of restitution.	6

References:

Text books:

1. S. Bhavikatti and Rajashekarappa, "Engineering Mechanics", New age International publication (India) Pvt. Ltd. New Delhi.
2. S. Ramamrutham "Engineering Mechanics", Dhanpat Rai Publishing Company Ltd. Ansari Road, Darya Gang, New Delhi.

Reference books:

1. S.Junnarkar, "Elements of Applied Mechanics", Charotar Publishing House (India) Pvt. Ltd., Anand (Gujarat)
2. F. Beer and E. Russell Johnson, "Vector Mechanics for Engineers (Statics and Dynamics)", McGraw Hill Publication, New York.
3. F. Singer, "Engineering Mechanics (Statics and Dynamics)" Publications (India) Pvt. Ltd. Noida.
4. S. Timoshenko and Young, "Engineering Mechanics (Statics and Dynamics)", McGraw Hill Publication, New York.

Class:-**S.Y. B. Tech. Civil Engineering**	Semester-**III**
Course Code:**CE2053**	Course Name: **Strength of Material**

L	T	P	Credits
3	--	--	3

Course Description:
Structural Engineering is one of the important branches of Civil Engineering. It deals with the analysis and design of various structures. The analysis of structure includes evaluation of all the forces acting on a structural element and finding the corresponding stresses induced. This course, 'Strength of Material' deals with the evaluation of various stresses acting on a section, analysis of determinate beams, and strain energy stored in the body. This course will provide a much needed foundation for all the upcoming courses in the structural engineering stream.

Course Outcomes:
After successful completion of the course, student will be able to
1. Analyze the section for various types of stresses and strains.
2. Construct shear force and bending moment diagrams for determinate beams.
3. Determine stresses (bending, shear and torsional) developed in the beam cross section.
4. Evaluate strain energy stored in a body due to various loading conditions.

Prerequisites:
Engineering Physics, Engineering Mathematics and Engineering Mechanics

COURSE CONTENT

Unit No.	Details of Content	Hrs.
1.	**Simple Stresses, Strains and Elastic Constants:** Concept of stress and strain, Hooke's law, Stress-Strain behaviour of materials, Deformations in composite sections under axial loading, compound bars and temperature stresses. Elastic constants and their relationships.	7
2.	**Principal Stresses:** Concept of principal planes and principal stresses, normal and shear stresses on an oblique plane, magnitude and orientation of principal stresses and maximum shear stress. Concept of Mohr's circle for plane stresses.	5
3.	**Shear Force and Bending Moment:** Concept of shear force and bending moment for determinate beams for various loadings. Relation between shear force, bending moment and loading. Shear force and bending moment diagrams for various boundary conditions and loadings.	6
4.	**Bending and Shear Stresses:** Bending Stresses: Theory of simple/pure bending. Derivation for flexure formula. Bending stress distribution diagrams. Moment of Resistance, flitched	6

	beam Shear Stresses: Derivation of shear stress equation, Shear stress distribution of various shapes cross-sections, average and maximum shear stress.	
5.	**Torsion:** Torsion of circular shafts: Theory of Torsion, assumptions, derivation of torsion formula. Stresses, strains and deformations in determinate shafts of hollow, solid subjected to twisting moments. Power transmitted through shafts.	6
6.	**Strain Energy**: Concept, expression of strain energy for axially loaded members under gradual, sudden and impact loads. Strain energy due to self weight, bending and torsion.	6

References:

Text Books:

1. H. Shah, and S. Junnarkar, "Mechanics of Structures", Charotar Publishing House Pvt Limited, New Delhi.
2. S. Ramamrutham, "Strength of Materials", Dhanpat Rai Publishing Company (P) Limited, New Delhi.

Reference Books:

1. R. Vaidyanathan, P. Perumal, P. Lingeswari, "Mechanics of Solids and Structures", Scitech Publications Pvt. Ltd., Chennai.
2. S. Timoshenko, "Strength of Materials Part-I: Elementary Theory and Problems", CBS Publishers.

Class: **S. Y. B. Tech Civil Engineering**	Semester-**III**
Course Code:**CE2193**	Course Name: **Professional Ethics, Values & code of conduct**

L	T	P	Credits
2	--	--	2

Course Description:
This course is intended to provide a much needed orientational input in value education to the young enquiring minds. It will help the students appreciate the essential complementarity between Values and Skills to ensure sustained happiness and prosperity, which are the core aspirations of all human beings.

Course Outcomes:
After completing the course, the student will be able to: -

1. Practice moral values in the engineering profession.
2. Resolve moral issues in the profession.
3. Justify the moral judgment concerning the profession.

Prerequisite:
Basic knowledge of concepts of Ethics and Values.

COURSE CONTENT		
Unit No.	**Details of Content**	**Hrs.**
1.	**Human Values:** Moral values, ethics, integrity, respect for others, living peacefully, caring and sharing, honesty, courage, value time, co-operation, commitment, empathy, team work.	**6**
2.	**Engineering Ethics & Social Engineering Practices:** Engineering ethics, variety of moral issues, moral dilemma, Profession & professional role models, responsibility, ethical theories, self-interest, customs, religion, Engineering & experimentation, engineers as responsible experiments, National standards & codes.	**6**
3.	**Introduction to Safety aspects, Responsibility & Rights** Human life safety, Property loss prevention, Introduction to Disaster Management, Safety & risk, assessment of safety & risk, risk benefit analysis, Best Global safety practices, loyalty, confidentiality, conflict of interests, occupational crimes, Human Rights and Employee Rights, whistle blowing.	**6**
4.	**Global Practices & Issues** Globalization, Global Warming & its impact on natural calamities, Green Technology, Green Supply Chains, Carbon Credits, IGBC, GREHA, LEED, Environmental ethics, multinational corporations, computer ethics, weapon development, moral leadership, ethics & codes of business conduct in MNC,	**6**

	corporate social responsibility, ethical audit. Case Studies based on professional ethics & any aspect mentioned in the syllabus.	

References:

1. R. S. Naagarazan "A textbook on professional ethics & human values" New Age International Publishers.
2. M. Govindarajan, S. Natarajan, V. S. Senthilkumar "Professional ethics & human values" PHI learning private ltd. Delhi.

Class: **S. Y. Civil**	Semester-**III**
Course Code: **CE2213**	Course Name: **Building Planning and Design**

L	T	P	Credits
3	--	--	3

Course Description:
The content of the course 'Building Planning and Design' provides an overview of properties and applications of various building materials. The course offers an insight into the functional design of building components. It enables the students in planning buildings. It also deals with various services and finishes employed in buildings.

Course Learning Outcomes:
After successful completion of the course, student will be able to,
1. Select appropriate materials for building construction applications.
2. Prepare a functional design of components for buildings.
3. Plan and design residential buildings.
4. Choose the appropriate type of plumbing and electrification system for buildings.
5. Explain types and uses of items related to building finishes.

Prerequisite:
Basic knowledge of engineering graphics.

COURSE CONTENT

Unit No.	Details of Content	Hrs.
1.	**Construction Materials** Properties and applications of Various materials viz. Stone, Aggregate, Brick, Steel, Aluminum, Timber, Glass, Flooring materials, Roofing materials, Cladding materials, Plumbing materials. Mortar, Plain Cement Concrete, Reinforced Cement Concrete.	07
2.	**Substructure of Building** Types of structures: Load Bearing Structure and Framed Structure; Concept of Soil Bearing Capacity, Substructure, Components of Substructure of a building, Types of foundation and their suitability, Types of Masonry: Types of brick and stone masonry, bonds in brickwork and stone masonry.	05
3.	**Superstructure of Building** Building components in superstructure: Column, Beam, Slab, Wall, Sill, Doors and Windows: Technical terms, classification, functional design; Lintel, Chajja, Ventilator, Types of Roofing, Parapet wall, Staircase: Technical terms, classification, functional design , Ramp, ladder, lift and escalator.	06

4.	**Planning of Buildings and Bye-laws** Types of buildings, Site Selection criteria, Significance of Sun & Wind Diagram, Basic requirements of good buildings, Concept of Planning, Principles of planning, Orientation and criteria under Indian condition. Bye-laws: Definition, Necessity and different bye-laws as per SP-7, 2016 National Building code.	06
5.	**Building Services** Concept of Plumbing & Drainage plan, Plumbing systems, Types of traps, Fittings, Septic Tank, Soak pit, Rainwater harvesting, and Plumbing layout for buildings. Electrification for residential buildings and its layout.	06
6.	**Building Finishes** Plastering and pointing Paints-Characteristics of ideal paints, constituents, classification, suitability, applying procedure and applications, defects. Varnishes- Characteristics of good varnish, ingredients, types, suitability, applying procedure and applications. Distemper- ingredients, applying procedure and applications. White washing and colour washing.	06

References –

References Books: -

1. V. B. Sikka, "A Course in Civil Engineering Drawing", S. K. Kataria and Sons. Mehta, Scarborough, Armpriest, Building Construction, Pearson Education
2. W.B Macay, "Building Construction", Pearson Education
3. S.Mantri, "The A to Z of Practical Building Construction and its Management", Satya Prakashan.
4. C.M. Kale, M.G. Shah, S.Y. Patki, "Building Drawing And Planning With An Integrated Approach To BuiltEnvironment",Tata McGraw-Hill Education Pvt. Ltd.

Text Books: -

1. S. P. Arora, S. P. Bindra, "A Text Book of Building Construction", Dhanpat Rai Publications
2. B. C. Punmia, "A Text Book of Building Construction", Laxmi Publications.

Codes of Practice :-

1. NBC 2016, National Building Code of India, Parts III, IV, VII and IX, B.I.S. New Delhi
2. SP 7- National Building Code Group 1 to 5, B.I.S. New Delhi
1. I.S. 962 – 1989, Code for Practice for Architectural and Building Drawings, B.I.S. New Delhi

Class: **S. Y. B. Tech Civil Engineering**	Semester-**III**
Course Code: **CE2073**	Course Name: **Surveying**

L	T	P	Credits
3	--	--	3

Course Description:
The course equips the student with theoretical and practical surveying knowledge and skills, relevant to the needs of construction industry and society. Before starting of any Civil Engineering project, surveying knowledge is very essential to a Civil Engineer. The students will learn the process of calculations of elevations, use of levelling in different civil engineering projects, Plotting of Contours maps, Theodolite and Tachometry, and Advanced Surveying Techniques and equipments like Total station, GIS, GPS, hydrographic and drone surveying.

Course Outcomes:
After successfully completing the course, student will able to:
1. Calculate reduced levels and interpret the characteristics of contour for topographical study.
2. Calculate the angular and linear measurements by using tachometry and trigonometry
3. Design and Set out the curve.
4. Demonstrate the principles of advanced surveying techniques.

Prerequisites:
Engineering Mathematics.

COURSE CONTENT

Unit No.	Details of Content	Hrs.
1	**Fundamentals of surveying** Definition, objectives, uses, classification of survey, principles of surveying, introduction to map and map projection, scales and types of scale, error and types of error.	6
2	**Levelling and Contouring** Terms and Types of levelling, Equipment used for levelling, calculation of elevation (RL)-methods, corrections in levelling, Contouring, Characteristics of Contours, Uses of Contour Maps, Direct and Indirect methods of contouring	6

3	**Theodolite Surveying** **Field operations** - systems of bearings, Types of Theodolite, Measurement of Horizontal and Vertical Angles, Theodolite Traversing – closing error, Calculation of latitudes and departures, Adjustment of Closed Traverse by Transit rule and Bowditch's rule, Preparation of Gale's Traverse Table. **Field applications**: - Tachometry and Trigonometric: Determination of elevations and distances.	6
4	**Curves and Computation of Area and Volume** Types and necessity of curve, design and data collection for setting out of simple circular and compound curves, area and volume calculations for any plotted plan by instrumental and mathematical methods.	6
5	**Advanced Surveying Techniques** Electronic Distance Measurement (EDM) instruments, Surveying using Total Station (T.S.) –Working principle and use of Total station, Data observations in T.S. Basics of Geographical information system (GIS), working principle, types and methodology. Analysis using raster and vector data, open source software, Geographical Positioning system (GPS) - working principle, types and methodology. Different segments: space, control and user segments – satellite, Hand Held and Geodetic receivers.	6
6	**Applications of Surveying:** Setting out work: Setting out building, pipeline surveying, road alignment and culverts. Hydrographic Survey: Introduction, Hydrographic survey Methods, Lead lines, sounding, Civil Engineering Applications. Drone surveying: Working flow, types of drones, data collection, post processing for map preparation.	6

References:

Text Books:

1. N.N. Basak, "Surveying and Levelling", Tata Mcgraw Hill, New Delhi,
2. S. K. Duggal, "Surveying Vol. I and II", Tata Mcgraw Hill, New Delhi,
3. B.C. Punamia, "Surveying Vol. I, II and III", Laxmi Publisher, New Delhi.

Reference Books:

1. A. Bannister and S Raymond, "Surveying, ELBS".
2. J. M. Anderson and E. M. Mikhail, "Introduction to Surveying", McGraw Hill Book Company.
3. D. Clark, "Plane and Geodetic Surveying", Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Seventh Edition.
4. R. R. Subramanian, "Surveying and Leveling", Oxford University.

Codes:

1. IRC: SP: 19 -Manual for Survey, Investigation and Preparation of Road Projects
2. IRC: SP: 54 - Project Preparation Manual for Bridges
3. IRC: 38 - Design Tables for Horizontal Curves for Highways

Class:- S.Y. B. Tech	Semester-III
Course Code : SH2173	Course Name: **Environmental Science**

L	T	P	Credits
1*	--	--	1

Course Description:
The syllabus of Environmental Science provides an integrated, quantitative and interdisciplinary approach to the study of environmental systems. The students of Engineering undergoing this course would develop a better understanding of the environment with due respect to perceptions and policies. The exposure to the various content of the course like understanding of alternative energy systems, pollution control and mitigation, natural resource management and the effects of global climate change, will help the students to bring a systems approach to the analysis of environmental problems.

Course Learning Outcomes:
After successful completion of the course, student will be able to,
1. Discuss the importance and sensitivity of the environment.
2. Interpret the over exploitation of natural resources and follow the environmental ethics.
3. Explain methods to protect the environment and prevent environmental pollution.
4. Apply their knowledge and skills to solve environment related problems.

COURSE CONTENT

Unit No	Details of Content	Hrs.
1.	**Natural Resources:** Renewable and Non-renewable resources, Forest resources, water resources, Mineral resources, food resources, Energy resources, alternative energy resources Land resources, Role of individual in conservation of natural resources, Equitable use of resources for Sustainable life styles.	04
2.	**Ecology and Environment** Definition, Principles and Scope of ecology, Ecosystem: Structure and Functions, biotic and abiotic components, energy flows, food chains, food web, ecological pyramids, Biodiversity, types of biodiversity, conservation of biodiversity.	04
3.	**Environmental Pollution and Control Measures** Environmental Pollution, types of pollution, Air pollution, Water Pollution, Noise Pollution, Soil Pollution, Marine Pollution, Radioactive Pollution, Thermal Pollution (Causes, sources and effects, abatement methods), Pollution Case studies-Bhopal Gas Tragedy, Chernobyl Accident: A nuclear Disaster, Ganga Water Pollution.	04

4.	**Solid Waste, Hazardous Waste and Disaster Management** Solid Waste management, Urban & industrial Waste Management, (Causes, sources, effects & control measures), Hazardous waste management, Plastic waste management, E-waste management, Waste minimization technology, Disaster management. Disaster management and risk analysis: Flood, Earthquakes, Cyclones, Landslides, Draught, Tsunami etc. Artificial and natural Pandemics.	04
5.	**Environmental Management** Environmental impact assessment- methodologies, Environmental impact statement and environmental management plan, Environmental audit, Cost-benefit analysis, Roles of Central Pollution Control Board (CPCB),State Pollution Control Board, NGO's, Information technology in environment & human health, Environmental Ethics: Issues & possible solutions, Awareness of Environmental Legislation.	04
6.	**Social Issues and Environment** From unsustainable to sustainable development, Urban problems related to energy, Water conservation: Rainwater harvesting, Watershed management, Resettlement & rehabilitation of people: Problems & concerns, Climate change, Global Warming, Ozone layer depletion, Acid Rain, Consumerism & waste Products, Concepts of Eco-labeled products, Eco-mark, Public Environmental education & awareness regarding environmental issues.	04

References –

Text Books:

1. D.K.Asthana, Meera Asthana, "A Textbook of Environmental Studies", S.Chand Publication.
2. S. Deswal& A. Deswal, "Basic course in environmental Studies", Dhanpat Rai & Co ltd., Delhi.

Reference Books:

1. E. D Enger, B. F. Smith, "Environmental science – a study of inter-relationships" Wm C Brown Publishers.
2. R. Francois "Ecology of Natural resources", John wiley& Sons
3. R. L. Smith, "Ecology and field biology", Harper Collins Publishers
4. G. M. Masters, "Introduction to Environmental Engineering & Science", Prentice Hall International Inc.

RAJARAMBAPU INSTT. OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

K.E.S.Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Class: **S. Y. B. Tech Civil Engineering**	Semester-**III**
Course Code: **CE2233**	Course Name: **Building Planning and Design Laboratory**

L	T	P	Credits
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Course Description:
'Building Construction and Planning Laboratory' course intends to develop the building planning and designing skills of the students. The students will be able to interpret and prepare drawings of different types of a building. The course gives an overview of construction project work through site visits. The course offers an insight into the functional design of building components. It also deals with various services and finishes employed in buildings.

Course Learning Outcomes:
After successfully completing the course, student will able to:
1. Design building components using AutoCAD.
2. Draw details of building components using AutoCAD.
3. Prepare measurement, submission and working drawings of residential buildings using AutoCAD.

Prerequisite: Engineering Graphics and AutoCAD software.

Expt. No.	Name of Experiment	Hrs.
1.	Introduction and necessity of building drawings, concept of scale, Types of building drawings-layout plan, site plan	02
2.	Preparation of sectional view drawing of load bearing and framed structure which shows different building components.	04
3.	Staircase design and drawing using AutoCAD (any one type).	04
4.	Drawing based on actual measurements of existing residential buildings consisting of plan, site plan, area statement & brief specifications using AutoCAD.	06
5.	Two site visits to building/Row houses/Apartment and technical report based on the visit. Educational Visits : 1. Ongoing Construction Site 2. Completed Residential Building and Public Building Site	08
6.	Planning & design of a residential building. Individual projects to be planned. Students should prepare following drawings using AutoCAD, 1. Municipal Submission drawing.	24

	2. Working Drawings: a. Centre line plan, b. Furniture layout plan, c. Water supply & drainage plan d. Electrical layout plan	

References:

References Books: -

1. V. B. Sikka, "A Course in Civil Engineering Drawing", S. K. Kataria and Sons. Mehta,Scarborough, Armpriest, Building Construction, Pearson Education
2. W.B Macay, "Building Construction", Pearson Education
3. S.Mantri, "The A to Z of Practical Building Construction and its Management", Satya Prakashan.
4. C.M. Kale, M.G. Shah, S.Y. Patki, "Building Drawing And Planning With An Integrated Approach To Built Environment"Tata McGraw-Hill.

Text Books: -

1. S. P. Arora, S.P. Bindra, "A Text Book of Building Construction", Dhanpat Rai Publications
2. B. C. Punmia, "A Text Book of Building Construction", Laxmi Publications.

Codes of Practice :-

1. NBC 2016, National Building Code of India, Parts III, IV, VII and IX, B.I.S. New Delhi
2. SP 7- National Building Code Group 1 to 5, B.I.S. New Delhi
3. I.S. 962 – 1989, Code for Practice for Architectural and Building Drawings, B.I.S. New Delhi

Class: **S. Y. B. Tech Civil Engineering**	Semester-**III**
Course Code: **CE2113**	Course Name: **Surveying Laboratory**

L	T	P	Credits
--	--	2	1

Course Description:
The course equips a student with theoretical and practical surveying knowledge and skills, relevant to the needs of construction industry and society. Before starting of any Civil Engineering project, surveying knowledge is very essential to a Civil Engineer. Surveying lab is offered as the course in the first semester of second year engineering, which focuses on the, application of levelling to calculate the elevations, plotting of contours maps, angular and linear measurements by using Theodolite and Tacheometer. Also, it focuses on setting out of curve on field and use of advanced surveying equipment's like Total station, GIS, GPS for preparation of maps.

Course Learning Outcomes:
After successfully completing the course, student will able to:

1. Determine reduced levels and prepare contour maps by using theodolite.
2. Design and Set out the curve on the field.
3. Perform setting out for various construction works.
4. Determine distances & elevations by using Tachometry and trigonometry concepts.
5. Prepare the layout map by using the Total Station.

Prerequisite –Engineering Mathematics

Laboratory Work:

It shall consist of practical exercises and projects as given below.

Expt. No.	Name of Experiment	Hrs.
1.	Calculation of reduced Levels using Dumpy and Auto Level.	02
2.	Measurement of area by Digital Planimeter.	02
3.	Measurement of horizontal angle by Repetition and Reiteration methods of Theodolite.	02
4.	Measurement of vertical angle and height of objects by Theodolite.	02

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5.	Tachometry: Determination of tachometric constants and grade of line by tachometer.	02
6.	Trigonometry: Determination of distance and elevation by Tachometer.	02
7.	Curve: Setting out of curves: Simple circular curves by linear methods.	02
8.	Curve: Setting out of curves: Simple circular curves by Angular methods (Rankin's Methods)	02
9.	Traversing by using Total Station	02
10.	Setting out of the building for a given plan by traditional methods.	02
11.	Geo-referencing and mapping of a given area.	02
12.	Development of contour map in GIS for given area.	02

Mini Projects:

1. Preparation of layout map for any property/campus with contour map by using Theodolite /Total station. (More than 1 acre area).
2. Project surveying for open traverse roadway, railways, drainage lines, water lines, canals etc., using Auto level for a minimum length of 500 m including fixing of alignment, profile levelling, cross-sectioning, and plotting of L section and Cross Section. (One full imperial sheet including plan, L-section and any five typical Cross-sections).

References:

Text Books:

1. N.N. Basak, "Surveying and Levelling", Tata Mcgraw Hill, New Delhi,
2. S. K. Duggal "Surveying Vol. I and II", Tata Mcgraw Hill, New Delhi,
3. Dr. B.C. Punamia "Surveying Vol. I, II and III", Laxmi Publisher, New Delhi.

Reference Books:

1. A. Bannister and S Raymond "Surveying, ELBS".
2. James M. Anderson and Edward M. Mikhail, "Introduction to Surveying", McGraw Hill Book Company.
3. D Clark, "Plane and Geodetic Surveying", Vols. I and II, C.B.S. Publishers and Distributors, Delhi.

Codes:

1. IRC: SP: 19 -Manual for Survey, Investigation and Preparation of Road Projects
2. IRC: SP: 54 - Project Preparation Manual for Bridges

3. IRC: SP: 42 - Guidelines on Road Drainage
4. IRC: SP: 50 - Guidelines on Urban Drainage
5. IRC: 38 - Design Tables for Horizontal Curves for Highways

Class:-**S.Y. B. Tech. Civil Engineering**	Semester-**III**
Course Code:**CE2133**	Course Name: **Strength of Material Laboratory**

L	T	P	Credits
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Course Description:
Strength of Material Laboratory deals with the various tests to be conducted on construction materials. The design of any structure or structural element is not possible unless the properties of materials are known. The testing of material includes determination of various strengths of different materials. For the design of any structural element we need to know the strength of materials. This course, 'Strength of Material Lab' deals with the testing of various materials such as steel, different metals, bricks and structural elements.

Course Outcomes:
After successful completion of this course students should be able to,
1. Demonstrate behavior of material under axial shear and bending forces.
2. Identify various types of stresses in various structural elements.
3. Determine various strengths of different construction materials

Prerequisites:
Engineering Mechanics and Physics. The knowledge of basic mathematics and trigonometry is also required.

Students have to perform any six experiments out of the following

Expt. No.	Description	Hrs
	i) Experiments	
1.	Tension test on Mild and TOR steel.	02
2.	Shear test on Mild steel.	02
3.	Brinell and Rockwell Hardness test on different metals.	02
4.	Impact test on different metals.	02
5.	Bending test on RC beam.	02
6.	Flexure test on flooring tiles.	02
7.	Water absorption & compression test on burnt brick.	02
8.	Buckling test on long columns	02
	ii) Assignments : One assignment per unit	08

References:

Text Books:

1. H. Shah and S. Junnarkar "Mechanics of Structures", Charotar Publishing House Pvt Limited, New Delhi.
2. S Ramamrutham "Strength of Materials", Dhanpat Rai Publishing Company (P) Limited, New Delhi.

Reference Books:

1. R. Vaidyanathan, P. Perumal, P. Lingeswari, "Mechanics of Solids and Structures", Scitech Publications Pvt. Ltd., Chennai.
2. S. Timoshenko "Strength of Materials Part-I: Elementary Theory and Problems", CBS Publishers.

Class:-**S.Y. B. Tech. Civil Engineering**	Semester-**III**
Course Code:**CE2153**	Course Name: Technical Aptitude-I

L	T	P	Credits
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Course Description:
Technical Aptitude-I consists of multiple-choice questions (MCQ) based on following courses.

1. Engineering Mechanics
2. Strength of Materials
3. Surveying
4. Building Planning & Design

Class:-**S.Y. B. Tech. Civil Engineering**	Semester-**III**
Course Code:**CE2173**	Course Name: **Engineering Mechanics Laboratory**

L	T	P	Credits
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Course Description:
Under this lab work, students will be performing experiments, interpreting results, and comparing results with analytical results. Problem solving will be done through cooperative learning and discussion. The lab focuses on full participation and involvement of all the students and will be assessed through rubrics designed. It is expected that students will have to perform experiments, handle the equipment and function effectively as an individual and in a team as an effective team member to complete a given task.

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

1. Verify law of polygon of forces, law of triangle of forces and principle of moment.
2. Compare coefficient of friction of various surfaces in contact.
3. Correlate theoretical and practical results of support reactions and Centroid of plane lamina.
4. Analyze a simple truss.

Prerequisite:
Engineering Mathematics, Engineering Physics

Students have to perform any ten experiments out of the following.

Expt. No.	Name of Experiment	Hrs.
1.	Verify Law of polygon of forces	02
2.	Verify principle of moment using Bell Crank Lever	02
3.	Support Reactions of simple beam	02
4.	Support Reactions of compound beam	02
5.	Study nature of forces in the members of Jib Crane	02
6.	Verify Lami's Theorem	02
7.	Compare value of coefficient of Friction for various contact surfaces	02
8.	Analysis of simple truss	02
9.	Analysis of simple truss by graphical method	02
10.	Centroid of plane & composite figures	02
11.	Study of curvilinear motion	02

12.	Demonstration of 'D' Alembert's Principle, Work-Energy Principle	02
13.	Support Reactions of beams by graphical method	02

References:

Text books:

1. S. Bhavikatti and Rajashekarappa, "Engineering Mechanics", New age International publication (India) Pvt. Ltd. New Delhi.
2. S. Ramamrutham "Engineering Mechanics", Dhanpat Rai Publishing Company Ltd. Ansari Road, Darya Gang, New Delhi.

Reference books:

1. S.Junnarkar, "Elements of Applied Mechanics", Charotar Publishing House (India) Pvt. Ltd., Anand (Gujarat)
2. F. Beer and E. Russell Johnson, "Vector Mechanics for Engineers (Statics and Dynamics)", McGraw Hill Publication, New York.
3. F. Singer, "Engineering Mechanics (Statics and Dynamics)" Publications (India) Pvt. Ltd. Noida.
4. S. Timoshenko and Young, "Engineering Mechanics (Statics and Dynamics)", McGraw Hill Publication, New York.

Class:- **S.Y. B. Tech**	Semester-**III**
Course Code : **SH2603**	Course Name : Environmental Science project

L	T	P	Credits
-	-	2	1

Course Description:
Mini Project has been incorporated to enhance high potential in the student and built research and positive attitude towards environment related issues, which will help them in their social and technical life ahead. The mini project is designed to make them apply practical knowledge with relevant tools and techniques to solve real life problems related to the environment and industry. It will help students in developing eco-friendly approach to achieve sustainable development

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Utilize scientific methods to solve environmental problems.
2. Evaluate technologies for restoration of degraded environment.
3. Develop presentation and report writing skills.
4. Develop as an individual and in group leadership quality.

Lab Work:
Students should be able to do elementary technical work and prepare report along with defining methods and probable suggestions to measures related to various sub-branches of Civil Engineering. The topic for the mini-project should be related to Societal Environmental issues.

Guidelines for Mini Project:
1. Mini project will be the team work consisting minimum 3 to maximum 5 students.
2. Project topics should be application oriented and with consideration to Environmental science problems in their respective stream. Selection and finalization will be through project guide.
3. Prepare project report as per guidelines.
4. Project group must provide a complete solution to the selected problem with conceptual clarity.
5. The project will be evaluated by respective branch HOD and project guide and senior faculty.
6. The mini project should be presented before the committee, which shall evaluate for 100 marks.

Class:- S.Y. B. Tech .	Semester-III/IV
Course Code : SH2633	Course Name : Professional Leadership Skills

L	T	P	Credits
-	-	2	1

Course Description: This course is one of various courses offered under Choice Based Professional Skills Development programme. This course guides those special students who want to be entrepreneurs and professional leaders. This course covers various aspects of Leadership which includes Team formation, conflict management, motivation and presentation skills.

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

1. Explain the traits of a leadership through real life examples.
2. Exhibit the ability to work effectively in team.
3. Prepare a presentation as per the audience and context requirements.

Prerequisite: A Student, who is going to enroll for this course should have -
1. Adequate knowledge of basic grammar of English language.
2. Intermediate level vocabulary of English language.
3. Ability to communicate moderately in English.

Minimum 12 sessions will be conducted from the following list.

Course Content

Experiment No	Description	Hrs
1.	**SMART Goal Setting, SWOT/C Analysis and Action Plan:** Discussion on Dos and Don'ts, Advantages, and Generation of the Document by Students and its Assessment	02
2.	**Assertiveness and Positive Thinking:** Types of Behaviour, Benefits of Being Assertive and Positive Thinking, Developing Positive Attitude, Case Studies and Presentations	02
3.	**Self Management:** Need of Self Management, Developing Self Acceptance, Steps of Self Management, Individual Classroom Activity and its Assessment	02
4.	**Leadership Styles and Change Management:** Introduction to Different Types of Leaderships, Effective Organizational Change Management, Individual Classroom Activity and its Assessment	02
5.	**Team Formation and Leading a Team-I:** Why Teams? Roles and Responsibilities in Teams, Strategies for Team Development, Barriers to Teams, Steps of Team Development	02
6.	**Team Formation and Leading a Team – II:** Case Studies of Teams and Student Presentations	02
7.	**Business Meetings and Decision Making – I:** Preparing for the Meeting, Role of Chairperson and Participants in Meetings	02
8.	**Business Meetings and Decision Making – II:** Mock	02

	Meetings, Decision Making Case Studies and Feedback	
9.	**Conflict Management:** Types of Personalities, Possible Reasons of Conflicts at Work Place, Conflict Resolution Strategies, Conflict Management Case Studies and Feedback	02
10.	**Time Management:** Time Management Techniques, Introduction to Time Management Tools, Benefits of Time Management, Case Studies and Presentations	02
11.	**Presentation Skills – I:** Preparation, Types of Presentations - Informative, Instructional, Arousing, Persuasive, Decision-making, Presentation Tools	02
12.	**Presentation Skills – II:** Body Language, Managing Questions and Student Presentations Student Presentations and Feedback, Student Presentations and Feedback	02
13.	**Creative and Critical Thinking:** Approaches to Creative Thinking, Strategies for Creative Thinking, Characteristics and Strategies of Critical Thinking	02
14.	**Motivating People:** Types of Motivation, Components of Motivation, Steps in Keeping Motivation Level High	02

References -

1. Krishna Mohan and Meera Banerji; *Developing Communication Skills*, Macmillan India Ltd., New Delhi
2. Masters, L. Ann et al. *Personal Development for Life and Work*, New Delhi: Cengage Learning.
3. Jeff Butterfield, *Soft Skills for Everyone*, Cengage Learning India Private Limited.
4. John Seely, *Oxford Guide to Effective Writing and Speaking*; Oxford University Press.
5. UNLESH the power within... Soft Skills – Infosys Training Manual *Module 1 to 5* (Infosys Campus Connect Programme)

Evaluation Scheme: ISE – 60% and ESE – 40% (Minimum Passing: 50% of ISE & ESE separately)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 06 performances of the student will be considered for ISE. ESE will be conducted separately at the end of the semester

Class: - S.Y. B. Tech.	Semester-III/IV
Course Code : SH2613	Course Name : Interpersonal Skills ('Jeevanvidya' for Work Life Balance)

L	T	P	Credits
-	-	2	1

Course Description: Jeevan means life and Vidya means knowledge. Jeevanvidya (JV) means science of life and art of successful and happy living. Achieving work-life balance is an art. The science behind work-life balance is based on the universal laws of nature. The aspects of it are applied on the art forms. At a high level, JV consists of management of health, wealth, mind and life. This course offers the tips and techniques to lead a life full of success, prosperity and happiness by changing the current mindset to that of positive and harmonious thinking. It further touches upon important aspects such as priorities in life, how to manage stress, teamwork, laws of nature, human body as a divine computer, power of mind, etc.

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

1. Exhibit interpersonal communication skills.
2. Demonstrate decision-making skills.
3. Apply conflict resolution styles appropriate in different situations.
4. Demonstrate skills to manage balance in work and life.
5. Apply Jeevanvidya wisdom in day to day life.

Prerequisite: A Student, who is going to enroll for this course, should have following English language abilities:

1. Adequate knowledge of basic grammar of English language.
2. Intermediate level vocabulary of English language.
3. Communicate moderately using English language.

Minimum 12 sessions will be conducted from the following list.

Course Content

Experiment No	Description	Hrs
1.	**Importance of Universal Laws of Nature in Human Life.-** Overview of Jeevanvidya's Philosophy, scientific, universal, secular, usefulness in every walk and phase of life, overview of Universal Laws of Nature, determining factor in human life, important laws of nature and its influence on life of individual, family, society and world at large. Jeevanvidya's wisdom, living life in tune with laws of nature	02
2.	**'You are the Architect of your Destiny' -** This unit will make you aware that none else but you alone are responsible and accountable for what you achieve in your life , freedom of decisions, choices to make up your future, guiding powers to make the choices in your life, achieving life full of health, wealth, success, peace and happiness for yourself and all	02

3.	**Setting and Achieving Goals** – Defining your own goals in life , Concept of power of mind , concepts of interaction of conscious and subconscious levels of mind, tips and techniques to harness the amazing power of subconscious mind to achieve goals, Visualization and auto-suggestion techniques, real life examples	02
4.	**Work-life Balance** – What 'Jeevanvidya' means by work-life balance, priorities in life, time management, its importance, practical tips that enable to achieve work-life balance	02
5.	**Art of Harmonious Thinking.** – Importance , concept of harmonious thinking, Wishful Thinking, Positive Thinking, difference between Harmonious Thinking and Positive Thinking, powerful techniques to inculcate the habit of Harmonious Thinking, concept of Spiritual Thinking , Divine Universal Prayer – the life changer, Bless All technique, benefits of chanting the prayer	02
6.	**Spirituality in Day-to-day Life** – Concept of Love Work, 7 dimensions of Love Work, benefits us as individual, family, society and entire human race, important to be a good human being, usefulness to become successful, tools to apply the different 'Jeevanvidya' principles in day-to-day life, simple but powerful and useful techniques such as attitude of gratitude , attitude of win-all	02
7.	**Human Values** – Ethics and Human values, difference in ethics and values, Qualities of human values	02
8.	**Communication Skills** – Ability to commendably read, write, speak and listen by conforming knowledge and presenting in a structured, cohesive fashion, Understanding and demonstrating workplace communication in the context of organization's business, understanding one's core skills for job	02
9.	**Interpersonal Skills** – Presenting interpersonal skills by amiable and respecting individuals, effective listening to stakeholders, bonding and developing rapport, Team success	02
10.	**Decision Making** – Importance of correct decision making, Analytical thinking / mind, Information processing ability, Making sound judgment and confident decision	02
11.	**Cross cultured sensitizations & Adaptability** – Adapting multinational & multicultural environment, embracing diversity, culturally sensitive and bonding to colleagues and stakeholders, sense of belongings and promotion of unity at work place	02
12.	Evaluation of Students for their Understanding of Various Concepts Discussed.	02

References -

1. Mr. P. W. Pai. JV's Spiritual Wisdom in Day-to-day life, Blog.
2. Satguru Shri W. G. Pai. Towards the goal of beautiful life, Nam Sampradaya Mandal Publication
2. Mr. P. W. Pai. JV's Spiritual Wisdom in Day-to-day life, Blog.
3. Satguru Shri W. G. Pai. Towards the goal of beautiful life, Nam Sampradaya Mandal Publication
4. Satguru Shri W. G. Pai. Master Key to Happy Life, Jeevanvidya Foundation
5. Satguru Shri W. G. Pai. Your Destiny In Your Thoughts: You Are The Architect Of your Destiny, Jeevanvidya Foundation
6. Satguru Shri W. G. Pai. Gift of Wisdom, Jeevanvidya Foundation
7. Satguru Shri W. G. Pai. Search For Happiness, Jeevanvidya Foundation
8. Satguru Shri W. G. Pai. Ideal Parents Ideal Students, Jeevanvidya Foundation
9. Satguru Shri W. G. Pai. Human Body - God Incarnate!, Jeevanvidya Foundation
10. Satguru Shri W. G. Pai. Shape Your Destiny, Jeevanvidya Foundation
11. Satguru Shri W. G. Pai. True Concept of Satguru, Jeevanvidya Foundation
12. Dr. J. Murphy. Power of your subconscious mind, Amazing Reads Publication
13. S. Covey. Seven people of highly effective people, Winx Club Publication
14. D. Carnegie. How to win friends and influence people, Fingerprint! Publishing

Evaluation Scheme: ISE- 60% ESE – 40% (Minimum Passing Marks: 50% (Separate ISE and ESE)

Evaluation Method: In each session student will be assessed. Each assessment will be of minimum 10 marks. In the end of semester ESE for 40 marks shall be conducted. There should be separate passing of 50% in ISE and ESE

Class: - S.Y. B. Tech.	Semester-III/IV
Course Code : SH2693	Course Name : Innovation Tools and Methods for Entrepreneurs

L	T	P	Credits
-	-	2	1

Course Description: This course helps students to identify different tools for developing the solution that student has already learned to ideate in the previous course "Creativity and Design Thinking". Further, students get information about various tools to carry out competitor analysis and user journey map. It would help him to come up with detailed specifications and USP of the product based on the competitor survey.

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

1. Explain structured approach to define the problem with every possible detail, identify conflicts and solve them
2. Apply User Journey Map to the selected problem to show user interaction at various stages
3. Analyze the solutions provided by competitors for effectiveness and gaps if any.

Prerequisite: A Student who is going to enroll for this course should have following abilities:

1. Creativity and Innovativeness
2. Problem identification
3. Apply design thinking approach to develop working prototype
4. Structured approach to problem solving

Minimum 12 sessions will be conducted from the following list.

Course Content

Experiment No	Description	Hrs
1.	**Systematic Innovation:** Define the problem in depth with all details, Trend prediction, Modeling the problem to identify tradeoffs and contradictions	02
2.	**TRIZ:** Theory of Inventive problem solving (TRIZ), HIT Matrix, Scamper, Algorithms of brain storming and innovation, Functional analysis	02
3.	**Frugal and Disruptive Innovation:** Biomimicry and frugal innovation for prototyping, Disruptive innovation.	02
4.	**User Journey Map:** Map showing user interaction at every stage of product/service. Step-by step process of UJM creation	02
5.	**Competitor analysis:** Analysis of competitor and users for similar products, effectiveness of existing solutions and identifications of gaps	02
6.	**Product/Software Design Specifications:** Detailed specifications for better product design, detailed UI for software for clarity on user interaction, specify USPs of the product in comparison to the	02

	competitors	
7.	**Business Canvas:** A. Definition of a Business Model B. The 9 Building Blocks: 1. Customer 2. Value Propositions 3. Channels, distribution, 4. Customer relationships 5. Revenue 6. Key Resources 7. Key Activities 8. Key Partnerships 9. Cost Structure	02
8.	**Design Thinking (Part I):** Customer Insights, Ideation, Visual Thinking.	02
9.	Design Thinking (Part II): A. Prototyping. B. Storytelling. C. Scenarios	02
10.	**Institutional arrangement for Entrepreneurship Development:** Institutional arrangement for Entrepreneurship Development – DIC, ITCOT, SIDCO, NSIC, SISI, TIIC, SIDBI, Commercial Banks	02
11.	**Project Report:** A. Economic Aspects B. Technical Aspects C. Financial Aspects D. Production Aspects **E.** Managerial Aspects **F.**	02
12.	**Investor Pitch Tool:** a. Introduction b. Helpful Tips about preparation, pitching and content sharing c. Does and Don'ts d. Introduction e. Problem f. Solution/Product/Service g. Traction h. Market Opportunities/ Size i. Competition j. Go To Market Strategies k. Financials l. Team	02
13.	**Revision -I**	02
14.	**Revision-II**	02

References -

1. J. Knapp. Design Sprint, Simon & Schuster Publisher.
2. D. Silverstein. The Innovator's Toolkit, Wiley Publishing House.
3. M. A. Orloff. ABC-TRIZ: Introduction to creative design thinking with modern TRIZ modeling, Springer Publication.
4. M. Laverty. Entrepreneurship, OpenStax Publication.

Evaluation Scheme: ISE – 60% and ESE – 40% (Minimum Passing: 50% of ISE & ESE separately)

Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 06 performances of the student will be considered for ISE. ESE will be conducted separately at the end of the semester.

Class: - S.Y. B. Tech.	Semester-III/IV
Course Code : SH2593	Course Name : **Personal Effectiveness and Body Language**

L	T	P	Credits
-	-	2	1

Course Description: This course is one of various courses offered under Choice Based Professional Skills Development programme. The course with its interactive and need based sessions helps students in knowing and managing self, set and pursue meaningful goals, and develop positive personal qualities for sustainability in today's global world.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Develop skills to build self-esteem and positive attitude.
2. Develop interpersonal skills characterized by effective communication and conflict resolution.
3. Discover ways to overcome procrastination.
4. Demonstrate responsiveness towards stress and health issues.
5. Interpret the non-verbal behaviour of a person.

Prerequisite: A Student, who is going to enroll for this course, should have following English language abilities:
1. Adequate knowledge of basic grammar of English language.
2. Intermediate level vocabulary of English language.
3. Communicate moderately using English language.

Minimum 12 sessions will be conducted from the following list.

Course Content

Experiment No	Description	Hrs
1.	**Self-awareness and Self Esteem** Meaning, Factors influencing self-esteem- environmental and social factors Developing self-esteem- strategies for building self-esteem	02
2.	**Goal Setting** Long term and short-term goals, Steps in goal setting (SMART)- - identify strategies - consider possible blocks and ways to deal with them - outline the steps - set deadlines	02
3.	**Self-Analysis** SWOT Analysis, who am I, Attributes, Importance of Self Confidence	02
4.	**Personality Typing** Extraversion, Introversion, Sensing, Intuition, Thinking, Feeling, Judging Perceiving	02
5.	**Life Skills for Personal Effectiveness** Values: Punctuality, Honesty, Loyalty, Dependability, Reliability- Application of Life Skills in day - to- day life - Life Skills for Adolescents and Youth	02

6.	**Time Management** Strategies for effective time management (Principles, Planning, Identify & Control time stealers, Prioritize, Problems and Solutions, learn to say NO	02
7.	**Stress Management** Sources of stress, types, signs and symptoms of stress - positive aspects of stress - negative aspects of stress	02
8.	**Stress Management Techniques** Coping mechanisms, Deep Breathing Exercise, Meditation and Visual Imagery techniques, Muscle Relaxation, Peer Sharing	02
9.	**Emotional Intelligence** Meaning –Components of Emotional Intelligence-Significance of managing Emotional intelligence –How to develop Emotional Quotient	02
10.	**Decision-making** Definition, Informed Decision Making, Consequences of Decision Making and Models of Decision Making	02
11.	**Creative Thinking** Out-of-the box thinking, Stages of Creative Thinking, Factors hindering creative thinking, Characteristics of Creative thinkers	02
12.	**Interpersonal skills** Meaning, need to develop interpersonal skills, components of interpersonal skills, techniques to improve skills, benefits with real life examples/case studies	02
13.	**Art of Communication** Verbal & Non-Verbal Communication, 7'Cs of Effective Communication Importance of Effective Communication	02
14.	**Body Language – I** Non-verbal codes: Kinesics, Proxemics	02
15.	**Body Language – II** Vocalics, Haptics, Appearance	02

References -

1. S. Hariharan, et al; *Soft Skills*, MJP Publishers, Chennai.
2. Gopalaswamy Ramesh et al. *The ACE of Soft Skills: Attitude, Communication and Etiquette for Success*, New Delhi: Pearson Education.
3. Jeff Butterfield, *Soft Skills for Everyone*, cengage Learning India Private Limited.
4. UNLESH the power within... Soft Skills – Infosys Training Manual *Module 1 to 5* (Infosys Campus Connect Programme)
5. Masters, L. Ann et al. *Personal Development for Life and Work*, New Delhi: Cengage Learning.
6. Covey, Stephen R., *Seven Habits of Highly Effective People*: *Powerful Lessons in Personal Change*
7. Barun K. Mitra, *Personality Development & Soft Skills*, Oxford Publishers, Third impression.

Evaluation Scheme: ISE – 60% and ESE – 40% (Minimum Passing: 50% of ISE & ESE separately)

Evaluation Method: In every session student will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE of 100 marks.

Class: - **S.Y. B. Tech.**	Semester-**III**
Course Code : **SH 2733**	Course Name : : **German Language - Basic Level**

L	T	P	Credits
-	-	2	1

Course Description: This course meets the requirements of student's overall personality development. The course helps the student in learning German as a foreign language. Vocabulary building activities, grammar, reading skills and basic conversational skills are addressed in this course.

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

1. Interpret the language if the next person is speaking slowly and clearly.
2. Make use of the language in routine life with the routing topics like family, shopping, work etc.
3. Demonstrate the language by self-introduction in German with simple sentences.

Prerequisite: A Student, who is going to enroll for this course, should have following English language abilities:

1. Adequate knowledge of basic grammar of English language.
2. Intermediate level vocabulary of English language.
3. Communicate moderately using English language.

Course Content		
Experiment No	**Description**	**Hrs**
1.	Professions and their workplace Getting acquainted with different professions, usual tasks in particular profession , likes, dislikes etc.	**02**
2.	Job advertisements reading and understanding. To express oneself about his preferences for part time jobs. his likes and dislikes	**02**
3.	Short texts about finding jobs(for understanding the short paragraphs) & telephonic conversation Grammar- conjunctions and ,or, but (und ,oder ,aber)	**02**
4.	Grammar-Present Perfect Tense Exercises based on present perfect tense	**02**
5.	Present perfect tense with helping verb haben and sein. Difference between these two verbs and related exercises	**02**
6.	Vocabulary of clothes and conversation while buying the clothes	**02**

7.	Grammar- 'W' questions related to clothes(welche und diese) Exercises related to welche und diese in nominative and accusativ	**02**
8.	Grammar- present perfect tense of separable and non-separable verbs	**02**
9.	Dativ verbs Exercises related to dativ verbs	**02**
10.	Dialog between shopkeeper and customer Personal Pronomen in Dativ	**02**
11.	Orientation in the shopping mall. Understanding the floors and information on notice boards.	**02**
12.	Revision of the grammar and doubts clearing	**02**
13.	Test and presentations assigned to students during semester	**02**

References -

1. Studio D – A 1, Cornelsen Verlag, Goyal Publishing House, New Delhi.
2. Tangram Aktuell – A 1, Goyal Publishing House, New Delhi.
3. Language A 1, Goyal Publishing House, New Delhi.
4. Network A 1, Goyal Publishing House, New Delhi.

The extra notes will be provided to the students to complete the required syllabus.

Evaluation Scheme: ISE – 60% and ESE – 40% (Minimum Passing: 50% of ISE & ESE separately)

Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 06 performances of the student will be considered for ISE. ESE will be conducted separately at the end of the semester.

Class: - **S.Y. B. Tech.**	Semester- **III**
Course Code : **SH2713**	Course Name : Japanese Language - Level III

L	T	P	Credits
-	-	2	1

Course Description: This course is designed to introduce students to the everyday language of Japan. Lessons are organized around natural conversational topics, leading students from fundamental aspects of grammar to readings in simple texts.

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

1) Make use of basic conversations in various situations.
2) Identify the sentence patterns.
3) Explain insights about the communication required for living in Japan.
4) Interpret Japanese work ethics required in their professional career.

Prerequisite: A Student, who is going to enroll for this course, should have following English language abilities:

1) Knowledge of basic grammar of Japanese Language.
2) Communicate moderately using Japanese Language.

All the 15 lab sessions will be conducted to meet the needs of following content delivery.

Course Content

Experiment No	Description	Hrs
1	Polite way of request for something, using て forms of the verbs.	02
2	Expressions used for offering to do something.	02
3	To ask for permission to do something.	02
4	Pattern used to express prohibition.	02
5	Use of て forms of the verbs to express sequence in action.	02
6	How to join two or more than two sentences together.	02
7	How to express something done after something.	02
8	Introduction of interrogative pronouns used to specify one item out of list of 2 or more than 2 things.	02

9	Rules for adjective – adjective combinations in one sentence.	02
10	How to make ない forms of the verbs.	02
11	Use of ない forms of the verbs to ask or to tell someone not to do something.	02
12	Must do pattern using なければ なりません。	02
13	How to make dictionary forms of the verbs.	02
14	Uses Potential form できる	02
15	How to express the hobby.	02

***Note**: Words written phonetically using the Latin alphabet (*romaji*) will be only used in the very initial stage to aid learning pronunciations.

References -

1. Minna No Nihongo I (3A Corporation, Japan), Publications: Goyal publishers.
2. Nihongo shouhou, Publication: JALTAP

Other reference material, practice papers & CDs for listening practice.
The extra notes will be provided to the students as per the requirement of the syllabus.

Evaluation Scheme: ISE – 60% and ESE – 40% (Minimum Passing: 50% of ISE & ESE separately)

Evaluation Method: In every session student will be assessed. Each assessment will be of minimum 10 marks. The best 6 performances of the student will be considered for ISE of 60 marks.

Class: **S. Y. B. Tech. Civil Engineering**	Semester-IV
Course Code: **SH2063**	Course Name: **Engineering Mathematics III**

L	T	P	Credits
3	1	--	4

Course Description:
This course intends to build the competency in the students to apply the knowledge of mathematics to the solution of engineering problems and to some extent analyze it. The Chapters in the course are linear differential equations, applications of linear differential equations to civil engineering, linear partial differential equations with constant coefficient, Fourier series, statistics and probability distribution.

Course Outcomes (COs):
After successful completion of the course the student should be able to:

1. Solve problems on linear differential equations (LDE) and linear partial differential equations (PDE).
2. Apply linear differential equations (LDE) to deflection of beams and columns.
3. Determine Fourier series of given functions.
4. Compute Karl Pearson's coefficient of correlation and to fit regression lines.
5. Solve problems on probability distributions.

Prerequisite: Engineering Mathematics, Elementary probability and statistics.

COURSE CONTENT

Unit No.	Details of Content	Hrs.
1.	**Linear Differential Equations (LDE)** Definition, Complete Solution of Linear Differential Equations with Constant Coefficients, Complete Solution of Linear Differential Equations with Variable Coefficients.	06
2.	**Application of LDE in Civil Engineering Problems** Application to: Bending of Beams- Freely Supported Beam and Cantilever Beam, Buckling of Columns, Rod, Struts.	06
3.	**Linear Partial Differential Equations with Constant Coefficients** Definition, Linear Homogeneous Partial Differential Equations of nth Order with Constant Coefficients, Methods of Solutions of Linear Homogeneous Partial Differential Equations of nth Order with Constant Coefficients, Non-homogeneous Linear partial Differential Equations.	06
4.	**Fourier Series** Definition, Euler's Formulae, Expansions of Functions, Change of Interval, Even and Odd Function, Half-range Sine and Cosine Series.	06

5.	**Statistics** Coefficient of Correlation, Lines of Regression of Bivariate Data, Fitting of Curves (Lines and Parabola) by Least Square Principle.	06
6.	**Probability Distribution** Random Variable, Discrete and Continuous Probability Distributions, Binomial, Poisson and Normal Distributions.	06

Tutorials:

1. Linear Differential Equations-I (with constant coefficients).
2. Linear Differential Equations-II (with variable coefficients).
3. Application of Linear Differential Equations.
4. Linear Homogeneous Partial Differential Equations.
5. Linear Non-homogeneous Partial Differential Equations-II.
6. Fourier Series-I (Change of interval).
7. Fourier Series-II (Half range).
8. Statistics-I (Coefficient of correlation and Lines of regression).
9. Statistics-II (Fitting of curves).
10. Probability Distribution.

References:

Text Books:

1. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publications, New Delhi.
2. H. K. Dass and Er. RajnishVerma, "Higher Engineering Mathematics", S. Chand Publications, New Delhi.

Reference Books:

1. N. P. Bali, Ashok Saxena and N. Ch. S. N. Iyengar, "A Text Book of Engineering Mathematics", Laxmi Publications, New Delhi.
2. P. V. O'Neil, "Advanced Engineering Mathematics", Cole publishing house.
3. E.Kreyszig, "Advanced Engineering Mathematics", Wiley Publications.

Class: **S. Y. B. Tech Civil Engineering**	Semester-**IV**
Course Code:**CE2043**	Course Name: **Concrete Technology**

L	T	P	Credits
3	--	-	3

COURSE DESCRIPTION

The contents of the course 'Concrete Technology' provides an overview of properties of various ingredients of concrete and the role played by them in the mix design and manufacturing process of quality concrete. The study of concrete properties and their determination in the fresh and hardened state are also covered including use of modern NDT methods. The course also focuses on properties and applications of some special concretes including 3D printed concrete. The durability aspects, which are important components of the concrete, are also covered to have illustrations of various concrete deterioration mechanisms. This course helps in building the competencies in the students such as selection of appropriate materials for making concrete, design of concrete mixes of required grades, performing laboratory as well as field testing of concrete and quality aspects in all the stages of the concreting process.

Prerequisite:

Basic knowledge of different materials or ingredients of concrete is essential.

Course Learning Outcomes:

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

1. Explain properties of various materials used in the manufacture of different kinds of concretes and role played by them in developing strong, durable concretes
2. Describe various properties of concretes in fresh and hardened state
3. Design concrete mixes of given grade using mix design procedures recommended by IS Code and ACI code.
4. Describe the properties and applications of special types of concrete.
5. Illustrate various mechanisms causing the deterioration of concrete /elements of concrete structures

COURSE CONTENT

Unit No.	Details of Content	Hrs.
1.	**Ingredients of Concrete :** Cement- chemical composition, hydration process, types of cement, properties of cement, and tests on cement, Fine and coarse aggregates- properties and uses Supplementary Cementitious Materials – properties and uses (fly ash, micro silica, ggbfs, metakaolin etc.). Chemical Admixtures- classification, mechanisms and applications.	6

	Use of relevant IS Codes.	
2.	**Properties of Fresh Concrete:** Concrete Preparation (Casting) process, workability of concrete – factors affecting, workability tests, Defects in concrete (segregation, bleeding, honeycombing etc.) and remedies, Quality aspects in Concreting jobs. Use of relevant IS Codes.	6
3.	**Mix Design of Concrete:** Mix design of Concrete using IS Code & ACI Code method of mix design.	6
4.	**Properties of Hardened Concrete:** Tests on hardened concrete - Compressive, flexural, split tensile strength, comparison of cube test and cylinder test, Failure modes in concrete. NDT Tests on R C C structures. Use of relevant IS Codes.	6
5.	**Special Concretes:** Lightweight aggregate concrete, high strength concrete, high performance concrete, self-compacting concrete, fibre reinforced concrete etc. Introduction to 3D Printed Concrete- Properties and applications	6
6.	**Durability of Concrete:** Strength & durability relationship, volume change in concrete, Impact of w/c ratio on durability, permeability tests, chemical attack on concrete, Alkali Aggregate Reaction, carbonation, corrosion of steel in concrete.	6

References –

Text Books:

1. M.L. Gambhir, "Concrete Technology", Tata Mc Graw-Hill Publishing Company Limited, New Delhi.
2. P. K. Mehta and P.J. M. Monteiro, "Concrete Microstructure, Properties and Materials", Mc Graw Hill Publications, NY.
3. A. M. Neville , "Properties of Concrete", Pearson.

Reference Books:

1. A.R. Santhakumar, "Concrete Technology", Published by Oxford University Press, New Delhi.
2. M.S.Shetty, "Concrete Technology", Multicolor Illustrative Edition, S. Chand & Company Ltd., New Delhi.

IS Codes:

1. Bureau of Indian Standard (1970) IS: 383-1970. Indian standard specification for coarse and fine aggregates from natural sources for Concrete. New Delhi, BIS.
2. Bureau of Indian Standards (2009) IS: 10262-2009. Indian standard code of practice for recommended Guidelines of Concrete Mix Design plain and reinforced concrete. New Delhi, BIS.
3. Bureau of Indian Standards (2000) IS 456: 2000. Indian standard code of practice for plain and reinforced concrete. New Delhi, BIS.
4. Bureau of Indian Standards (1959) IS 1199: 1959. Indian standard code of methods of sampling and analysis of concrete. New Delhi, BIS.

Class: **S. Y. B. Tech Civil Engineering**	Semester-IV
Course Code: **CE2063**	Course Name: **Fluid Mechanics**

L	T	P	Credits
3	--	--	3

Course Description
Fluid mechanics is the branch of physics that studies the mechanics of fluids (liquids and gases) and the forces on them. Fluid mechanics has a wide range of applications, including for civil engineering, mechanical engineering, chemical engineering, geophysics, astrophysics, and biology. Fluid mechanics consists offluid statics, the study of fluids at rest and fluid dynamics, the study of the effect of forces on fluid motion.

Course Outcomes:
After completing the course, the student should be able to: -
1. Analyze different physical properties of fluid.
2. Calculate various forces acting on submerged and floating bodies.
3. Discriminate fluid kinematics and fluid dynamics.
4. Illustrate flow through pipe and flow through open channels.
5. Prepare dimensional analysis using different theories and models.
6. Explain the concept of hydraulic pumps.

Prerequisites: Engineering Mechanics

COURSE CONTENT

Unit No.	Details of Content	Hrs.
1.	**Fundamental Concepts of Fluid Flow:** Introduction to Fluid mechanics, Properties of fluid (density, unit weight, specific surface, viscosity, surface tension, capillarity, compressibility), Vapour pressure and cavitation. Pascal's law and its applications, Classification of fluids.	4
2.	**Fluid Statics** Fluid pressure: Absolute, atmospheric, gauge and vacuum pressures, Pressure head, Pressure measuring devices, hydrostatic forces on submerged surfaces (horizontal, vertical and inclined surface), Buoyancy and floatation: Buoyancy, buoyant force, centre of buoyancy, metacentre, metacentric height, theoretical background of stability of submerged and floating bodies.	6
3.	**Fluid Kinematics & Fluid Dynamics:** Displacement, velocity and acceleration of fluid particles, Continuity equation, Introduction to: rotational and irrotational flow, velocity potential and stream function flow net. Euler's equation, Bernoulli's equation and its applications for measurement of flow , impulse momentum theorem and its application, siphon, water hammer in pipes	6

4.	**Flow Through Pipes** Introduction, Reynolds experiment, Laws of fluid friction for laminar and turbulent flow, Introduction to Laminar and turbulent flow in pipes. Head loss: Concept of major and minor head loss, Darcy-Weisbach equation for determination of major loss, determination of minor losses, pipes connected in series and parallel, concept of equivalent pipe, Turbulent flow in smooth and rough pipes. Introduction to pipe network design (PND)	6
5.	**Flow Through Open Channels** Classification of flow, Uniform flow, Prismatic and non prismatic channel, hydraulically efficient channel cross sections (rectangular, trapezoidal, circular) concept of specific energy, subsequent depths, subcritical and supercritical flow in rectangular channels, hydraulic jump, practical section for open channel flow. Introduction, theoretical background of Notches and weir for measurement of flow, types.	8
6.	**Dimensional Analysis, Similitude and Pumps** Dimensional homogeneity, Buckingham's π theorem, important dimensional numbers and their significance, geometric, Kinematic and dynamic similarity, Model studies: distorted and undistorted models, scale effect in models. Pumps, types of pumps, efficiency, characteristics of pumps, head calculations, engineering application of pumps	6

Text Book:

1. Modi and Seth, "Hydraulics and Fluid mechanics including Hydraulic Machines" A. D. Computers, New Delhi.
2. R. K. Bansal, "Fluid Mechanics" Lakshmi Publications Pvt. Ltd.

Reference Books:

1. S. Nagarathanam, "Fluid Mechanics" Khanna Publication, Delhi.
2. R. S. Khurmi, "Fluid Mechanics" S. Chand & Company Ltd. New Delhi.
3. R. S. Rajput, "Hydraulic & Hydraulic Mechanics" S. Chand & Company Ltd. New Delhi.
4. J. Lal, "Fluid Mechanics and hydraulics" Metropolitan Book Co-Ltd.
5. Y. A. Cingel J. M. Oimbala, "Fluid Mechanics (SI Units)", Tata McGraw Hill.
6. J. F.Douglas, Janul and M. Gasiosek and J.A.Swaffield "Fluid Mechanics" by Pearson Education Asia".

Class: **S. Y. B. Tech Civil Engineering**	Semester-IV
Course Code: **CE2083**	Course Name: **Mechanics of Structures**

L	T	P	Credits
3	--	--	3

Course Description:
Structural Engineering is one of the important branches of Civil Engineering. It deals with the design of various structures. The design of any structure or structural element is not possible unless all the forces and corresponding stresses induced in the structure are known. The analysis of structure includes determination of all the forces acting on a structural element and finding the corresponding stresses induced. Thus for design of any structural element analysis is the first stage. This course, 'Mechanics of structures' deals with the analysis of various determinate structures, such as beams, columns, three hinged arches and trusses. This will help the students to analyze and design different structural elements.

Course Outcomes:
After successful completion of the course, student will be able to
1. Analyze and design axially loaded columns.
2. Analyze and design structural members subjected to direct and bending stresses.
3. Compute slopes and deflections at various locations for determinate beams.
4. Construct ILD for determinate beams and 2D trusses.
5. Analyze three hinged arches and suspended cables.

COURSE CONTENT

Unit No.	Details of Content	Hrs.
1.	**Axially Loaded Columns:** Critical load and buckling, derivation of Euler's formula. Concept of equivalent length for various end conditions, Rankine's formula, safe load on column and limitations of Euler's formula.	6
2.	**Combined Direct and Bending Stresses:** Combined direct and bending stresses, eccentric load on short columns, kern of a section, eccentricity of load about both axes of section. Chimneys are subjected to wind pressure, simple problems on dams and retaining walls.	6
3.	**Slope and Deflection of Beams I:** Slope and deflection of determinate beams – Double Integration method, Macaulay's method.	6
4.	**Slope and Deflection of Beams II:** Slope and deflection of determinate beams – Moment area method, Conjugate beam method	6
5.	**Influence Line Diagrams:** Muller-Breslau's Principle, Influence Line Diagrams for Simple and	6

	compound beams. Application of influence line diagram to determinate 2D trusses under dead load and live load.	
6.	**Three hinged arches:** Horizontal thrust, support reaction, bending moment. **Cables:** Analysis of cables under concentrated loads, udl, self weight.	6

References

Text Books:

1. H. Shah and S. Junnarkar "Mechanics of Structures", Charotar Publishing House Pvt Limited, New Delhi.
2. S Ramamrutham "Strength of Materials", Dhanpat Rai Publishing Company Pvt. Limited, New Delhi.
3. R.Vaidyanathan,P.Perumal,S.Lingeswari "Mechanics of Solids and Structures", Scitech Publications Pvt. Ltd., Chennai.

Reference Books:

1. S. Timoshenko "Strength of Materials Part-I",CBS Publisher Private Limited, New Delhi.
2. J. Gere, "Mechanics of Materials",CBS Publisher Private Limited, New Delhi.
3. L. Negi and R.Jangid "Structural Analysis", Tata McGraw Hill Pub.Co., New Delhi.

Class: **S. Y. B. Tech Civil Engineering**	Semester-IV
Course Code:**CE2123**	Course Name: **Applications of Programming Language in Civil Engineering**

L	T	P	Credits
--	--	2	1

Course Description:
This course introduces basic skills required to develop computer programs using modern computer systems, assuming little or no previous experience. It also introduces fundamental concepts of program construction in a suitable high-level programming language. The course has a significant practical component requiring students to construct small programs in the civil engineering field.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply programming language concepts to solve problems of civil engineering domain.
2. Apply Microsoft excel concepts to solve problems of civil engineering domain
3. Validate and execute the programs and correct syntax and logical errors.

Prerequisite:
The course learns through prerequisite courses of Programming for problem solving, Microsoft excel.

Laboratory Content		
Expt. No.	**Description**	**Hrs**
1.	Support reactions of beam	02
2.	Moment of inertia of regular figures	02
3.	Moment of inertia of composite figures(Excel)	02
4.	Stability analysis of gravity dam	02
5.	Stability analysis of gravity dam(Excel)	02
6.	Shear Force & Bending Moment calculation	02
7.	Concrete Mix design(Excel)	02
8.	Simple horizontal curves	02
9.	Profile leveling(Excel)	02
10.	Calculation of quantity of earthwork and footing	02
11.	Program using Scilab	02
12.	Program using MATLAB	02

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K.E.S. Rajarambapu Institute of Technology Rajaramnagar Autonomous 415 414 Dist. Sangli. M.S.

Text Books:

1. P. Reddy, "Computer Concepts & C Programming", McGraw Hill Education,
2. J. Shah, " Programming in C", Charoter publisher

Reference Books:

1. E. Balaguruswami "Programming in ANSI C", McGraw Hill Education,
2. Y.Kanetkar "Let us C", BPB Publications

Class: **S. Y. B. Tech Civil Engineering**	Semester-**IV**
Course Code:**CE2143**	Course Name: **Engineering Geology Laboratory**

L	T	P	Credits
-	--	2	1

Course Description:
This course explores the fundamentals of geology applied to civil engineering problems. The course include rock and mineral types, soil properties, geological structures, active tectonics and earthquake hazards, slope stability and landslides, groundwater, rivers and flood hazards. The goal of the course is to increase the student's knowledge and understanding of geology, and apply this knowledge to engineering projects such as dams, landfills, rock quarries, roads and tunnels

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

1. Recognize and describe common geological formations related to civil engineering.
2. Identify the different Rock types.
3. Implement various methods for water conservation techniques.
4. Use of electrical resistivity method for determining depth of bedrock or groundwater.

Prerequisite:
Environmental Science

Course Content		
Expt. No.	**Description**	**Hrs.**
1.	Study of common rock forming minerals.	04
2.	Study of Igneous rocks.	02
3.	Study of Sedimentary rocks.	02
4.	Study of Metamorphic rocks.	02
5.	Study and interpretation of Geological Maps.	04
6.	Study of Strike and dip of geological formations.	02
7.	Applications of electrical resistivity	02
8.	Educational visit to study geological formations and features	02

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References –

Text Books

1. P. K. Mukerjee, "A Text Book of Geology", The World Press Pvt. Ltd., Calcutta.
2. R. B. Gupte, "A Text Book of Engineering Geology", Pune VidyarthiGrihaPrakashan, Pune.
3. D. K.Todd, "Groundwater Hydrology", John Wiley and Son, New York.
4. H. H. Read, Rutley's Elements of Mineralogy, CBS Publishers and Distributors, Delhi.

Reference Books

1. P. Singh, "Engineering and General Geology", S. K. Katariya and Sons Delhi.
2. D. V. Reddy, "Engineering Geology for Civil Engineering", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. N ChennaKesavulu, "Engineering Geology", Macmillan Publishers India limited Delhi.
4. B. S. SathyaNarayanswami, "Engineering Geology", Dhanpat Rai and Co. (P). Ltd.Delhi.
5. K. M. Bangar, "Principles of Engineering Geology" - Standard Publishers Distributors 1705-B NaiSarak, Delhi.
6. G. W. Tyrrell "Principles of Petrology", B. I. Publication Pvt. Ltd., New Delhi.
7. Holmes, "Principles of Physical Geology", ELBS Chapman and Hall, London.
8. M. P. Billings, "Structural Geology", Prentice Hall of India Private Ltd., New Delhi.

Class: **S. Y. B. Tech Civil Engineering**	Semester-**IV**
Course Code:**CE2163**	Course Name: **Fluid Mechanics Laboratory**

L	T	P	Credits
-	--	2	1

Course Description:
Fluid mechanics can be mathematically complex, and can best be solved by numerical methods, typically using computers. A modern discipline, called computational fluid dynamics (CFD), is devoted to this approach to solving fluid mechanics problems. Particle image velocimetry, an experimental method for visualizing and analyzing fluid flow, also takes advantage of the highly visual nature of fluid flow. Fluid statics or hydrostatics is the branch of fluid mechanics that studies fluids at rest. It embraces the study of the conditions under which fluids are at rest in stableequilibrium and is contrasted with fluid dynamics, the study of fluids in motion. Fluid dynamics is a sub discipline of fluid mechanics that deals with fluid flow the natural science of fluids (liquids and gases) in motion.

Course Outcomes:
After successful completion of this course, should be able to,

1. Determine metacentric height, type of flow, major losses, minor losses, coefficient of discharge, coefficient of contraction, and coefficient of velocity of liquid.
2. Design most economical open channel section.
3. Measure velocity of flow using wind tunnel.

Prerequisites
Engineering Mechanics

Course Content		
Expt. No.	**Description**	**Hrs.**
1.	Use of pressure measuring devices.	02
2.	Verification of Bernoulli's Theorem	02
3.	Determination of metacentric height (Stability of submerged and floating body).	02
4.	Determination of coefficient of discharge by using a venturimeter.	02
5.	Identify of type of flow using Reynolds apparatus.	02
6.	Determination of major losses, when fluid is flowing through a closed pipe.	02
7.	Determination of loss of head due to sudden expansion, contraction, elbow, bend, globe valve etc. (Minor head loss).	02
8.	Determination of coefficient of contraction Cc, coefficient of velocity Cv and coefficient of discharge using Orifice.	02

9.	Determination of equivalent pipe diameter when flow through parallel and series pipes.	02
10.	Calculate coefficient of discharge for V-notch and rectangular notch.	02
11.	Flow velocity measurement using Wind Tunnel	02

Text Book:

1. Modi and Seth, "Hydraulics and Fluid mechanics including Hydraulic Machines" A. D. Computers, New Delhi.
2. R. K. Bansal, "Fluid Mechanics" Lakshmi Publications Pvt. Ltd.

Reference Books:

1. S. Nagarathanam, "Fluid Mechanics" Khanna Publication, Delhi.
2. R. S. Khurmi, "Fluid Mechanics" S. Chand & Company Ltd. New Delhi.
3. R. S. Rajput, "Hydraulic & Hydraulic Mechanics" S. Chand & Company Ltd. New Delhi.
4. J. Lal, "Fluid Mechanics and hydraulics" Metropolitan Book Co-Ltd.
5. Y. A. Cingel J. M. Oimbala, "Fluid Mechanics (SI Units)", Tata McGraw Hill.
6. J. F.Douglas, Janul and M. Gasiosek and J. A.Swaffield "Fluid Mechanics" by Pearson Education Asia".

Class: **S. Y. B. Tech Civil Engineering**	Semester-**IV**
Course Code:**CE2183**	Course Name: **Concrete Technology Laboratory**

L	T	P	Credits
-	--	2	1

COURSE DESCRIPTION

This laboratory course covers the determination of properties of various ingredients and also of the concrete manufactured using these ingredients, for assessing the quality. An exercise on concrete mix design followed by performing various tests on fresh and hardened concrete is included. In addition to the semi-destructive and destructive tests of concrete, the test exercises on concrete specimens and/or elements using the latest non-destructive equipment are also included. In order to get the feel of concreting jobs (involving steel reinforcement), a field exercise on actual casting of small RCC elements becomes an important part of this laboratory course.

This laboratory course provides the students hands-on experience in performing various tests on concrete specimens and/or concrete elements following the standard guidelines which will help in evaluating the concrete quality.

Prerequisite:

Basic knowledge of different materials or ingredients of concrete is essential.

Course Learning Outcomes:

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

1. Assess properties of various concrete ingredients as per the standard testing procedures.
2. Perform tests on ingredients of concrete and on fresh as well as hardened concrete for determining their properties as per the standard procedures
3. Design the concrete mix for a given grade of concrete as per the guidelines of IS code.
4. Prepare the test set up for conducting various tests on concrete mixes / specimens
5. Evaluate the quality of concrete specimens/ elements using NDT equipments

Laboratory Content		
Unit No.	**Description**	**Hrs.**
1.	**Tests on Cement** a. Fineness, b. Consistency, c. Initial and Final setting time test, d. Compressive Strength Test	**4**
2.	**Tests on Fine and Coarse Aggregates** a. **Fine Aggt:** Sieve Analysis, Sp. Gravity, Water Absorption, Moisture	**4**

	Content, Bulking of sand. b. **Coarse Aggt.:** Sieve Analysis, Sp. Gravity, Bulk Density, Water Absorption, Moisture Content, Flakiness and Elongation Index	
3.	**Concrete Mix Design:** IS Code method of mix design	2
4.	**Tests on Fresh Concrete: (Any one)** **Workability Tests:** Slump, Flow, Compaction factor, Ve Be Consistometer	2
5.	**Tests on Hardened Concrete:** Compressive Strength on Cube & Cylinder, Flexural Test, Split Tensile Strength Test, Non Destructive Tests- Rebound Hammer, UPV, GISS Concrete Scanner	4
6.	**Field Exercise:** a. Casting of RCC element/s (Beam)	4

References –

Text Books:

1. M.L Gambhir, Concrete Technology, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.

Reference Books

1. A.R. Santhakumar, Concrete Technology, Published by Oxford University Press, New Delhi.
2. M.S. Shetty, Concrete Technology, Multicolor Illustrative Edition, S. Chand & Company Ltd., New Delhi.

I S Codes:

1. Bureau of Indian Standard (1970) IS: 383-1970. Indian standard specification for coarse and fine aggregates from natural sources for Concrete. New Delhi, BIS.
2. Bureau of Indian Standards (1982) IS: 10262-1982. Indian standard code of practice for recommended Guidelines of Concrete Mix Design plain and reinforced concrete. New Deli, BIS.
3. Bureau of Indian Standards (2000) IS 456: 2000. Indian standard code of practice for plain and reinforced concrete. New Delhi, BIS.
4. Bureau of Indian Standards (1959) IS 1199: 1959. Indian standard code of methods of sampling and analysis of concrete. New Delhi, BIS

Class: S. Y. Civil	Semester-IV
Course Code:CE2203	Course Name: Technical Aptitude-II

L	T	P	Credits
--	--	--	1

COURSE DESCRIPTION

Technical Aptitude-IIconsists of multiple choice questions (MCQ) based on following courses.

1. Engineering Mathematics III
2. Mechanics of Structures,
3. Fluid Mechanics,
4. Concrete Technology

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Class: - **S.Y. B. Tech.**	Semester- **IV**
Course Code : **SH2623**	Course Name : Japanese Language - Level IV

L	T	P	Credits
-	-	2	1

Course Description: This course is designed to introduce students to the everyday language of Japan. Lessons are organized around natural conversational topics, leading students from fundamental to advanced aspects of grammar to readings in simple texts.

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

1) To be able to make basic conversations in various situations.
2) To recognize the sentence patterns.
3) To improve Japanese Language proficiency.
4) To give students insights about the communication required for living in Japan.
5) To expose students to the Japanese work ethics required in their professional careers.

Prerequisite: A Student, who is going to enroll for this course, should have following English language abilities:

1) Knowledge of basic grammar of Japanese Language.
2) Communicate moderately using Japanese Language.

All the 15 lab sessions will be conducted to meet the needs of following content delivery.

Course Content

Experiment No	Description	Hrs
1	How to make た forms of the verbs.	02
2	To express "have the experience of " using た forms of the verbs.	02
3	To express two or more than two actions in one list using た forms of the verbs.	02
4	Polite forms & plain forms (Style of speech)	02
5	Conversation in plain forms & polite forms.	02
6	To express ideas or judgements.	02
7	Report speech.	02

8	To express recommendation, suggestion.	**02**
9	How to seek agreement or confirmation from the listener.	**02**
10	Noun modification.	**02**
11	Describing an appointment, errand.	**02**
12	Rules while using とき	**02**
13	Verbs used for giving & receiving of things (polite & plain forms)	**02**
14	Conditional forms of verbs, adjectives & nouns.	**02**
15	Subject of subordinate clause.	**02**

***Note**: Words written phonetically using the Latin alphabet (*romaji*) will be only used in the very initial stage to aid learning pronunciations.

References -

1. Minna No Nihongo I (3A Corporation, Japan), Publications: Goyal publishers.
2. Nihongo shouhou, Publication: JALTAP

Other reference material, practice papers & CDs for listening practice.
The extra notes will be provided to the students as per the requirement of the syllabus.

Evaluation Scheme: ISE – 60% and ESE – 40% (Minimum Passing: 50% of ISE & ESE separately)

Evaluation Method: In every session student will be assessed. Each assessment will be of minimum 10 marks. The best 6 performances of the student will be considered for ISE of 60 marks.

Class: - **S.Y. B. Tech.**	Semester- **IV**
Course Code : **SH 2643**	Course Name : **German Language - Advanced Level**

L	T	P	Credits
-	-	2	1

Course Description: This course exposes a learner to LSRW skills of German language. The course takes a student's German language skills to advanced level with situational conversations. The course helps learners in creating cross-cultural sensitization and adaptability skills. Here, a student prepares himself for German language examination.

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

1. Interpret the language if the next person is speaking slowly and clearly.
2. Make use of the language in routine life with the routing topics like family, shopping, work etc.
3. Demonstrate the language by self-introduction in German with simple sentences.

Prerequisite: A Student, who is going to enroll for this course, should have following English language abilities:

1. Adequate knowledge of basic grammar of English language.
2. Intermediate level vocabulary of English language.
3. Communicate moderately using English language.

Course Content

Experiment No	Description	Hrs
1.	Body parts and Krankheiten(diseases) and home remedies	02
2.	Grammar- Imperative for du ,ihr, Sie	02
3.	Health tips and conversation at clinic Modal verbs - dürfen & sollen	02
4.	Professions related to health	02
5.	Vocabulary of vacation and activities in vacation	02
6.	Writing a postcard Grammar- Pronoun - man	02
7.	Topic- Weather Reading texts related to vacation and formation of "W" questions	02
8.	Grammar revision for the entire book	02
9.	Explaining the pattern of the exam and explanation of each skill's	02

	exam requirement	
10.	Practice for Skill "Writing" and " Speaking"	**02**
11.	Practice for skill "Reading" and "Listening"	**02**
12.	Solving exam set 1 Speaking practice	**02**
13.	Solving exam set 2 speaking practice	**02**

References -

1. Studio D – A 1, Cornelsen Verlag, Goyal Publishing House, New Delhi.
2. Tangram aktuell A 1, Goyal Publishing House, New Delhi.
3. Lagune A 1, Goyal Publishing House, New Delhi.
4. Netzwerk A 1, Goyal Publishing House, New Delhi.

The extra notes will be provided to the students to complete the required syllabus.

Evaluation Scheme: ISE – 60% and ESE – 40% (Minimum Passing: 50% of ISE & ESE separately)

Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 06 performances of the student will be considered for ISE. ESE will be conducted separately at the end of the semester.

Class: **S. Y. Civil**	Semester-**IV**
Course Code:**CE2223**	Course Name: **Internship**

L	T	P	Credits
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COURSE DESCRIPTION

The students are required to undergo rigorous field training in Civil Engineering for 21 days. Field training work will be commenced at the end of semester III. Student shall contact to supervisor and site for field training to be given by supervisor. Students shall submit the report of the field training taken and necessary certificate from the organization where such training is undertaken in semester IV.

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

1. Make aware the responsibility of student on work site.
2. Seek knowledge, information and details at site from live situations at field.
3. Co relate practical and theoretical information and understand the concept of experienced learning.

The students are required to undergo rigorous field training in Civil Engineering for 21 days. Field training work will be commenced at the end of semester III. Student shall contact to supervisor and site for field training to be given by supervisor. Students shall submit the report of the field training taken and necessary certificate from the organization where such training is undertaken in semester IV.

The Site Work shall consist of:

1. Survey and Layout
2. Actual Site measurement
3. Quality control on site
4. Evaluation of Specification for Building materials.

The report shall consist of:

1. Site details.
2. Site layout
3. Bar chart of work done
4. Daily material consumption and Work progress report

Evaluation of field work report will be done by the Departmental Committee. The Departmental Committee consist of three members.

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Third Year B. Tech. Civil Engineering Syllabus
With effective from 2022-23[2020-24 & 2021-25 Batch]
Department of Civil Engineering

Class: - **T. Y. Civil**	Semester: -**V**
Course Code: **CE 3013**	Course Name: **Design of Steel Structures**

L	T	P	Credits
3	--	--	3

Course Description:
The course is intended to develop a fundamental ability to evaluate the design forces in the members of steel structures and design steel tension members, compression members, columns, column bases, beams, gantry girder, plate girder and their connections. Design requirements focus on behavior and failure mechanism of structural members and develop optimum design.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Refer and use design codes and hand book for design of steel structural elements.
2. Analyze steel structural members.
3. Design steel structural members.

Prerequisite: Basic knowledge of mathematics, structural analysis and strength of material.

Course Content

Unit No.	Description	Hrs
1.	**Introduction to Design of Steel Structures:** Advantages &Disadvantages of steel as a structural material, permissible stresses, factor of safety, Methods of design, Types of connections, various types of standards rolled sections, introduction to cold formed light gauge steel. Introduction to Limit state Method: Basic concept of Limit state Method, analysis procedure and design philosophy, loads and load combinations, partial safety factors for loads and materials, comparison with working stress method.	05
2.	**Tension members:** Common sections, behavior of tension members, modes of failure, load carrying capacity, design of angle sections in trusses, design of bolted and welded connections.	05

3.	**Compression members:** Common sections, modes of failure, classification of cross sections, load carrying capacity, design of angle sections in trusses. Design of bolted and welded connections.	06
4.	**Columns:** Load carrying capacity of simple and built-up sections, design of simple and built-up sections. Design of Lacing and Battening. Column Bases: Design of slab base, gusseted base.	06
5.	**Design of beams:** Laterally restrained and unrestrained simply supported beams. Web buckling and web crippling. Design of built-up beams. Curtailment of flange plates. Beam to beam (framed) and beam to column (seated) connections.	07
6.	**Gantry girder:** Forces acting on gantry girder, commonly used sections, design of gantry girder as laterally unsupported beam. Design of welded plate girder.	07

References:

Text Books:

- Duggal S.K., "Design of Steel Structures", Tata Mc-Graw Hill publishing company Ltd.
- Shah V. L. and Gore V., "Limit State Design of Steel Structures", Structures Publication.
- Shiyekar M. R., "Limit State Design in Structural Steel", PHI Learning.

Reference Books:

- Subramanian N., "Design of Steel Structures", Oxford University Press.
- Dayaratnam "Design of Steel Structures", Wheeler Publishing.
- Chandra R., "Design of Steel Structures", Standard Book House.
- Arya A.S. and Azamani J.L., "Design of Steel Structures", Nemchand and Bros.
- Vazirani and Ratwani, "Design of Steel Structures", Khanna Publishers.
- Punmia B. C., Jain & Jain, "Design of Steel Structures", Laxmi Publication.

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.

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Class: - **T. Y. Civil**	**Semester: -V**
Course Code: **CE3033**	Course Name: **Geotechnical Engineering**

L	T	P	Credits
3	--	--	3

Course Description:
The course deals with the civil engineer activities which 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 must be 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. Classify types of soil using different index properties of soil.
2. Calculate permeability of various types of soil using different methods.
3. Analyze compressibility phenomenon of soil using Laboratory and field considerations.
4. Determine settlement, shear strength and bearing capacity of soil.

Prerequisite: Basic knowledge of mathematics and fluid mechanics etc.

Course Content

Unit No.	Description	Hrs.
1.	**Introduction to Geotechnical Engineering:** Origin & formation of soil. Clay mineralogy and soil structure, phase systems, weight volume relationships. Index Properties of Soils: methods of determination and its significance, activity of clay. Classification of soil: particle size classification system, unified soil classification system (UCS) and IS classification system - Plasticity chart and its importance. Textural classification.	06
2.	**Permeability and Seepage:** Introduction to Darcy's law, factors affecting on permeability. Coefficient of permeability and its determination (Laboratory and field methods), permeability of stratified soils, seepage velocity & discharge velocity, seepage analysis, general flow equation, flow net and its application. Effective Stress on Soil: concept-total pressure and effective stress, quick sand phenomena, capillary phenomenon.	06

3.	**Compaction:** Definition, standard and modified Proctor compaction tests as per IS-2720, factors affecting compaction, effect of compaction on soil properties, Field compaction control, field compaction equipment, Vibrofloatation.	**06**
4.	**Consolidation:** Definition, Mass-spring analogy, Relationship between effective stresses and void ratio, Terzaghi's one dimensional consolidation theory (Derivation not required), foundation settlement, normally consolidated, under consolidated and over consolidated soils, Consolidation characteristics of soil. Time rate of consolidation. Consolidation settlement of pile foundation.	**06**
5.	**Shear Strength of Soils:** Concept of shear strength, Relationship between principle stresses and shear parameters, Mohr's strength theory, modified Mohr-coulomb theory. Factors affecting on shear strength of soil, Sensitivity and Thixotropy of clay. Measurement of shear parameters- Direct shear test, unconfined compression test, Triaxial compression test and vane shear test, Tests under different drainage conditions.	**06**
6.	**Bearing Capacity of Soil:** Modes of shear failure, Terzaghi's are bearing capacity equations, assumptions and limitations. Effect of ground water table on bearing capacity of soil. I.S. Code method of bearing capacity evaluation & computation. Effect of various factors on bearing capacity. Bearing capacity of footing subjected to eccentric loading. Plate load test with reference to IS1888, Standard penetration test, cone penetration test.	**06**

References –

Text Books: -

- Arora K. R., "Soil mechanics and Foundation engineering", Standard Publishers Distributers.
- Punmia B. C., Jain A. K., "Soil mechanics and Foundation engineering", Laxmi Publications Pvt. Ltd.
- Singh A., "Soil mechanics in theory and practice", Asian Publishing House.
- Ramamurthy T. N., Sitharam, T. G., "Geotechnical Engineering", S Chand Publications.

References Books: -

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

Class: **T. Y. B. Tech Civil Engineering**	Semester-**V**
Course Code: **CE3053**	Course Name: **Irrigation and Hydraulic Structures**

L	T	P	Credits
3	--	--	3

Course Description

India is agricultural country. Irrigation Engineering is a sub engineering branch that comes under the branch of civil engineering. In which the study is based on the aim of Irrigation Engineering, that is to deal with the water-related issues that occur in agriculture. The key focus of Irrigation Engineering is to meet the need for water in the agriculture field. Through this course student will be acquainted to hydrology, ground water hydrology, hydrograph and flood hydrograph, dams and canals.

Course Learning Outcomes:

After completion of the course, the student will be able to: -

1. Explain hydrological cycle and ground water flow.
2. Calculate various surface and ground water hydrology parameters
3. Estimate water requirement of crops.
4. Design canal and canal regulator structures.

Course Content

Unit No.	Description	Hrs.
1.	**Introduction of Hydrology:** Hydrological cycle and its components; Precipitation-types and forms, measurement, annual average precipitation measurement, optimum number of rain gauge station, Hyetograph. Infiltration - factors affecting and measurement methods. Evaporation and evapotranspiration - factors affecting and measurement methods.	06
2.	**Hydrograph and Floods:** Runoff- factor affecting, rainfall runoff relationship Hydrograph - Component parts of hydrograph, Storm hydrograph, Base flow and Separation of base flow, direct runoff hydrograph, Unit hydrograph, theory, assumptions, limitations and use, S-curve hydrograph, Synthetic unit hydrograph.	06

3.	**Ground water hydrology:** Occurrence, of ground water Zones of underground water, movement of ground water and its velocity.	06
4.	**Introduction to Irrigation:** Definition and necessity of irrigation, types and methods of irrigation, Water logging and land drainage. Water Requirement of Crops: Principal crops and crop seasons, Classes and availability of soil water, Duty, delta, base period and their relationship, factors affecting duty, methods of improving duty, Assessment and efficiency of irrigation water. Gross command area, cultural command area and command area calculations based on crop water requirement. Depth and frequency of irrigation.	06
5.	**Introduction to dams:** Types of dams, selection of site for dams, selection of type of dam, Control levels. Gravity dam: Component parts, Forces acting on dam, Stability analysis, Earthen dam: Component parts, Construction and types of earthen dam, plotting of phreatic line, Modes of failure, seepage control measures.	06
6.	**Canals:** Distribution systems for canal irrigation, canal capacity, canal losses, alignment of main and distributary canals, most efficient section, lining of canals, their design, regime theory, critical shear stress, bed load. Canal structures: Design of head regulators, canal falls, aqueducts, metering flumes and canal outlets Introduction to PDN	06

References-

Text Books:

- Dr. Modi P. N., "Irrigation Water Resources and Water Power Engineering" Rajsons Publishers Pvt. Ltd.
- Sharma R.K. and Sharma T.K., "Irrigation Engineering", S Chand Publisher

Reference Books:

- Garg S.K., "Hydrology, Flood Control & Ground Water Engineering" Khanna Publishers Delhi.
- Garg S.K., "Irrigation Engineering and Hydraulic Structures", Khanna Publishers Delhi.
- Subramanya K., "Engineering Hydrology", McGraw Hill Education Delhi,

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Class: **T. Y. B.Tech. Civil Engineering**	Semester-V
Course Code: **CE3073**	Course Name: **Environmental Engineering**

L	T	P	Credits
3	--	--	3

Course Description:
Environmental Engineering course offered in 5th 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 and 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.

Course Learning Outcomes:
After successful completion of the course, students will be able to
1. Analyze water and wastewater for various parameters.
2. Identify and value the effect of pollutants on the environment: atmosphere, water and soil.
3. Prepare layout of water and wastewater treatment process.
4. Design water and wastewater Treatment Plant.
5. Interpret the impact of humans on environment.

Prerequisite: Environmental science and Mathematics

Course Content

Unit No.	Description	Hrs.
1.	**Introduction to Water Supply Engineering:** 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
2.	**Water Treatment Process:** Aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes, design problems on water treatment process	06

3.	**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, National River cleaning plans.	**06**
4.	**Wastewater Treatment Process:** Wastewater 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.	**06**
5.	**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, Hazardous waste: Types and nature of hazardous waste	**06**
6.	**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. Introduction to global issues- Global warming, acid rain, climate change, Air quality standard, standard guidelines of MPCB.	**06**

References –

Text Books: -

- Modi P. N., "Water Supply Engineering", Standard Book House.
- Modi P. N., "Wastewater Engineering", Standard Book House.
- Punmia B. C., Jain A. K and Jain A. K., "Water Supply Engineering", Laxmi Publishers.

References Books: -

- Peavy H.S, Rowe, D.R., Techobanoglous G., "Environmental Engineering", Mc-Graw -Hill International Editions.
- Ministry of Urban Development, New Delhi Manual on "Water Supply and Treatment".
- Metcalf and Eddy, "Wastewater Engineering", Treatment disposal and reuse, Tata McGraw-Hill.

Codes of Practice: -

- IS 10500:2012 Drinking water quality standards, B.I.S.
- IS 1172:1993 Code of basic requirements for water supply, drainage and sanitation.

Class: **T. Y. B. Tech. Civil Engineering**	Semester-V
Course Code: **CE3093**	Course Name: **Transportation Engineering**

L	T	P	Credits
3	--	--	3

Course Description
Transportation plays important role in the development of the country. Efficient road, railway and air transport network is essential to cater the increased need of the passengers and goods trips. Study of this subject imparts knowledge of survey for road projects, traffic survey, material quality control, pavement design, bridge investigations, and design and analysis rail systems.

Course Learning Outcomes:
After successful completion of the course, students will be able to,-
1. Design of geometric components of highway
2. Determine traffic volume for design of road infrastructure
3. Perform pavement design and different tests on highway materials
4. Design geometrically rail transportation system.

Prerequisites: Nil

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Highway Alignment and Geometric Design:** Ideal alignment, Design controls and criteria for geometric design, cross sectional element, sight distance requirements, super elevation, radius of horizontal curves, extra widening, Horizontal transition curves, Design of vertical alignment, types of gradients, grade compensation on horizontal curves, vertical curves.	**06**
2.	**Surveys and Studies in Traffic Engineering:** Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, parking study, accident study and analysis, signal design by Webster's method; Types of intersections and channelization; Highway capacity and level of service of rural highways and urban roads.	**06**

3.	**Highway Materials Quality Control:** Aggregate properties for different layers of road aggregate blending, pavement quality concrete, Bitumen and Tar- origin, preparation, properties and chemical constitution of bituminous road binders, Bituminous emulsions and cutback - preparation, characteristics uses and tests, Bituminous mix design. Concrete pavement mix design.	06
4.	**Pavement Design and Pavement Distresses:** Design factors for flexible and rigid pavements, Design of flexible pavement using IRC: 37-2018, Design of rigid pavements using IRC: 58-2015, Distresses in rigid and flexible pavement	06
5.	**Introduction to Railway Engineering:** Overview, Component parts of railway track, recent development in railways specifically w.r.t. track structure, Organizational structure of Indian railways, railway lines classification based on speeds, Critical speed, types of sleepers and ballast, rail gauge, introduction to metro railways.	06
6.	**Railway Geometric Design:** Geometric design of track, sleeper density, Points and Crossing, Signaling, Interlocking, Tracking Power and Resistance	06

References

Text Book:

- Khanna, S.K., Justo C.E.G. and Veeraragavan A., "Highway Engineering", Nem Chand and Brothers.
- Saxena, S.C., Arora S. P., "A Text Book of Railway Engineering", Dhanpat Rai and Sons.
- Mundrey, J. S., "Railway Track Engineering", Tata McGraw Hill Education.

Reference Books:

- Yang, H. Huang, "Pavement Analysis and Design", Pearson Education.
- Rangwala Abdulla S., "Railway Engineering", Charotar Publishing House

Codes of Practice:

- IRC 37, Guidelines for the Design of Flexible Pavements, Indian Roads Congress, New Delhi.
- IRC 58, Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, Indian Roads Congress.
- MoRTH, Specification for Road and Bridge Works, Ministry of Road Transport and Highways

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Class: **T. Y. B. Tech. Civil Engineering**	Semester-**V**
Course Code: **CE3113**	Course Name: **Geotechnical 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 geotech and soil mechanics with emphasis on advanced soils Laboratory testing, field testing and monitoring.
The laboratory course deals with the use of standard and advanced soils laboratory testing equipment which facilitates triaxial stress path testing with local strain measurement, automatic compaction machine, permeability testing, direct shear testing etc.

Course Learning Outcomes:
After successful completion of the course, students will be able to
1. Determine index and engineering properties of soil.
2. Classify soil based on its index properties.
3. Analyze field conditions through Laboratory tests

Prerequisite: Basic knowledge of mathematics and fluid mechanics

Course Content		
Expt. No.	**Description**	**Hrs.**
1.	Specific Gravity of Soil Grains.	**02**
2.	Field Density a) Core Cutter Method b) Sand Replacement Method	**02**
3.	Grain Size Distribution a) Dry Analysis b) Wet Analysis	**02**
4.	Consistency Limits a) Liquid Limit b) Plastic Limit c) Shrinkage Limit	**02**
5.	Proctor Compaction Test	**02**
6.	Permeability Test a) Constant Head method b) Falling Head method.	**02**
7.	Direct Shear Test	**02**
8.	Unconsolidated Undrained Triaxial Test (UU)	**02**
9.	Unconfined Compressive Strength Test (UCS)	**02**

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10.	One Dimensional Consolidation Test	**02**
11.	Standard Penetration Test	**02**
12.	Vane Shear Test	**02**
13.	Field Visit regarding identification of soil	**02**

References –

Text Books: -

- Arora K. R., "Soil mechanics and Foundation engineering", Standard Publishers Distributers.
- Punmia B. C., Jain A. K., "Soil mechanics and Foundation engineering", Laxmi Publications Pvt. Ltd.
- Ramamurthy T. N., Sitharam, T. G., "Geotechnical Engineering", S Chand Publications.

References Books: -

- Murthy V.N.S., "Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors.
- Gopal Ranjan and Rao A.S.R., "Basic and Applied Soil Mechanics", New Age International (P) Ltd.
- Terzaghi K., Peck R. B., Mesri G., "Soil Mechanics", John Willey & Sons publication.

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Class: **T. Y. B.Tech. Civil Engineering**	Semester-V
Course Code: **CE3133**	Course Name: **Environmental Engineering Laboratory**

L	T	P	Credits
--	--	2	1

Course Description:
The course equips the student with theoretical and practical knowledge and skills, relevant to water and wastewater analysis. Environmental Engineering laboratory is offered as the course in the fifth semester of third year engineering consists of two modules, the first module focuses on analysis of water and wastewater characteristics. The second module focuses on the design of treatment systems of water and wastewater.

Course Learning Outcomes:
After successfully completing the course, student will able to:
1. Analyse water and wastewater characteristics.
2. Prepare a layout of water treatment plant and design.
3. Prepare a layout of wastewater treatment plant and design.

Prerequisite – Fundamentals of Environmental Science, chemistry

Laboratory Work:

It shall consist of practical exercises and projects as given below.

Course Content		
Expt. No.	**Name of Experiment**	**Hrs.**
Part A	**Analysis of any ten parameters from following**	
1.	Determination of pH of water, Acidity and alkalinity of water	**02**
2.	Determination of Chloride Content of water	**02**
3.	Determination of Hardness of water	**02**
4.	Determination of Turbidity of water	**02**
5.	Determination of Residual chlorine in water	**02**
6.	Determination of Total solid of water and wastewater	**02**
7.	Determination of Total dissolved solids through measurement of electrical conductivity	**02**
8.	Determination of Dissolved Oxygen of water and wastewater	**02**
9.	Determination of Most Probable Number	**02**
10.	Determination of Biological Oxygen Demand of wastewater	**02**
11.	Determination of Chemical Oxygen Demand of Wastewater	**02**

12.	Demonstration of Five gas analyzer for Air Quality assessment.	**02**
Part B	Design/ Analysis problems on water treatment unit & wastewater treatment	**02**
Part C	Visit to a water or wastewater treatment plant	**02**

References –

Text Books: -

- Modi P. N., "Water Supply Engineering", Standard Book House.
- Modi P. N., "Wastewater Engineering", Standard Book House.
- Punmia B. C., Jain A. K and Jain A. K., "Water Supply Engineering", Laxmi Publisher

References Books: -

- Peavy, H.S, Rowe, D.R, Tchobanoglous, G. "Environmental Engineering", Mc-Graw -Hill International Editions.
- Ministry of Urban Development, New Delhi Manual on Water Supply and Treatment.
- Metcalf and Eddy Wastewater Engineering, Treatment disposal and reuse, Tata McGraw-Hill.

Codes of Practice: -

- IS 10500:2012 Drinking water quality standards, B.I.S.
- IS 1172:1993 Code of basic requirements for water supply, drainage and sanitation.

Class: **T. Y. B. Tech. Civil Engineering**	Semester-V
Course Code: **CE3153**	Course Name: **Transportation Engineering Laboratory**

L	T	P	Credits
-	--	2	1

Course Description
The objective of Transportation Engineering laboratory course is to determine the properties of materials used in road construction. Experiments include tests for impact, abrasion, and shape test for coarse aggregate and tests for penetration, ductility, viscosity, softening point and flash and fire point for bitumen. The students will be able to infer the suitability of these materials for construction of road. This laboratory course will help the students to understand the theoretical concepts learned in the transportation engineering course.

Course Learning Outcomes:
After successful completion of the course, students will be able to,-
1. Characterize the pavement materials
2. Perform quality control tests on pavement materials
3. Design bituminous mixes for flexible pavement
4. Design concrete mix for rigid pavement
5. Calculate thickness of different layers of pavement

Prerequisites: Nil

Perform any ten experiments

Course Content		
Expt. No.	**Name of Experiment**	**Hrs.**
1.	Determination of aggregate impact value of aggregates used in road construction	**02**
2.	Determination of abrasion value of aggregates by Los Angeles Abrasion Test	**02**
3.	Determination of Flakiness and Elongation Index of aggregates used in road construction	**02**
4.	Determination of California Bearing Ratio value of subgrade soil	**02**
5.	Determination of California Bearing Ratio value of subgrade soil by Dynamic Cone Penetrometer Test	**02**
6.	Determination of penetration value of bitumen	**02**
7.	Determination of softening point of bitumen	**02**
8.	Determination of flash and fire point of bitumen	**02**

9.	Estimation of binder content in bituminous mixture by centrifugal extraction method	**02**
10.	Determination of viscosity of bitumen by Say bolt Viscometer	**02**
11.	Estimation of optimum binder content of bituminous mix by Marshall Stability Test	**02**
12.	Design of concrete mix for PQC layer of concrete pavement	**02**

References

Text Book:

- Khanna S.K., Justo C.E.G. and A Veeraragavan, "Highway Engineering", Nem Chand and Brothers.
- Saxena S. C., Arora S. P., "A Text Book of Railway Engineering", Dhanpat Rai and Sons.
- Mundrey J. S., "Railway Track Engineering", Tata McGraw Hill Education.

Reference Books:

- Yang H. Huang, "Pavement Analysis and Design", Pearson Education.

Codes of Practice:

- IRC 37, Guidelines for the Design of Flexible Pavements, Indian Roads Congress, 4th Edition.
- IRC 58, Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, Indian Roads Congress.
- MoRTH, Specification for Road and Bridge Works, Ministry of Road Transport and Highways, 5th Revision.

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Class: - **T.Y. B. Tech**	Semester-**V**
Course Code: **SH 3033**	Course Name: **Scholastic Aptitude I**

L	T	P	Credits
2*	-	-	2

Course Description:
Quantitative and Reasoning tests form a major part of most of the competitive exams and recruitment processes. They evaluate numerical ability and problem-solving skills of candidates. Along with the arithmetic abilities, candidate's patience while reading through the question is also tested. Decision making is also a crucial part of the process with a question having multiple solutions and the candidate has to choose the most efficient one. The course includes the tricks used for fast calculations which is an integral part of a student's career, calculating the remuneration and efficiency, estimating profits and interests on the principal, using a logical approach towards solving a problem is now a routine affair for a professional.

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

1. Develop a logical approach towards solving Aptitude and Reasoning problems.
2. Analyze usage of basic aptitude terms of percentages, averages, ratios and applications of business aptitude terms of profits and interests.
3. Develop a bridge in analogies, series and visualizing directions.
4. Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams.

Prerequisite: Fundamentals of various Mathematical and Arithmetic operations, Calculations.

Course Content		
Unit No.	**Description**	**Hrs.**
1.	Vedic Maths	**03**
2.	Percentage Understand Conversion, Single change, Successive change, Product Stability, Applications of percentage.	**03**
3.	Average, Allegations Weighted average, Concept of average speed & allegation, Applications of Average & mixture allegation.	**03**
4.	Ratio & Proportion Comparison of Ratio & fraction, Properties of Ratio & Proportion, Mean Proportion.	**03**

5.	HCF, LCM Different Methods to find LCM-HCF, HCF-LCM relation, Applications of HCF -LCM	**03**
6.	Profit & Loss Same selling price different Cost Price, Same cost price different selling price. Concept of false scale.	**03**
7.	Simple interest -Compound interest Difference between SI CI, Conversion Periods, Depreciation.	**03**
8.	TRW, Pipes & Cisterns Time, Rate and Work-Unitary Method, LCM Method, Calculation of remuneration.	**03**
9.	Numerical Analogy Relation between two numbers	**03**
10.	Pattern, Step Completion Image completion, Mirror images, Water images, input-Output	**03**
11.	Series Completion Types of series, Number series pattern, Letter series, Alphanumeric series,	**03**
12.	Direction Sense, Coding Decoding Basics, shadow-based concept, Concept of local time zone (IST, GMT, Longitude, Latitude), Problems on local time difference, Coded direction sense	**03**
13.	Data Interpretation	
14.	Quantitative Revision I Percentage, Average, Allegations, Ratio & Proportion, HCF, LCM	**03**
15	Quantitative Revision II Profit & Loss, Simple interest -Compound interest, TRW, Pipes & Cisterns	**03**
16	Logical Reasoning Revision	**06**
	Total Hrs	**45**

***Note: One Extra lecture will be allotted in the time table.**

References

Reference Books:

- Aggarwal R. S., "Quantitative Aptitude", S Chand Publishing, New Delhi.
- Aggarwal R. S., "Logical Reasoning", S Chand Publishing, New Delhi.
- Arun Sharma, "Quantitative Aptitude", McGraw Hill Publishing, New Delhi
- Arun Sharma, "Logical Reasoning", McGraw Hill Publishing, New Delhi

Class: **T.Y. B. Tech. Civil Engineering**	Semester-**V**
Course Code: **CE 3173**	Course Name: **Technical Aptitude- III**

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

Course Description:

Technical Aptitude- III consists of multiple-choice questions (MCQ) based on following courses.

1. Design of Steel Structures
2. Geotechnical Engineering
3. Irrigation and Hydraulic Structure
4. Environmental Engineering
5. Transportation Engineering

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Class: - **T.Y. B. Tech**	Semester-**V**
Course Code: **SH 3011**	Course Name: **Constitution of India**

L	T	P	Credits
2	-	--	Audit

Course Description:
The Constitution of India (IAST: *Bhāratīya Saṃvidhāna*) is the supreme law of India. The document lays down the framework demarcating fundamental political code, structure, procedures, powers, and duties of government institutions and sets out fundamental rights, directive principles, and the duties of citizens. It is the longest written constitution of any country on earth. B. R. Ambedkar, chairman of the drafting committee, is widely considered to be its chief architect.
Indian Constitution is audit course offered at the fifth semester of Civil Engineering undergraduate programme to have fundamental knowledge of Indian Constitution. It consist of six units covering all areas of Indian Constitution.

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

1. Create awareness about law depiction and importance of Constitution
2. Define Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsibilities.
3. Create Awareness of their Surroundings, Society, Social problems and their suitable solutions while keeping rights and duties of the citizen keeping in mind.
4. Recognize distribution of powers and functions of Local Self Government.
5. Comprehend the National Emergency, Financial Emergency and their impact on Economy of the country.

Prerequisite: Fundamental of political science

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Constitution – Structure and Principles:** Historical perspective of the constitution of India, Meaning and importance of Constitution, Making of Indian Constitution – Sources, Salient features of Indian Constitution.	04
2.	**Fundamental Rights and Directive Principles:** Fundamental Rights, Fundamental Duties, Directive Principles.	04

3.	**Government of the Union:** President of India – Election and Powers, Prime Minister and Council of Ministers, Lok Sabha – Composition and Powers, Rajya Sabha – Composition and Powers.	**04**
4.	**Government of the States:** Governor – Powers, Chief Minister and Council of Ministers, Legislative Assembly – Composition and powers, Legislative Council – Composition and powers	**04**
5.	**The Judiciary:** Features of judicial system in India, Supreme Court –Structure and jurisdiction, High Court – Structure and jurisdiction.	**04**
6.	**Administrative organization and constitution:** Federalism in India – Features, Local Government -Panchayats –Powers and functions; 73rd and 74th amendments, Election Commission – Organisation and functions, Citizen oriented measures – RTI and PIL – Provisions and significance.	**04**

References -

Text Books:

- Durga Das Basu, "Introduction to the Constitution of India", Gurgaon; LexisNexis

Reference Books:

- M.V.Pylee, "India's Constitution", New Delhi; S. Chand Pub.
- J.N. Pandey, "The Constitutional Law of India", Allahabad Central Law Agency.
- Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf
- Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa.

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**V**
Course Code: **CE 3193**	Course Name: **Structural Analysis**

L	T	P	Credits
3	--	--	3

Course Description
Structural Analysis consists of analysis of determinate and indeterminate trusses, three hinged and two hinged arches. Also, plastic analysis of beams, unsymmetrical bending of beams, analysis of frames by approximate methods and application of theories of failure is included in this course. All these topics lead to understand the behavior of structural elements and useful while studying the design courses.

Course Learning Outcomes:
After completing the course, the student should be able to,

1. Analyze pin jointed truss for deflection by strain energy method.
2. Analyze and design thin and thick shells under various loading.
3. Evaluate stresses in curved bars and springs.
4. Determine bending stresses in beams due to unsymmetrical bending.
5. Evaluate principal strains of a loaded element.
6. Predict failure of structure by using various theories of failure.

Prerequisites: Engineering Mechanics, Strength of Materials, Mechanics of Structures

Course Content

Unit No.	Description	Hrs.
1.	**Deflection of pin jointed truss:** Strain energy of axially loaded members, unit load method, Castigliano's 1st theorem, Deflection of determinate trusses, determination of support displacement of trusses, Deflection of cantilever determinate truss.	06
2.	**Thin Shells and Thick Cylinders** Thin cylindrical shell: circumferential and hoop stresses, longitudinal stresses, maximum shear stresses, Design of thin cylindrical shell. Thick Cylinders: Lame's theory, longitudinal and shear stresses, Design of thick cylindrical shell, Thick spherical shells.	06

3.	**Plastic analysis of structures:** Assumptions, fundamentals of plastic analysis, Flexure of beam, collapse mechanism, shape factor, plastic moment, plastic section modulus. Plastic analysis of fixed and continuous beams.	06
4.	**Unsymmetrical bending and Shear Center:** Unsymmetrical bending of beams of symmetrical sections. Unsymmetrical bending of beams of unsymmetrical sections. Concept of shear center and determination of shear center of channel and angle section.	06
5.	**Principal Strains:** Principal Strains: Direct strain on oblique plane due to direct pull, shear force and due to two normal pulls and shear force, Strain on inclined section, Ellipse of strains, Mohr's circle of strain, Principal strains and strain energy due to principal stresses	06
6.	**Theories of Failure:** 1. Maximum Principal stress theory 2. Maximum Principal strain theory 3. Maximum shear stress theory 4. Total energy theory 5. Distortion energy theory	06

References –

Text Books: -

- Junnarkar S. B. and Shah H.J., "Mechanics of Structures", Charotar Publishers.
- Ramamruthum S., "Theory of Structures", Dhanpat Rai & Sons publications.
- Bhavikatti S. S., "Structural Analysis-II", Vikas Publishing House Pvt, Ltd.
- Rajput R. K., "Strength of Material", S. Chand & Company Pvt. Ltd.

References Books: -

- Vazirani and Ratwani, "Analysis of Structures", Khanna Publishers.
- Wang C. K., "Intermediate Structural Analysis", Indian Edition, Tata McGraw-Hill Education.
- Gere and Timoshenko, "Mechanics of Materials", CBS Publisher Private Limited.

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**V**
Course Code: **CE 3213**	Course Name: **Composite Materials**

L	T	P	Credits
3	--	--	3

Course Description:
The course covers a broad range of composite geometries and properties covering extensively transport properties. Fibers are not viewed as available components but their fabrication and ways to control effectively orientation, mechanical and surface properties are considered in full detail, fabrication of composites is a also treated in detail. Mechanical properties considered are not limited to those of composites with regular arrangements of fibers (random arrangements of fibers, dispersions of low-aspect ratio particles and platelets are also considered). Properties considered include a systematic presentation of transport propertied for random and ordered arrangements of the second phase

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

1. Explain the methods of manufacturing, properties and applications of various composites materials.
2. Determine stresses and strains in composites.
3. Apply failure criteria and critically evaluate the results.
4. Explain mechanical behavior of composites due to variation in temperature and moisture.

Prerequisites: The fundamental knowledge of the courses Mechanics of Solids, Metallurgy and Material Science is essential.

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Introduction:** Polymer matrix composites (PMC) Reinforcements and matrices, Types of reinforcements, Types of matrices, Types of composites, Carbon Fiber composites, Properties of composites in comparison with standard materials.	06
2.	**Manufacturing methods:** Hand and spray lay-up, injection molding, resin injection, filament winding, Pultrusion, centrifugal casting and prepregs. Fiber/Matrix Interface, mechanical. Measurement of interface strength, Characterization of systems, carbon fiber/epoxy, glass fiber/polyester, Graphite epoxy etc.	06

3.	**Mechanical Properties:** Stiffness and Strength: Geometrical aspects, volume and weight fraction, Unidirectional continuous fiber, discontinuous fibers, Short fiber systems, woven reinforcements. Mechanical Testing: Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear.	**06**
4.	**Laminates:** Types of Laminates, Symmetric Laminates, Antisymmetric Laminate, Balanced Laminate, Quasi-isotropic Laminates, Cross-ply Laminate, Angleply Laminate, Orthotropic Laminate, Laminate Moduli, Hygrothermal Stresses.	**06**
5.	**Advances in Composites:** Carbon/carbon composites, Advantages of carbon matrix, Limitations of carbon matrix Carbon fiber, Chemical vapour deposition of carbon on carbon fiber perform, Sol gel technique, Composites for aerospace applications.	**06**
6.	**Joining Methods:** Joining, Advantages and disadvantages of adhesive and mechanically fastened joints, Typical bond strengths and test procedures.	**06**

References:

Text Books:

- Sharma, S.C., "Composite Materials", Narosa Publications.
- Strong, A.B, "Fundamentals of Composite Manufacturing", SME.

Reference Books:

- Chawla, K. K., "Composite Materials", Springer, Verlag
- Chawla, Krishan K, "Composite Materials, Springer", Verlag New York.
- Chung, Deborah D. L, "Composite Materials Science and Applications", Springer-Verlag London.
- Clyne, T.W. and Withers, P.J., "Introduction to Metal Matrix Composites", Cambridge University Press.

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Class: **T. Y. B. Tech Civil Engineering**	Semester- **V**
Course Code: **CE 3233**	Course Name: **Construction Safety Management**

L	T	P	Credits
3	--	--	3

Course Description:
The Construction Safety and Quality Management course covers the standards and laws associated with health and safety in construction activities, identification and controlling of workplace dangers and hazards and practical application of knowledge in real time situation. To join and study this course, no previous health and safety knowledge is required although it is advised that candidates/learners should have basic understanding of construction activities.

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

1. Apply various quality improvement techniques.
2. Diagnose problems in the quality improvement process
3. Suggest safety precautions to be taken during the execution of various construction works
4. Analyze possible hazards and accidents in construction projects
5. Interpret various legal aspects of safety in construction.

Prerequisites: Construction activities in construction industry.

Course Content

Unit No.	Description	Hrs.
1.	**Introduction to quality:** Importance of quality, quality transition, quality control and inspection, quality assurance, total quality management, evolution of quality management.	06
2.	**Planning and control of quality:** Quality Concerns in Construction, Work and Material specifications, Benchmarking, Quality Function Deployment, Customer Satisfaction, Employee Involvement, Continuous Process Improvement.	06

3.	**Safety in Construction:** Indian construction industry, challenges before construction industry in India, safety hazard, safety precautions in construction, safety committee and its function, Role of govt. in safety promotions, Safety education & training, safety audit, personal protective equipment's (PPE), Roles & responsibility of safety officers, duties of safety officers, Safety signs and symbols.	**06**
4.	**Hazards of Construction and Prevention:** Excavations, basement and wide excavations, trenches, shafts-scaffolding, safety hazards, scaffolding inspection checklist. Accidents- types, causes, unsafe act & unsafe condition, prevention techniques, accident reporting & investigation. Construction safety in high rise buildings, working on contaminated sites, safety in demolition work, fire hazards.	**06**
5.	**Safety in Handling Construction Machinery:** Selection, operation, inspection and testing of hoisting cranes, mobile cranes, tower cranes, crane inspection checklist, builder's hoist, winches, chain pulley blocks, use of conveyors - concrete mixers, concrete vibrators, Safety in earth moving equipment's- excavators, dozers, loaders, dumpers, motor grader, concrete pumps, welding machines, use of portable electrical tools, drills, grinding tools.	**06**
6.	**Aspects of Safety in Construction** Acts & regulations related to constructions- Building and other construction workers' act-1996, Occupational health Laws, occupational safety & health act (OSHA), employer and employees- duties and rights.	**06**

References:

Text Books:

- Mishra, R. K., "Construction Safety", AITBS Publishers.
- Bhattacharjee, S. K., "Safety Management in Construction", Khanna Publishers.

Reference Books:

- Construction safety manual, National Safety Commission of India.
- Safety Management in Construction Industry, McGraw Hill Construction, Smart Market Report.
- Kelar, J. J., OSHA, "Construction Safety Handbook".
- Girimaldi, and Simonds, "Safety management", AITBS Publishers.

Class: **T. Y. B. Tech Civil Engineering**	Semester-**V**
Course Code: **CE 3253**	Course Name: **Construction Techniques**

L	T	P	Credits
3	--	--	3

Course Description

Construction Technology plays an important role in civil engineering. This course caters for imparting application-based knowledge in the area of construction technologies used to construct civil engineering infrastructure.

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

1. Develop method statements for construction techniques.
2. Select construction techniques for particular activities.
3. Justify application of construction technique for particular tasks.
4. Justify construction safety needs and management on projects.

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Fundamentals of Construction Technology:** Construction activities, Process, Workers, Estimation and Schedule. Construction documentation & records. Codes & regulation.	06
2.	**Construction of High-rise Structures:** Foundation, Structural System, Life Safety System, vertical transportation, MEP services, Construction & Processes.	06
3.	**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.	06

4.	**Underwater Construction & Trenchless Technology:** Problems encountered in excavation, Underwater drilling & blasting, Grouting Soft and hard soil Trenchless Technology, Definition, Method & application.	**06**
5.	**Mechanized Construction:** Introduction, fundamental & Mechanization for plants, tolls, earthwork, transportation, movement & handling. Mechanization in concrete mixers and pumps.	**06**
6.	**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 Saraswathi 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", Longman Group Limited.

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Class: **T. Y. B. Tech. Civil Engineering**	Semester-V
Course Code: **CE 3273**	Course Name: **Advanced Water Treatment**

L	T	P	Credits
3	--	--	3

Course Description
The course is meant to give a more thorough theoretical understanding of the various unit processes used in wastewater treatment than what is given in the core course. A focus is given on physical and chemical processes such as; coagulation / flocculation and precipitation processes, oxidation processes, particle separation processes and membrane separation processes. An emphasis will be made on in depth understanding of the unit processes and the application of this in research-based projects.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain need of water treatment for sustainable development.
2. Explain importance of water analysis in water treatment
3. Prepare layout of water treatment plant
4. Design Water Treatment Plant and water Supply Scheme for rural/urban area
5.Calculate efficiency of water treatment plant

Prerequisites: Basic knowledge of science, Environmental Engineering sub

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Introduction** Introduction to Water Supply System, Components of water supply system, Difference between rural water supply system and urban water supply system, sources of water and strengthening water sources by using innovative technique, Impurities in water and removal technique, Nutrient management for control of water pollution.	**06**
2.	**Coagulation and Flocculation:** Coagulation Process, Stability of colloids, Repulsive and Attractive Potentials, destabilization of Colloids, Transport of colloidal particles, Destabilization in Water Treatment by Al (III) and Fe (III). Synthetic Organic polymers, Activated	**06**

	Silica, Selection of a coagulant. Sedimentation Processes: Zone Settling, Compression, Sedimentation tank design for water treatment plant, Design of tube settlers, Concept and design aeration and gas transfer process.	
3.	**Filtration:** Filtration process; Principle Mechanisms of filtration, Filter Hydraulics backwash hydraulics, Rate control Patterns and Methods, Head loss patterns at Constant Rate, Slow sand and Rapid sand Filtration and their performances, Design of Gravity filters, Design and Operating variables for deep Granular Filters: Filter media, Fluidization and bed expansion in backwashing, Under drainage systems with design, operational problems.	**06**
4.	**Disinfection:** History and modes of disinfection, rates of disinfection, disinfection concentration Factors affecting disinfection such as temperature, pH and organic matter, Chemical Disinfectants – chlorine and Chlorine derivatives; Non-Chemical Methods for Disinfection: Ozonation, UV radiation	**06**
5.	**Transmission of water:** Pumping and gravity mains, choice of pipe materials, forces acting on pipes, leakage and pressure testing of pipe, corrosion types and control measures Distribution of water: Water distribution systems, method of distributing water, layout pattern, basic system requirements for water distribution system, methods of network analysis: Hardy Cross method and Newton Rapson method, valves and its uses.	**06**
6.	**Advanced Treatment:** Adsorption processes: types of adsorptions, factors influencing, adsorption equilibrium and development of adsorption isotherms, activated carbon adsorption kinetics, analysis and design of Granular Activated carbon and PAC contactors. Miscellaneous methods: Ion Exchange: Exchange processes, Exchange Materials, Synthetic Exchange resins, Exchange reaction, Equilibria, Exchange Isotherm.	**06**

References:

Text Book:

- Modi P. N., "Water Supply Engineering", Standard Book House. New-Delhi
- Punmia B. C., Jain A. K. "Water Supply Engineering", Laxmi Publishers, New-Delhi,

Reference Books:

- Peavy H.S, Rowe, D.R., Tchobanoglous, G. "Environmental Engineering", Mc-Graw -Hill International Editions.
- Ministry of Urban Development, New Delhi Manual on Water Supply and Treatment.
- Manual of water supply and treatment by Government of India publication, Third edition (2007)

IS Code:

- IS 10500:2012 Drinking water Specification published by Bureau of Indian Standard

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Class: **T. Y. B. Tech Civil Engineering**	Semester-**V**
Course Code: **CE 3293**	Course Name: **Tunnel Docks and Harbors Engineering**

L	T	P	Credits
3	--	--	3

Course Description
Tunnels are required to be made for underground metros passing through cities or for roads/rails crossing the hills. Tunnels are also required for making subways for pedestrian crossing the busy roads. Thus, knowledge about tunnel design features and its maintenance are important for civil engineers. India has a very large coastal line and therefore coastal shipping plays a very vital role in the development and growth of economy of our country. Docks and Harbor are the integral part of coastal shipping transport system Therefore, knowledge and understanding of various construction and maintenance aspects of docks and Harbors are very important for engineers working at site in order to make shipping transport system safe and efficient.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Compare tunnel construction technologies
2. Decides a safety and ventilation system for tunnels
3. Suggest appropriate location for construction of docks and harbours
4. Select dredging method for particular operation.

Prerequisites: Nil

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Introduction to Tunnel Engineering:** Advantages and disadvantages of tunnel with respect to open cuts. Geotechnical Exploration for tunnels and its importance, Tunnel surveying Criteria for Selection of size and shape of tunnels, Factors affecting the methods of Tunneling, Component of Tunnel	**06**
2.	**Tunnel Construction in Soft and Hard Ground:** General, Characteristics of soft ground, 'NATM' method of Tunneling, Sequence of operation and work cycle, Drill blast method of tunneling **for** hard strata, Different patterns of drilling, types of explosives, method of blasting, mechanized tunneling in hard and soft strata.	**06**

3.	**Safety and Ventilation:** Ventilation, requirements a ventilating system, Methods of ventilation with advantages and disadvantages. Lighting and aspects of drainage in brief. Method of supporting roof consisting of shot creating. Cement grouting, rock bolting, Cast in-situ and precast lining, Construction Safety	**06**
4.	**Docks and Harbour:** Introduction, Requirements of harbour and port, classification of harbours, Factors affecting growth of port, Major Ports in India and abroad, Planning of Port, Selection of ideal location for harbor.	**06**
5.	**Breakwater, Jetty and Types of Docks:** Breakwater and materials of construction for breakwater, Dock, Bulkhead and Sea Walls, Water front structures, Wharves, Jetty, Dolphins, Different types of dock fenders, Uses of wet docks and Dry/ Repair docks. Port facilities, Transit sheds and warehouses.	**06**
6.	**Dredging:** General, Classification of dredging works, Types and operation of dredgers, Execution of dredging work, Uses of dredged material	**06**

References:

Text Book:

- Bindra S.P., "Docs and Harbour Engineering", Dhanpat Rai Publications.
- Srinivasan R., "Harbour Dock and Tunnel Engineering", Charotar Publishing House.

Reference Books:

- John O. Bickel, Thomas R. Kuesel, Elwyn H. King, "Tunnel Engineering Handbook".
- Peurifory Shexnayder, Shapira, "Construction Planning, Equipment and Methods", McGraw Hill Education.

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Class: **T. Y. B. Tech Civil Engineering**	Semester-**V**
Course Code: **CE 3313**	Course Name: **Urban Transportation Systems**

L	T	P	Credits
3	--	--	3

Course Description
Due to rapid urbanization, population and number of vehicles are increased very fast in urban areas. Urban area necessitates efficient road/railway network and reliable mass transportation systems to cater the increased need of the passengers and goods trips within urban as well as suburban area. Safe, economic, timely and comfortable urban mass transportation systems reduce private vehicle trips, which ultimately reduce traffic congestion, accidents and environmental pollution. Study of this subject imparts knowledge of urbanization process, urban transportation system planning, land use planning, travel demand modeling procedure, different urban mass transportation systems and urban goods movement.

Course Learning Outcomes:
After successful completion of the course, students will be able to, -
1. Categorize the transportation problems in urban area
2. Perform the transportation survey in urban area to predict the travel demand
3. Explain different urban transportation planning methods
4. Predict route and schedule for mass transit system
5. Explain different methods of preparation of transportation plan

Prerequisites: Transportation Engineering

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Introduction to Urbanization and Travel Demand:** Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, concepts of travel demand, factors affecting demand.	**06**
2.	**Transportation Surveys:** The transportation study area definition; division into traffic zones; network identification; types of travel and characteristics of various surveys; home interview; roadside survey; goods, mass transit and intermediate public	**06**

	transport surveys; sampling and expansion factors; accuracy checks, screen line checks, consistency checks.	
3.	**Travel Demand Forecasting:** Trip generation, Trip distribution models, Desire line diagram. Modal split analysis-trip end models, trip interchange models, logit models, Trip assignment techniques-route choice, diversion curves, shortest path algorithms, all-or-nothing assignment, capacity restraint models and Direct demand models.	**06**
4.	**Urban Transportation Planning:** Trip generation; zonal regression methods and category analysis; trip distribution method; gravity models and opportunity models; modal split methods; factors affecting modal split; trip end models and trip distribution models; route assignment; factors affecting route choice; diversion curve; shortest paths	**06**
5.	**Mass Transit System:** Introduction to routing and scheduling, transit system's performance parameters. Corridor identification and corridor screen line analysis.	**06**
6.	**Transportation Plan Preparation:** Urban forms and structures: point, linear, radial, poly-nuclear developments and suitable transit systems, Urban goods movement. Preparation of comprehensive plan and transportation system management planning	**06**

References:

Text Book:

- Kadiyali L. R., "Traffic Engineering and Transport Planning", Khanna Publishing.

Reference Books:

- Khisty C. J. and Lall B. K., "Transportation Engineering: An Introduction", Pearson Publication.

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Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3023**	Course Name: **Theory of Structures**

L	T	P	Credits
3	--	--	3

Course Description:
The course 'Theory of Structures' is offered as core course in 6th semester which focuses on analysis of indeterminate structures like fixed and continuous beams and portal frames. Various methods of structural analysis like Force methods, Displacement methods and Matrix methods will be applied for analysis.

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

1. Analyze indeterminate structures using force methods- Consistent deformation method and three moment equation.
2. Analyze indeterminate structures using displacement methods- Slope-deflection equation and moment distribution method.
3. Analyze indeterminate beam and portal frame using matrix methods of analysis- Stiffness and flexibility matrix method.

Prerequisite: Knowledge of analysis of determinate structures, strength of material and structural analysis

Course Content

Unit No.	Description	Hrs.
1.	**Indeterminacy and Consistent deformation method:** Concept of degree of static and kinematic indeterminacy, degree of freedom, Consistent deformation method- fixed beam and propped cantilever with uniform section, yielding of support.	06
2.	**Three Moment Theorem:** Clapeyron's theorem of three moments, application to statically indeterminate beam, sinking of support, beam with different M.I.	04
3.	**Slope Deflection Method:** Slope deflection equation, modified slope deflection equation, sinking of support, application to beam, portal frame without and with sway. (Involving not more than two unknowns)	06

4.	**Moment Distribution Method:** Sinking of support, application to beam, portal frame without and with sway. (Involving not more than two unknowns)	**06**
5.	**Stiffness Method:** Stiffness coefficients. development of stiffness matrix, analysis of beam and portal frame (Involving not more than two unknowns)	**07**
6.	**Flexibility Method:** Flexibility coefficients, development of flexibility matrix, analysis of beam and portal frame (Involving not more than two unknowns)	**07**

References

Text Books: -

- Junnarkar S. B. and Shah, H.J., "Mechanics of Structures", Charotar Publishers.
- Ramamruthum S., "Theory of Structures", Dhanpat Rai& Sons pub.
- Bhavikatti S. S., "Structural Analysis-II", Vikas Publishing House Pvt, Ltd.

References Books: -

- Vazirani and Ratwani, "Analysis of Structures", Khanna Publishers.
- Wang C. K., "Intermediate Structural Analysis", Indian Edition, Tata McGraw-Hill Education.
- Gere and Timoshenko, "Mechanics of Materials", CBS Publisher Private Limited.

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Class: **T.Y. B. Tech. Civil Engineering**	Semester- **VI**
Course Code: **CE 3043**	Course Name: **Estimation & Contracts**

L	T	P	Credits
2	--	--	2

Course Description:
Estimating and Costing is one of the core courses offered at sixth semester of Civil Engineering undergraduate programme and it comprises of six modules. The prerequisite for this course is to possess unit conversions and the fundamental information of different materials of construction with their rates. This course intends to develop the proficiency and confidence of the students so that they can prepare estimate of different civil engineering structures. The students will be able to analyze the rate of different building items. Thus, by studying this course, students will be more comfortable to prepare different bills on construction site.

Course Learning Outcomes:
After successfully completing the course, Student will able to:
1. Apply standard requirements to prepare detailed estimate
2. Prepare detailed estimate of building,
3. Determine Rates for construction items,
4. Prepare tenders and contracts documents
5. Perform valuation of property.

Prerequisite: Basic knowledge of building drawings

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Basics of quantity Surveying- (State Schedule of Rates):** General introduction to Quantity surveying, Purpose of estimates, Types of Estimates- Approximate and Detailed, Various items to be included in estimates, Modes of measurement for different construction items, I.S.1200, Prime cost, Provisional sums, Provisional quantities, administrative approval and technical sanction to estimates. Introduction to State Schedule of Rates (SSR) general notes and guide lines.	**04**

2.	**Specifications and Detailed estimate of items:** Specification-purpose and types, General specifications for different class of buildings, Detailed specifications of building items, Measurement sheet, Abstract sheet, Long wall-short-wall and center line method for finding quantities and problems.	04
3.	**Detailed Estimate of Structures:** Detailed estimate of Buildings and Infrastructures	04
4.	**Rate Analysis:** Factors affecting the cost of materials and labors, Task work, Plants and equipment -hour costs based on total costs and outputs, transports, overhead charges, rate analysis of civil engineering items like PCC, RCC, Brickwork, Plastering, Pointing, Flooring, painting. Price escalation, preparation of bar bending schedule for isolated footings, pile footings, beams, columns, slabs, staircase, lintel, chajja.	04
5.	**Tender & Contract Documents:** Organization of Public Work Department (PWD), Tender- Notice, Documents, Procedure and Types, Contract- Types, Conditions, Earnest money, Security deposit, Validity period, Defect liability period, Liquidated and unliquidated damage, Arbitration, Escalation of cost, Daily reports maintained on site.	04
6.	**Valuation:** Necessity, Cost, Price, Value, Types of values, Depreciation and obsolescence, sinking fund, Methods of calculating depreciation, Annuity, Year purchase, Land valuation, Methods of land and building valuation, Freehold and leasehold property, types of lease, Mortgage, Mortgage deed and Precautions, Problems based on valuation.	04

References

Text Books: -

- Rangwala S. C., "Elements of Estimating and Costing", Charotar Publishing House.

References Books: -

- Dutta B.N, "Estimating and Costing in Civil Engineering", USB Publishers, Distributors Pvt. Ltd.
- Chakraborty M., "Estimating and Costing", Specification and Valuation in civil engineering, USB Publishers.
- Patil B. S., "Civil Engineering Contracts and Estimates", Universities Press Private Ltd.

Codes of Practice: -

- P.W.D. schedule of rates. Pune region
- IS-1200, code for units of measurement of items, Bureau of Indian Standard.

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Class: **T Y B. Tech Civil Engineering**	Semester-**VI**
Course Code: **CE 3063**	Course Name: **Construction Management**

L	T	P	Credits
3	--	--	3

Course Description
Technology deals with material things while management deals with both material things as well as human-beings. Planning is the most important phase of construction management. Effective management increases productivity through technological innovation. Construction management is the core course of Civil engineering. The study of this course gives insights into management of construction projects. It deals with construction management tools, resource allocation, resource leveling etc.

Course Outcomes:
After completing the course, the student should be able to: -
1. Apply the functions & principles of management.
2. Develop and analyze the network diagram for civil engineering projects.
3. Use various project monitoring and controlling methods.
4. Demonstrate AON Concept and its applications.
5. Explain principles of work study & apply it to real-time construction projects
6. Apply various techniques for inventory control.

Prerequisites: -- Fundamentals of Management, Indian Construction Industry

Course Content

Unit No.	Description	Hrs.
1.	**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	4

2.	**Project Planning & Management:** Project, categories of Projects, Objectives & importance of Project management, Agencies, Phases; Work Breakdown Structure, Project Planning - Bar Chart, Milestone Chart, CPM, A-O-A method concept, Development of CPM Network – Time Estimates, Floats, Critical Path.	8
3.	**Monitoring & Controlling techniques:** Network Compression, Network Updating, Resource allocation – smoothing and leveling,	8
4.	**Precedence Networking method:** A-O-N method concept, Development of Precedence Network, Network analysis by precedence diagramming method. PERT Method, PERT analysis, Introduction to Computer based Project Management	6
5.	**Introduction to Work Study:** Definition, objectives, basic procedure of work study, symbols, activity charts, string diagrams, Method study, time study, purpose, important steps used.	4
6.	**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, Typical Layout of few Major Construction Projects.	6

References -

Text Book:

- 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: - **T.Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **SH 3021**	Course Name: **Biology for Engineers**

L	T	P	Credits
3	-	--	3

Course Description:
The purpose of this course is to provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.

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

1. Apply biological engineering principles, procedures needed to solve real-world problems
2. Describe the functions of biological systems
3. Analyze biological phenomena and compute work done at microscale.
4. Explain working of different biomedical instruments
5. Select the sensors for given biological applications
6. Explain relevant aspect of movement control process.

Prerequisite: Nil

Course Content

Unit No	Description	Hrs.
1.	**Introduction:** Purpose of learning n biology, Characteristics of living organisms-Basic classification-cell theory, structure of prokaryotic and eukaryotic cell-Introduction to biomolecules, Important functions of carbohydrates, lipids, proteins.	06
2.	**Human Physiology:** Basic Cell structure, Blood and lymph; Circulatory system; Respiratory and Cardiovascular system, Gastro- intestinal system; Kidney and excretory system; Neuromusculara system; Sensory systems- visual, auditory.	06
3.	**Physical Biology:** Physical Properties of a globular protein, force, Forces acting on a protein molecule, Motion of Mechanical element: Mass, spring and dashpot, Motion of combination of mechanical elements.	06

4.	**Basic concepts of Medical Instrumentation:** Generalized medical Instrumentation System, Classification of Biomedical Instruments, Generalized static and dynamic characteristics, Design criteria, Biomedical transducers: optical, photo- electric, electrochemical, electrical, mechanical. Specialty areas in Bioinstrumentation—Confocal, FACS, PCR, MRI, CT, USG, Endoscopy, ECG.	**06**
5.	**Biosensors:** Introduction to Biosensors, transducers, amplifiers; Bio imaging-Introduction to medical imaging and different medical Imaging modalities; Review of Signals and system; Electro Physiological Signal Analysis. Bio-telemetry Communication in living systems by photo, bio, chemo, tactic methods; Diagnostic Devices- Radiography, Therapeutic Devices-Cardiac Pacemakers, Cardiac defibrillators, Surgical Diathermy, Diagnostic application of LASERs.	**06**
6.	**Movement Science:** Motor control and Learning, Neuro physiology of motor control, Features of system for movement production, Skeletal Systems(Joints, Bones, Ligaments), Muscle structure and its forces, Motor Units, Sensory/Perceptual Systems, Visual Systems	**06**

References –

Text Books:

- Thyaga Rajan S., Selvamurugan N., Rajesh M. P, Nazeer R. A., Richard W. Thilagaraj, S. Barathi, and. Jaganathan M. K, "Biology for Engineers", Tata McGraw- Hill, New Delhi.
- Suraishkumar G.K., "Biology for Engineers", Oxford university press.

Reference Books:

- Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, "Biochemistry", Freeman and Co. Ltd.
- Robert Weaver, "Molecular Biology", McGraw-Hill.
- Eric R. Kandel, James H. Schwartz, Thomas M. Jessell, "Principles of Neural Science", McGraw-Hill.
- R. Phillips, J. Kondev, J. Theriot, H. Garcia, "Physical Biology of the cell", Garland.

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Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3083**	Course Name: **Estimation & Contracts Laboratory**

L	T	P	Credits
--	--	4	2

Course Description
The 'Estimating and Costing laboratory' course is one of the core course offered at sixth semester of Civil Engineering undergraduate programme it comprises of four modules. The prerequisite for this course is to possess unit conversions and the fundamental information of different materials of construction. This course intends to develop the proficiency and confidence of the students so that they can prepare estimate of different civil engineering structures. Thus, by studying this course, students will be more comfortable to prepare different bills on construction site.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain mode of measurement and current market rates of civil engineering materials and labours.
2. Prepare detailed estimate of different structures like building, road, canal, culvert and factory shed etc.
3. Prepare bar bending schedule of different RCC items.

Course Content		
Expt. No.	**Name of Experiment**	**Hrs.**
1.	Assignment based on market rates of civil engineering materials and labours.	**04**
2.	Prepare detailed specification for any one item of building and any one item from other civil engineering structures	**02**
3.	Detailed estimate of G+1residential building (Minimum area should be 100 sqm including advance construction materials).	**16**
4.	Preparing detailed estimate for any one of the following: a. Road about1Km.long including earthwork. b. Canal about1Km.long. c. Culvert d. Factory shed of steel frame.	**16**
5.	Preparation of bar bending schedule of different building components such as slab, beam, column, staircase, lintel, chajja etc.	**04**
6.	Preparation of rate analysis of PCC, RCC, Brickwork, Stone masonry plastering and pointing item.	**04**
7.	Prepare valuation report for a building	**02**

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References

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- Chakroborty M., "Estimating, Costing, Specification and Valuation in civil engineering", USB Publishers.
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Class: **T. Y. B. Tech Civil Engineering**	Semester-**VI**
Course Code: **CE 3103**	Course Name: **Design of Steel Structures Laboratory**

L	T	P	Credits
-	--	2	1

Course Description
This course is introduced to design the steel structural members and structure as a whole according to the limit state design concept. The behavior and design of tension members, compression members, laterally restrained and unrestrained beams, beam-columns and design of connections will be performed. Students are expected to design industrial shed and to prepare structural drawings.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Analyze and design steel industrial shed using STAAD-Pro software.
2. Interpret the results obtained from the software.
3. Prepare structural drawing of steel industrial shed.

Prerequisites: Basic knowledge of mathematics, structural analysis and strength of material.

Laboratory work consists of detailed structural design and drawing of industrial shed consisting of roof truss, purlins, gantry girder, columns and column bases following IS: 800-2007 and using STAAD-Pro software.

References:
Text Books:
- Duggal S.K., "Design of Steel Structures", Tata Mc-Graw Hill publishing company Ltd.
- Sairam K. S., "Design of Steel Structures", Pearson publication.
- Shah V. L. and Gore V., "Limit State Design of Steel Structures", Structures Publication.

Reference Books:
- Subramanian N., "Design of Steel Structures", Oxford University Press.
- Dayaratnam S., "Design of Steel Structures", Wheeler Publishing.
- Chandra R., "Design of Steel Structures", Standard Book House

Codes of Practice:
- IS: 800 (2007), General Construction in Steel — Code of Practice, Bureau of Indian Standards.

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- 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.

Class: **T.Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3123**	Course Name: **Technical Aptitude IV**

L	T	P	Credits
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Course Description:

Technical Aptitude IV consists of multiple-choice questions (MCQ) based on following courses.

1. Theory of Structures
2. Estimation and Contracts
3. Construction Management

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Class: - **T.Y. B. Tech**	Semester-**VI**
Course Code: **SH304**	Course Name: **Psychology for Engineers**

L	T	P	Credit
1	-	--	1

Course Description:
All organizations are run by people. The functioning of an organization depends upon how people think, work and behave in the organization. Human behavior in organizations is highly unpredictable, it is so because it arises from people's deep-seated needs and value systems. However, it can be partially understood in terms of the framework of psychology, behavioral science, management and other disciplines. There is no idealistic solution to organizational problems. All that can be done is to increase our understanding and skills so that human relations at work can be enhanced to increase effectiveness and efficiency.
This course provides an introduction to the area of psychology known as Engineering, Organizational Psychology. This addresses the human development process in terms of human behavior from psychological perspective. The overall goal of this course is to assist the students in understanding the Engineer-at-Work concept and the interaction of psychological, professional and cultural systems and the reciprocal impact on human Behavior.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Interpret human behavior as a system from a psychological perspective.
2. Appraise the various factors affecting human behavior at work.
3. Apply behavioral theories to manage/lead people and emotions at work.

Prerequisite: No prerequisite.

Course Content		
Unit No	**Description**	**Hrs**
1	**Engineer at Work:** Introduction- Nature and Development of Engineering/Industrial/Work psychology, Scope & Challenges, Current status, Role of Technology Individual Differences: Cognitive and Neuroergonomic Perspective,	05

	Personality, Intelligence, Creativity & Innovation, Perception, Attitudes and Mindsets, Motivation- Need for achievement (N-Ach), Expectancy Theory & Equity Theory, Modern Approach to Motivation.	
2.	**Factors Affecting Behavior** Mental Workload, stress and individual differences, Working Conditions- Physical & Psychological. Safety & Health Practices at Workplace-Accidents, Violence, Harassment, addictions. Managing Change, Stress at Workplace- Individual Responses to Stress; 3 Cs of Stress- Causes, Consequences & Coping with Work Stress. Relationships at workplace, Issues, Developing Effective Relationships, Diversity at Workplace- Cultural Differences (Multiculturalism, Work related Attitude, Team work)	**07**
3.	**Emotional Intelligence for Engineers:** The Relationship between EQ and IQ, Consequences of Low and High EQ. Recognizing Emotions, Empathizing with Others, Developing High Self-esteem, Managing Emotional Upsets, Emotional 'Winner', Art of Influencing People, Managing Anger, Conflict Management, other related areas.	**04**

References

Text Books:

- Fred Luthans, "Organizational Behavior: An Evidence-Based Approach", McGraw-Hill
- Keith Davis, John W. Newstrom, "Human Behaviour at Work", McGraw-Hill Education
- Frank J. Landy, Jeffrey Conte, "Work in the 21st Century", John Wiley & Sons, Inc
- Dalip Singh, "Emotional Intelligence at Work-A Professional Guide", Sage Publications, New Delhi

Reference Books:

- Daniel Kahneman, "Thinking fast and slow", Penguin Books, UK
- Steve M. Jex and Thomas, W. Britt, "Psychology- A Scientist-Practitioner Approach", John Wiley & Sons, Inc
- Christopher D. Wickens and Justin G. Hollands, "Engineering Psychology and Human Performance", Routledge Publication, London
- Theodore Millon, Melvin J. Lerner, "Handbook of Psychology- Personality and Social Psychology", John Wiley & Sons, Inc.

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Class: **-T.Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3143**	Course Name: **Capstone Project Phase-I**

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

Course Outcomes:

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

1. Function efficiently as an individual and in a group with the capacity to be a leader
2. Identify gap and analyze the social, cultural, global and environmental issues related to civil engineering.
3. Design and conduct experiments and interpret data.
4. Develop technical material through oral presentations and reports and commit to professional ethics and responsibilities in civil engineering practice.
5. Develop interest to carry out research in civil engineering.

General guidelines:

The capstone project phase-I of this semester carries two credits. The project group need to form the project phase-I and that will be continue to work in VII semester and submit the completed project work to department by the prescribed data usually two weeks before the end of VII semester as mentioned below:

1. Executed Project
2. Project report

The capstone project phase-I report should be prepared using the format provided. Students should complete regularly progress work and get the approval from DPC.

Project Evaluation:

The students shall be evaluated individually and groupwise for his/her project through the quality of work carried out, the novelty of the concept, the report submitted and presentation etc.

The ISE evaluation of capstone project phase-I will be carried out for 100%. The assessments are carried out as per the rubrics given to the guides.

The ISE evaluation will be done as per schedule given by COE for 100%, where students have to present their entire project work carried out throughout the Sem-VI. The evaluation will be done by panel of examiner containing guide and a faculty appointed by DPC.

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Class: - **T.Y. B. Tech**	Semester-**VI**
Course Code: **SH 3063**	Course Name: **Scholastic Aptitude -II**

L	T	P	Credits
2*	-	-	2

Course Description:
Quantitative and Reasoning tests form a major part of most of the competitive exams and recruitment processes. They evaluate numerical ability and problem-solving skills of candidates. Along with the arithmetic abilities, candidate's patience while reading through the question is also tested. Decision making is also a crucial part of the process with a question having multiple solutions and the candidate has to choose the most efficient one.
The course includes the tricks used for fast calculations which is an integral part of a student's career, calculating the remuneration and efficiency, estimating profits and interests on the principal, using a logical approach towards solving a problem is now a routine affair for a professional.

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

1. Develop a logical approach towards solving Aptitude and Reasoning problems.
2. Analyze usage of basic aptitude terms of percentages, averages, ratios and applications of business aptitude terms of profits and interests.
3. Develop a bridge in analogies, series and visualizing directions.
4. Apply various short cuts & techniques to manage speed and accuracy to get equipped for various competitive and campus recruitment exams.

Prerequisite: Fundamentals of various Mathematical and Arithmetic operations, Calculations.

Course Content

Unit No	Description	Hrs.
1.	**Speed Time Distance:** Average Speed, Special Cases of Average Speed, Relative Speed, Cases of relative speed, Circular motion, Applications of STD	03

2.	**Trains:** Stationary Object with Negligible length, Stationary Object with considerable length, moving object with negligible length, moving object with considerable length, Including-Excluding Stoppages.	03
3.	**Boat & Streams:** Upstream case, Downstream case, Perpendicular movement	03
4.	**Races:** Head Start, Dead heat, defeat,3 man participating in race, ratio related examples	03
5.	**Permutation & Combination:** Difference between P & C, Theorems of Permutation Theorems of Combination, Counting numbers of squares & rectangles, Triangle	03
6.	**Geometry:** Triangles, Quadrilaterals, Circles, Polygons	03
7.	**Mensuration:** Cube, Cuboid, Cylinder, Cone Sphere, Prism	03
8.	**Blood Relation:** Symbols for genders and different relations, Generation tree diagram, Symbolic/coded blood relation, Complex problems	03
9.	**Clock:** Basic, Time lag constant, Standard time of coincidence, Various concepts of hour and minute hand, Questions on strikes of clock, Find time in the mirror, Questions based on faulty clock, Time gains or loss	03
10.	**Calendar:** Leap year, Odd day concept, Month code, century codes, Same Calendar concept, Finding day or date (Box method)	03
11.	**Seating Arrangement:** Type of arrangements, Types of information, Data extraction, Linear-Non-Linear movement, Advance movement	03
12.	**Complex Arrangement:** Combination of 2 or more topics, Scheduling of events/months/Days/Years/ lectures, Seating arrangement, Tabular arrangement, Checklist method, Tabular Method (comparison)	03
13.	**Number System:** Basics, Base System, Exponents, LCM and HCF, Factors, Cyclicity	03

14.	**Data Sufficiency:** Two statements, Five options, Blood relation, Direction sense, Seating arrangement, Coding decoding, Order, ranking / Comparison, Syllogism, Complex arrangement, Puzzles, Ages, Calendar	**03**
15.	**True False Statement** Types of statements, matrix pattern, Comparison between different elements, Questions based on no. of persons and statements	**03**
	Total Hours	**45**

References:

Reference Books:

- Aggarwal R. S., "Quantitative Aptitude", S Chand Publishing, New Delhi.
- Aggarwal R. S., "Logical Reasoning", S Chand Publishing, New Delhi.
- Sharma Arun, "Quantitative Aptitude", McGraw Hill Publishing, New Delhi
- Sharma Arun, "Logical Reasoning", McGraw Hill Publishing, New Delhi

***Note: One Extra lecture will be allotted in the time table.**

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Class: - **Third Year B. Tech**	Semester-**VI**
Course Code: **CE 3163**	Course Name: **Design of Industrial Structures**

L	T	P	Credits
3	---	--	3

Course Description:
This is introduced at the second semester of T Y B Tech Civil Engineering as program elective II. This covers the design of industrial buildings, transmission towers, water tanks, truss bridge. This course intends to build the competency in the students to analyze and design the steel industrial structures.

Course Learning Outcomes:
At the end of the course, the student will be able to:
1. Design industrial buildings, beam columns
2. Design open web sections
3. Design steel towers, water tanks, truss bridge

Prerequisite: This course requires the knowledge of structural analysis and design of basic structural elements of steel structures

Course Content		
Unit No.	**Description**	**Hrs.**
1	**Industrial buildings:** Structural framing, knee bracing of columns, design of purlins, girts and eave strut, plane trusses, open web steel joists.	06
2	**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
3	**Design of Open web sections:** Open web sections, application area, mechanical behavior of beams with web openings, Design of Castellated beams.	06
4	**Steel towers:** Introduction, Material Properties, Clearances and Tower Configurations, Factors of Safety and Load, Tower Design	06

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5	**Design of bridges:** Introduction, classification of steel bridges, loads and load combinations, analysis of truss girder bridges, design of truss bridges.	**06**
6	**Steel water tanks:** Design of steel water tank, bottom plates, joints, ring girder, design of staging and foundation.	**06**

References:

Text Books:

- 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: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3183**	Course Name: **Repair and Rehabilitation of Structures**

L	T	P	Credits
3	--	--	3

Course Description:
Concrete structures are subjected to constant deterioration due to effects of ageing, inadequate maintenance, severe environmental exposure, penetration of catalytic agencies such as moisture, gases like CO_2 & oxygen, chloride ions, industrial pollutants etc. This deterioration needs to be timely arrested before it leads to irreparable damage making it very important to repair and upgrade (retrofit/strengthening) the current stock of deteriorated and deficient structures. This course has been designed with an aim to give the students an insight into the subject of concrete repair, its protection and strengthening. Also, the course focuses on various facets of maintenance and repairs of existing damaged structures.

Course Learning Outcomes:

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

1. Diagnose the causes of distress and deterioration of concrete structure
2. Describe the procedures of various repair techniques or methods.
3. Suggest appropriate materials and techniques for repair and strengthening structures/elements
4. Prepare a report on condition assessment of buildings based on observations

Prerequisites: Basic concepts and principles of Concrete Technology, Structural Analysis, Design of Reinforced Concrete structure, Earthquake Engineering are required.

Course Content

Unit No.	Description	Hrs.
1.	**Introduction:** Need for Repair and Rehabilitation of structures, distress in structures. Definitions and terminologies, deterioration of RC structures, physical, chemical and other causes.	06
2.	**Condition Assessment of Structures:** Condition assessment of concrete structures, exposure conditions, stages visual inspection, on situ and laboratory testing of concrete, Interpretation	06

	and reporting of NDT results, preparation of report, Case studies of condition assessment of distressed due to corrosion, fire, leakage, earthquake, landslide	
3.	**Service Life Prediction methods:** Introduction, service life, types, parameters affecting service life, methods for prediction of service life viz. life 365 software.	**04**
4.	**Repair Materials:** Factors considered in the selection of repair method, repair stages. Materials for repair: desirable properties of materials, special mortar and concretes, concrete chemicals, special cements and high-grade concrete – expansive cement, polymer concrete, admixtures of latest origin	**06**
5.	**Repair Materials:** Cement based repair materials, polymer modified repair materials, resin-based products, micro concrete, composites	**07**
6.	**Repair Techniques and strengthening of structures:** Repairs using mortars, Dry pack and Epoxy bonded dry pack, preplaced aggregate concrete, gunite or shotcrete, grouting, polymer impregnation, resin injection, routing and sealing, stitching, surface patching. shoring and underpinning Strengthening techniques: section enlargement, composite construction, post tensioning, flexural and shear strengthening of beam, strengthening of columns, footings	**07**

References:

Text Books:

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

Reference Book:

- Denison C., Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical.
- Allen R.T. & Edwards, S.C, "Repair of Concrete Structures", Blakie and Sons.
- Ravishankar K., Krishnamoorthy, T.S., "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers.
- Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India.

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Class: **T. Y. B. Tech. Civil Engineering**	Semester-VI
Course Code: **CE 3203**	Course Name: **Construction Economics and Finance**

L	T	P	Credits
3	--	--	3

Course Description
With the changing paradigm of the construction industry, and introduction of different contracting models, with the government trying to play more of a regulatory role and withdrawing from financial commitments, and the space being occupied by financial institutions, civil engineers in the modern day are expected to be familiar with basic accounting and finance. For any construction project to be successful, it must be technically sound and the resulting benefits must exceed the cost associated with the project. This course "Construction Economics and Finance" basically aims at describing various aspects of engineering economics. The field of construction economics and finance deals with the systematic evaluation of cost and benefit associated with different projects. This course will definitely help the students in understanding the underlying principles and concepts in construction economics and finance.

Course Learning Outcomes:
After completion of the course, the student will be able to: -
1. Identify appropriate economic alternatives.
2. Calculate depreciation and taxes for economic analysis.
3. Select appropriate alternative related to equipment.
4. Discuss methods of estimate.
5. Discuss basics of financial management.

Prerequisites: Nil

Course Content

Unit No.	Description	Hrs.
1.	**Engineering Economics:** Basic principles – Time value of money, Quantifying alternatives for decision making, Cash flow diagrams, Equivalence- Single payment in the future (P/F, F/P), Present payment compared to uniform series payments (P/A,A/P),	06

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	Future payment compared to uniform series payments (F/A,A/F),Arithmetic gradient, Geometric gradient.	
2.	**Comparison of alternatives:** Present, future and annual worth method of comparing alternatives, Rate of return, Incremental rate of return, Break-even comparisons, Capitalized cost analysis, Benefit-cost analysis.	06
3.	**Depreciation:** Inflation and Taxes: Depreciation, Inflation, Taxes.	06
4.	**Equipment Economics:** Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis.	06
5.	**Cost estimating:** Types of Estimates, proximate estimates – Unit estimate, Factor estimate, Cost indexes, Parametric estimate, Life cycle cost.	06
6.	**Financial management:** Construction accounting, Chart of Accounts, Financial statements – Profit and loss, Balance sheets, Financial ratios, Working capital management	06

References-

Text Books:

- Peurifoy R. L., Schexnayder, C. J. and Shapira, A., "Construction Planning, Equipment and Methods", Tata McGraw-Hill.
- Prasanna C., "Projects: Planning, Analysis, Selection, Financing, Implementation, and Review", McGraw Hill Education.

Reference Books:

- Blank L. T. and Tarquin A. J., "Basic Engineering Economy", WCB/McGraw-Hill.
- Jha K. N., "Construction Project Management", Theory and Practice, Pearson.

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Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3223**	Course Name: **Disaster Management**

L	T	P	Credits
3	--	--	3

Course Description
All countries face a wide range of hazards, both natural and man-made, that have the potential to result in catastrophic damage. Despite actions taken by local emergency management professionals, international trends show that the economic and social impact of disaster has increased around the world. This is especially true in the developing world, where large-scale disasters can result in enormous loss of life as well as considerable economic damage.

Course Learning Outcomes:
After completion of the course, the student will be able to: -
1. Analyze effects of natural and manmade disasters.
2. Demonstrate disaster management program.
3. Analyze vulnerable conditions and risk assessment.
4. Construct layout for sanitary landfill site and composting site
5. Describe stakeholder's role in disaster response.

Prerequisites: Environmental Science

Course Content

Unit No.	Description	Hrs.
1.	**Natural Disasters:** Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion	06
2.	**Manmade Disasters:** Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents.	06

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3.	**Disaster Management:** Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.	06
4.	**Risk Assessment and Vulnerability Analysis:** Disaster preparedness plan, use and application of emerging technologies, role and responsibilities of various agencies and mitigation strategies	06
5.	**Disaster Response:** Immediate impact and post-impact phase of disasters, Disaster Response Plan, Communication, Participation, and Activation of Emergency Preparedness Plan, Logistics Management, Needs and Damage Assessment, Disaster Response: Central, State, District, and Local Administration, Role of Multiple Stockholders in Disaster Response.	06
6.	**Rehabilitation, Reconstruction and Recovery:** Damage Assessment, Role of Various Agencies in Disaster Management and Development, Information Management Structure, Parameters of Vulnerability, Development of Physical and Economic Infrastructure, Creation of Long-term Job Opportunities and Livelihood Options, Role of Housing/Building Authorities, Education and Awareness, Long-term Recovery, Long-term Counter Disaster Planning	06

References-

Text Books

- Reiter L., "Earthquake Hazard Analysis: Issues and Insights", Columbia University Press.
- Mileti D.S., "Disasters by Design: A Reassessment of Natural Hazards in United States", The National Academic Press.

Reference Books

- Mac Daniels, T.L. and Small M.J. (eds.), "Risk Analysis and Society: An Interdisciplinary Characterization of the Field", Cambridge University Press.
- Singh R.B. (Ed), "Disaster Management", Rawat Publication.

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Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3243**	Course Name: **Air Quality Monitoring and Modelling**

L	T	P	Credits
3	--	--	3

Course Description
As a comprehensive course, it introduces the effects of air pollutants on human beings and environment, the sources of air pollution, and the physical and chemical behavior of pollutants in the atmosphere. Also, it covers legislation and regulation; control technologies and future trends toward preventing air pollution.

Course Learning Outcomes:
After completion of the course, the student will be able to: -
1. Illustrate structure of the atmosphere Air Pollution, Scales of air pollution
2. Interpret impact of air pollution on natural and artificial elements.
3. Analysis of air quality parameters by using air quality monitoring methods
4. Design Stack height for pollution control.

Prerequisites: Environmental Science

Course Content		
Unit No.	**Description**	**Hrs**
1.	**Structure of Atmosphere:** Study of bio-sphere and atmospheric structure, Scales of air pollution, Sources of air pollution: natural and artificial, classification of pollutant, quantity and composition of particulate & gaseous pollutant, Units of measurements, etc	**06**
2.	**Sources and Effects of Air Pollution**: Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles. Revise to application level	**06**
3.	**Transport of Air Pollution:** Elements of atmosphere and dispersion of pollutants – Meteorological factors – Wind roses – Lapse rate – Atmospheric stability and turbulence – Plume rise – Dispersion of pollutions – Gaussian dispersion models – Applications.	**06**

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4.	**Control of Air Pollution:** Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment, gaseous pollutant control by adsorption & absorption, condensation, combustion – Pollution control for specific major industries.	**06**
5.	**Air Quality Management and Modeling:** Air quality standards – Air quality monitoring – Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment – Methods, Live case of Delhi air pollution.	**06**
6.	**Noise Pollution and Control:** Sound and Noise: Sources of noise pollution – environmental and industrial noise; effects of noise pollution - fundamentals of sound generation - propagation, sound measurement - sound level meters – types, components, Noise prevention & control measures, environmental and industrial noise - noise control legislation	**06**

References: -

Text Books: -

- Rao M. N. and Rao H. N., "Air Pollution and Control" MC Graw Hill Publication.

References Books: -

- Peavy H.S, Rowe, D.R, Tchobanoglous, G., "Environmental Engineering", Mc-Graw -Hill International Editions.
- Wark and Warner, "Air pollution and Control", McGraw-Hill publication.
- Ross R. D., "Air Pollution and Industry", New York: Van Nostr and Reinhold Company

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Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3263**	Course Name: **Railway and Airport Engineering**

L	T	P	Credits
3	--	--	3

Course Description
Good network of Railway and airport plays an important role progress of the country. This course is expected to develop the competency to execute the construction and maintenance of rail and airport transport system.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Design of geometric component of rail transport system.
2. Analyze needs of modern rail system.
3. Design of runway and taxiway
4. Carry out airport planning

Prerequisites: Nil

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Introduction to Railway Engineering:** History of Indian Railways, Component parts of railway track, recent development in railways specifically w.r.t. track structure, Organizational structure of Indian railways, railway lines classification based on speeds, types of sleepers and ballast, rail gauge	06
2.	**Railway Design and Maintenance:** Geometric design of track, sleeper density, Points and Crossing, Signaling, Interlocking, Tracking Power and Resistance	06
3.	**Modern Railway:** Metro railway, mono rail, semi and high-speed train, magnetically elevated train, cargo train, types of wagons.	06

4.	**Airport Planning:** Aircraft characteristics, airports site selection, survey and drawings for airport planning, Major Terminal Components, Objectives in Selecting Terminal Concepts, Airport Master Plan, Factors influencing Terminal Configuration and Size, Forecasts, Terminal Apron Areas.	**06**
5.	**Airport Layout:** Characteristics of good layout, runway configuration, imaginary surfaces, location of terminal buildings, aprons and hangers, Zoning requirements regarding permissible heights of construction and landing within the airport boundary, planning aspect of important airports in the world.	**06**
6.	**Runways and Taxiways:** Runway Location and orientation, wind coverage, use of wind, rose diagram, Basic runway length, geometric design standards, Taxiway System and Aprons, Exit Taxiways, By Pass Taxiways, sight-distance, turning radius and rate of change of longitudinal gradients, Airport Lighting and Markings, VFR Approach and Departure Paths.	**06**

References

Text Book:

- Saxena S.C., Arora S.P., "A Text Book of Railway Engineering", Dhanpat Rai and Sons.
- Khanna S.K., Arora M.G., Jain S. S, "Airport Planning and Design", Nem Chand and Brothers.

Reference Books:

- Robert Horonjeff, Franscis, S. McKelvey, William, J. Sproule, Seth B. Young, "Planning and Design of Airports", McGraw Hill.

Codes of Practice:

- IRC: 6 (1974), Standard Specifications and Code of Practice for Road Bridges, Section II, Indian Roads Congress, 3rd Revision.
- IRC: 5(1998), Standard Specifications and Code of Practice for Road Bridges, Section I, Indian Roads Congress, 6th Revision.

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Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE3283**	Course Name: **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 must be 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. Compute stress distribution in soil using different theories.
3. Design shallow and deep foundation on different types of soil.
4. Analyze stability of slope using different slope stability analysis techniques.
5. Compute lateral earth pressure for different conditions of soil.

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

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.	**Stress Distribution in Soil:** Boussinesq theory- point load, pressure distribution due to line load, strip load, pressure bulb, Vestergaard's theory, contact pressure, approximate stress distribution method.	06
3.	**Shallow Foundation:** Definition, types and their selection. Assumptions and limitations of rigid design analysis. Design of isolated, combined, strap footing (rigid analysis), Raft foundation (elastic analysis,), concept of floating foundation, Types of settlement.	06

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4.	**Pile Foundation:** Pile classification, Load carrying capacity of pile using static and dynamic methods, Pile load test, Group action, Efficiency of pile group, Negative skin friction, Settlement of single and group of piles, Under reamed pile foundation, Introduction to well foundation.	**06**
5.	**Lateral Earth Pressure:** Earth pressure on vertical wall, Rankin's theory, lateral earth pressure due to submerged backfill, backfill with uniform surcharge, backfill with sloping surface, Coulomb's theory.	**06**
6.	**Stability of Earth Slopes:** Slope classification, modes of slope failure. Infinite slope in cohesive and cohesion less soil, Taylor's stability number, Friction circle method, Landslides.	**06**

References –

Text Books: -

- Arora K. R., "Soil mechanics and Foundation engineering", Standard Publishers Distributers.
- Punmia B. C., Jain A. K., Jain, A. K., "Soil mechanics and Foundation engineering", Laxmi Publications Pvt. Ltd.
- Singh A., "Soil mechanics in theory and practice", Asian Publishing House.

References Books: -

- Murthy V.N.S., "Soil Mechanics and Foundation Engineering", UBS Publishers and Distributors.
- Gopal Ranjan and Rao A.S.R., "Basic and Applied Soil Mechanics"- New Age International (P) Ltd.
- Purushottam Raj., "Geotechnical Engineering", Tata McGraw Hill Co. Ltd.

Class: **T.Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE3303**	Course Name: **Advanced Wastewater Engineering**

L	T	P	Credits
3	--	--	3

Course Description
The course is meant to give a more thorough theoretical understanding of the various unit processes used in wastewater treatment than what is given in the core course. A focus is given on physical and chemical processes such as; coagulation/ flocculation and precipitation processes, oxidation processes, particle separation processes and membrane separation processes. An emphasis will be made on in depth understanding of the unit processes and the application of this in research-based projects.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Explain need of wastewater treatment for sustainable development.
2. Explain importance of wastewater analysis in waste treatment
3. Prepare layout of wastewater treatment plant
4. Design wastewater Treatment scheme for rural/urban area
5.Calculate efficiency of wastewater treatment system

Prerequisites: Basic knowledge of science, Environmental Engineering subject

Course Content

Unit No.	Description	Hrs.
1.	**Introduction:** Wastewater Treatment, need of wastewater treatment in pollution control, component parts of wastewater treatment systems, difference between centralized and decentralized wastewater treatment, Emerging trends in wastewater treatment, Development of flowsheet for layout of wastewater treatment system, Environmental legislation, Role of SBCB, CBCB & MoEF, stream and effluent standard.	6
2.	**Primary Treatment of wastewater:** Flow chart on Community wastewater treatment system, screenings, grit chamber, Oil and Grease removal, Aeration, Equalization basin, primary and secondary settling tanks and design.	6

3.	**Secondary Treatment (Aerobic):** Definition, Significance in Biological treatment and their determination. Aerobic treatment (Activated Sludge Process and its modifications, tricking filter and Rotating Biological Contactor)	6
4.	**Low-cost wastewater treatment systems:** Basics of low-cost wastewater treatment, advanced baffle wall reactor, Waste Stabilization Pond, Oxidation Pond, Aerated lagoon, constructed wetland	6
5	**Secondary Treatment (anaerobic):** Definition, Significance in Biological treatment and their determination. anaerobic treatment (Up-flow anaerobic sludge blanket Reactor (UASBR), sludge treatment: Sludge drying bed and biogas for energy generation from waste	6
6.	**Emerging trends in wastewater Treatment:** Sequential Batch Reactor(SBR), Membrane Bioreactor (MBR), Movable membrane bioreactor technology(MBBR), Septic tanks, two-pit latrines, Eco-toilet, soak pits, constructed wetland.	6

References:

Text Books:

- Modi P. N., "Sewage Treatment & disposal and wastewater treatment", Standard Book House. New-Delhi
- Punmia B. C., Jain A. K and Jain A. K. "Wastewater Engineering" (Environmental Engineering-II), Laxmi Publishers, New-Delhi.
- Garg S. K., "Sewage Waste Disposal and Air Pollution Engineering", Khanna Publication.

References Books: -

- Ministry of Urban Development, New Delhi Manual on Water Supply and Treatment.
- Metcalf and Eddy, Wastewater Engineering, Treatment disposal and reuse, Tata McGraw-Hill.
- Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development

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Class: **T.Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **OE 3063**	Course Name: **Environmental Impact Assessment**

L	T	P	Credits
3	--	--	3

Course Description
Environmental Impact Assessment deals with definitions and concepts, rationale and historical development of EIA, EIA in Engineering, Initial environmental examination, environmental impact statement, environmental appraisal, environmental impact factors and areas of consideration, measurement of environmental impact, organization, scope and methodologies of EIA, status of EIA in India.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Study and apply EIA methods.
2. Analyse the all projects by using Environmental Impact assessment tool.
3. Provide solution for decision making in Industrial development Problem.
4. Prepare EIA report for submission to concerned authority.

Prerequisites: Environmental science course

Course Content

Unit No.	Description	Hrs.
1.	**Evolution of EIA:** Environmental Impact Assessment: Introduction, Stages of EIA, Origin of EIA, Establishments of Procedure: Legislative Option, Project Screening for EIA, Methods, Projects thresholds, Sensitive area criteria Matrices. Scope studies for Environmental Impact Studies (EIS). Preparation for EIS Planning, Public Participation and Review of EIS.	6
2.	**Methods for Impact Assessment:** Background information, interaction matrix methodologies, network methodologies, mathematical modelling, environmental setting, environmental impact assessment methodology, documentation and selection process, environmental indices and indicators for describing affected environment, Life cycle assessment	6

3.	**Prediction and Assessment of Impact for Air and Noise Environment:** Basic information of air quality, identification of type and quantity of air pollutant, existing air quality and air quality standards, impact prediction and assessment, mitigation. Basic information of noise, existing noise levels and standards, prediction of noise levels and assessment of impact, mitigations	6
4.	**Prediction and Assessment of Impact for Water and Soil Environment:** Basic information of water quality (Surface water and ground water), water quality standards, identification of impact, prediction of impact and assessment, mitigations. Background information of soil environment, soil and ground water standards, prediction and assessment of impact for ground water and soil, mitigations.	6
5	**Prediction and Assessment of Impact on Cultural and Socioeconomic Environment:** Basic information on cultural resources, rules and regulations for cultural resources like archaeological, historical structures, Cultural system, prediction and assessment of impact, mitigations. Basic information of socioeconomic environment, description of existing socioeconomic environment, prediction and assessment of impact, mitigation, resettlement and rehabilitation.	6
6.	**Decision Methods for Evaluation of Alternative:** Categorization of Industries for seeking environmental clearance from concerned authorities, procedure for environmental clearance, procedure for conducting environmental impact assessment report, Rapid and Comprehensive EIA, general structure of EIA document, Environmental management plan, post environmental monitoring.	6

References:

Text Books:

- Canter R.L., "Environmental Impact Assessment", McGraw Hill International Edition.
- Barthwell R. R., "Environmental Impact Assessment", New Age International Publishers

References Books: -

- Abbasi, "Environmental Impact Assessment", McGraw Hill International Edition
- Rau J. G. and David C. Wooten (Ed), "Environmental Impact Analysis Handbook", McGraw Hill Book Company.

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Class: **T.Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **OE 3083**	Course Name: **Material Management**

L	T	P	Credits
3	--	--	3

Course Description
Any engineering project can only be completed consuming resources. Project materials constitute major portion of project cost averagely to the tune of 65%, over and above this @ 10-15 % cost goes in management of these materials. Engineering refers to providing optimized solutions. Research shows that 1% saved through materials management is equal to 6-10 % increase in sells volume. This course floated as open elective at VIII semester of B. Tech. would be applicable to all branches, as materials and their management is required by all disciplines. This course will help students to find, procure, store, manage and utilize materials in an optimized manner. Students will also be familiar with international purchase, negotiation and decision making related to materials.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Plan and control materials for a project,
2. Use codification and standardization processes,
3. Perform material procurement and material storage,
4. Apply inventory control techniques for material management,
5. Apply MRP logic and systems for MM.

Prerequisites: Basic knowledge of the materials as a resource, basic mathematical operators

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Introduction to Material Management:** Importance of materials management, Materials function, Need of Integrated Concept, Scope of material management, Organizing materials management, Types of materials, span of Control.	6
2.	**Purchasing and vendor development:** Functions, steps, purchasing cycle. Types of buying, Details of International buying, Procedure, Relevance of Good Supplier – Need for Vendor Evaluation- Goals of **Vendor** Rating- Advantages of Vendor Rating – Cost-ratio Method –Forced Decision Matrix, Negotiation.	6

3.	**Warehousing and stores management:** Layout of stores and warehouse, material handling in stores, physical control of stocks: obsolete, surplus and scrap management, accounting and record keeping of stores	6
4.	**Codification and standardization:** Standardization and simplification, Aim, pro's and con's and scope of standardization, classification and levels of standards, Classification and codification, Nature of codification, Process and advantages of Codification	6
5	**Inventory Management and Control:** ABC analysis- advantages, mechanism, purpose, objectives Importance & Scope of Inventory Control, Types of Inventories, Costs Associated with Inventory, Inventory Control, Selective Inventory Control, Economic Order Quantity, Safety Stocks	
6.	**Materials requirement Planning (MRP):** Introduction, objectives, Terminology, Functions served by MRP, MRP Logic, systems and output, Management information form, Lot size consideration, Introduction to Manufacturing resource planning (MRP II).	6

References:

Text Books:

- Tony Arnold J. R., Stephan Chapman and Lloyd Clive, "Introduction to Materials management", Pearson publication.
- Dr. Sadiwala C. M. and Sadiwala R. C., "Material's and Financial Management" New Age International (P) Ltd., Publishers

References Books: -

- Telsang M. T., "Industrial engineering and production management", S. Chand publication.
- Dutta A.K., "Materials Management-Procedures", Pearson publication.
- Subramanian N., "Inventory Management – Principles and Practices", Excel

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE4013**	Course Name: **Design of Reinforced Concrete Structures**

L	T	P	Credits
3	-	-	3

Course Description:
Design of Reinforced Concrete Structures is offered as core course in 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. Consequently, every civil engineer must have sufficient knowledge of concrete and Reinforced Concrete elements and structures. Without good knowledge of design of concrete structures, a civil engineer will be incomplete.
The course includes design of various R.C.C. elements like slab, beam, column, staircase and footings etc. The design is based on limit state method and guidelines provided by IS 456 (2000): Plain and Reinforced Concrete - Code of Practice.

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

Prerequisite: Knowledge of structural analysis and strength of material.

Course Content

Unit No.	Description	Hrs.
01	**Design philosophies, LSM:** Design philosophies. Limit State Method: Limit State of Collapse, Serviceability, Design of singly reinforced beams.	06
02	**Doubly reinforced beams and flanged sections:** 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
04	**Shear, bond and torsion in beams:** Shear in beams, Cracks, Modes of failure, Critical sections for shear, Design	06

	for Shear reinforcement. Types of bonds, curtailment in bars. Detailing of reinforcement, Design of beams in torsion.	
05	**Design of column:** 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:

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.

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).

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Class: **Final Year B. Tech Civil**	Semester-**VII**
Course Code: **CE4033**	Course Name: **Construction Equipment and Methods**

L	T	P	Credits
2	--	--	2

Course Description:
Construction equipment and methods is a core subject, this subject deals with construction methods and equipment used on construction projects. This course is designed to fulfill the requirements of construction managers to select appropriate equipment based on the construction technique and site condition. Major emphasis in the course is on various earthwork operations and equipment and equipment performance. Also this course discusses various commonly used techniques on construction projects.

Course Learning Outcomes:
After completing the course, the student should be able to: -
1. Plan equipment/plants utilization for construction activities,
2. Perform productivity and economic analysis of equipment,
3. Develop method statement for construction task,
4. Discuss equipment requirement for construction task.

Prerequisites: Nil

Course Content

Unit No.	Description	Hrs.
01	**Equipment economics** Selection of equipment, equipment economics, site access, construction services. Manual Vs Mechanical construction. Planning for construction.	4
02	**Earth work Equipment** Process of earthwork, equipment for earthwork, cycle time of earth work equipment (Dozer, Hoe, Shovel, Loader, Hauling equipment, scrapper, compacting equipment)	4
03	**Hard rock excavation** Ripping, definition, process. Drilling equipment, splitting equipment, Excavation by Blasting, Blasting materials.	4
04	**Productivity Analysis** Productivity of Earthwork equipment. (Dozer, Hoe, Shovel, Loader, Hauling equipment)	4

05	**Dewatering and Groundwater control** Introduction to dewatering, Methods of dewatering, Installation of dewatering and groundwater control systems.	4
06	**Pile construction** Introduction to piling, Pile classification, Pile installation methods & equipment.	4

References:

Text Book:

- R. L. Purifoy, "Construction planning equipment and methods", McGraw Hill Book
- Frank W. Stubbs, "Handbook of Heavy Construction", McGraw-Hill Professional Publishing;

Reference Books:

- James J. O'Brien, "Standard handbook of heavy construction", McGraw-Hill Professional Publishing;
- Douglas D. Gransberg, Calin M. Popescu and Richard C. Ryan, "Construction Equipment Management for Engineers, Estimators and owners" CRC Press, Taylor and Francis group

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4473**	Course Name: **Earthquake Engineering**

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

Course Description:
This course integrates information from various engineering and scientific disciplines in order to provide a rational framework for the design of earthquake-resistant structures. The focus of the course is on building structures, but general issues are covered related to the design of bridges, industrial facilities and other types of structures that are allowed to respond in the inelastic range in the event of a major earthquake. The course emphasizes understanding the fundamental factors that influence and control the response of such structures, establishing a performance-based framework with which to assess seismic response, selecting project appropriate structural systems, configurations and proportions, and developing effective, but simplified, design procedures capable of reliably achieving specified performance goals

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain various concept related to engineering seismology.
2. Evaluate responses for a single degree of freedom system for free and force vibration.
3. Apply principles of earthquake resistant structural systems for building planning.
4. Estimate lateral loads developed due to earthquake force by equivalent static method.
5. Design and detail ductile RCC Structural elements.
6. Explain different methods to improve earthquake resisting capacity of the structure.

Prerequisite: Engineering Mechanics, Structural analysis and Differential equations.

Course Content

Unit No.	Description	Hrs.
01	**Elements of Seismology:** Terminology used in earthquake engineering, structure of earth, phenomenon of earthquake, earthquake causes, plate tectonic theory, elastic rebound theory, magnitude and intensity of earthquake, earthquake waves, seismic zoning.	04
02	**Fundamentals of Theory of Vibration:** Introduction to structural dynamics, static versus dynamic loads, different types of dynamic loads, mathematical modeling of dynamic system, equivalent stiffness, free and forced vibration of single degree of freedom, response spectra, support motion and transmissibility	04

03	**Conceptual Design of Earthquake Resistant Structure:** Importance of earthquake resistant design, seismic forces, characteristics of earthquake resistant structure, design response spectrum, application of response spectrum theory in seismic design, lateral force path, requirements of an efficient earthquake resistant structural system.	04
04	**Computation of Seismic Forces on the Structure:** Seismic design philosophy, clauses given in IS 1893 2016, computation of lateral loads by equivalent static method, determination of base shear, lateral distribution of base shear as per IS 1893-2016.	04
05	**Ductile Detailing of RCC Structures:** Concept of ductile design and detailing of flexural member, column, joints of frames and shear wall as per IS 13920.	04
06	**Earthquake Resisting Building Systems:** Base isolation technique, seismic dampers, vibration controlling methods, and demonstration of behavior of structures under horizontal and vertical motion.	04

References:

Text Books:

- Hosur, V., "Earthquake Resistant Design of Building Structures", WILEY.
- Duggal, S. K., "Earthquake Resistant Design of Structures", OXFORD University Press.
- Shrikhande, Agrawal P., "Earthquake Resistant Design of Structures".

Reference Books:

- Mario Paz, "Structural Dynamics Theory and Computation", CBS Publication.
- Thomson, W. T., Dahleh M. D., "Theory of Vibration with Application", Pearson Education
- A. K. Chopra, "Dynamics of Structures: Applications to Earthquake Engineering", Prentice-Hall, New York.

Codes of Practice:

- Bureau of Indian Standards IS: 1893 2016, Criterion for Earthquake Resistant Design of Structure. New Delhi, BIS.
- Bureau of Indian Standards IS: 13920 2016, Indian standard code of practice for Ductile Design and Detailing of Reinforced Concrete Structures Subjected to Seismic Forces. New Delhi, BIS.

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4353**	Course Name: **PE-III Design of Bridges**

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

Course Description:
This subject deals with structural design of R.C.C. bridges into the various aspects of Bridge engineering, along with bringing out the advanced theories and practical knowledge of Bridge engineering. The topics cover overall analysis of R.C.C. bridges It includes hydrological properties, design of substructure, super-structure, foundation, of bridges.
Add about RC bridges

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1.Explain various components of bridge hydrology and types of loading on bridge.
2.Analyze the sub structure and super structure of R.C.C. bridges.
3.Design the sub structure and super structure of R.C.C. bridges.

Prerequisite: Possess basic knowledge of R.C.C. design

Course Content

Unit No.	Description	Hrs
01	**Introduction:** Introduction, various types of bridges, geometric design parameters, bridge hydrology. Types of loading as per IRC.	04
02	**Design of R.C.C. slab and box bridges:** Introduction, Analysis of R.C.C. culvert, calculation of moments, design of deck slab, box culvert, kerb design, shear and moment checks	08
03	**Design of R.C.C. beams for bridges :** Design of R.C.C. longitudinal and cross beams, Pieguads and Courbon's theory for moment calculation, shear and moment checks in beams	06
04	**Multi-span R.C.C. bridges:** Calculation of moments, design of R.C.C. multi-span bridges, depth calculation, shear design.	06
05	**Design of sub structure for R.C.C. bridges** Components, stress calculation, design of bridge foundation, piers,	06

	abutments, wing walls.	
06	**Bearing and joints:** Introduction to joints, various types and design of bearings,	06

References:

Text Books:

- Jagadish & Jayaram, "Design of Concrete Bridges", Tata McGraw Hill Delhi.

Reference Books:

- Victor, "Design of Concrete Bridges", Tata McGraw Hill
- Raina V.K, "Concrete Bridge Practice", Tata McGraw Hill. Delhi.
- Punmia B.C., Ashok Kumar Jain, "Reinforced Concrete Structures", Laxmi Publications

Codes of Practice:

- Bureau of Indian Standards IS: 456-2000. Indian standard code of practice for concrete.
- IRC-21 Indian standard code of practice for bridge engineers.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4373**	Course Name: **PE-III Design of Formwork**

L	T	P	Credits
3	-	-	3

Course Description:
This course mainly focuses on types and design of false-work required for concrete structures (i.e. formwork). Although cost of formwork contributes significantly to the total reinforced concrete construction cost and formwork failure will result in a very complicated construction problem, formwork design is often neglected and left to the foreman to design. Therefore, in this course emphasis is given on materials used for form work, design of various formworks for regular structural members, design of formwork for special structures, some special formwork systems and failure of formwork.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Design the form work for Beams, Slabs, columns, Walls and Foundations.
2. Design the form work for Special Structures.
3. Explain the working of flying formwork.
4. Explain the formwork failures through case studies.

Prerequisite: Concrete technology, Strength of material, Design of RCC.

Course Content

Unit No.	Description	Hrs
01	**Introduction:** Introduction to formwork system, requirements of formwork and factors affecting selection of formwork	06
02	**Formwork Materials:** Timber, plywood, steel, aluminum, plastic, and accessories, horizontal and vertical formwork supports.	06
03	**Formwork Design:** Concepts, formwork Systems and design for foundations, walls, columns, slab and beams.	06
04	**Formwork Design for Special Structures:** Shells, domes, folded plates, overhead water tanks, natural draft cooling tower, bridges.	06

05	**Flying Formwork:** Table form, tunnel form, slip form, formwork for precast concrete, formwork management issues –pre- and post-award, doka formwork	06
06	**Formwork Failures:** Causes and case studies in formwork failure, formwork issues in multi-story building construction.	06

References –

Text Books:-

- Purify, "Formwork for Concrete Structures", McGraw Hill India.
- Kumar Neeraj Jha, "Formwork for Concrete Structures", Tata McGraw Hill Education.

IS Code:-

- Bureau of Indian Standards IS:14687: 1999, Falsework for Concrete Structures - Guidelines. New Delhi, BIS.

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Class: **Final Year B. Tech Civil**	Semester-**VII**
Course Code: **CE4393**	Course Name: **PE-III Advanced Construction Equipment**

L	T	P	Credits
3	--	--	3

Course Description:
Advance Construction equipment an elective course deals with construction equipment used commonly on construction projects. This course is designed to fulfill the requirements of construction managers to select appropriate equipment based on the construction technique and site condition.

Course Learning Outcomes:
After completing the course, the student should be able to: -
1. Select appropriate equipment for construction task.
2. Discuss processes of operation of equipment.
3. Develop method statement for construction tasks.

Prerequisites: Nil

Course Content

Unit No.	Description	Hrs.
01	**Construction Plants:** Brief introduction, process and layout of construction plants (Stone Crusher, RMC and Hot mix Asphalt plants)	6
02	**Cranes:** Major crane types, lifting capacity and working range. Crane operations, Safety while working with cranes.	6
03	**Drilling Equipment:** Introduction to drilling equipment, Drill bits, rock and earth drills, drilling methods.	6
04	**Finishing Equipment:** Introduction, Graders- components parts, operations, tasks performed, graders safety.	6
05	**Trenchless Technology:** Introduction to trenchless technology, Concept, trenchless technology for new construction and maintenance of the old, equipment and applications.	6

06	**Dredging equipment:** Dredging operation, equipment and methods of dredging.	6

References:

Text Book:

- R. L. Purifoy, "Construction planning equipment and methods", McGraw Hill Book
- Frank W. Stubbs, "Handbook of Heavy Construction", McGraw-Hill Professional Publishing;

Reference Books:

- James J. O'Brien, "Standard handbook of heavy construction", McGraw-Hill Professional Publishing;
- Douglas D. Gransberg, Calin M. Popescu and Richard C. Ryan, "Construction Equipment Management for Engineers, Estimators and owners" CRC Press, Taylor and Francis group

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Class: **Final Year B. Tech Civil**	Semester-**VII**
Course Code: **CE4413**	Course Name: **PE-III Environmental Management System**

L	T	P	Credits
3	--	--	3

Course Description
An Environmental Management System (EMS) 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.

Prerequisites:--Environmental Engineering

Course Content

Unit No.	Description	Hrs.
01	**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	6
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.	6
03	**Environmental Legislation:** Role of MPCB, CPCB, MOEF in Environmental legislation, IS14000, Environmental Impact assessment	6
04	**Impact Assessment** :Impact Prediction, Evaluation and Mitigation, Forecasting Environmental Changes, Strategic Environmental Assessment (SEA), Environmental Clearance Procedure in India and EIA	6

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.	6
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	6

References -

Text Book:

- 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: **CE4433**	Course Name: **PE- III Geographical Information System (GIS)**

L	T	P	Credits
3	-	-	3

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 principles and components of GIS
2. Describe types of data used in GIS
3. Describe the data editing operations
4. Explain various steps used for Disaster Management

Prerequisite: Environmental Science, Irrigation Hydraulic engineering,

Course Content

Unit No.	Description	Hrs
01	**Introduction to GIS** Basic concepts: Components of GIS, Recent trends and applications of GIS; Data structure and formats, Spatial data models – Raster and vector, Database design- editing and topology creation in GIS, Linkage between spatial and non-spatial data, Data inputting in GIS.	06
02	**Data Types and Models** Spatial Data; Non-Spatial Data, Data Input; Existing GIS Data, Metadata; Conversion of Existing Data, Creating New Data, Data Models; Vector Data Model; Raster Data Model; Integration and Comparison of Vector and Raster Data Models.	08
03	**Spatial Data Editing** Types of Digitizing Errors, Causes for Digitizing Errors; Topological Editing and Non-topological Editing; Other Editing Operations; Editing Using Topological Rules.	05

04	**Spatial Analysis Spatial Data:** Definition, Analysis, Processes & Steps, Software and Tools, Geodatabase Model, Role of Databases in GIS, Creating, Editing and Managing, Classification scheme of Vector- Based and Raster- Based GIS Operation, Digital Terrain Analysis and Modeling- Triangular Inverted Network and Digital Elevation Model,	05
05	**Natural resources management** Water Resources & Environmental Studies: Site selection of Hydraulic Structures, Surface water delineation, surface keys for subsurface water, Steps in water investigations of the area, Water management	06
06	**Disaster Management** Geo-information in Disaster Management Cycle, Prevention & Mitigation, Hazard Mapping, Risk Assessment, Modeling, Preparedness and Early Warning, Response and Relief, Damage assessment, Rehabilitation and Recovery Planning, Case Studies and advances in the field, Issues and Challenges	06

References:

Text Books:

- McHaffie, Patrick, Sungsoon Hwang, and Cassie Follett. "GIS: An Introduction to Mapping Technologies: An Introduction to Mapping Technologies", CRC Press.
- Bolstad, Paul, "GIS fundamentals: A first text on geographic information systems" Eider (PressMinnesota).
- 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 MCGraw 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 : **CE4453**	Course Name: **PE-III Metro Rail Technology**

L	T	P	Credits
3	-	-	3

Course Description:
Metro Transportation Technology aims in providing the technical knowledge and understanding in the domain of Mass Rapid Transit System. This course will help the students to bring the modern tools and techniques in implementing strategies by serving the society with the best urban public transportation system. This course is blended with on ground practices and industrial approaches

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

1. Relate the importance of metro rail infrastructure to the development of India.
2. Choose suitable methods for preliminary survey of metro rail.
3. Identify rail and signal components in Metro.
4. Illustrate the codal provisions and the Metro Act.

Prerequisite: Possess basic knowledge of transportation and railway engineering

Course Content

Unit No.	Description	Hrs
01	**Basics of Metro development in India and at global level:** Origin of railways and metro, Development of metro in Indian metropolitan cities, Rail transit development in foreign countries, Various organizations working for the development of metro rail transit system, Governing bodies behind the development of Metro rail in India.	06
02	**Engineering surveys for metro construction:** Preliminary Investigations for a Metro Railway, Traffic Survey, Reconnaissance, Survey, Preliminary Survey, Preliminary Engineering-cum-traffic Survey, Final Location Survey, Alignment and Land utilization for urban metro rail, Design of horizontal and Vertical alignment	06
03	**Geometric Design of components:** Geometric design of railway track: Gradients, Grade compensation, Speed of trains on curves, Super elevation, Cant deficiency, Negative super elevation, Curves, widening on curves, Formation, Gauge, Type of rails, Sleepers, Rail joiners, rail & Sleeper fasteners, Special joints, Insulated joints, Expansion allowance and expansion joints, Check rails, Sleeper spacing, Short welded rails (SWR), Long welded rails (LWR) & Continuous welded	06

	rails (CWR), ballast.	
04	**Metro electrification (introduction) and signal designing:** Different Types of signaling systems (historic), Semaphore (Lower & Upper Quadrant), Mechanical signals, Multiple Aspect Colour Light Signals, Track circuits – Train detection (occupancy of track) Panel Interlocking signaling system, Route Relay Interlocking (RRI) system, Electronic Interlocking Axle counters, Principle and Methods of Interlocking and Devices used for interlocking	06
05	**Tunnel lighting, ventilation, and safety:** Tunnel lighting and types of tunnel lighting, Spacing of lights, Ventilation, Methods of ventilation, Permanent ventilation and noise pollution, Dust control methods, Pre drainage and dewatering in tunnels, Permanent drainage, Safety precautions in tunneling, Health protection in tunnel construction	06
06	**Metro act and Codal provisions:** Introduction of metro act, Report of Ministry of Urban Development on standardization of metro system. Metro Policy 2017, Comprehensive Mobility Plan (CMP), Alternatives analysis report (AAR), Detailed Project Report (DPR)	06

References:

Text Books:

- M. Ramachandran, "Metro Rail Projects in India: A Study in Project Planning"
- Lu Guang Lin. Chen Shao Zhang, "Urban rail transit construction technology demonstration project: Guangzhou Metro Line",

Reference Books:

- Satish Chandra and M.M. Agrawal, "Railway Engineering", Oxford University Press, New Delhi
- S.C. Saxena and S. P. Arora, "A Text Book of Railway Engineering", Dhanpat Rai & Sons, New Delhi
- Indian Railways, "Indian Railways Permanent Way Manual", Indian Railways corrected.

Codes:

- The Metro Railway Corporation and Maintenance ACT 2002 PART A – Act Indian Railway Board Act, 1905
- The Railways Act, 1989 Railway Protection Force Act, 1957 PART B – Codes
- Indian Railways Administration and Finance an Introduction Indian Railways Code for the Accounts Department Part - I
- Indian Railways Code for the Accounts Department Part – II
- Indian Railways Establishment Manual Volume-I
- Indian Railways Establishment Manual Volume-II
- Indian Railways Commercial Manual Volume-I

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Class: **Final Year B. Tech Civil**	Semester- **VII**
Course Code: **CE4093**	Course Name: **PE-IV Advanced Structural Design**

L	T	P	Credits
3	--	--	3

Course Description
Advanced Structural Design is offered as Program Elective course in 7th semester of Civil Engineering undergraduate programme. This course deals with the design various R. C. structural elements of building, such as flat slab, combined footing, raft footing and pile foundation. The structures like retaining wall and water tank are also included in the course, as an engineer may have to deal with them, frequently.

Course Learning Outcomes:
After the completion of this 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.

Prerequisites: Design of Reinforced Concrete Structures, Theory of Structures

Course Content

Unit No.	Description	Hrs.
01	**Flat slab:** Introduction, analysis of flat slab panel by direct design method, equivalent frame method, design of flat slab, detailing of reinforcement.	6
02	**Combined Footing:** Design of rectangular and trapezoidal combined footing.	6
03	**Raft footing:** Design of raft footing.	6
04	**Pile foundation:** Introduction to pile foundations, structural design of reinforced concrete piles, design of pile cap. Detailing of reinforcement.	6
05	**Cantilever and counter fort retaining walls:** Introduction, classification, drainage arrangements for retaining walls, stability requirements of retaining wall, design of cantilever retaining wall, design of 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:

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.

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).

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Class: **Final Year B. Tech Civil**	Semester-**VII**
Course Code: **CE4113**	Course Name: **PE-IV Pre-stressed 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 programme focuses on the mechanics of pre-stressed concrete, stress concept, strength concept and load balancing concept, systems of pre stressing, losses and design of various construction items like beams, end blocks etc. This course helps the students to understand concept of Pre-Stressed Concrete Structures and design of the same.

Course Learning Outcomes:
1. Explain the concept and importance of pre-stressing.
2. Analyze the pre-stressed concrete sections.
3. Design the pre-stressed concrete sections for flexure and shear.
4. 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 to pre-stressed concrete:** Basic concept and general principles, materials used and their properties, methods of pre-stressing, pre-stressing systems, loss of pre-stress.	6
02	**Analysis of pre-stressed concrete sections:** Loading stages and computation of section properties, critical sections under working load for pre-tensioned and post-tensioned members, load balancing method of analysis of pre-stressed concrete beams.	6
03	**Design of pre-stressed concrete sections for flexure:** General philosophy of design, design approaches in working stress method and limit state method, critical conditions for design, limit state of collapse in flexure, permissible stresses in concrete and steel, kern points, choice and efficiency of sections, cable profiles and layouts, cable zone, deflections of pre-stressed concrete members.	6
04	**Design for shear:**	6

	Calculation of principle tension under working load, permissible principle tension, shear strength calculation under limit state of collapse for both sections cracked and un-cracked in flexure.	
05	**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.	6
06	**Design of pre-stressed concrete beams and slabs:** Design of simply supported pre-tensioned and post tensioned slabs and beams, introduction to application of pre-stressing to continuous beams, linear transformation and concordancy of cables.	6

References

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 : **CE4133**	Course Name: **PE-IV Project Management**

L	T	P	Credits
3	-	-	3

Course Description:
This course is intended to get the students acquainted to project management concept and practices. It encompasses theory and practical application of concepts in project management life cycle process, Identification, Planning, Execution, Close-out. Human resource management is also studied in the last unit

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

1. Apply principles of project management for the success of the project
2. Analyze impact of time, cost and scope on construction projects.
3. Develop pre-feasibility report for construction project.
4. Plan the project using various techniques.
5. Develop project close out checklist for given project.
6. Apply techniques for human resource management.

Prerequisite: Construction Management

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
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**
Course Code: **CE4153**	Course Name: **PE-IV Rock Mechanics**

L	T	P	Credits
3	--	--	3

Course Description:
This course provides an introduction to the theory of rock mechanics and its applications in construction and operation. Students are presented with the fundamental concepts of stress and strain 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. 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. Classify the various types of rocks based on geological strata and engineering parameters of the rock.
2. Analyze the theory of in-situ induced stresses in a rock mass and structurally controlled failure.
3. Analyze the rock slope stability and rockfall hazards.
4. Determine settlement and bearing capacity of rock foundation.
5. Apply the concepts of rock mechanics for various subsurface conditions.

Prerequisite:
Basic knowledge of mathematics and fluid mechanics etc.

Course Content

Unit No.	Description	Hrs.
01	**Introduction to Rock Mechanics:** Definition, Importance, History of Rock Mechanics, Distribution of rocks – Archean Rocks, Cuddapah Rocks, Vindhyan Rocks, Palaeozoick Rocks, Mesozoic rocks, Gondwana Rocks, Deccan Traps, Steriographic presentation of Geological data.	06
02	**Engineering Classification of Rock:** Rock Quality Designation, Rock Mass Rating system, Terzaghi's rock load classification, Deere Miller. Classification based on strength and modulus, Classification based on strength and failure strain, rock discontinuity qualitative description.	06

03	**Strength, Modulus and Stress Strain Behavior of Rocks:** Factors influencing rock behavior, Strength criteria for Isotropic Intact Rocks, Modulus of Isotropic Intact Rocks, Compressive strength and modulus from Standard Penetration Test, Stress Strain models – Elastic model, Elasto plastic model, Visco elastic model.	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.
- Hudson, J.A. and Harrison, "Engineering Rock Mechanics – An Introduction to Principles", J.P., Pergamon.
- T. Ramamurthy, "Engineering in Rocks", PHI Learning Pvt. Ltd.

References Books: -

- Murthy V.N.S., Soil Mechanics and Foundation Engineering, 4th Edition, UBS Publishers and Distributors, New Delhi.
- Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics- New Age International (P) Ltd., New 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.
- Obert and Duvall, "Rock Mechanics and Design of Structures", John Willey & Sons.
- Mogi Kiyoo, "Experimental Rock Mechanics", Published by Taylor & Francis.
- Stag and Zienkiewez, "Rock Mechanics in Engineering Practice", John Willey & Sons

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Class: **Final Year B. Tech. Civil**	Semester-**VII**
Course Code: **CE4173**	Course Name: **PE-IV Industrial Waste Management**

L	T	P	Credits
3	--	-	3

Course Description
Industrial Waste Management is a highly interdisciplinary degree program that emphasizes waste management and the environment, energy technology and efficiency, and sustainability and society. The discipline seeks opportunities for alternative sourcing, conservation, efficiency and repurposing through an understanding of product life cycles from origins to recycling or inevitable disposal. Green technologists will design products, processes and complex infrastructure systems to promote sustainable attributes of importance to the environment and the global community.

Course Learning Outcomes:
After successfully completing the course, student will able to:
1. Explain various techniques of wastewater volume and strength reduction.
2. Discuss characteristics of Industrial wastewater.
3. Suggest different wastewater treatment options for industrial wastewater.
4. Prepare layout of ETP for Industrial Wastewater Management.
5. Design Effluent Treatment Plant for Industrial wastewater treatment.

Prerequisites: Basic knowledge of Environmental Engineering is essential

Course Content

Unit No.	Description	Hrs.
01	**Introduction of Industrial wastewater:** Use of water in industry, sources of wastewater, quality and quantity variations in waste discharge, water budgeting, characterization and monitoring of wastewater flow, Concept of Zero discharge, stream standards and effluent standards.	6
02	**Wastewater volume and strength reduction** Waste volume and strength reduction, in-plant measure, good housekeeping, process change, leakage prevention, segregation and recycling Neutralization, equalization and proportioning of waste	6
03	**Manufacturing Process of various industries** Manufacturing processes in major industries, water requirements, wastewater sources, composition of wastes, sugar, distillery, dairy, pulps, paper mill, fertilizer, Tannery, chemical, steel industry, power plants,	6

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	textile Treatment flow sheets alternative methods of treatment, factors affecting efficiency of treatment plant.	
04	**Treatment Techniques for Industrial wastewater** Different types of waste treatment & their selections, Development of treatment flow diagram based on characteristics of waste of industrial wastewater	6
05	**Self-Purification of natural stream**: Water Quality monitoring of Streams, Self-purification of streams, B.O.D. reaction rate, D.O. sag curve and D.O. deficit calculations, Miscellaneous methods of dissolved solids removal, sludge disposal methods	6
06	**Water Pollution Control Act** Water pollution control act 1974, organizational set up of central and state boards for water pollution control, MoEF, classification of river on water use, minimal national standards, socio-economic aspects of water pollution control, Recent development in Industrial waste treatment	6

References :

Text Books: -

- Rao M. N. & Datta A. K., "Wastewater Treatment" Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
- Patwardhan A. D, "Industrial Wastewater Treatment" PH India Pvt. Ltd. New Delhi.
- Punmia B. C., "Wastewater Treatment and Reuse" Lakshmi Publications Pvt. Ltd. New Delhi

References Books: -

- Woodard Frank, "Industrial Waste Treatment Handbook" Elsevier Publication.
- Metcalf and Eddy, "Wastewater Engineering: Treatment & Reuse" Tata McGraw Hill Publication.

Class: **Final Year B. Tech Civil**	Semester: **VII**
Course Code: **CE4193**	Course Name: **PE-IV Pavement Analysis and Design**

L	T	P	Credits
3	--	--	3

Course Description:
This course presents techniques and methodologies to analyze and design flexible and rigid pavements. The course is designed to provide engineering students exposure to pavement materials and characterization, evaluation of performance, and the many elements of pavement design. Specifically, the students will develop a working knowledge of flexible and rigid pavement analyses in order to understand pavement design and construction practices that are globally followed.

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

1. Select the material based on its specifications and design criteria of pavements.
2. Analyze the stresses in flexible and rigid pavements.
3. Design of flexible and rigid pavements.
4. Compose different steps for construction and strengthening of pavements.

Prerequisites: Basic knowledge of Transportation Engineering, Traffic Engineering.

Course Content

Unit No.	Description	Hrs.
01	**Pavement Materials & Characterization:** Types of Pavement, Factors Affecting Design of Pavements, Wheel Loads, ESWL Concept, Tyre Pressure, Contact Pressure, Material Characteristics, Environmental and Other Factors. Pavement Materials, Soil, Aggregate, Bitumen and Tar, Tests on Aggregates, Aggregate Properties and Their Importance, Tests on Pavement Materials, Marshall's Method of Bituminous Mix Design.	6
02	**Stresses in Pavements:** Stresses in Flexible Pavement Stresses in Flexible Pavement, Layered Systems Concept, One Layer System, Boussinesq Two Layer System, Burmister Theory for Pavement Design. Stresses In Rigid Pavement, Relative Stiffness of Slab, Modulus of Sub-Grade Reaction, Stresses Due to Warping, Stresses Due to Loads, Stresses Due to Friction.	5
03	**Design of Flexible Pavement:** ESWL of Multiple Wheels, ESAL, VDF, Repeated Loads and EWL factors, Sustained Loads and Pavement behaviour under Traffic Loads,	6

	Empirical, Semi-empirical, Analytical and Mechanistic-empirical approaches, Pavement Design Method, Mechanistic Empirical Pavement Design – IRC SP 37-Guidelines and examples.	
04	**Design of Rigid Pavement:** Types of Joints in Cement Concrete Pavements and their Functions, Joint Spacing, Design of Slab Thickness, Design of Joint Details for Longitudinal Joints, Contraction Joints and Expansion Joints, IRC Method of Design–Mechanistic Empirical Pavement Design as per IRC 58(2015).	6
05	**Construction of Pavements :** Construction Procedure Of Embankment, Subgrade, Sub Base (Granular, Sub Base), Drainage Layer, Filter /Separation Layer, Base Course-WBM, WMM, Lime Stabilized, Cement Stabilized (Granular Layer), Bituminous Mix – Binder Course And Wearing Course, Its Selection, Construction Requirements for Earthwork, Granular Sub Base, Drainage Layer, Dry Lean Concrete as Per IRC-49(2014), Pavement Quality Concrete Construction Requirements as Per IRC:15(2011) and IRC:58(2015) and MORTH.	7
06	**Pavement Maintenance and Strengthening:** Need For Pavement Maintenance, Failures In Flexible Pavements, Types And Causes, Rigid Pavement Failures, Types and Causes, Pavement Evaluation - Benkelman Beam Method, Strengthening of Existing Pavements, Overlays Design, Types of Overlays, Methods of Overlay, Importance of Highway Drainage	6

References:

Text Books:

- Justo C. E. G. & Khanna S. K., "Highway Engineering", Nem Chand & Bro. Pub.
- Robert D. Krebs "Highway Materials", McGraw Hill Text.
- Kadiyali L.R and Dr.Lal N.B., "Principles and Practices of Highway Engineering" Khanna Publishers, New Delhi.

Reference Books:

- Huang, Y. H. "Pavement Analysis and Design", Pearson Prentice Hall, NJ, USA.
- Yoder, E. J. and Witczak M. W, "Principles of Pavement Design", Wiley, USA.
- Harold N. Atkins, "Highway Materials, Soils and Concrete", Prentice Hall.
- Das A, "Analysis of Pavement Structures", CRC Press, Taylor and Francis Group.

Codes of Practice:

- IRC: 37-2018, Guidelines for the Design of Flexible Pavements.
- IRC: 58-2015, Guidelines for the Design of Rigid Pavements.
- IRC: 49- 2014, Guidelines for the use of Dry Lean Concrete
- IRC: 15- 2011, Standard specifications and code of practice for Construction of Concrete Roads.
- MORTH Specifications for Road and Bridge Works, Indian roads Congress.
- Mechanistic Empirical Pavement Design Guide, NCHRP, TRB.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4513**	Course Name: **PE-IV Advanced Concrete Technology**

L	T	P	Credits
3	-	-	3

Course Description:
This course is intended to encourage the students to research deeper in to the behavior of concretes by evaluating the mechanisms at the microscopic level. Course contents also involves studies of topics regarding working mechanisms of admixtures, fresh and hardened concrete behavior associated with rheology, shrinkage and durability aspects of concrete. Course also deals with specifications, mix-proportioning criteria, properties and applications of special purpose concretes

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

1. Evaluate concrete quality based on the microstructural analysis/ properties.
2. Recommend appropriate admixture for given concreting applications.
3. Examine the mechanisms affecting the properties of fresh and hardened concrete.
4. Justify the use of special purpose concretes for a given concreting job.

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 Nonhydraulic 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, Superplasticizers, Set-Controlling, Foaming agents, corrosion inhibitators, admixtures of different brands. Mineral Admixtures, Significance, Classification, Natural Pozzolanic Materials, Byproduct Materials, Significance, Applications	06
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, Behavior of concrete under shearing stress, Behavior of concrete under biaxial and multiaxial stresses.	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, introduction to Concrete Containing Polymers	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", Mc Graw Hill Publications, NY
- Irving Kett, "Engineered Concrete- Mix Design and Test Methods", 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: 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: **CE4533**	Course Name: **PE-V Advanced Structural Analysis**

L	T	P	Credits
3	-	-	3

Course Description:
Analysis and design of any structure plays a very important role in civil engineering. Analysis of simple structures like beam, column, truss, arches etc. is covered previously in the curriculum. This elective course deals with analysis of complex structures like beams curved in plan, beams on elastic foundation and space trusses. It also covers application of the influence line concept and application of different energy principles for analysis of indeterminate beams. The content in this course will be helpful for students for various competitive exams and further studies in structural engineering specialization

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Construct ILD for indeterminate structures.
2. Apply energy principles/theorems for analysis of indeterminate structures.
3. Construct SFD, BMD and TMD for beam curves in plan.
4. Analyze beams on elastic foundations under various loads.
5. Evaluate forces in space truss members.
6. Analyze building frames using approximate methods of analysis.

Prerequisite: Strength of Material, Mechanics of Structures, Theory of Structures, Structural Analysis

Course Content		
Unit No.	**Description**	**Hrs**
01	**Influence Lines for Indeterminate Structures** Uses of ILD, Muller Breslau's principle, ILD for propped cantilever, fixed beam, two span continuous beams and two-hinged arches.	06
02	**Application of Energy Principles** Maxwell's reciprocal theorem, Castiglione's theorem, statically indeterminate beam, truss and two hinged parabolic arch and portal frame (Indeterminacy up to 2)	06
03	**Beams Curved in Plan** Forces developed at a section in curved beam, Analysis of rectangular and semicircular beams curved in plan subjected to concentrated load and uniformly distributed load.	06

04	**Beams on Elastic Foundation** Types of beams on elastic foundation, Analysis of infinite beams subjected to point load, uniformly distributed load and moment, simple, fixed and hinged support.	06
05	**Space Trusses** Introduction to space truss, Types of supports, equilibrium conditions in space, Analysis of space truss by tension coefficient method.	06
06	**Approximate methods of Analysis:** Approximate methods of analysis of multistoried, multi bay rigid jointed frames by following method. 1. Portal frame method 2. Cantilever method 3. Substitute frame method	06

References:

Text Books:

- Bhavikatti S. S. "Structural Analysis-II", Vikas Publishing House Pvt. Ltd., New Delhi.
- Ramamrutham S. and Narayan R. "Theory of Structures", Dhanpat Rai Publication, New Delhi.
- Reddy C. S. "Basic Structural Analysis", McGraw Hill Education, New Delhi.
- Jangid L. S. and Negi R. S. "Structural Analysis" Tata McGraw-Hill Education, Noida (UP).
- Vazirani V. N., Ratwani M. M. and Duggal S. K. "Analysis of Structure Vol. 2" Khanna Publishers, Delhi.

Reference Books:

- Thandavamoorthy S. "Analysis of Structures (Strength and Behavior)" Oxford University Press, New Delhi.
- Wang C. K. "Intermediate Structural Analysis", Tata McGraw-Hill Education, Noida (UP).
- Krishnaraju N. and Gururaja D. "Advanced Mechanics of Solids and Structures", Narosa Publishing House, New Delhi.
- Timoshenko S. "Strength of Materials Vol. 2", CBS Publishers & Distributors, New Delhi.
- Junnarkar S. B. and Shah H. J. "Mechanics of Structures Vol. II", Charotar Publishing House Pvt. Ltd., Anand Gujarat.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4553**	Course Name: **PE-V Finite Element Analysis**

L	T	P	Credits
3	-	-	3

Course Description:
FEM is a powerful tool for the numerical solution of a wide range of engineering problems. With advances in computer technology, complex problems can be modelled/solved with relative cases. This FEA course focuses on basic concept and finite element procedure, variational methods, development of element stiffness matrix [k] for 1-D, 2-D, 3-D elements and axisymmetric elements, relevant applications of beam, truss. Also it consists of shape function, isoparametric formulation of FEM and convergence requirements

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply variational approach for solving 1D,2D problems
2. Analyze linear springs, bars, beam and truss by FEM
3. Describe convergence and compatibility requirement
4. Develop element stiffness matrix [K] for isoparametric element
5. Formulate element stiffness matrix for 3D and axisymmetric element

Prerequisite: The course learns through prerequisite courses of Engineering Mathematics, Engineering Mechanics, Structural Analysis and Numerical methods, should have a clear understanding of methods of analysis of structures. This course intends to build the competency in the students to analyze the structures by use of matrix methods.

Course Content

Unit No.	Description	Hrs.
01	**Introduction:** Stress-strain, strain displacement relations, plane stress and plane strain problems. equations for two and three dimensional problems finite element procedure, principle of minimum potential energy, Galerkin approach, Rayleigh Ritz method	06
02	**Discretization:** Discretization of continuum, displacement model, application to linear spring, bars with constant and variable cross sections subjected to axial forces. Numbering of nodes, minimization of band width, finite representation of infinite bodies.	06
03	**Development of Stiffness Matrix (Beam, Truss):** Development of element stiffness matrix, displacement and nodal load	08

	vector for beam and truss elements. Transformation of matrix, application of FE method to continuous beams and plane truss.	
04	**Convergence requirements:** Convergence requirements, selection of order of polynomials, confirming and non-confirming elements, element aspect ratio, Pascal's triangle, invariance of element.	05
05	**Shape Function and Isoparametric element:** 2D elements of triangular shapes for plane stress and plane strain problems, shape function, cartesian and natural coordinate system, Lagrange polynomials, concept of isoparametric element, sub parametric, super parametric elements, 1-D and 2-D isoparametric element.	06
06	**3-D elements, Axisymmetric problems:** Various 3-D elements, development of element stiffness matrix and nodal load vector for tetrahedron element. axisymmetric problems, formulation of stiffness matrix of axisymmetric elements.	05

References:

Text Books:

- O.C. Zienkiewicz, R.L. Taylor, "The Finite Element Method Vol. I & II", Tata McGraw Hill.
- Y.M. Desai, T. I. Eldho, A.H.Shah, "Finite Element Method with application in Engineering", Pearson, Delhi

Reference Books:

- J.N.Reddy, "An introduction to the Finite Element Method", Tata McGraw Hill Pub.
- R. D. Cook, "Concept and Application of Finite Element Analysis", John Wiley & sons
- Hutton D.V., "Fundamentals of Finite Element Analysis", Tata McGraw Hill Pub.
- C. S. Desai, J. F. Abel, "Introduction to the Finite Element Method", CBS Pub.
- C. S. Krishnamoorthy, "Programming in the Finite Element Method", Tata McGraw Hill
- T. R. Chandrupatla, Belegundu, "Introduction to the Finite Element in Engineering", Prentice Hall of India, pvt.ltd
- Bathe K.J., "Finite Element Procedures", PHI learning pvt. Ltd
- S.S.Bhavikatti, "Finite Element Analysis", New Age International Publishers
- Buchanan G.R., "Finite Element Analysis", McGraw Hill Publications, New York
- Lewis P. E. Ward J. P., "The Finite Element Method", Addison-Wesley Pub. Co.

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE4573**	Course Name: **PE-V Matrix Method of Structural Analysis**

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

Course Description:
The matrix method of structural analysis is used as a fundamental principle in many applications in civil engineering. This method is carried out, using a stiffness and flexibility matrix. This course is mainly concerned with the analysis of beams, plane truss, & plane frame subjected to only static loads using matrix methods. This course also deals with the use of MATLAB for structural analysis.

Course Learning Outcomes:
After completing the course, the student should be able to: -
1. Develop stiffness and flexibility matrix of structural members.
2. Analyze structure using flexibility and stiffness matrix method
3. Apply direct stiffness approach for structural analysis.
4. Analyze the structure using the matrix method by application of MATLAB.

Prerequisite: Engineering Mathematics, Structural analysis, Theory of structures

Course Content

Unit No.	Description	Hrs
01	**Matrix algebra and Basics of Structural Analysis** Introduction matrix algebra, inverse of matrix, determinant of matrix, matrix multiplication. Basic concepts of structural analysis, equilibrium and compatibility conditions, static and kinematic indeterminacy, concepts of stiffness and flexibility.	06
02	**Element Flexibility Matrix Method:** Introduction to flexibility approach, derivation of flexibility matrix for bar, beam, and frame structures, analysis of determinate and indeterminate structures using flexibility matrix method.	06
03	**Element Stiffness Matrix Method:** Introduction to stiffness approach, derivation of stiffness matrix for bar, beam, and frame structures, analysis of determinate and indeterminate structures using stiffness matrix method	06
04	**Analysis of Truss** Development of stiffness and flexibility matrix for truss, analysis of	06

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	truss using stiffness and flexibility matrix method, analysis of truss subjected to temperature stresses and lack of fit.	
05	**Introduction to direct stiffness method** Local and global coordinate system, transformation of variables, member displacement matrix, member force matrix, stiffness matrix, overall stiffness matrix, boundary conditions, computation of internal forces, analysis of trusses and continuous beams by direct stiffness method.	06
06	**Application of MATLAB** Problem definition in MATLAB, boundary condition definition, development of stiffness and flexibility matrices, development of force and displacement vector, analysis of determinate beam and truss using MATLAB	06

References:

Text Books:

- Pandit G. and Gupta S., "Structural Analysis: A Matrix Approach", McGraw Hill Education, Delhi.
- Praveen Nagarajan, "Matrix Methods of Structural Analysis", CRC press, Taylor & Francis, New York.
- Rajasekaran S, "Computational Structural Mechanics", Prentice Hall of India, New Delhi.

Reference Books:

- Jean H. Prevost, "An Introduction to Matrix Structural Analysis & Finite Element Methods", World Scientific Pub., New York.
- R. K. Livesley, "Matrix Methods of Structural Analysis", Elsevier Ltd., London.
- Moshe, F., Rubenstein, "Matrix Computer Analysis of Structures", Prentice Hall, New York.

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE 4593**	Course Name: **PE-V Construction Resource Planning and Management**

L	T	P	Credits
3	-	-	3

Course Description:

Resources contribute 90% of the project cost; of the five major resources this course covers two, Material and Human. Projects cannot be completed without handling these resources, this course deals with proper handling and development of resources in order to help managers to control and successfully complete the project

Course Learning Outcomes:

After successful completion of the course, students will be able to,
1. Draft layout for store and material management,
2. Select vendor for material purchase,
3. Build proper inventory management skill,
4. Describe employee development and welfare facilities,
5. Design performance appraisal matrix

Course Content

Unit No.	Description	Hrs.
01	**Basics of Material Management:** Importance of materials management, functions, objectives and organizations for materials management, codification and standardization: process and advantages, stores management, layout, material handling.	06
02	**Purchasing and vendor development:** Functions, steps, purchasing cycle. Procedure, Relevance of Good Supplier Need for Vendor Evaluation- Goals of Vendor Rating-Advantages of Vendor Rating Cost-ratio Method Forced Decision Matrix	06
03	**Inventory Management:** ABC analysis- advantages, mechanism, purpose, objectives Importance & Scope of Inventory Control, Types of Inventory, Costs Associated with Inventory, Inventory Control, Selective Inventory Control, Economic Order Quantity, Safety Stocks	06
04	**HRM Basics:** Manpower Planning, functions of HRM, Development and Operation of human resources - Managerial Staffing Recruitment Selection - Placement, Training and Development.	06
05	**Welfare Measures:** Compensation Safety and health, Wages and Salary, GPF EPF Group Insurance Housing - Pension Laws related to welfare measures. Employee Benefits, employee appraisal and assessment	06
06	**Performance appraisal** Employee hand book and personnel manual - Job description ns and organization structure and human relations Productivity of Human resources. Special Human resource problems,	06

References:

Text Books:

- P. Gopalkrishna & M. Sudarson, "Material management, An Integrated Approach", PHI.
- A. K. Dutta, "Material Management Procedures text and cases", PHI.
- Gopal Krishnan, "Hand book of material management", PHI
- Memoria C. B., "Personal Management", Himalaya Publication Company.
- K. Ashwathapa, "Human resources and personal management", TATA McGraw Hill Publication.

Reference Books:

- Joy J Familaro "Handbook of Human resources Administration", TATA McGraw Hill international Publication.
- C. M. sadiwal, Ritesh C. Sadiwal, "Material and financial Management", New Age International Publishers.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4613**	Course Name: **PE-V Total Quality Management**

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

Course Description:
Today managers of many manufacturing and service 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". 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. Illustrate Quality Management philosophies and the contribution of Quality Gurus in TQM Journey.
2. Identify the basic concept and framework of Total Quality management
3. Apply the tools and techniques of quality management in manufacturing and services sector.
4. Summarize the codal provisions for quality improvement.

Prerequisite: Knowledge of construction activities and processes

Course Content

Unit No.	Description	Hrs
01	**Introduction to TQM** Introduction to Quality, Dimensions of product and service quality, The quality cycle, Quality – vision, mission and policy statements. Customer Focus customer perception of quality, Translating needs into requirements, customer retention., TQM framework, Benefits of TQM, Need of TQM in construction sector.	06
02	**Principles and philosophies of quality management** Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi techniques – introduction, loss function, Concepts of Quality circle, Japanese 5S principles and 8D methodology.	06
03	**Statistical Process Control** Meaning and significance of statistical process control (SPC), Control	06

	charts for variables, Central Limit theorem, Constructing $\ddot{X}$-R chart, $\ddot{X}$-S chart, Control charts for attributes 'p' chart, 'np' chart, 'c' chart and 'u' chart, Control chart selection, Implementation of statistical process control.	
04	**Tools for quality management** Quality functions development (QFD) – Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Seven old (statistical) tools, Seven new management tools of quality assurance.	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.	06
06	**TQM - Continuous Improvement** Introduction to ISO 9000 series, Six Sigma- Features of six sigma, Goals of six sigma, DMAIC, Six Sigma implementation, Business-Process-Reengineering	06

References:

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.

Reference Books:

- Robert.E.Stean, "The Theory of constraints: applications in quality manufacturing"
- Dale H. Besterfield, Glen H. Besterfield, Hemant Urdhwareshe, "Total Quality Management", Pearson, Seventh impression.
- S. Rajaram "Total Quality Management" by Dreamtech Press.

Class:- Final Year B. Tech Civil	Semester-VII
Course Code : CE4633	Course Name : PE-V Air Pollution and Control

L	T	P	Credits
3	-	--	3

Course Description:
As a comprehensive course, it introduces the effects of air pollutants on human beings and environment, the sources of air pollution, and the physical and chemical behavior of pollutants in the atmosphere. Also, it covers legislation and regulation; control technologies and future trends toward preventing air pollution.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1.Examine structure of the atmosphere air pollution, scales of air pollution
2.Interpret on sources of air pollution natural and artificial, air pollution Episodes
3.Analyze effect of different air pollutants on man, animals and plants.
4.Design Stack height and explain meteorology, transport and control mechanism
5.Evaluate effects of noise pollution.

Prerequisite: Environmental Engineering

Course Content

Unit No	Description	Hrs
01	**Structure of Atmosphere** Definition and Scope of Air Pollution, Study of bio-sphere and atmospheric structure, Scales of air pollution Sources: natural and artificial, Classification of pollutant, quantity and composition of particulate & gaseous pollutant, Units of measurements	06
02	**Sources and Effects of Air Pollution** Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles.	06
03	**Air Pollutant Transport** Elements of atmosphere and dispersion of pollutants – Meterological factors – Wind roses – Lapse rate – Atmospheric stability and turbulance – Plume rise – Dispersion of pollutions – Gaussian dispersion models – Applications.	06
04	**Control of Air Pollution** Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment, gaseous pollutant control by adsorption & absorption, condensation, combustion – Pollution control for specific major industries.	06
05	**Air Quality Management** Air quality standards – Air quality monitoring – Air pollution control efforts	06

	– Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment – Methods.	
06	**Noise Pollution & Control** Sound and Noise: Sources of noise pollution – environmental and industrial noise; effects of noise pollution - fundamentals of sound generation - propagation, sound measurement - sound level meters – types, components, Noise prevention & control measures, environmental and industrial noise - noise control legislation.	06

References:

Text Books:

- Wark and Warner, "Air Pollution", McGraw-Hill
- Martin Crawford, "Air Pollution", New York : McGraw-Hill
- R. D. Ross, "Air Pollution and Industry", New York [etc.] : Van Nostrand Reinhold Company

Reference Books:

- Rao and Rao, "Air Pollution", Tata McGraw-Hill Education
- Peavy & Rowe, "Environmental Engineering", New York : McGraw-Hill
- Stern, "Air Pollution", Elsevier Store

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE 4653**	Course Name: **PE-V Fundamentals of Urban and Regional Planning**

L	T	P	Credits
3	-	-	3

Course Description:
One of the major factors driving urbanization is migration from rural to urban areas. The relationship between urban and rural areas is an interdependent one. It is crucial, therefore, for planners to understand this dynamics in the light of various development policies

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1.Demonstrate appreciation and knowledge of histories of planning
2.Express basic understanding of sociological processes generally as they relate to urban and regional planning
3.Analyze planning and policy issues for urban and regional infrastructure
4.Develop knowledge of constitutional amendments as they impact urban and regional planning.
5.Analyze the nature, form and planning of metropolitan cities and regions in India

Course Content		
Unit No.	**Description**	**Hrs.**
01	**Definitions and Rationales of Planning:** Various definitions of town and country planning; Goals and objectives of planning; Components of planning; Benefits of planning; Arguments for and against planning	06
02	**Foundations of Planning:** Orthodoxies of planning including the Lamps of Planning; Sustainability and rationality in planning; Components of sustainable urban and regional development; Defining what counts as planning knowledge: various sources of planning knowledge, various forms of planning knowledge; Reasoning and its various forms in planning; Space, place and location	06
03	**Development Plans and Development Regulations:** Definition of development plan; Types of development plans: master plan, city development plan, structure plan, district plan, action area plan, subject plan, town planning scheme, regional plan, sub-regional plan; Planning Advisory Group report and the UDPFI Guidelines; Sector plans and spatial plans; Defining development and development control regulations, types of development control; Implications of violations of development control regulations; Conforming and Non-conforming land uses; Compatible and non-compatible land uses, LULU and NIMBY	06
04	**Governance of Planning:** Local government in India; District Planning Committees and Metropolitan	06

	Planning Committees; Introduction to Internationalization and globalization of planning: meanings and forms of globalization; Characteristics of a global city; Principles for planning for a global city.	
05	**Theories of Urbanization:** Theories of urbanization including Concentric Zone Theory; Sector Theory; Multiple Nuclei Theory and other latest theories; Land Use and Land Value Theory of William Alonso; City as an organism: a physical entity, social entity and political entity	06
06	**Trends in Urban and Rural Development:** Changes in asset ownership, Agriculture and land utilisation. Policies and Programmes: National Five Year Plans (1950 to 2012), National Housing Policies- 1994, 1998 and 2007, Programmes such as the JNNURM, Rural Employment Schemes, Command Area Programme, PURA etc.	06

References:

Text Books:

- Gupta A., and Sivaramakrishnan, K, "The State in India after Liberalization, Routledge"
- Capolla, D.P, "Introduction to International Disaster Management", Butterworth Heinemann, London.
- Joshi, A.D, "Text Book of Disaster Management", Lotus Publication of Pvt. Ltd., Mumbai.

Reference Books:

- Baud, I., and Wit, J, "New Forms of Urban Governance in India: Shifts, Models, Networks and Contestations. New Delhi: Sage".
- Desai, R, "Governing the Urban Poor: Riverfront Development, Slum Resettlement and the Politics of Inclusion in Ahmedabad, Economic and Political".
- Diwakar, D, "Resettlement of Urban Poor in Chennai, Tamilnadu: Concerns in R and R Policy and Urban Housing Programme", Journal of Land and Rural Studies,
- Freire, M. and Stren, R, "The Challenges of Urban Government: Policies and Practices, World Bank, Washington, D.C".

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4673**	Course Name: **PE-V Solid and Hazardous Waste Management**

L	T	P	Credits
3	-	-	3

Course Description
This course provides an in-depth understanding of solid and hazardous waste characteristics and management. Some basics of radioactive waste characterization and handling are also provided. The course would cover-general It provides basic terminology like definition of solid wastes–municipal waste, biomedical waste, hazardous waste, e-waste. This subject will information on legal issues and requirements for solid waste management; sampling and characterization of solid waste; analysis of hazardous waste constituents including QA/QC issues; health and environmental issues related to solid waste management; steps in solid waste management-waste reduction at source, collection techniques, materials and resource recovery/recycling, transport, optimization of solid waste transport, treatment and disposal techniques (composting, vermi-composting, incineration, non-incineration thermal techniques, refuse derived fuels, land-filling); economics of the onsite vs. offsite waste management options (individual vs. common treatment/disposal practices, integrated waste management; and waste minimization and concepts of industrial symbiosis and industrial ecology

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply basic concepts for management of municipal, biomedical, hazardous, e-waste, industrial wastes.
2. Explain different techniques for solid wastes management.
3. Assess environmental and health impacts solid waste mis-management
4. Design landfill site for different solid waste management

Prerequisite: Environmental Engineering, Environmental Science

Course Content

Unit No.	Description	Hrs
1	**Introduction of Solid Waste:** General introduction including definitions of solid waste including municipal, hospital and industrial solid waste; requirements for solid waste management, legal issues, health and environmental issues.	06
2	**Municipal Solid Waste (MSW) Management** – Fundamentals Sources; composition; generation rates; collection of waste; separation, transfer and transport of waste; treatment and disposal options (Anaerobic digestion technologies, Slow pyrolysis, Black soldier fly processing), Introduction:	06

	Desludging of septic tanks and advanced on-site systems, Treatment of Septage, Solid Waste Management in rural areas, Bangalore and Indor Method of Composting, Biogas Technology	
3	**Advanced municipal solid waste treatment methods** Decentralized Waste water treatment systems, Site selection criteria, waste stabilization ponds technology, Duckweed pond system, Constructed Wetland, Phytorid Technology for Sewage Treatment, Soil Bio Technology (SBT) for Sewage Treatment, Anaerobic Baffled Reactor (ABR), Up flow Anaerobic Sludge Blanket (UASB) Reactor, Settling Contact Aeration System, Sequencing Batch Reactor (SBR) Process	08
4	**Hazardous Waste Management** – Fundamentals Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects, **Radioactive Waste Management** – Fundamentals Sources, measures and health effects; nuclear power plants and fuel production; waste generation from nuclear power plants; disposal methods.	05
5	**Environmental Risk Assessment** Defining risk and environmental risk; methods of risk assessment; case studies, Physico-chemical treatment of solid and hazardous waste: Chemical treatment processes for MSW; physico-chemical processes for hazardous wastes management; groundwater contamination and remediation.	05
6	**Landfill design and advanced methods:** Landfill site design for solid and hazardous wastes management; leachate collection and removal; landfill covers; Incineration, Carbon offsets, Plasma arc gasification, Advanced methods for solid waste management	06

References:

Text Books:

- Central Public Health and Environmental Engineering Organization (CPHEEO), "Manual on Municipal Solid Waste Management", New Delhi, Controller of Publications.
- Freeman H.M, "Standard Handbook of Hazardous Waste Treatment and Disposal, New York", McGraw-Hill.

Reference Books:

- John Pichte, "Waste Management Practices CRC Press", Taylor and Francis Group.
- LaGrega, M.D.Buckingham, P.L. and Evans, J.C, "Hazardous Waste Management", McGraw Hill International Editions, New York.
- Richard J. Watts, "Hazardous Wastes - Sources, Pathways", Receptors John Wiley and Sons, New York,

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Class:- Final Year B. Tech. Civil	Semester-VII
Course Code: CE4693	Course Name: PE-V Photogrammetry Surveying

L	T	P	Credits
3	-	--	3

Course Description:
The course including the theoretical knowledge and principles of surveying, relevant to the needs of construction industry and society. Before starting of any Civil Engineering project, surveying knowledge is very essential to a Civil Engineer. A civil engineer has to be conversant with all the measurement techniques to know the ground topography and he should be able to use the modern survey equipment's and be able to use different software applications in surveying. The module focuses on Advanced Surveying Techniques like photogrammetry, remote sensing, and GIS.

Course Learning Outcomes:
After successfully completing the course, Student will able to:
1. Apply advanced surveying methodologies to conduct topographical survey measurements.
2. Calculate the errors in topographical surveying measurements.
3. Illustrate the principles of advanced surveying techniques.

Prerequisite –Fundamentals of Civil Engineering, Elementary course on surveying.

Course Content

Unit No	Description	Hrs
01	**Geodetic Surveying** Introduction & object of Geodetic Surveying, Principal & classification of triangulation system, Selection of base line and stations, Orders of triangulation-triangulation figures, Station marks and signals-marking signals, Examples on Phase error, Extension of base, reduction of center, selection and marking of stations	06
02	**Field Astronomy** Introduction & Instruments & purpose, Astronomical terms, Time & conversion of time, Abbreviations, Determination of azimuth, Latitude and longitude & Examples of azimuth, Latitude and longitude.	06
03	**Photogrammetric Surveying:** Introduction, principle, uses Aerial camera, aerial photographs Definitions, scale of vertical and tilted photograph Ground coordinates, ground control, examples on scale, Displacements and errors, Examples	06

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	on Displacement and errors, Procedure of aerial survey, Examples on Flight planning, Photomaps and mosaics. Difference between Mosaic & Map, Stereoscopes, Parallax bar, Examples on Parallax bar.	
04	**Remote Sensing** Introduction, Principles of energy interaction in atmosphere and earth surface features, Image interpretation techniques, visual interpretation, Digital image processing, Global Positioning system, Introduction, image rectification and restoration, image enhancement, image transformation, image classification. Applications of remote sensing to civil engineering.	**06**
05	**Geographical Information System:** Definition of GIS, Key Components of GIS, Functions of GIS, Spatial data, spatial information system Geospatial analysis, Integration of Remote sensing and GIS, and Applications in Civil Engineering.	**06**
06	**Special Survey Instruments:** Introduction, Electromagnetic Distance Measurement, Electronics Theodolite, Total station, Site square, Penta Graph, Special Compasses, Brunton Universal, Pocket Transit, DGPS, Introduction to surveying government agencies for data collection. Drone Technology, LIDAR Tech	**06**

Text Books:

- N.N. Basak, "Advanced Surveying", Tata McGraw Hill, New Delhi
- S. K. Duggal, "Surveying Vol. II and III", Tata McGraw Hill, New Delhi.
- Dr. B.C. Punamia, "Surveying Vol. I, II and III", Laxmi Publisher, New Delhi
- Arora. K.P, "Surveying", Standard Book House.

Reference Books:

- Bannister. A and Raymond S, "Surveying, ELBS.
- James M. Anderson and Edward M. Mikhail, "Introduction to Surveying", McGraw Hill Book Company.
- Clark. D, "Plane and Geodetic Surveying", Vols. I and II, C.B.S. Publishers and Distributors, Delhi.

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE4713**	Course Name: **PE-V Geo-informatics for Engineering**

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

Course Description:
Geoinformatics is a course that deals with the science and technology which uses and also develops information science to look after the problems of geography, geosciences and cartography and branches related to science and engineering. The students will learn basic computing skills and know about different storage and data analysis mechanisms

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain the principles of Geo-informatics
2. Describe the Remote Sensing process
3. Demonstrate the image interpretation and ground investigation
4. Analyze and apply Remote sensing techniques for ground investigation

Prerequisite: Environmental Science, Engineering Survey

Course Content

Unit No.	Description	Hrs
01	**Introduction to Geo-Informatics:** Meaning and scope of Geo-Informatics, Components of Geo-Informatics, Introduction to Space, Solar System, Earth - Orbit, Rotation, Time, Satellite orbits. Stages in remote sensing technology, Advantages of Remote Sensing over conventional methods of survey and inventorying, interdisciplinary nature and relation with other disciplines, overview of Remote sensing in India and in other countries.	06
02	**Remote sensing process:** Physics of Remote Sensing - Energy Sources, Electromagnetic Radiation (EMR): EMR Spectrum and its properties, EMR wavelength regions Black body radiation & Stephen Boltezman law, Energy Interaction with Atmosphere –Scattering, Absorption, Refraction, Atmospheric windows and its types, Energy interaction with earth surface features - (Absorption, Reflection, and Transmission).	06
03	**Remote Sensing Systems:** Platforms: -Remote Sensing Platforms, Space and orbits, Keppler's law of motion, Orbiting Mechanisms of Satellites, Satellite positioning systems; satellites for land, ocean, and	06

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	atmospheric studies. Optical Remote Sensing Resolutions: Spectral, Spatial, Temporal and Radiometric Resolutions, photograph v/s image, Data selection criteria.	
04	**Image Interpretation:** Generation of True color and False color composites (FCC), scales of the data products, annotation of satellite data products. Introduction to image Interpretation, Decoding of different imageries, Techniques of image Interpretation, Visual verses digital Interpretation, Interpretation Keys.	08
05	**Spatial data classification methods:** Multivariate analysis, Allocating individuals to existing classes, Expert systems for GIS. Data Quality and Standards: Definition of data quality, components of geographic data quality – positional accuracy, attributes accuracy, temporal accuracy, logical consistency and completeness; assessment of data quality.	06
06	**Ground Investigation in support of Remote Sensing:** Uses of ground data, spectral signature, interpretation and application of Synthetic Aperture Radar (SAR) for ground data	04

References:

Text Books:

- Shan, J., & Toth, C. K. (Eds.), "Topographic laser ranging and scanning: principles and processing", CRC press.
- Sinha, A. K. (Ed.). "Geoinformatics: data to knowledge". Geological Society of America.
- Lo, C.P. and Yeung, Albert K.W. "Concepts and Techniques of Geographic Information Systems", Prentice Hall.

Reference Books:

- Kumar, P., Rani, M., Pandey, P. C., Sajjad, H., & Chaudhary, B. S. (Eds.).. "Applications and Challenges of Geospatial Technology: Potential and Future Trends", Cham: Springer International Publishing.
- Liu, Jian Guo, and Philippa J. Mason. "Image processing and GIS for remote sensing: techniques and applications", John Wiley & Sons.
- Reddy, M. A, "Geoinformatics for environmental management", BS publications.
- Scholten, H. J., & Stillwell, J. (Eds.). "Geographical information systems for urban and regional planning", Springer Science & Business Media.

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Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code: **CE4733**	Course Name: **PE-V Docks, Harbour and Airport Engineering**

L	T	P	Credits
3	-	-	3

Course Description:
India has a very large coastal line and therefore coastal shipping plays a very vital role in the development and growth of economy of our country. Docks and Harbor are the integral part of coastal shipping transport system Therefore, knowledge and understanding of various construction and maintenance aspects of docks and Harbors are very important for engineers working at site in order to make shipping transport system safe and efficient

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. List out various types of docks and harbour based on its selection criteria.
2. Identify various component parts of docks and harbour and its constructional aspects.
3. Analyze the requirements of airport layout with respect to international regulations
4. Summarize concepts for planning of runway, taxiway, apron and terminal building facility.

Course Content		
Unit No.	**Description**	**Hrs.**
01	**Docks and Harbour** Introduction, Requirements of harbour and port, classification of harbours, Factors affecting growth of port, Major Ports in India and abroad, Planning of Port and Selection of ideal location for harbor.	06
02	**Breakwater, Jetty and Types of Docks** Breakwater and materials of construction for breakwater, Dock, Bulkhead and Sea Walls, Waterfront structures, Wharves, Jetty, Dolphins, Different types of dock fenders, Uses of wet docks and Dry/ Repair docks. Port facilities, Transit sheds and warehouses.	06
03	**Dredging** General, Classification of dredging works, Types and operation of dredgers, Execution of dredging work, Uses of dredged material	06
04	**Airport Planning** Aircraft characteristics, airports site selection, airport classifications as per ICAO, survey and drawings for airport planning, Major Terminal Components, Objectives in Selecting Terminal Concepts, Airport Master Plan, Factors influencing Terminal Configuration and Size, Forecasts,	06

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	Terminal Apron Areas.	
05	**Airport Layout** Characteristics of good layout, runway configuration, imaginary surfaces, location of terminal buildings, aprons and hangers, Zoning requirements regarding permissible heights of construction and landing within the airport boundary, planning aspect of important airports in the world.	06
06	**Runways and Taxiways** Runway Location and orientation, wind coverage, use of wind, rose diagram, Basic runway length, geometric design standards, Taxiway System and Aprons, Exit Taxiways, By Pass Taxiways, sight-distance, turning radius and rate of change of longitudinal gradients, Airport Lighting and Markings, VFR Approach and Departure Paths.	06

References:

Text Books:

- Bindra, S.P., "Dock and Harbour Engineering", DhanpatRai Publications
- Srinivasan, R., "Harbour Dock and Tunnel Engineering", Charotar Publishing House.
- Khanna, S.K., Arora, M.G., S. S. Jain, "Airport Planning and Design", NemChand and Brothers.
- Robert Horonjeff, Francis Mc Kelvey, William Sproule and Seth Young, "Planning and Design of Airports".

Reference Books:

- DeNeufville R. and Odoni A., "Airport Systems: Planning Design and Management", McGraw-Hill.
- Horonjeff R. and McKelvey F., "Planning and Design of Airports", McGraw-Hill Publications.
- Sehgal S. B. and Bhanot K. L., "Textbook of Highway and Airport Engineering", S. Chand Publishers.
- Oza H. P. and Oza G.H., "Dock and Harbour Engineering", Charotar Publishing House.
- Quinn, "Planning and construction of Docks and Harbours", Tata McGraw Hill, Latest Edition
- Norman J. Ashford, Saleh Mumayiz and Paul H. Wright, "Planning, Design and Development of 21st Century Airports", John Wiley &Sons.
- Alexander T. Wells, Ed. D & Seth, B. Young, "Airport Planning and Management".
- Rangwala, "Harbor Engineering", Charotar Publishing House.

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Class: **Final Year. B. Tech. Civil**	Semester: **VII**
Course Code: **CE4213**	Course Name- **PE-IV Advanced Structural Design Laboratory**

L	T	P	Credits
-	--	2	1

Course Description:
Advanced Structural Design Laboratory is offered as Program Elective course in 7th semester of Civil Engineering undergraduate programme. This course deals with the design of various R. C. structural elements of building, such as flat slab, combined footing, raft footing and pile foundation. The structures like retaining wall and water tank are also included in the course, as an engineer may have to deal with them, frequently. This course deals with design of flat slab, combined footing, raft footing, pile foundation, retaining wall and water tank using standard software.

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.

Prerequisites: Knowledge of design of reinforced concrete structures, Auto CAD

Course Content		
Expt. No.	**Name of Experiment**	**Hrs.**
	The students are expected to complete any four design projects from the below list.	
01	Design of Flat slab using appropriate software.	06
02	Design of combined footing using appropriate software.	06
03	Design of raft footing using appropriate software.	06
04	Design of pile foundation using appropriate software.	06
05	Design of retaining wall using appropriate software.	06
06	Design of elevated circular water tank using standard software.	06

References:

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.

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).

Class: **Final Year B. Tech Civil**	Semester- **VII**
Course Code: **CE4233**	Course Name: **PE-IV Pre-stressed Concrete Structures Laboratory**

L	T	P	Credits
-	-	2	1

Course Description:
Design of Pre-Stressed Concrete Structures Laboratory is offered as Program Elective course in 7th semester of Civil Engineering undergraduate programme. The course focuses on the analysis and design of pre-stressed concrete sections. This course will help students to understand the significance of prestressed concrete sections in the construction of various structures.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Design the pre-stressed concrete sections for flexure and shear.
2. Design an end block for pre-stressed members.
3. Design the pre-stressed concrete beams.

Prerequisite: Knowledge of Prestressed concrete structures.

Course Content		
Expt. No.	**Description**	**Hrs**
01	Introduction to equipment and accessories required for prestress concrete structures	2
02	Demonstration of prestressing in post tensioning prestress concrete beam.	2
03	Case-study based problems solution on losses in prestress.	4
04	Case-study based problems solution on analysis of prestressed concrete sections.	4
05	Case-study based problems on design of prestresses concrete sections for flexure and shear.	6
06	Visit to ongoing construction site where prestressed concrete elements are being used.	6

References

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 : **CE4253**	Course Name: **PE-IV 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: Nil

Laboratory Course Content		
Unit No.	**Description**	**Hrs**
01	Develop a project charter for a construction project.	06
02	Analyze feasibility of project.	06
03	Schedule a project using primavera/ 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

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**
Course Code: **CE4273**	Course Name: **PE-IV Rock Mechanics Laboratory**

L	T	P	Credits
--	--	2	1

Course Description: The design and analyses of any rock engineering project for civil applications require careful mechanical characterization of the host rock. For this purpose, rock cores are drilled on-site 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 Learning Outcomes:
After successfully completing the course, student will able to:
1. Determine the physical and mechanical properties of rock samples.
2. Classify various types of rock based on observations and laboratory testing.
3. Prepare the site investigation report.

Prerequisites: Basic knowledge of geology, soil mechanics course is essential.

Course Content		
Exp. No.	**Name of Experiment**	**Hrs.**
01	Introduction and Identification of Different Types of Rock	**2**
02	Determination of Core Recovery and RQD of Rock Sample	**2**
03	Determination of Moisture Content and Porosity of Rock Sample	**2**
04	Unconfined Compressive Strength Test	**2**
05	Point Load Strength Index Test	**2**
06	Brazilian Tensile Strength Test	**2**
07	Direct Shear Test on Rock Sample	**2**
08	Permeability of Rock Sample	**2**
09	Triaxial Test on Rock Sample	**2**
10	Taking Borelog on Site- Site Experiment	**2**
11	Site Investigation Report	**2**

References –

Reference Books:

- Jaeger, J.C., Cook, N.G.W., Zimmerman, R.W., "Fundamentals of Rock Mechanics", 4th Edition, 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.

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Class: **Final Year B. Tech. Civil**	Semester-**VII**	**L**	**T**	**P**	**Credits**
Course Code: **CE4293**	Course Name: **PE-IV Industrial Waste Management Laboratory**	--	--	**2**	**1**

Course Description
Industrial Waste Management Laboratory is a highly interdisciplinary degree program that emphasizes waste management and the environment, energy technology and efficiency, and sustainability and society. The discipline seeks opportunities for alternative sourcing, conservation, efficiency and repurposing through an understanding of product life cycles from origins to recycling or inevitable disposal. Green technologists will design products, processes and complex infrastructure systems to promote sustainable attributes of importance to the environment and the global community.

Course Learning Outcomes:
After successfully completing the course, student will able to:
1. Analyze characteristics of Industrial wastewater.
2. Prepare a water budget for industry.
3. Suggest different wastewater treatment options for industrial wastewater treatment.
4. Prepare layout of ETP for Industrial Wastewater Management.
5. Design Effluent Treatment Plant (ETP) for Industrial wastewater treatment.

Prerequisites: Basic knowledge of Environmental Engineering course is essential

Course Content

Unit No.	Description	Hrs.
01	Study of Industrial Waste characteristics for Sugar factory/ Paper Mill/ Dairy/ Textile mill/ Distillery	8
02	Prepare a water budget for industry.	2
03	Prepare layout of Effluent Treatment Plant (ETP) for industrial wastewater.	4
04	Design of Effluent Treatment Plant (ETP) for industrial wastewater.	4
05	Study of self-purification of river.	2
06	Detailed report of selected industry including wastewater characteristics, water budget, layout of ETP and design of ETP.	4

References :

Text Books: -

- Rao M. N. & Datta A. K., "Wastewater Treatment" Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.
- Patwardhan A. D. "Industrial Wastewater Treatment" PH India Pvt. Ltd. New Delhi.
- Punmia B. C., "Wastewater Treatment and Reuse" Lakshmi Publications Pvt. Ltd. New Delhi

References Books: -

- Woodard Frank, "Industrial Waste Treatment Handbook" Elsevier Publication.
- Metcalf and Eddy, "Wastewater Engineering: Treatment & Reuse" Tata McGraw Hill Publication.

Class: **Final Year. B. Tech. Civil**	Semester: **VII**
Course Code: **CE4313**	Course Name - **PE-IV Pavement Analysis and Design Laboratory**

L	T	P	Credits
–	--	2	1

Course Description:
The objective of this course presents techniques and methodologies to analyze and design flexible and rigid pavements. The course is designed to provide engineering students exposure to pavement materials and characterization, evaluation of performance, and the many elements of pavement design. This laboratory course will help the students to understand the theoretical concepts learned in the pavement analysis and design course.

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

1. Select materials based on its suitability in different layers of pavement.
2. Evaluate different methods of quality control during pavement construction.
3. Design of bituminous mix for flexible pavement.
4. Design of concrete mix for rigid pavement.

Prerequisites: Basic knowledge of Transportation Engineering.

Course Content		
Expt. No.	**Name of Experiment**	**Hrs.**
01	Study the different code of practices used for the design of pavements.	02
02	Determination of optimum binder content of bituminous mix by Marshall Stability test.	02
03	Determination of CBR for subgrade soil by Dynamic Cone Penetration test.	02
04	Design of bitumen mix for flexible pavement.	04
05	Design of concrete mix (PQC) for rigid pavement.	04
06	Design of pavement by software method.	02
07	Measurement of slope of road surface.	02
08	Determination of Skid Resistance of Flexible/Rigid pavement.	02
09	Structural evaluation of flexible pavements by using Benkelman	02

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	Beam Deflection Method.	
10	Visit to flexible/ rigid pavement site and write a detailed report on it.	02

References:

Text Books:

- Justo C. E. G. & Khanna S. K., "Highway Engineering", Nem Chand & Bro. Publication.
- Robert D. Krebs "Highway Materials", McGraw Hill Text.
- Kadiyali L.R and Dr. Lal N.B., "Principles and Practices of Highway Engineering" Khanna Publishers, New Delhi.

Reference Books:

- Huang, Y. H. "Pavement Analysis and Design", Pearson Prentice Hall, NJ, USA.
- Yoder, E. J., and Witczak, M. W. "Principles of Pavement Design", Wiley, NY, USA.
- Harold N. Atkins, "Highway Materials, Soils and Concrete", Prentice Hall.
- Das, A., "Analysis of Pavement Structures", CRC Press, Taylor and Francis Group, Florida, USA.

Codes of Practice:

- IRC: 37-2018, Guidelines for the Design of Flexible Pavements.
- IRC: 58-2015, Guidelines for the Design of Rigid Pavements.
- IRC: 49- 2014, Guidelines for the use of Dry Lean Concrete
- IRC: 15- 2011, Standard specifications and code of practice for Construction of Concrete Roads.
- MORTH Specifications for Road and Bridge Works, Indian roads Congress.
- Mechanistic Empirical Pavement Design Guide, NCHRP, TRB.

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4333**	Course Name: **PE-IV Advanced Concrete Technology Laboratory**

L	T	P	Credits
-	-	2	1

Course Description:
This laboratory course is intended to allow the students to carryout experimental investigations on concrete. Course contents involves experimental studies of concrete properties related to microstructure, flowabilty, admixture use, corrosion and durability. The laboratory exercise also involves site visits and report preparation.

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

1. Evaluate the quality of concrete/ concrete elements based on the data collected during condition assessment of RCC building.
2. Design the mixes of special concretes using the available guidelines.
3. Perform the workability tests on flowable concretes.

Prerequisite: Possess basic knowledge of concrete technology laboratory

Laboratory Course Content		
Unit No.	Description	Hrs
01	Microstructural Characterization of concrete using SEM micrographs and XRD data	02
02	Mix design of special concrete following the standard/ existing guidelines (minimum one type)	04
03	Workability testing of self-compacting concrete	04
04	Effect of admixtures on concrete properties of fresh concrete	04
05	Mini Project: Effect of admixtures on concrete properties of hardened concrete	06
06	Visit to a construction site involving use of special concretes and advanced concreting techniques and preparation of report. (*Visits are preferred to cement manufacturing plant, RMC plants, high-rise construction, 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", Mc Graw Hill Publications, NY
- Irving Kett, "Engineered Concrete- Mix Design and Test Methods", 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: 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.

Class: **Final Year. B. Tech. Civil**	Semester **VII**
Course Code: **CE4053**	Course Name - **Design of Concrete Structures Laboratory**

L	T	P	Credits
-	--	2	1

Course Description:
Design of 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 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, column and footing.

Prerequisites: Knowledge of design of reinforced concrete structures, Auto CAD

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:

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.

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).

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4493**	Course Name: **Capstone Project Phase-II**

L	T	P	Credits
-	-	4	4

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, student will be able to conclude 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 problem.
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	Here in this phase student need to undergo remaining work of project in team and should achieve all the objectives stated in the synopsis during previous semester. Student should collect all the primary/secondary data and analyse the same in order to solve the problem. Progress presentations for the Capstone Project- II will be held during the semester. Student need to complete the objectives of the project and present the work before panel of experts along with supervisor from civil engineering department. In semester evaluation consist of presentation of work done before panel of experts. Rubrics assessment will be carried out during ISE & ESE.	**48**

Class: **Final Year B. Tech. Civil**	Semester: **VII**
Course Code : **CE4073**	Course Name: **Employment Enhancement Skills**

L	T	P	Credits
-	-	2	1

Course Description:
Under this course we offer wide range of soft computing tools to help civil engineers throughout design and construction processes. Software can help in every project stage, including drafting & documenting, designing, visualizing & analyzing. This course introduces basic skills required to develop computer programs using modern computer systems, assuming little or no previous experience.

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

1. Develop technical competency in software in the Civil Engineering field,
2. Solve civil engineering problems by using software.
3. Develop presentation skills for project/case study.
4. Design and interpret data by soft skill Civil Engineering projects.

Prerequisite: Basics of civil engineering course for which software is being used.

Course Content

Unit No.	Description	Hrs
01	This lab course is offered in Semester VII of Final Year B. Tech. Student need to select and undergo one of the software as per his/her interest. Student learns the software and need to complete the assigned work of selected software course during the semester and submit the same in the required format to course in charge. Student should carry out application oriented project work in a batch for selected software from the following list. In Semester Evaluation is based on the assigned work. ESE evaluation is done by External examiner 1. E-Tab 2. PRIMAVERA P6/ MS project 3. Google Sketch up 4. Arc-GIS/GRASS 5. Water Gems/EPANET/SewerGems 6. Terramodel 7. Road Master	24

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Class:- **Final Year B. Tech Civil**	Semester-**VIII**
Course Code : **OE4381**	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
01	**Finance Terminologies & Financial Statement:** Key terms of Accounting and Finance, Accounting Principles underlying Preparation of Financial Statements	6
02	**Analyzing Health of a Firm:** Techniques of Analyzing Health of a Firm, Classification of Ratios – Liquidity, Leverage, Activity, Profitability, Analysis of Cash Flows	6
03	**The Management of Working Capital:** Need of Working Capital, Operating Cycle of Working Capital, Determinants of Working Capital, Preparation of Working capital statement	6
04	**Investment Decision Rules:** Investment Decision Rules, Evaluation Criteria for Investment Decision: Payback, ARR, NPV, PI & IRR, Decision Tree Analysis	6
05	**Long Term Financing:** Long Term Financing: Shares, Debentures, Loan capital, foreign	6

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	capital, FDI, Euro issues & external borrowings, Venture capital financing.	
06	**Financing Decisions and Cost of Capital:** Risk & Return, Cost of Capital, Cost of Equity, Cost of Debt, Weighted Average Cost of Capital	6

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 Civil**	Semester-**VIII**
Course Code : **OE4361**	Course Name : **Engineering Management & Economics (Online Course)**

L	T	P	Credits
2	-	--	2

Course Description:
Engineering management is the application of the practice of management to the practice of engineering. Engineering Management is a specialized form of management that is required to successfully lead engineering or technical personnel and projects. This course consists of two modules i.e. Engineering Management and Engineering Economics. First module deals with managerial skillsets that are required to coach, mentor and motivate technical professionals to the practice of engineering.
Engineering economics is a fundamental skill that all successful engineering firms employ in order to retain competitive advantage and market share. Second module focuses on decision making with reference to economics.

Course Learning Outcomes:
After successful completion of this course, students will be able to,
1. Develop administrative, organizational and planning skills to execute engineering project.
2. Develop bar chart/mile stone chart for the project.
3. Analyze profit/cost data and carry out economic analysis to take optimal decision.
4. Calculate depreciation as per various methods.

Prerequisite: Basics of Mathematics

Course Content

Unit No	Description	Hrs
01	**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
02	**Organizational skills** Levels of management, Organizations-elements, types and characteristics of organization, Management by Objectives (MBO)	04
03	**Planning Tools** Methods of scientific management- Critical Path Method (CPM), Programme Evaluation & Review Techniques (PERT), Network Crashing, Bar Chart, Mile-Stone chart	04
04	**Methods of Economic Analysis** Economic equivalence, Methods of comparison of alternatives- Present Worth Method, Rate of Return method, Benefit-Cost ratio method, Net Present Value method	04
05	**Make or Buy Decision** Approaches of make or buy decision-Simple cost analysis, Economic	04

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	analysis, break-even analysis, Payback analysis	
06	**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 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 : **IP4023**	Course Name: **Internship & Project**

L	T	P	Credits
-	-	--	08

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

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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.

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Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : **OE4381**	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**
01	**Finance Terminologies & Financial Statement:** Key terms of Accounting and Finance, Accounting Principles underlying Preparation of Financial Statements	6
02	**Analyzing Health of a Firm:** Techniques of Analyzing Health of a Firm, Classification of Ratios – Liquidity, Leverage, Activity, Profitability, Analysis of Cash Flows	6
03	**The Management of Working Capital:** Need of Working Capital, Operating Cycle of Working Capital, Determinants of Working Capital, Preparation of Working capital statement	6
04	**Investment Decision Rules:** Investment Decision Rules, Evaluation Criteria for Investment Decision: Payback, ARR, NPV, PI & IRR, Decision Tree Analysis	6
05	**Long Term Financing:** Long Term Financing: Shares, Debentures, Loan capital, foreign	6

	capital, FDI, Euro issues & external borrowings, Venture capital financing.	
06	**Financing Decisions and Cost of Capital:** Risk & Return, Cost of Capital, Cost of Equity, Cost of Debt, Weighted Average Cost of Capital	6

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 : **OE4361**	Course Name : **Engineering Management & Economics (Online Course)**

L	T	P	Credits
2	-	--	2

Course Description:
Engineering management is the application of the practice of management to the practice of engineering. Engineering Management is a specialized form of management that is required to successfully lead engineering or technical personnel and projects. This course consists of two modules i.e. Engineering Management and Engineering Economics. First module deals with managerial skillsets that are required to coach, mentor and motivate technical professionals to the practice of engineering.
Engineering economics is a fundamental skill that all successful engineering firms employ in order to retain competitive advantage and market share. Second module focuses on decision making with reference to economics.

Course Learning Outcomes:
After successful completion of this course, students will be able to,
1. Develop administrative, organizational and planning skills to execute engineering project.
2. Develop bar chart/mile stone chart for the project.
3. Analyze profit/cost data and carry out economic analysis to take optimal decision.
4. Calculate depreciation as per 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	04
4.	**Methods of Economic Analysis** Economic equivalence, Methods of comparison of alternatives- Present Worth Method, Rate of Return method, Benefit-Cost ratio method, Net Present Value method	04
5.	**Make or Buy Decision** Approaches of make or buy decision-Simple cost analysis, Economic analysis, break-even analysis, Payback analysis	04

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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 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 : **RE4043**	Course Name : **Research Project**

L	T	P	Credits
-	-	08	08

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 the ability to explain how the project will impact the relevant body of work.
7. Develop advanced discipline-relevant skills and competencies.
8. Construct an accurate record of research performed.
9. 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

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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 : **ED4103**	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. Prepare business Plan for selected business.
2. Make risk analysis& market analysis of selected project.
3. Make risk analysis& market analysis of selected project
4. Make financial appraisal of selected project.

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

Course Content

Unit No	Description	Hrs
1.	**Project appraisal Introduction**-Project Development Cycle, Identifying data requirements and analyzing their suitability for 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, applying various techniques and integrating the data gathered into a full-fledged business plan.	06
2.	**Project Analysis**-Environmental Analysis, Risk Analysis, Infrastructure Development & Financing, Risk Management, Risk identification, Qualitative risk analysis, Quantitative risk analysis, Risk planning, Risk control, Evaluating the rewards & risks for sustainable opportunities. National Cost-Benefit Analysis, Financing Sustainable Opportunities.	06
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.	06
4.	**Commercial Appraisal:** Economic feasibility and commercial viability, market analysis, Market Research, Industry Analysis, Competitor analysis, defining the target market, market segmentation, market positioning,	06

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	building a marketing plan, market strategy.	
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	06
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	06

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 : **ED4043**	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 Financial Terminologies.
2. Prepare & analyze financial statements.
3. Prepare financial Plan for venture.
4. Apply basic principles of marketing for various products.
5. Prepare market survey.
6. Apply knowledge of marketing management for selected business.

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; basics of financial statements, generally accepted accounting concepts, principles and conventions; double entry system. Accounting Records: Fundamentals of record keeping, the accounting process, transactional analysis, the Adjusting and Closing process. Accounting systems. Computer-based accounting systems. Accounting cycle.	06
2.	**Financial Statements:** Balance sheet: assets, liabilities. Income statement: concept of income, concept of expenses, concept of gain and losses. Components of the income statement. Other concepts of income. Cash flow statements: purpose, components, and categories. Preparation of cash flow statements: concept, activities. Accounting and pricing.	06

3.	**The concept of Financial Management** – Definition, nature, objectives, functions and scope of financial management, Preparation of financial plan – its objectives, essential features, consideration in formulating financial plan, Capitalization: over, under and fair capitalization. Concept of risk and returns, Time value of money.	06
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, Assessment of demand & supply, Preparation of survey questionnaire.	06
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, customer value proposition.	06
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, Digital Marketing	06

References -

Text Books:

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

Reference Books:

1. Ghosh, T.P., Financial Accounting for Managers, Tax-mann Allied Services
2. Gupta, A., Financial Accounting for Management, Prentice Hall
3. Jain, S.P. and Narang, K.L., Advanced Accountancy, Kalyani Publishers.
4. Smith, J.K., Smith, R.L. and Bliss, R.T., Entrepreneurial Finance, Stanford University Press
5. Smith, J.K. and Smith, R.L., Entrepreneurial Finance, Wiley.
6. Rogers, S., Entrepreneurial Finance, McGraw Hill.

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7. Chandra, P., Financial Management, McGraw Hill.
8. 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).

Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : **ED4063**	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 : **ED4083**	Course Name: Entrepreneurship Development Project

L	T	P	Credits
-	-	7	7

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

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