K.E. Society's
Rajarambapu Institute of Technology, Sakharale
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation
With effective from 2018-22 [2018-22 & 2019-23 Batch]
Department of Civil Engineering

Rev: CE/RIT/01/2018-22

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Cr	Scheme	Theory (Marks)			Practical (Marks)	
							Max	Min. for passing%		Max.	Min. for passing %
CE2012	Building Planning and Design	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE2032	Engineering Mechanics	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE2052	Strength of Material	2	-	-	2	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
SH2052	Engineering Mathematics III	3	1	-	4	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE2072	Surveying	2	-	-	2	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
SH2172	Environmental Science	1*	-	-	1	ISE	50	40	40	-	-
						ESE	50	40		-	-
CE2092	Building Planning and Design lab	-	-	4	2	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE2112	Surveying Lab	-	-	2	1	ISE	-	-	--	50	50
						ESE	-	-		50	50
CE2132	Strength of Material lab	-	-	2	1	ISE	-	-	-	100	50
CE2152	Comprehensive Exam I	-	-	-	1	ESE	-	-	-	100	50
CE2172	Engineering Mechanics Lab	-	-	2	1	ISE	-	-	-	100	50
SH2602	Environment Project	-	-	2	1	ISE				100	50
	Open Elective –II Choice Based Soft Skill Program-I	-	-	2	1	ISE	-	-	-	100	50
	TOTAL	**14**	**01**	**14**	**23**	-	-	-	-	-	-

Total Contact Hours/week : 29
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 Comprehensive Exam: Engg. Mathematics, Engg. Mechanics, Strength of Materials, Advanced Surveying

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

Open Elective –II

List of Choice Based Soft Skill Program-I

Sr. No.	Subject Name		Course Code
1.	Choice Based Soft Skill Program-I & II	Personal Effectiveness & Body Language	SH2592
2.		Interpersonal Skills (Work life Balance)	SH2612
3.		Leadership & Public Speaking	SH2632
4.		Innovation Tools and Methods for Entrepreneurs	SH2692
5.		German Language – Basic Level	SH2732
6.		Japanese Language – Basic Level	SH2712

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 – Basic Level' in S.Y. B. Tech Sem-III will by default (mandatorily) appear for Advance Levels of said courses in Semester-IV.

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Rev: CE/RIT/01/2018-22

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

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Cr	Scheme	Theory (Marks)		Practical (Marks)	
							Max.	Min. for passing%	Max.	Min. for passing %
CE2022	Engineering Geology	2	-	-	2	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2042	Concrete Technology	3	-	-	3	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2062	Fluid Mechanics	3	-	-	3	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2082	Mechanics of Structures	3	-	-	3	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2102	Human Values and Professional Ethics	2	-	-	2	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2122	Applications of Programming Language in Civil Engineering	-	-	2	1	ISE	-	-	100	50
CE2142	Engineering Geology Lab	-	-	2	1	ISE	-	-	100	50
CE2162	Fluid mechanics Lab	-	-	2	1	ISE	-	-	100	50
CE2182	Concrete Technology Lab	-	-	2	1	ISE	-	-	100	50
CE2202	Comprehensive Exam II	-	-	-	1	ESE	-	-	100	50
	Open Elective –III Choice Based Soft Skill Program-II	-	-	2	1	ISE	-	-	100	50
CE2222	Internship	-	-	-	2	ISE	-	-	100	50
	TOTAL	**13**	**0**	**10**	**21**	-	-	-	-	-

Total Contact Hours/week : **23**
Total Credits : **21**

Courses for Comprehensive Exam: Mechanics of Structures, Fluid Mechanics, Concrete Technology

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

Open Elective –III

List of Choice Based Soft Skill Program-I & II

Sr. No.	Subject Name		Course Code
1.	Choice Based Soft Skill Program-I & II	Personal Effectiveness & Body Language	SH2592
2.		Interpersonal Skills (Work life Balance)	SH2612
3.		Leadership & Public Speaking	SH2632
4.		Innovation Tools and Methods for Entrepreneurs	SH2692
5.		German Language – Basic Level	SH2732
6.		Japanese Language – Basic Level	SH2712

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 – Basic Level' in S.Y. B. Tech Sem-III will by default (mandatorily) appear for Advance Levels of said courses in Semester-IV.

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Cr	Scheme	Theory (Marks)			Practical (Marks)	
							Max.	Min. for passing%		Max.	Min. for passing %
CE3012	Design of Steel Structures	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3032	Geotechnical Engineering	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3052	Irrigation and Hydraulic Structures	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3072	Environmental Engineering	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3092	Transportation Engineering	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
	Programme Elective - I	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE3112	Geotechnical Engineering lab	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE3132	Environmental Engineering lab	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE3152	Transportation Engineering lab	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
SH3032	Aptitude Training -I	2*	-	-	2	ISE	20	40	40	-	-
						UT1	15				
						UT2	15				
						ESE	50	40			
CE3172	Comprehensive Exam III	-	-	-	1	ESE	-	-	-	100	50
SH301	Indian Constitution	2	-	-	Audit	ISE	100	40	-	-	-
	TOTAL	**22**	**00**	**06**	**24**	-	-	-	-	-	-

Total Contact Hours/week : 28
Total Credits : 24

Note:
* One extra lecture to be allotted to Environment Science in time table.

Courses for Comprehensive Exam III: Design of Steel Structures, Geotechnical Engineering, Environmental Engineering, Transportation Engineering, Irrigation and Hydraulic Structures

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

List of Program Elective-PE I

Sr. No.	Course Code	Domain	Course
1	CE3192	Structural Engineering	Structural Analysis
2	CE3212		Composite Materials
3	CE3232	Construction Management	Construction Safety and Quality Management
4	CE3252		Advanced Construction Techniques
5	CE3272	General Civil Engineering (Environmental, Geotechnical, Transportation etc.)	Instrumental Monitoring of Environment and Modeling
6	CE3292		Tunnel Docks and Harbor Engineering
7	CE3312		Urban Transportation Systems

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

Course Code	Course	Teaching Scheme				Scheme	Evaluation Scheme				
							Theory (Marks)			Practical (Marks)	
		L	T	P	Cr		Max.	Min. for passing%		Max.	Min. for passing %
CE 3022	Theory of Structures	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE 3042	Estimation & Contracts	2	-	-	2	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE 3062	Design of Reinforced Concrete Structures	4	-	-	4	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
	Program Elective –II	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
	Program Elective –III	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
	Open Elective -IV	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
SH 302	Biology for Engineers	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE 3082	Estimation & Contracts Laboratory	-	-	4	2	ISE	-	-		50	50
						ESE	-	-		50	50
CE 3102	Design of Steel Structures Laboratory	-	-	2	1	ISE	-	-		50	50
						ESE	-	-		50	50
CE 3122	Comprehensive Exam-IV	-	-	2	1	ESE	-	-		100	50
CE 3482	Capstone Project phase-I	-	-	2	2	ISE	---	---		100	50
SH3042	Aptitude Training II	2*	-	-	2	ISE	20	40	40	-	-
						UT1	15				
						UT2	15				
						ESE	50	40			
	TOTAL	**23**	**00**	**10**	**29**	-	-	-	-	-	-

Total Contact Hours/week : 33
Total Credits : 29

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

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

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

List of Program Elective PE– II

Sr. No.	Course Code	Domain	Course
1	CE 3162	Structural Engineering	Design of Industrial Structures
2	CE 3182		Repair and Rehabilitation of Structures
3	CE 3202	Construction Management	Construction Economics and Finance
4	CE 3222		Disaster Preparedness and Planning
5	CE 3242	General Civil Engineering (Environmental, Geotechnical, Transportation etc.)	Air Quality Monitoring and Modeling
7	CE 3262		Railway and Airport Engineering

List of Program Elective PE– III

Sr. No.	Course Code	Discipline	Course
1	CE 3302	Structural Engineering	Design of Bridges
2	CE 3322		Design of Earthquake Resistant Structures
3	CE 3342	Construction Management	Advanced Construction Equipment
4	CE 3382	General Civil Engineering (Environmental, Geotechnical, Transportation etc.)	Environmental Management System
5	CE 3402		Geographical Information System (GIS)
6	CE 3422		Foundation Engineering
7	CE 344		Intelligent Transport System

Open Elective-IV

Sr. No.	Branch	Course Code	Open Elective-IV Courses
1	Automobile	OE3022	Reliability Engineering
2	Automobile	OE3042	Renewable Energy Sources
3	Civil	OE3062	Environmental Impact Assessment
4	Civil	OE3082	Material Management.
5	Computer	OE3102	Network Administration
6	Computer	OE3122	Information Technology Foundation Program
7	E&TC	OE3142	Mechatronics
8	Electrical	OE3162	Electrical Materials
9	Electrical	OE318	Industrial Drives
10	CS&IT	OE320	Artificial Intelligence
11	CS&IT	OE322	Cyber Forensics
12	MBA	OE3242	Marketing for Engineers
13	Mechanical	OE3262	Aircraft Systems
14	Mechanical	OE3282	Supply Chain Management
15	Mechanical	OE330	New Product Design and Development
16	Mechanical	OE3322	Entrepreneurship Development
17	Mechanical	OE334	Research Methodology

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

Course Code	Course	Teaching Scheme				Exam	Evaluation Scheme				
							Theory (Marks)			Practical (Marks)	
		L	T	P	Cr		Max.	Min. for passing%		Max.	Min. for passing %
CE 4632	Construction Management	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE 4032	Construction Equipment and Methods	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		-	-
CE 4612	Site Experience	-	-	-	2	ISE	-	-	-	100	50
	Program Elective -IV Lab	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE 4052	Design of Concrete Structures Laboratory	-	-	2	1	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE 4372	Capstone Project Phase-II	-	-	4	4	ISE	-	-	-	100	50
						ESE	-	-	-	100	50
CE 4072	Employment Enhancement Skills (Software in Civil Engg.)	-	-	2	1	ISE	-	-	-	100	50
	TOTAL	**12**	**00**	**10**	**21**	-	-	-	-	-	-

Total Contact Hours/week : 22
Total Credits : 21

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

List of Program Elective (PE) – IV

Sr. No.	Course Code	Discipline	Course
1	CE 4092	Structural Engineering	Advanced Structural Analysis
2	CE 4112		Finite Element Analysis
3	CE 4132	Construction Management	Project Management
4	CE 4152	General Civil Engineering (Environmental, Geotechnical, Transportation etc.)	Rock Mechanics
5	CE 4172		Industrial Waste Management
6	CE 4192		Pavement Analysis and Design

List of Program Elective (PE) - IV Laboratory

Sr. No.	Course Code	Discipline	Course
1	CE 4212	Structural Engineering	Advanced Structural Analysis Laboratory
2	CE 4232		Finite Element Analysis Laboratory
4	CE 4652	Construction Management	Project Management Laboratory
5	CE 4272	General Civil Engineering (Environmental, Geotechnical, Transportation etc.)	Rock Mechanics Laboratory
6	CE 4672		Industrial Waste Management Laboratory
7	CE 4312		Pavement Analysis and Design Laboratory

List of Program Elective (PE)–V

Sr. No.	Course Code	Domain	Course
1	CE 4392	Structural Engineering	Advanced Structural Design
2	CE 4412		Pre-stressed Concrete structures
3	CE 4432		Matrix Method of Structural Analysis
4	CE 4452	Construction Management	Construction Resource Planning and Management
5	CE 4472		Total Quality Management
6	CE 4492	General Civil Engineering (Environmental, Geotechnical, Transportation etc.)	Air Pollution and Control
7	CE 4512		Fundamentals of Urban and Regional Planning
8	CE 4532		Solid and Hazardous Waste management
9	CE 4552		Photogrammetry Surveying
10	CE 4572		Geo-informatics for Engineering
11	CE 4592		Docks, Harbors and Airport Engineering

Open Elective-V

Sr. No.	Branch	Course Code	Open Elective-IV Courses
1	Automobile	OE3022	Reliability Engineering
2	Automobile	OE3042	Renewable Energy Sources
3	Civil	OE3062	Environmental Impact Assessment
4	Civil	OE3082	Material Management.
5	Computer	OE3102	Network Administration
6	Computer	OE3122	Information Technology Foundation Program
7	E&TC	OE3142	Mechatronics
8	Electrical	OE3162	Electrical Materials
9	Electrical	OE318	Industrial Drives
10	CS&IT	OE320	Artificial Intelligence
11	CS&IT	OE322	Cyber Forensics
12	MBA	OE3242	Marketing for Engineers
13	Mechanical	OE3262	Aircraft Systems
14	Mechanical	OE3282	Supply Chain Management
15	Mechanical	OE330	New Product Design and Development
16	Mechanical	OE3322	Entrepreneurship Development
17	Mechanical	OE334	Research Methodology

Track I: Industry Internship & Projects (IIP)

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks)			Practical (Marks)	
							Max.	Min. for passing%		Max.	Min. for passing%
OE438	Finance for Engineers (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ES	75	40		---	---
OE436	Engineering Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ES E	75	40		---	---
IP4022	Internship & Project	-	-	-	8	ISE	---	----		50	50
						ES E	---	---		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 for IP4022 course, 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					
		L	T	P	Credits	Scheme	Theory (Marks)			Practical (Marks)	
							Max.	Min. for passing (%)		Max.	Min. for passing (%)
OE438	Finance for Engineers (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
OE436	Engineering Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
RE4042	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

Sr.No	Course Code	Course	Teaching Scheme			Credits	Evaluation Scheme					
			L	T	P		Scheme	Theory (Marks)			Practical (Marks)	
								Max	Min. for passing%		Max	Min. for passing%
1	**ED4102**	Project Management	2*	-	-	2	ISE	20	40	40		
							UT-1	15				
							UT-2	15				
							ESE	50	40			
2	**ED4042**	Commercial Aspects of the Project	2*	-	-	2	ISE	20	40	40		
							UT-1	15				
							UT-2	15				
							ESE	50	40			
3	**ED4062**	Entrepreneurship Development Program (EDP)	-	-	-	1	ISE				100	50
4	**ED4082**	Entrepreneurship Development Project	-	-	7	7	ISE				50	50
							ESE				50	
Total			**4**	**-**	**7**	**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:
1] * One extra lecture to be allotted to Project Management and Commercial Aspects of the Project course in time table.

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Final Year B. Tech. Civil Engineering Syllabus
To be implemented from 2021-22
Department of Civil Engineering

Class: **Final Year B. Tech Civil Engineering**	Semester-**VII**
Course Code: **CE 4632**	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 project 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 project management tools, resource allocation, resource leveling etc.

Course Outcomes:
After completing the course, the student should be able to: -
1. Apply principles of management.
2. Develop and analyze the network diagram for civil engineering projects.
3. Apply principles of work study to design site layout.
4. Apply various techniques for inventory control.

Prerequisites:--Nil

Course Content

Unit No.	Description	Hrs.
1.	**Principles of Management (by Henry Fayol)** Functions of Management, Planning, Organizing, Staffing, Directing, Coordination, Communication, Motivation and Controlling. Levels of management, Organizations-elements, types and characteristics	4
2.	**Project Management** Objectives, Agencies, Phases; Work Breakdown Structure, Project Planning - Bar Chart, MileStone Chart, CPM, Development of CPM Network – Time Estimates, Floats, Critical Path.	6
3.	**Network** Network Compression, Network Updating, Resource allocation – smoothing and leveling, Introduction to PERT,	6
4.	**Precedence Network** Concept, Development of Precedence Network, Network analysis by precedence diagramming method.	6
5.	**Introduction to Work Study** Method study, time measurement, time management, Direct cost, Indirect cost, Total cost, Introduction to Computer based Project Management	8
6.	**Site Layout** Factor Affecting, Typical Layout of few Major Construction Projects, Material Management – Objectives, Functions, Inventory Control-Necessity, Techniques Such As ABC, EOQ Analysis, Safety Stocks.	6

References -

Text Book:

1. Punmia B. C., Khandelwal K. K, "Project Planning & Control with PERT & CPM", Laxmi Publications Pvt Ltd.
2. Harold Kerzner "Project Management: A Systems Approach to Planning, Scheduling, and Controlling" Wiley.

Reference Books:

1. Chitkara K. K. "Construction Project Management", McGraw Hill Education.
2. Sengupta B. and Guha H. "Construction Management and Planning", McGraw Hill Education (India).
3. Chandra Parsanna, "Projects: Planning, Analysis, Selection, Financing, Implementation and Review", McGraw-Hill; Ninth edition
4. Khanna O.P. "Industrial Engineering and Management", Dhanpat Rai Publications.
5. Gopal Krishnan, "Materials Management: An Integrated Approach", PHI.

Class: **Final Year B. Tech Civil Engineering**	Semester-**VII**
Course Code: **CE 4652**	Course Name: **Project Management Laboratory**

L	T	P	Credits
2	--	--	1

Course Description
This course focuses on guidelines for managing individual projects and project management related key concepts. It also covers the project management life cycle and related processes, human planning resources for construction projects.

Course Outcomes:
After successfully completing the course, student will 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. Develop project in Microsoft project tool.
5. Plan resources required for execution of the project.

Course Content

Expt. No.	Name of Experiment	Hrs.
1	Development of project charter for a construction project.	06
2	Case study based on Pre-Feasibility Study and Feasibility Studies for a construction project*	04
3	Determine the optimum time and optimum cost of project through compression of CPM network for a construction project	06
4	Planning & scheduling of projects through Microsoft project tool.	06
5	Resource planning for construction projects.	02

*First session should be used to discuss pre-feasibility of construction projects and the second session should be utilized to undertake case study for pre-feasibility analysis of construction projects.

References -
Text Book:
1. Punmia B. C., Khandelwal K. K, "Project Planning & Control with PERT & CPM", Laxmi Publications Pvt Ltd.
2. Harold Kerzner "Project Management: A Systems Approach to Planning, Scheduling, and Controlling" Wiley.

Reference Books:
1. Chitkara K. K. "Construction Project Management", McGraw Hill Education.
2. Sengupta B. and Guha H. "Construction Management and Planning", McGraw Hill Education (India).
3. Chandra Parsanna, "Projects: Planning, Analysis, Selection, Financing, Implementation and Review", McGraw-Hill.

Class: **Final Year B. Tech Civil Engineering**	Semester-**VII**
Course Code: **CE 4672**	Course Name: **Industrial Waste Management Laboratory**

L	T	P	Credits
2	--	--	1

Course Description
Industrial waste treatment 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 Outcomes:
After successfully completing the course, student will able to:
1. Analyse Industrial wastewater characteristics.
2. Prepare a layout of wastewater treatment plants for Industrial wastewater.
3. Design of Effluent Treatment Plant for Industrial wastewater.
4. Prepare Field visit Report of ETP of Industry.

Prerequisites: Basic knowledge of Fundamentals of chemistry and Wastewater Engineering course is essential.

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

Course Content

Expt. No.	Name of Experiment	Hrs.
Analysis of wastewater and Design of ETP		
1	Determination of physical properties of Industrial wastewater	04
2	Determination of Chemical properties of Industrial wastewater	08
3	Determination of Biological properties of Industrial wastewater	02
4	Prepare layout of Effluent Treatment Plant (ETP) for Industrial wastewater	04
5	Design of Effluent Treatment Plant (ETP) for Industrial wastewater	04
6	Industrial Visit Report: Prepare detail Industrial visit Report (Sugar Factory, Distillery, Paper mill, Textile mill, Dairy, Tannery)	02

Text Book:
1. Rao M. N. & Datta A. K.. "Wastewater Treatment" Oxford and IBH publishing Co. Pvt. Ltd. New Delhi.

2. Patwardhan A. D. "Industrial Wastewater Treatment" Prentic Hall India Pvt. Ltd. New Delhi.
3. Punmia B. C., "Wastewater Treatment and Reuse" Lakshmi Publications Pvt. Ltd. New Delhi

Reference Books:

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

K.E. Society's
Rajarambapu Institute of Technology, Sakharale
(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation **Batch: 2018-2022**
To be implemented from **(2018-19)**

***Rev: CE** Course Structure/RIT/02/2018-19*

Department : Civil Engineering
Class :S.Y.B.Tech. **Semester:** III

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Cr	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min. for passing		Max.	Min. for passing
CE2012	Building Planning and Design	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE2032	Engineering Mechanics	3	-	-	3	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE2052	Strength of Material	2	-	-	2	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
SH2052	Engineering Mathematics III	3	1	-	4	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
CE2072	Surveying	2	-	-	2	ISE	20	40	40	-	-
						UT1	15			-	-
						UT2	15			-	-
						ESE	50	40		-	-
SH2172	Environmental Science	1*	-	-	1	ISE	50	40	40	-	-
						ESE	50	40		-	-
CE2092	Building Planning and Design lab	-	-	4	2	ISE	-	-	-	50	50
						ESE	-	-	-	50	50
CE2112	Surveying Lab	-	-	2	1	ISE	-	-	--	50	50
						ESE	-	-		50	50
CE2132	Strength of Material lab	-	-	2	1	ISE	-	-	-	100	50
CE2152	Comprehensive Exam I	-	-	-	1	ESE	100	50		-	-
CE2172	Engineering Mechanics Lab	-	-	2	1	ISE	-	-	-	100	50
SH2602	Environment Project	-	-	2	1	ISE	-	-	-	100	50
SH****	**Open Elective –II** Choice Based Soft Skill Program-I	-	-	2	1	ISE	-	-	-	100	50
	TOTAL	**14**	**01**	**14**	**23**	-	-	-	-	-	-

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

Total Contact Hours/week : 29
Total Credits : 23

Courses for Comprehensive Exam: Engg. Mathematics, Engg. Mechanics, Strength of Materials, Advanced Surveying

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

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

Open Elective –II

List of Choice Based Soft Skill Program-I

Sr.No.	Course Code	Course
1.	SH2592	Personal Effectiveness & Body Language
2.	SH2612	Interpersonal Skills (Work life Balance)
3.	SH2632	Leadership & Public Speaking
4.	SH2692	Innovation Tools and Methods for Entrepreneurs
5.	SH2732	German Language – Basic Level
6.	SH2712	Japanese Language – Basic Level
7.	SH2642	German Language – Advanced Level
8.	SH2622	Japanese Language – Advanced Level

Note:

1. A student has to complete any two courses out of six choices offered under Choice Based Soft Skills Program. 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 S.Y. B.Tech Sem-IV only.

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

Class: **S. Y. Civil**	Semester-**III**
Course Code: **CE2012**	Course Name: **Building Planning and Design**

L	T	P	Credits
3	--	--	3

Course Description:
Building Planning and Design course offered in 3rd semester which focuses on building materials, types and design components for residential buildings. The course enables students to work as a consultant and or contractor for residential building projects.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Choose s suitable building materials for building construction applications.
2. Explain suitability and functions of various building components.
3. Prepare a functional design and AutoCAD drawing of building components.
4. Plan and design a residential building according to the principles of planning and Bye laws.
5. Choose the appropriate type of pluming, furniture, electrification system and building finishes for residential buildings.

Prerequisite:
Basic knowledge of construction building materials, applications, procedures etc.

Course Content

Unit No.	Description	Hrs.
1.	**Introduction to building drawings and building materials** Introduction to building drawings: Necessity, Concept of scale, Types of building drawings-layout plan, site plan, submission drawing and working drawings. Types, properties and applications of building materials: Stone, Brick, Aggregates, Timber, Steel, Cement, Flooring materials, Roofing materials, Aluminum, Glass, Plastic and Admixtures. Seasoning and defects of timer.	06
2.	**Components of building** Components of sub structure and super structure and their functions, Foundations: Types & their suitability, Doors and Windows: Technical terms, classification, uses. Staircase: Types, materials, design of stair. Ramps, ladders, lifts and escalator. Masonry: Types of brick and stone masonry, bonds in brickwork and stone masonry.	06
3.	**Design and Drawing of Components of Building** Detailed design and drawing of Isolated footing and under-reamed pile foundation using AutoCAD. Detailed design and drawing of paneled door and windows using AutoCAD. Detailed design and drawing of quarter turn, dog legged and open well staircase using AutoCAD	06

4.	**Principles of planning and Bye Laws** Site Selection criteria, Significance of Sun &Wind Diagram, Types of buildings, Basic requirements of good buildings, Planning, Orientation and criteria under Indian condition, Principles of planning, Ventilation- objectives, types, selection of ventilation system, Concept of green building. Bye laws: Definition, Necessity and different bye laws as per SP-7, 1983 National Building code.	**06**
5.	**Submission Drawing of Residential Buildings** Planning and Design of Residential buildings, Preparation of Submission drawing using AutoCAD - Bungalow, Twin Bungalow, Apartments.	**06**
6.	**Plumbing, Furniture, Electrification and Finishes of Building** Concept of Plumbing & Drainage plan, Plumbing systems, Types of traps, Fittings, Septic Tank, Soak pit, rainwater harvesting, and Plumbing layout for residential buildings using AutoCAD. Furniture for residential buildings, Furniture layout for residential buildings using AutoCAD. Electrification layout for residential buildings using AutoCAD, Types of wiring.Plastering and Pointing- Necessity, Process, Materials, Types.Paints – Necessity, Process, types.	**06**

References –

References Books: -

1. V. B. Sikka (2015), A Course in Civil Engineering Drawing, 7th Edition, S. K. Kataria and Sons.
2. Mehta, Scarborough, Armpriest (2018), Building Construction, 3rd Edition, Pearson Education
3. W.B Macay (2013),Building Construction, 5th Edition, Pearson Education
4. Mantri (2016), The A to Z of Practical Building Construction and its Management, 2ndEdition, Satya Prakashan.

Text Books: -

1. Arora, Bindra (2014),A Text Book of Building Construction,6th Edition, DhanpatRai Publications
2. Punmia (2005),A Text Book of Building Construction, 5th Edition, 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:**CE2032**	Course Name: **Engineering Mechanics**

L	T	P	Credits
3	---	--	3

Course Description:
Engineering mechanics is offered as the course in the third semester of civil engineering; 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, as it develops the thinking, analytical ability and imaginative skill of student.

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, students will be able to,

1. Classify various forces and their effects, to analyze real life problems.
2. Analyze engineering problems applying conditions of equilibrium
3. Apply fundamental concepts of Kinematics and Kinetics to the analysis of practical problems
4. Determine Centroid & Moment of Inertia of the geometrical plane lamina

Prerequisite:
The course learns through prerequisite courses of Engineering Mathematics, Engineering Physics,

COURSE CONTENT

Unit No.	Details of Content	Hrs.
1.	**Fundamentals of Mechanics and Force Systems:** Scope of the subject, 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, Equilibrium of strings, circular bodies. Concept of virtual	6

	work.	
3.	**Friction and Analysis of Plane Trusses** **3.1 Friction:** Introduction to Laws of friction, Surface friction for bodies on horizontal and inclined planes, Application to problems involving block friction, ladder friction. **3.2 Analysis of plane trusses** by using Method of joints and Method of sections.	**6**
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.	**Rectilinear Motion of Particle:** 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**

References:

Text books:

1. S.S.Bhavikatti and Rajashekarappa, (2008)"Engineering Mechanics", new age International publication (India) Pvt. Ltd. New Delhi 3rd Edition.
2. S. Ramamrutham, (2008)"Engineering Mechanics", Dhanpat Rai Publishing Company Ltd. Ansari Road, Darya Gang, New Delhi,9th Edition.

Reference books:

1. Junnerkar S.B., (2001)"Elements of Applied Mechanics", Charotar Publishing House (India) Pvt. Ltd., Anand (Gujarat) 12th Edition.
2. Ferdinand. P. Beer and E. Russell Johnson, (2004)"Vector Mechanics for Engineers (Statics and Dynamics)", the McGraw Hill Publication, New York 8th Edition.
3. Ferdinand L. Singer; Harper and Collins,(2005)"Engineering Mechanics (Statics and Dynamics)" Publications (India) Pvt. Ltd. Noida 3rd Edition.
4. Timoshenko and Young, (2001) "Engineering Mechanics (Statics and Dynamics)", Mc GRAW-HILL International Editions 4th Edition.

Class:-**S.Y. B. Tech. Civil Engineering**	Semester-**III**
Course Code:**CE2052**	Course Name: **Strength of Material**

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

Course Description:
Strength of Material is one of the core courses offered at third semester of Civil Engineering undergraduate program. 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, 'Strength of Material' deals with the analysis of various determinate structures, such as beams, columns 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 structural members for various types of stresses and strains.
2. Determine shear and bending stresses for determinate beams.
3. Construct shear force and bending moment diagrams for determinate beams.

Prerequisites:
For studying this course the student should have studied the courses Engineering Mechanics and Physics. The knowledge of Engineering Mechanics will help to identify different types of loads, preparing free body diagrams and finding support reactions. The knowledge of Strength of Materials will help them to determine, stresses and strains due to axial loadings, shear force and bending moment at various sections of beams, shear and bending stresses in the various beam sections. The knowledge of basic mathematics and trigonometry is also required.

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 diagrams for brittle, elastic and plastic materials, Deformations in composite sections under axial loading, compound bars, and temperature stresses. Elastic constants and their relationships.	7
2.	**Principal Stresses:** Principal stresses: Concept of principal planes and principal stresses, normal and shear stresses on an oblique plane, magnitude and orientation of principal	6

	stresses and maximum shear stress. Concept of Mohr's circle for plane stresses.	
3.	**Shear Force and Bending Moment Diagrams:** 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 beam Shear Stresses: Derivation of shear stress equation, Shear stress distribution of variousshapes cross-sections, average and maximum shear stress.	**5**

References:

Text Books:

1. Dr. H. J. Shah, and S.B. Junnarkar (2007) "Mechanics of Structures", Charotar Publishing House Pvt Limited, New Delhi, 27th Edition.
2. R.S. Khurmi, (2015)"Strength of Materials", Chand (S.) & Co Ltd, India.
3. S.Ramamrutham, (2012) "Strength of Materials", Dhanpat Rai Publishing Company (P) Limited, New Delhi.

Reference Books:

1. R.Vaidyanathan,P.Perumal, S.Lingeswari, (2012) "Mechanics of Solids and Structures", Scitech Publications Pvt. Ltd., Chennai, Vol. I.

Class: **S. Y. B. Tech Civil Engineering**	Semester-**III**
Course Code: **SH2052**	Course Name: **Engineering Mathematics III**

L	T	P	Credits
3	1	--	3

Course Description

Engineering Mathematics – III is one of the core courses offered at third semester of Civil Engineering undergraduate program. 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 with constant coefficients.
2. Apply linear differential equations (LDP) to deflection of beams and Columns
3. Solve problems on linear partial differential equations with constant coefficients
4. Determine Fourier series of given function
5. Compute Karl Pearson's coefficient of correlation and determine regression lines
6. Use probability distributions to solve the engineering problems

Pre-requisite:

First Year Engineering Mathematics, Elementary probability and statistics.

Unit No.	Details of Content	Hrs.
1.	**Linear Differential Equations** Introduction and definition, complete solution of Linear Differential Equations with constant coefficients, complete solution of Linear Differential Equations with variable coefficients	6
2.	**Application of Linear Differential Equations to Civil Engineering** Application to: Bending of beams, Buckling of columns, rod, Struts, Cantilever struts.	6
3.	**Linear Partial Differential Equations with constant coefficients** Introduction and Definition , Linear homogeneous partial Differential Equations of the order with constant coefficients , Methods of solutions of Linear homogeneous Partial Differential Equations of nth order with constant coefficients , Non-homogeneous Linear Equations.	6
4.	**Fourier Series** Definition, Euler's Formulae, Expansions of functions, Change of interval, Even and odd function,Half range sine and cosine series.	6

5.	**Statistics** Coefficient of correlation, Lines of regression of bivariate Data, fitting of curves(lines and parabola) by least square principle	**6**
6.	**Probability Distribution** Random Variable, Discrete and continuous Probability Distributions, Binomial, Poisson and Normal Distributions.	**6**

References:

Text Books:

1. B. S. Grewal, (2005) "Higher Engineering Mathematics", 39th edition, Khanna Publications, New Delhi.
2. Erwin Kreyszig, (2011) "Advanced Engineering Mathematics", Wiley Eastern, 9th edition.

Reference Books:

1. N. P. Bali, Ashok Saxena and N. Ch. S. N. Iyengar (2004)"A Text Book of Engineering Mathematics", Laxmi Publications, New Delhi, 6th edition,.
2. Peter V. O'Neil (2002)"Advanced Engineering Mathematics", Cole publishing house, 4th edition.
3. P. N. Wartikar and J. N. Wartikar (2005)"A Text book of Applied Mathematics", Vol. I, Vol. II, VidyarthiGrihaPrakashan, Pune. 9th Revised edition, October 1984, Reprints: September.

Class: **S. Y. B.Tech Civil Engineering**	Semester-**III**
Course Code: **CE2072**	Course Name: **Surveying**

L	T	P	Credits
2	--	--	2

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 is offered as the course in the first semester of second year engineering consists of two modules, the first module focuses on the calculations of elevations, use of levelling in different civil engineering projects, Plotting of Contours maps, Theodolite and tachometry. The second module focuses on and Advanced Surveying Techniques like Total station, GIS, GPS.

Course Outcomes:

After successfully completing the course, Student will able to:

1. Calculate reduced levels and prepare contour maps.
2. Calculate the angular and linear measurements by using tachometry and trigonometry
3. Design and Set out the curve on field.
4. Illustrate the principles of advanced surveying techniques.

Prerequisites:

Fundamentals of Civil Engineering, Engineering Mathematics.

COURSE CONTENT

Unit No.	Details of Content	Hrs.
1.	**Levelling and Contouring** Importance of surveying to engineers, plane and geodetic surveying, principles of surveying, classification of surveys, Terms and Types of leveling, Equipment used for leveling, calculation of elevation (RL)-methods, corrections in levelling, Contouring, Characteristics of Contours, Uses of Contour Maps, Direct and Indirect methods of contouring,	6
2.	**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**: - Tacheometry and Trigonometric: Determination of	6

	elevations and distances.	
3.	**Curves and Computation of Area and Volume** Types and necessity Curve, Design and data collection for setting out of simple circular and compound curves, Areas and Volumes Calculations for any plotted plan by instrumental mathematical methods.	**6**
4.	**Advanced Surveying Techniques** Electronic Dist0ance Measurement (EDM) instruments, Surveying using Total Station –Working principle and use of Total station, Data observations in T.S, Basics of Geographical information system (GIS) and Geographical Positioning system (GPS)- working principle, types and methodology.	**6**

References:

Text Books:

1. N.N. Basak, (2014)"Surveying and Levelling", Tata Mcgraw Hill, 2nd edition, New Delhi,
2. S. K. Duggal (2009)"Surveying Vol. I and II", Tata Mcgraw Hill, 4th edition, New Delhi,
3. Dr. B.C. Punamia (2004)"Surveying Vol. I, II and III", Laxmi Publisher, New Delhi.

Reference Books:

1. A.Bannister and S Raymond, (2002)"Surveying, ELBS", Eighth edition,.
2. James M. Anderson and Edward M. Mikhail, (2001)"Introduction to Surveying", McGraw Hill Book Company, Third Edition.
3. D Clark, (2002)"Plane and Geodetic Surveying", Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Seventh Edition.

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: **SH2172**	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 human relationships, perceptions and policies towards the environment and focus on design and technology for improving environmental quality. Their exposure to subjects like understanding of earth processes, evaluating 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 Outcomes:
After successful completion of this course students should be able to :

1. Studythe importance and sensitivity of environment.
2. Interpret the over exploitation of natural resources and follow the environmental ethics.
3. Explain the methods to protect environment and prevent environmental pollution.
4. Apply their knowledge and skills to solve their 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(Use & overexploitation, Problems), Role of individual in conservation of natural resources, Equitable use of resources for sustainable life styles.	4
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.	4
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),	4

	Pollution Case studies-Bhopal Gas Tragedy, Chernobyl Accident: A nuclear Disaster, Ganga Water Pollution.	
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.	**4**
5	**Environmental Management** Environmental impact assessment, Impact Assessment Methodologies, Environmental impact statement and environmental management plan, Environmental audit, Cost-benefit analysis, Role of Central Pollution Control Board (CPCB), State Pollution Control Board, Role of NGO's, Role of Information technology in environment & human health, Environmental Ethics: Issues & possible solutions, Awareness of Environmental Legislation.	**4**
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.	**4**

References:

Text Books:

1. D.K.Asthana, Meera Asthana, (2006) A Textbook of Environmental Studies, S. ChandPublication Revised edition.
2. S. Deswal& A. Deswal, (2009) Basic course in environmental Studies, Dhanpat Rai &Co ltd., Delhi, Second revised edition.

Reference Books:

1. Eldon D Enger, Bradley F. Smith, (1989) Environmental science – a study of interrelationships Wm C Brown Publishers
2. Francois Ramade (1984) Ecology of Natural resources, John Wiley& Sons
3. Robert Leo Smith, (1990) Ecology and field biology, Harper Collins Publishers
4. Gilbert M. Masters, (2015) Introduction to Environmental Engineering & Science,Prentice Hall International Inc. Third Edition

Class: **S. Y. B. Tech Civil Engineering**	Semester-**III**
Course Code: **CE2092**	Course Name: **Building Planning and Design Lab**

L	T	P	Credits
--	--	4	2

Course Description:
Building Planning and DesignLab course intends to develop the skill and confidence of the students so that they can plan and design the residential buildings and their components. The students will be able to read and draw different types of building. Thus, by studying this course, students will be more comfortable to work at the construction sites.

Course Learning Outcomes:
After successfully completing the course, Student will able to:
1) Explain properties and uses of different building materials.
2) Draw various building components using AutoCAD software.
3) Prepare submission drawing of residential building using AutoCAD.
4) Prepare working drawings of residential building using AutoCAD.
5) Draw line plan of various public buildings.

Prerequisite: Basic knowledge of Engineering Graphics and AutoCAD software.

Exercise No.	Description
1.	Site visit for data collection of any five new building materials and write its properties and uses with presentation. (2 H)
2.	Preparation of sectional view drawing of load bearing and framed structure which shows different building component. (2 H)
3.	Staircase design and drawing (plan and section) using AutoCAD (any one type). (4 H)
4.	Drawing based on actual measurement of existing residential building consisting of plan, elevation, site plan, area statement & brief specifications using AutoCAD. (8 H)
5.	A site visit on Residential Bunglow/Row houses/ Apartment scheme and technical report based on the visit. (4 H)
6.	Planning & design of a residential building. Individual project to be planned by each student. Students should prepare submission and working drawings of building project and give its presentation. (20 H) Following set of drawings for the building planned using AutoCAD is to be prepared. • Municipal Submission drawing.

	• Working Drawings: (Centre line plan, Furniture layout plan, Water supply & drainage plan and Electrical layout plan)
7.	Preparation of line plans of following public buildings: (8 H) • Any one from Primary School/Secondary School/Collage Building /Library Building/Hostel Building • Any one from Mall Building/ Any Government office /Sport Complex /Hospital Building/ Cinema theatre/ S. T. Stand

References:

References Books: -

1. Sikka V. B. (2015), A Course in Civil Engineering Drawing, 7th Edition, S. K. Kataria and Sons.
2. Mehta, Scarborough, Armpriest (2018), Building Construction, 3rd Edition, Pearson Education
3. Macay W.B (2013),Building Construction, 5th Edition, Pearson Education
4. Mantri (2016), The A to Z of Practical Building Construction and its Management, 2ndEdition, Satya Prakashan.

Text Books: -

1. Arora, Bindra (2014),A Text Book of Building Construction,6th Edition, DhanpatRai Publications
2. Punmia (2005),A Text Book of Building Construction, 5th Edition, 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: **CE2112**	Course Name: **Surveying Lab**

L	T	P	Credits
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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 consists of two modules, the first module focuses on the calculations of elevations, use of levelling in different civil engineering projects, Plotting of Contours maps, Theodolite and tachometry. The second module focuses on and Advanced Surveying Techniques like Total station, GIS, GPS.

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

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

Prerequisite – Fundamentals of Civil Engineering, Engineering Mathematics

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

Expt.No.	Name of Experiment
1.	Calculation of reduced Levels using Dumpy and Auto Level.
2.	Measurement of area by Digital Planimeter.
3.	Measurement of horizontal angle by Repetition and Resection methods of Theodolite.
4.	Measurement of vertical angle and height of objects by Theodolite.
5.	Tacheometry: Determination of tachometric constants and grade of line by Tachometer.
6.	Trigonometry: Determination of Distance and Elevation by Tachometer.
7.	Curve: Setting out of curves: Simple circular curves by linear methods.
8.	Curve: Setting out of curves: Simple circular curves by Angular methods (Rankin's Methods)

9.	Traversing by using Total Station.
10.	Setting out of building for given plan by traditional methods.
11.	Geo-referencing and mapping of given area.
12.	Development of contour map in GIS for given area.

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 100 m including fixing of alignment, profile levelling, cross-sectioning, and plotting of L section and Cross Section. (Onefull imperial sheet including plan, L-section and any five typical Cross-sections).

References:

Text Books:

4. N.N. Basak, (2014) "Surveying and Levelling", Tata Mcgraw Hill, 2nd edition, New Delhi,
5. S. K. Duggal (2009) "Surveying Vol. I and II", Tata Mcgraw Hill, 4th edition, New Delhi,
6. Dr. B.C. Punamia (2004) "Surveying Vol. I, II and III", Laxmi Publisher, New Delhi.

Reference Books:

4. A.Bannister and S Raymond, (2002) "Surveying, ELBS", Eighth edition,.
5. James M. Anderson and Edward M. Mikhail, (2001) "Introduction to Surveying", McGraw Hill Book Company, Third Edition.
6. D Clark, (2002) "Plane and Geodetic Surveying", Vols. I and II, C.B.S. Publishers and Distributors, Delhi, Seventh Edition.

Codes:

6. IRC: SP: 19 -Manual for Survey, Investigation and Preparation of Road Projects
7. IRC: SP: 54 - Project Preparation Manual for Bridges
8. IRC: SP: 42 - Guidelines on Road Drainage
9. IRC: SP: 50 - Guidelines on Urban Drainage
10. IRC: 38 - Design Tables for Horizontal Curves for Highways

Class:-**S.Y. B. Tech. Civil Engineering**	Semester-**III**
Course Code:**CE2132**	Course Name: **Strength of Material lab**

L	T	P	Credits
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Course Description:
Strength of Material Lab is one of the core practical courses offered at third semester of Civil Engineering undergraduate program and it comprises of Eight experiments. Structural Engineering is one of the important branches of Civil Engineering. It 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 all the forces acting on a material and finding the corresponding stresses induced. Thus for design of any structural element analysis is the first stage. This course, 'Strength of Material Lab' deals with the analysis of various materials such as steel, different metals, bricks and structural element.

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:
For studying this course the student should have studied the courses Engineering Mechanics and Physics. The knowledge of basic mathematics and trigonometry is also required.

Course Content	
Experiment No.	**Description**
1.	**i) Experiments (Any six)**
2.	Tension test on Mild and TOR steel.
3.	Shear test on Mild steel.
4.	Brinell and Rockwell Hardness test on different metals.
5.	Impact test on different metals.
6.	Bending test on timber.
7.	Flexure test on flooring tiles.

8.	Water absorption & compression test on burnt brick.
9.	Buckling test on long columns
10.	**ii) Assignments :** One assignment per unit

References:

Text Books:

1. H. J. Shah, and S.B. Junnarkar (2007) "Mechanics of Structures", Charotar Publishing House Pvt Limited, New Delhi, 27th Edition.
2. R.S. Khurmi, (2015) "Strength of Materials", Chand (S.) & Co Ltd, India.
3. S.Ramamrutham, (2012) "Strength of Materials", Dhanpat Rai Publishing Company (P) Limited, New Delhi.

Reference Books:

R.Vaidyanathan, P.Perumal, S.Lingeswari, (2012) "Mechanics of Solids and Structures", Scitech Publications Pvt. Ltd., Chennai, Vol. I.

Class:-**S.Y. B. Tech. Civil Engineering**	Semester-**III**
Course Code:**CE2152**	Course Name: **Comprehensive Exam I**

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

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

Class:-**S.Y. B. Tech. Civil Engineering**	Semester-**III**
Course Code:**CE2172**	Course Name: **Engineering Mechanics Lab**

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 equipments and function effectively as an individual and in a team as effective team member to complete 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:
The course learns through prerequisite courses of Engineering Mathematics, Engineering Physics

Course Content

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

12.	Demonstration of D' Alembert's Principle
13.	Demonstration of Work- Energy Principle
14.	Gravitational Acceleration
15.	Support Reactions of beams by graphical method

Students have to perform any 10 experiments from above list

References:

Text books:

1. S.S. Bhavikatti and Rajashekarappa, (2008) "Engineering Mechanics", new age International publication (India) Pvt. Ltd. New Delhi 3rd Edition.
2. S. Ramamrutham, (2008) "Engineering Mechanics", Dhanpat Rai Publishing Company Ltd. Ansari Road, Darya Gang, New Delhi,9th Edition.

Reference books:

1. Junnerkar S.B., (2001) "Elements of Applied Mechanics", Charotar Publishing House (India) Pvt. Ltd., Anand (Gujarat) 12th Edition.
2. Ferdinand. P. Beer and E. Russell Johnson, (2004) "Vector Mechanics for Engineers (Statics and Dynamics)", the McGraw Hill Publication, New York 8th Edition.
3. Ferdinand L. Singer; Harper and Collins, (2005)"Engineering Mechanics (Statics and Dynamics)" Publications (India) Pvt. Ltd. Noida 3rd Edition.
4. Timoshenko and Young, (2001) "Engineering Mechanics (Statics and Dynamics)", Mc GRAW-HILL International Editions 4th Edition.

Class: **S. Y. Civil Engineering**	Semester-**III**
Course Code: **SH2602**	Course Name: **Environmental Project**

L	T	P	Credits
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Course Description:
Environment 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 & industry. It will help students in developing eco-friendly approach to achieve sustainable development.

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

1. Develop as an individual and in group leadership quality.
2. Identify and analyse social problems in Civil Engineering.
3. Develop presentation skill through oral and report writing.
4. Acquire theoretical knowledge regarding various problems in Civil Engineering.

Lab Work:
Students should 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.

Class:- **S. Y. B. Tech Civil Engineering**	Semester-**III/IV**
Course Code: **SH 2592**	Course Name : **Personal Effectiveness and Body Language**

L	T	P	Credits
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Course Description:
Choice Based Soft Skills program offers students a choice to select the course that will meet the requirements of their overall personality development. Particularly this course helps students in knowing and managing self.

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

1. Develop skills to build self-esteem and positive attitude.
2. Discover ways to overcome procrastination.
3. Demonstrate responsiveness towards stress and health issues.
4. 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.

Course Content

Unit No.	Description	Hrs
1.	Competency Mapping (Concept, Criteria, Need, Tools)	2
2.	Personality Typing (Extraversion, Introversion, Sensing, Intuition, Thinking, Feeling, Judging Perceiving)	2
3.	Goal Setting	2
4.	SWOT Analysis	2
5.	Effective Personal Time utilization (Benefits and Obstacles)	2
6.	Strategies for effective time management (Principles, Planning, Identify & Control time stealers, Prioritize, Problems and Solutions, Learn to say NO)	2
7.	Stress Management (Meaning, Causes, Types, Remedies)	2
8.	Stress Management Techniques-I: Deep Breathing Exercise, Meditation and Visual Imagery	2
9.	Stress Management Techniques-II: Muscle Relaxation, Peer Sharing	2
10.	Learning Styles – I (visual)	2

11.	Learning Styles – I (auditory, tactile)	**2**
12.	Body Language – I (Proxemics)	**2**
13.	Body Language – II (Kinesics: movement, gesture, posture, facial expression and eyes)	**2**
14.	Body Language – III Paralanguage (vocal cues) and Haptics (touch)	**2**
15.	Body Language – IV (Appearance)	**2**

References –

1. S. Hariharan, et al; Soft Skills, MJP Publishers, Chennai (2010)
2. Gopalaswamy Ramesh et al. The ACE of Soft Skills: Attitude, Communication and Etiquette for Success, New Delhi: Pearson Education, 2012. Print.
3. Jeff Butterfield, Soft Skills for Everyone, cengage Learning India Private Limited, 2010.
4. UNLESH the power within... Soft Skills – Infosys Training Manual Module 1 to 5 (Infosys Campus Connect Program)
5. Masters, L. Ann et al. Personal Development for Life and Work, New Delhi: Cengage Learning, 2012. Print.

Class:- **S. Y. B. Tech Civil Engineering**	Semester-**III/IV**
Course Code: **SH 2612**	Course Name: **Interpersonal Skills (Work life Balance)**

L	T	P	Credits
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Course Description:
Choice Based Soft Skills program offers students a choice to select the course that will meet the requirements of their overall personality development. Particularly this course helps students in making their interactions with others more meaningful and effective. In this course, the student will also learn to manage others during communication.

Course Learning 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 leadership skills.

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

Unit No.	Description	Hrs
1.	Goal Setting	2
2.	SWOT Analysis	2
3.	Social Networking	2
4.	Interpersonal Relationships – I (in Public Social Settings)	2
5.	Interpersonal Relationships – II (in the Workplace)	2
6.	Dealing with Difficult People – I (Basic Set of Strategies)	2
7.	Dealing with Difficult People – II (Specific Types of Difficult People)	2
8.	Conflict Resolution - I (Constructive Conflict Resolution, Conflict Resolution Strategies)	2
9.	Conflict Resolution – II (Destructive Conflict Resolution, Peer Mediation, Problem Solving and Negotiation)	2

10.	Decision Making – I (Approaches to Decision Making, Make Good Choices, Effect of Choices)	**2**
11.	Decision Making – II (Individual and Group Decisions)	**2**
12.	Personal Branding/ Self Presentation	**2**
13.	Facilitation, Inspiring	**2**
14.	Persuasion,Collaborating	**2**
15.	Preparing for and Dealing with Change	**2**

References –

1. S. Hariharan, et al; Soft Skills, MJP Publishers, Chennai (2010)
2. D. Sudha Rani; Business Communication and Soft Skills Laboratory Manual, Pearson Education, Mumbai (2012)
3. Krishna Mohan and Meera Banerji; Developing Communication Skills, 2nd Edition, Macmillan India Ltd., New Delhi (2012)
4. Gopalaswamy Ramesh et al. The ACE of Soft Skills: Attitude, Communication and Etiquette for Success, New Delhi: Pearson Education, 2012. Print.
5. Masters, L. Ann et al. Personal Development for Life and Work, New Delhi: Cengage Learning, 2012. Print.
6. UNLESH the power within... Soft Skills – Infosys Training Manual Module 1 to 5 (Infosys Campus Connect Program)
7. Jeff Butterfield, Soft Skills for Everyone, cengage Learning India Private Limited, 2010.

Class:- **S.Y. B. Tech Civil Engineering**	Semester-**III/IV**
Course Code: **SH 2632**	Course Name: **Leadership& Public Speaking**

L	T	P	Credits
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Course Description:
Choice Based Soft Skills program offers students a choice to select the course that will meet the requirements of their overall personality development. Particularly this course helps especially that student who wants to overcome his/her stage fright. Also, this course helps the student in developing and improving his/herleadership skills.

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

1. Exhibit the ability to work effectively in team.
2. Describe the traits of a leadership through real life examples.
3. Plan the speech as per the audience and context requirements.
4. Analyze public speeches.

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		
Unit No.	**Description**	**Hrs**
1.	Goal Setting	**2**
2.	SWOT Analysis	**2**
3.	What is a team? Personalities and role preferences in teams, Critique a hypothetical team, Everyday teamwork planning tools	**2**
4.	Leadership, assertiveness, and cooperation	**2**
5.	Maintaining your team, Addressing team conflict	**2**
6.	Leadership and Change: Personal leadership and leadership styles, Learning and learning to learn, Leadership of change, Appreciative inquiry and Appreciative leadership, People's reactions to change	**2**
7.	Leadership Skills: Coaching skills, Leadership in groups: building and leading efficient teams	**2**
8.	Leadership Skills: Conflict management and handling difficult conversation, Communications skills, especially listening skills	**2**

9.	Strategic Management: Creating a vision,Analyse the strengths and weaknesses of an organisation	**2**
10.	Strategic Management:Organisational Design, The basics of a planning process	**2**
11.	Qualities Of Effective Speakers, Managing Nerves and Building Confidence	**2**
12.	Doing the initial planning and knowing your audience, Planning the basic structure of your presentation	**2**
13.	Making your presentation convincing and surprising, PowerPoint Presentation and Audio-Visual Excellence	**2**
14.	Audience Engagement	**2**
15.	Handling questions and answers with ease	**2**

References –

1. Krishna Mohan and Meera Banerji; Developing Communication Skills, 2nd Edition, Macmillan India Ltd., New Delhi (2012)
2. Masters, L. Ann et al. Personal Development for Life and Work, New Delhi: Cengage Learning, 2012. Print.
3. UNLESH the power within... Soft Skills – Infosys Training Manual Module 1 to 5 (Infosys Campus Connect Program)
4. Jeff Butterfield, Soft Skills for Everyone, cengage Learning India Private Limited, 2010.
5. John Seely, Oxford Guide to Effective Writing and Speaking; Oxford University Press, 2009.

Class:- **S. Y. B. Tech Civil Engineering**	Semester-**III/IV**
Course Code: **SH 2692**	Course Name : **Innovation Tools and Methods for Entrepreneurs**

L	T	P	Credits
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Course Description:
This course helps students to depict user engagement in the solution that he has already learned to ideate in the previous course "Creativity and Design Thinking". Here he learns various tools that help him 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 Learning Outcomes:
After successful completion of the course, students will be able to,

1. Learn 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.

Course Content

Unit No.	Description	Hrs
1.	**Systematic Innovation**: Define the problem in depth with all details, Trend prediction, Modeling the problem to identify tradeoffs and contradictions	2
2.	**TRIZ:** Theory of Inventive problem solving (TRIZ), HIT Matrix, Scamper, Algorithms of brain storming and innovation, Functional analysis	2
3.	**Frugal and Disruptive Innovation:** Biomimicry and frugal innovation for prototyping, Disruptive innovation.	3
4.	**User Journey Map:** Map showing user interaction at every stage of product/service. Step-by-step process of UJM creation	2
5.	**Competitor analysis**: Analysis of competitor and users for similar products, effectiveness of existing solutions and identifications of gaps	2
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 competitors	2

References -

1. Design Sprint, J. Knapp
2. The Innovator's Toolkit, D. Silverstein, P. Samuel and N. DeCarlo
3. ABC-TRIZ: Introduction to creative design thinking with modern TRIZ modeling, M. A. Orloff.

Class:- **S. Y. B. Tech Civil Engineering**	Semester-**III**
Course Code : **SH 2732**	Course Name : **German Language- Basic Level**

L	T	P	Credits
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Course Description:
Choice Based Soft Skills program offers students a choice to select the course that will meet the requirements of their overall personality development. Particularly this course helps the student in developing and improving his/her literary comprehension skills.

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

1. Introduce herself or himself in German.
2. Can listen and understand alphabets, numbers in German language.
3. make basic and easy sentences required in day to day situations
4. Read, write, speak and listen basic and simple text in German.

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

Unit No.	Description	Hrs
1.	i. Introduction (Name, country, living place, languages etc.) ii. Asking the other person's information iii. Greetings	2
2.	i. German Alphabets ii. Numbers (1 -100) iii. Giving and asking Information related to numbers (age, telephone number, mobile number etc.)	2
3.	i. Difference between Formal and Informal form. ii. Personal Pronouns, verb conjugation	2
4.	i. Learning about the things in the classroom. ii. Definite , indefinite, negative articles	2
5.	Possessive Articles with the reference of all the nouns learnt in the last lecture	2

6.	Watch timings learning	**2**
7.	Routine activities	**2**

References -

Reference Books:

1. Studio D – A 1, CornelsenVerlag
2. Netzwerk A 1 , KlettVerlag

There will not be any fixed text book for the above given syllabus
The extra notes will be provided to the students to complete the required syllabus.

Class:- **S. Y. B. Tech Civil Engineering**	Semester-**III**
Course Code : **SH 2712**	Course Name : **Japanese Language- Basic Level**

L	T	P	Credits
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Evaluation Scheme: ISE- 100% (Minimum Passing Marks: 50%)

Course Description:
Choice Based Soft Skills program offers students a choice to select the course that will meet the requirements of their overall personality development. Particularly this course helps the student in developing and improving his/her literary comprehension skills.

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

1. To get the students acquainted with foreign language.
2. To gain knowledge of basic Japanese grammar.
3. To acquire basic Japanese language skills (listening, speaking, writing, and reading).
4. To enable students demonstrate an awareness of the relevance of Japanese language to professions and careers.
5. To make students understand the cultures and civilizations of the country of Japan.
6. To enable the students to function in an environment where Japanese is used exclusively.

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

1. Adequate knowledge of basic grammar of English language.
2. Communicate moderately using English language.

Minimum 10 sessionswill be conductedto meet the needs of following content delivery

Course Content		
Unit No.	**Description**	**Hrs**
1.	Introduction. i) Geographical features, culture of Japan. ii) The origin of the script of Japanese language. iii) Introduction of Basic script, Hiragana. (46 Characters)	**2**
2.	i) Greetings in Japanese Language- Good Morning, Good afternoon, Good evening, Good Night, etc. ii) Writing Hiragana Letters from aa to zo and related words	**2**

3.	i) Writing Hiragana Letters from taa to po and related words. ii) Writing Hiragana Letters from maa to n and related words	**2**
4.	i) Self introduction in Japanese. ii) Writing Katakana letters from aa to zo.	**2**
5.	i) Numerals 1 to 100 ii) Writing Katakana letters from ta to n. iii) Contracted consonant letters (Hiragana script).	**2**
6.	i) Doubling of consonants with the use of TSU in half case (Hiragana script). ii) Contracted consonant letters (Katakana script) iii) Classroom vocabulary. Ex. Book, homework, question, answer, practice etc.	**2**
7.	i) Doubling of consonants with the use of TSU in half case (Katakana script). ii) Expressing nationality of a particular country.	**2**
8.	i) Introduction of Demonstrative Pronouns. This, that - この、その、あの。 ii) Verbs in Japanese.	**2**
9.	i) Basic particles in Japanese Language は、が、の、か。 ii) Introduction of pictoral script Kanji 人、上、山、下、川、日本語。	**2**
10.	i) Introduction of Demonstrative Pronouns. これ、それ、あれ。 ii) Multiples of 100	**2**
11.	i) Multiples of 1000 ii) Multiples of 10,000 iii) Introduction of demonstrative pronouns koko, soko, asoko	**2**
12.	i) To express time in Japanese Language. 9 o'clock, half past nine etc.	**2**
13.	i) Introduction of date and month. ii) Days of week.	**2**
14.	i) Introduction of Time Phrase ii) This month, last month, last week, today, tomorrow etc.	**2**

References -

Reference Books:

1. Minnano Nihongo (Part I)
2. Nihongo Shouho
3. Other reference material, practice papers & CDs for listening practice.

Evaluation Method: In each session student should be assessed. Each assessment should be of minimum 10 marks.

Class:- **S. Y. B. Tech Civil Engineering**	Semester-**IV**
Course Code : **SH 2642**	Course Name : **German Language-Advanced Level**

L	T	P	Credits
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Course Description:
Choice Based Soft Skills program offers students a choice to select the course that will meet the requirements of their overall personality development. Particularly this course helps the student in developing and improving his/her literary comprehension skills.

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

1. Introduce herself or himself in German.
2. Can listen and understand alphabets, numbers in German language.
3. make basic and easy sentences required in day to day situations
4. Read, write, speak and listen basic and simple text in German.

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

Unit No.	Description	Hrs
1.	Prose/Essay: i. My house/ my room ii. Learning of vocabulary related to living (furniture, room names etc.)	2
2.	i. Telling about the position of things in the room/ in the house ii. Changing Prepositions with Position question Wo? iii. Introduction of Dativ	2
3.	i. Keeping the things on the proper place. ii. Changing Prepositions with the action question Wohin?	3
4.	i. Learning the professions ii. Telling about and asking for the professions	2
5.	Learning modal verbs with reference to the professions	2
6.	Vocabulary related to vacation. Modes of transportation and different activities and things related to vacation.	2
7.	i. Speaking about last vacation. ii. Learning of Präteritum form of haben and sein	2

	iii. Learning of Perfekt with regular verbs.	
8.	Learning of Perfekt with irregular verbs and verbs with helping verb sein.	**2**
9.	Body parts, routine illnesses and learning of imperative sentences for du form, ihr form and Sie form	**2**

References -

Reference Books:

3. Studio D – A 1, CornelsenVerlag
4. Netzwerk A 1 , KlettVerlag

There will not be any fixed text book for the above given syllabus
The extra notes will be provided to the students to complete the required syllabus.

Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

Class:- **S. Y. B. Tech Civil Engineering**	Semester-**IV**
Course Code : **SH 2622**	Course Name : **Japanese Language- Advanced Level**

L	T	P	Credits
--	--	2	1

Course Description:
Choice Based Soft Skills program offers students a choice to select the course that will meet the requirements of their overall personality development. Particularly this course helps the student in developing and improving his/her literary comprehension skills.

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

1. To get the students acquainted with foreign language.
2. To gain knowledge of basic Japanese grammar.
3. To acquire basic Japanese language skills (listening, speaking, writing, and reading).
4. To enable students demonstrate an awareness of the relevance of Japanese language to professions and careers.
5. To make students understand the cultures and civilizations of the country of Japan.
6. To enable the students to function in an environment where Japanese is used exclusively.

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

1. Basic knowledge of Japanese script.
2. Can give self-introduction in Japanese Language.

Minimum 10 sessions will be conducted to meet the needs of following content delivery

Course Content		
Unit No.	**Description**	**Hrs**
1.	Introduction of Tenses i. Simple present tense. ii. Simple future tense.	**2**
2.	Affirmation and negation in simple present tense and simple future tense.	**2**
3.	Direct speech	**2**
4.	i. Introduction to adjectives. ii. Introduction to colors, tastes, seasons.	**2**
5.	i. Affirmation and negation of adjectives in simple present tense. ii. Affirmation and negation of adjectives in simple past tense.	**2**
6.	i. Adverbs of degree.	**2**

	ii. Adverbs of quantity.	
7.	Existence, position of living things and non-living things.	**2**
8.	Introduction of Unique Counting System in Japanese language.	**2**
9.	How to use quantifier.	**2**
10.	Superlative degree.	**2**
11.	To use particle in case of transitive verbs.	**2**
12.	Verbs indicating imperative/ receiving things or information.	**2**
13.	Omission of Particles.	**2**
14.	Substitute for Noun.	**2**

References -

Reference Books:

1. Minnano Nihongo (Part I)
2. Nihongo Shouho (Part I)
3. Other reference material, practice papers & CDs for listening practice.

There will not be any fixed text book for the above given syllabus
The extra notes will be provided to the students to complete the required syllabus

Evaluation Method: In each session student should be assessed. Each assessment should be of minimum 10 marks.

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Autonomous
415414

Department : Civil Engineering
Class : S. Y. B. Tech. **Semester:** IV

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Cr	Scheme	Theory (Marks %)		Practical (Marks %)	
							Max.	Min. for passing	Max.	Min. for passing
CE2022	Engineering Geology	2	-	-	2	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2042	Concrete Technology	3	-	-	3	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2062	Fluid Mechanics	3	-	-	3	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2082	Mechanics of Structures	3	-	-	3	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2102	Human Values and Professional Ethics	2	-	-	2	ISE	20	40	-	-
						UT1	15		-	-
						UT2	15		-	-
						ESE	50	40	-	-
CE2122	Applications of Programming Language in Civil Engineering	-	-	2	1	ISE	-	-	100	50
CE2142	Engineering Geology Lab	-	-	2	1	ISE	-	-	100	50
CE2162	Fluid mechanics Lab	-	-	2	1	ISE	-	-	100	50
CE2182	Concrete Technology Lab	-	-	2	1	ISE	-	-	100	50
CE2202	Comprehensive Exam II	-	-	-	1	ESE	-	-	100	50
SH****	**Open Elective –III** Choice Based Soft Skill Program-II	-	-	2	1	ISE	-	-	100	50
CE2222	Internship	-	-	-	2	ISE	-	-	100	50
	TOTAL	**13**	**0**	**10**	**21**	-	-	-	-	-

Total Contact Hours/week : **23**
Total Credits : **21**

Courses for Comprehensive Exam: Mechanics of Structures, Fluid Mechanics, Concrete Technology

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

Open Elective –III

List of Choice Based Soft Skill Program-II

Sr.No.	Course Code	Course
1	SH2592	Personal Effectiveness & Body Language
2	SH2612	Interpersonal Skills (Work life Balance)
3	SH2632	Leadership & Public Speaking
4	SH2692	Innovation Tools and Methods for Entrepreneurs
5	SH2642	German Language – Advanced Level
6	SH2622	Japanese Language – Advanced Level
7	SH2732	German Language – Basic Level
8	SH2712	Japanese Language – Basic Level

Note:

1. A student has to complete any two courses out of six choices offered under Choice Based Soft Skills Program. 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 – Basic Level' in S. Y. B.Tech Sem-III will by default (mandatorily) appear for Advance Levels of said courses in Semester-IV.

Class: **S. Y. B. Tech Civil Engineering**	Semester-**IV**
Course Code:**CE2022**	Course Name: **Engineering Geology**

L	T	P	Credits
2	--	-	2

COURSE DESCRIPTION

This course explores the fundamentals of geology applied to civil engineering problems. Topics 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. GIS is an effective tool to analyze spatial, non-spatial data on drainage, geology, land form parameters to understand their interrelation ship.

Prerequisite:

The prerequisite for this course is to have the basic knowledge of natural resources and environmental science.

Course Learning Outcomes:

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

1. Identify common Earth materials and interpret their composition, origin, and uses.
2. Recognize and interpret geological structures, and be able to apply their knowledge and skills to interpret earth processes.
3. Classify hydro geological properties of various rocks.
4. Describe the processes operating at and beneath the Earth's surface.
5. Compare the suitable site s for construction of dam, tunnel in different geological formation and geological structures.
6. Interpret spatial relationships of geological and geographical features.

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Physical Geology** Definition of geology, Scope and subdivisions, Geology and Civil Engineering. Weathering, Types of weathering. Interior of the Earth, Basic Seismology, R.I.S, Types of volcanic eruption and products. Geological work of River in the process of erosion, deposition and transportation, Landslides – Types, causes, prevention.	7
2.	**Mineralogy and Petrology** Definition of mineral, classification of minerals. Rock types- Igneous, Metamorphic, and Sedimentary, textures and structures of rocks, civil engineering significance, Engineering properties of Rocks, Requirements of	7

	good building stone, building stones in India.	
3.	**Structural Geology and Groundwater** Outcrop, strike and dip, unconformities, Folds, Faults, Joints,- Parameters, classification, causes, civil engineering significance. Sources of ground water, water table, zones, porosity and permeability, Types of aquifers. Importance of groundwater investigation in civil engineering projects. Application of electrical resistivity method by Wenner configuration in civil engineering aspects such as locating spot for groundwater, finding out thickness of overburden and depth of hard rock.	7
4.	**Geological investigation.** Preliminary geological investigations, testing, and monitoring for geotechnical sites, including: drilling and sampling methods, sample logging (rock, rock cuttings, and soil)field testing methods, instrumentation, and trench logging, Applications of GIS.	7

References –

Reference Books

1. Prabin Singh, (1984)"Engineering and General Geology", S. K. Katariya and Sons Delhi, 1st Edition.
2. D. V. Reddy, (1995)"Engineering Geology for Civil Engineering", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1st Edition,.
3. N ChennaKesavulu, (2009)"Engineering Geology", Macmillan Publishers India limited Delhi, 2nd Edition.
4. B. S. SathyaNarayanswami, (2014)"Engineering Geology", Dhanpat Rai and Co. (P). Ltd.Delhi.2nd Edition.
5. K. M. Bangar, (2015)"Principles of Engineering Geology" - Standard Publishers Distributors 1705-B NaiSarak, Delhi.1st Edition,.
6. G. W. Tyrrell(1978)"Principles of Petrology", B. I. Publication Pvt. Ltd., New Delhi, 1st Edition.
7. Holmes, (1993)"Principles of Physical Geology", ELBS Chapman and Hall, London.4th Edition.
8. M. P. Billings, (1962)"Structural Geology", Prentice Hall of India Private Ltd., New Delhi. 1st Edition.

Text Books

1. P. K. Mukerjee, (2005)"A Text Book of Geology", The World Press Pvt. Ltd., Calcutta. 1st Edition.
2. R. B. Gupte, (1962)"A Text Book of Engineering Geology", Pune VidyarthiGriha Prakashan, Pune, 1st Edition.
3. Todd D. K., (1988)"Groundwater Hydrology", John Wiley and Son, New York. 3rd Edition, 2004. H. H. Read, Rutley's Elements of Mineralogy, CBS Publishers and Distributors, Delhi, 27th Edition.

Class: **S. Y. B. Tech Civil Engineering**	Semester-IV
Course Code:**CE2042**	Course Name: **Concrete Technology**

L	T	P	Credits
3	--	-	3

COURSE DESCRIPTION

Concrete Technology is one of the core courses offered at fourth semester of Civil Engineering undergraduate program and it comprises of six units. Concrete is a composite material and is considered to be the most widely used building material in the construction industry. The course 'Concrete Technology' has been so designed that its contents will give an overview about properties of different materials used for the manufacture of concrete and the role played by the materials in obtaining a good quality product called 'concrete'. The study of the course will help students understand the behavior of this versatile composite material from the stage of its design, manufacture to the stage of its placing in the actual field conditions.

The course intends to build competency in the students to select appropriate materials (through testing) for making concrete, design concrete mixes of different grades, carry out lab as well as field tests on concrete (in fresh & hardened state) and orient them with qualitative aspects concreting process.

Prerequisite:

The prerequisite for this course is to have the basic knowledge of different materials or ingredients of concrete.

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 ASTM,ACI code
4. Describe the properties of special types of concretes based on their material composition and method of manufacture
5. Illustrate various mechanisms causing the deterioration of concrete /elements of concrete structures

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Ingredients of Concrete :** Cement- chemical composition, chemistry, types of cement, properties of cement, and tests on cement, study of SEM Images Fine and coarse aggregates- properties and uses Mineral Admixtures – fly ash, micro silica, ggbfs, metakaolin etc.	6

	Chemical Admixtures- classification, mechanisms and applications Use of relevant IS Code.	
2.	**Mix Design of Concrete:** Mix design of Concrete using IS Code & ACI Code method of mix design	**6**
3.	**Fresh Concrete:** Manufacturing process, workability of concrete – factors affecting, workability tests, segregation and bleeding, plastic and thermal cracking, use of relevant IS Code	**6**
4.	**Properties of Hardened Concrete:** Tests on hardened concrete - flexural strength, comparison of cube test and cylinder test, Failure patterns, Use of relevant IS Code Factors affecting strength, relation between compressive and tensile strength, modulus of elasticity, factors affecting modulus of elasticity, definition and factors affecting, creep and shrinkage, Split tensile test, Shear strength of concrete.	**6**
5.	**Properties and Applications of Special Concretes:** Light weight aggregate concrete, high strength concrete, high performance concrete, self-compacting concrete, fibre reinforced concrete etc.	**6**
6.	**Durability of Concrete:** Strength & durability relationship, volume change in concrete, Impact of w/cratioon durability, permeability, chemical attack on concrete, Alkali Aggregate Reaction, carbonation, corrosion of steel in concrete.NDT Tests on R C C structures.	**6**

References -

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.
5. Gambhir, M.L. (2005). Concrete Technology, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.
6. Mehta, P. K. and Monteiro, P.J. M. (2006). Concrete Microstructure, Properties and Materials. Third Edition, Mc Graw Hill Publications, NY.
7. Santhakumar, A.R. (2009). Concrete Technology, Published by Oxford University Press, New Delhi.
8. Shetty, M.S. (2008). Concrete Technology, Multicolor Illustrative Edition, S. Chand & Company Ltd., New Delhi.

Class: **S. Y. B. Tech Civil Engineering**	Semester-IV
Course Code: **CE2062**	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 mechanical engineering, chemical engineering, geophysics, astrophysics, and biology. Fluid mechanics can be divided in fluid 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 varies forces acting on submerged and floating bodies.
3. Discriminate fluid kinematics and fluid dynamics.
4. Illustrate flow through pipe and flow through open channel.
5. Prepare dimensional analysis using different theories and models.
6. Explain terms used in hydraulic pumps.

Prerequisites: Engineering Mechanics

Course Content

Unit No.	Description	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, 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 particle, 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 theory and its application, siphon,	6

	water hammer in pipes	
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.	
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. R. S. Khurmi (1983) "Fluid Mechanics" S. Chand & Company Ltd. New Delhi, 12th Edition.
2. R. S. Rajput (2013) "Hydraulic & Hydraulic Mechanics" S. Chand & Company Ltd. New Delhi, 15th Edition.
3. S.Nagrathanam (2011) "Fluid Mechanics" Khanna Publication, Delhi, 6th Edition.
4. Modi and Seth (2012) "Hydraulics and Fluid mechanics including Hydraulic Machines" A. D. Computers, New Delhi, 8th Edition.
5. R. K. Bansal (2008) "Fluid Mechanics" Lakshmi Publications Pvt. Ltd.

Reference Books:

1. Jagadishlal (1997), "Fluid Mechanics and hydraulics" Metropolitan Book Co-Ltd.
2. Yunus A. Cingel John M.Oimbala (2006), "Fluid Mechanics (SI Units)", Tata MaGrawHill.
3. John F.Douglas, Janul and M.Gasiosek and john A.Swaffield (2006) "Fluid Mechanics by, Pearson Education Asia", 5th edition

Class: **S. Y. B. Tech Civil Engineering**	Semester-**IV**
Course Code: **CE2082**	Course Name: **Mechanics of Structures**

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

Course Description:
Mechanics of structures is one of the core courses offered at fourth semester of Civil Engineering undergraduate program and it comprises of six units. 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 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. Analysis of circular shafts subjected to torsion.
2. Compute slopes and deflections at various locations for determinate beams.
3. Design axially loaded columns.
4. Construct ILD for determinate beams and 2D trusses.
5. Determine strain energy stored in the material due to gradual, sudden and impact loads. (Note – combine co)

COURSE CONTENT		
Unit No.	**Details of Content**	**Hrs.**
1.	**Axially Loaded Columns:** 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. Chimney subjected to wind pressure, simple problems on dams and retaining walls.	**6**
3.	**Slope and Deflection of Beams:** Basic concepts of structural analysis, Slope and deflection of determinate	**8**

	beams – Double Integration method, Moment area method, Conjugate beam method	
4.	**Influence Line Diagrams:** Muller-Breslau's Principle, Influence Line Diagrams for Simple and compound beams. Application of influence line diagram to determinate 2D trusses under dead load and live load.	**6**
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.	**5**
6.	**Strain Energy**: Strain energy: Concept, expression of strain energy for axially loaded member under gradual, sudden and impact loads. Strain energy due to self weight, bending and torsion.	**5**

References

Text Books:

1. Shah, H. J. and Junnarkar S.B. (2007) "Mechanics of Structures", Charotar Publishing House Pvt Limited, New Delhi, 27th Edition.
2. R.S. Khurmi, (2015)"Strength of Materials", Chand (S.) & Co Ltd, India.
3. S.Ramamrutham, (2012) "Strength of Materials", Dhanpat Rai Publishing Company (P) Limited, New Delhi.
4. R.Vaidyanathan,P. Perumal,S.Lingeswari, (2012) "Mechanics of Solids and Structures", Scitech Publications Pvt. Ltd., Chennai, Vol. I.

Reference Books:

1. Timoshenko,(2004)"Strength of Materials Part-I", CBS Publisher Private Limited, New Delhi, 3rd Edition.
2. Timoshenko, (2002) "Strength of Materials Part-II", CBS Publisher Private Limited, New Delhi, 3rd Edition.
3. Gere and Timoshenko, (2006) "Mechanics of Materials", CBS Publisher Private Limited, New Delhi, 2ndEdition.
4. Negi and Jangid, (2004) "Structural Analysis", Tata McGraw Hill Pub.Co., Delhi,
5. C. K.Wang, (2017) "Intermediate Structural Analysis", McGraw Hill Education, New Delhi, Indian Edition.

Class: **S. Y. B. Tech Civil Engineering**	Semester-IV
Course Code:**CE2102**	Course Name: **Human Values and Professional Ethics**

L	T	P	Credits
3	--	--	3

Course Outcomes:
After completing the course, the student should be able to: -
1. Practice the moral value in engineering profession.
2. Resolve the moral issues in the profession.
3. Justify the moral judgment concerning the profession.

COURSE CONTENT

Unit No.	Details of Content	Hrs.
1.	**Human Values:** Moral values, ethics, integrity, service learning virtues, respect for others, living peacefully, caring and sharing, honesty, courage, value time, co-operation, commitment, empathy, challenge in the work place, spirituality.	6
2.	**Engineering Ethics** Sense of engineering ethics, variety of moral issues, moral dilemma, moral autonomy & development, consensus & controversy, profession & professional role models, responsibility, ethical theories, self interest, customs, religion.	6
3.	**Engineering as Social Experimentation**: Engineering & experimentation, engineers as responsible experiments, codes of ethics, industrial standards, balanced outlook on law.	6
4.	**Safety, Responsibility & Rights** Safety & risk, risk analysis, assessment of safety & risk, safe exit, risk benefit analysis, safety lessons, loyalty, confidentiality, conflict of interests, occupational crimes, whistle blowing.	6
5.	**Global Issues** Globalization, multinational corporations, computer ethics, weapon development, moral leadership, ethics & codes of business conduct in MNC, corporate social responsibility, ethical audit.	6
6.	**Case Studies** 6 to 8 case studies based on professional ethics	6

References:
1. R. S. Naagarazan (2006)"A textbook on professional ethics & human values", New Age International Publishers, 2nd Edition.
2. M. Govindarajan, S. Natarajan, V. S. Senthilkumar (2009) "Professional ethics &

human values" PHI learning private ltd. Delhi, Third Printing

Class: **S. Y. B. Tech Civil Engineering**	Semester-**IV**
Course Code:**CE2122**	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.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Formulate simple programs for arithmetic, logical and loops problems(in C language)
2. Formulate simple programs for arithmetic, logical and loops problems(Microsoft excel)
3. Test 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**
1.	Support reactions of beam
2.	Moment of Inertia of regular figures
3.	Moment of inertia of regular figures(Excel)
4.	Stability analysis of gravity dam
5.	Stability analysis of gravity dam(Excel)
6.	SF& BM at regular interval(Excel)
7.	Calculation of Reservoir capacity
8.	Simple horizontal curves
9.	Profile leveling(Excel)
10.	Calculation of Quantity of Earthwork
11.	Analyze and Design structural element (Excel)
12.	Analyze and Design structural element (Excel)

References

1. Balaguruswami (2012)"Programming in ANSI C", McGraw Hill Education, 6 edition.
2. H. Sohildt (2000)"C The Complete Reference", McGraw-Hill Education, 4th edition.
3. Y.Kanetkar (2016)"Let us C", BPB Publications, 13th Revised and Updated edition.

Class: **S. Y. B. Tech Civil Engineering**	Semester-**III**
Course Code:**CE2142**	Course Name: **Engineering Geology Lab**

L	T	P	Credits
-	--	2	1

Course Description:
This course explores the fundamentals of geology applied to civil engineering problems. Topics 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, should 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**
1.	Study of common rock forming minerals.
2.	Study of Igneous rocks.
3.	Study of Sedimentary rocks.
4.	Study of Metamorphic rocks.
5.	Study and interpretation of Geological Maps.
6.	Study of Strike and dip of geological formations.
7.	Applications of electrical resistivity
8.	Educational visit to study geological formations and features

References –
Reference Books

1. Prabin Singh, (1984) "Engineering and General Geology", S. K. Katariya and Sons Delhi, 1st Edition.

2. D. V. Reddy, (1995) "Engineering Geology for Civil Engineering", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1st Edition,.
3. N Chenna Kesavulu, (2009) "Engineering Geology", Macmillan Publishers India limited Delhi, 2nd Edition.
4. B. S. Sathya Narayanswami, (2014) "Engineering Geology", Dhanpat Rai and Co. (P). Ltd.Delhi.2nd Edition.
5. K. M. Bangar, (2015) "Principles of Engineering Geology" - Standard Publishers Distributors 1705-B NaiSarak, Delhi.1st Edition,.
6. G. W. Tyrrell (1978) "Principles of Petrology", B. I. Publication Pvt. Ltd., New Delhi, 1st Edition.
7. Holmes, (1993) "Principles of Physical Geology", ELBS Chapman and Hall, London.4th Edition.
8. M. P. Billings, (1962) "Structural Geology", Prentice Hall of India Private Ltd., New Delhi. 1st Edition.

Text Books

1. P. K. Mukerjee, (2005) "A Text Book of Geology", The World Press Pvt. Ltd., Calcutta. 1st Edition.
2. R. B. Gupte, (1962) "A Text Book of Engineering Geology", Pune VidyarthiGriha Prakashan, Pune, 1st Edition.
3. Todd D. K., (1988) "Groundwater Hydrology", John Wiley and Son, New York. 3rd Edition, 2004. H. H. Read, Rutley's Elements of Mineralogy, CBS Publishers and Distributors, Delhi, 27th Edition.

Class: **S. Y. B. Tech Civil Engineering**	Semester-**III**
Course Code:**CE2162**	Course Name: **Fluid Mechanics Lab**

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 stable equilibrium 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**
1.	Use of pressure measuring devices.
2.	Verification of Bernoulli's Theorem
3.	Determination of metacentric height (Stability of submerged and floating body).
4.	Determination of coefficient of discharge by using venturimeter.
5.	Identify of type of flow using Reynolds apparatus.
6.	Determination of major losses, when fluid is flowing through closed pipe.
7.	Determination of loss of head due to sudden expansion, contraction, elbow, bend, globe valve etc. (Minor head loss).
8.	Determination of coefficient of contraction Cc, coefficient of velocity Cv and coefficient of discharge using Orifice.

9.	Determination of equivalent pipe diameter when flow through parallel and series pipes.
10.	Design of most economical triangular and rectangular open channel through Notches and Weirs.
11.	Flow velocity measurement using Wind Tunnel

Text Book:

1. R. S. Khurmi (1983) "Fluid Mechanics" S. Chand & Company Ltd. New Delhi, 12th Edition.
2. R. S. Rajput (2013) "Hydraulic & Hydraulic Mechanics" S. Chand & Company Ltd. New Delhi, 15th Edition.
3. S. Nagrathanam (2011) "Fluid Mechanics" Khanna Publication, Delhi, 6th Edition.
4. Modi and Seth (2012) "Hydraulics and Fluid mechanics including Hydraulic Machines" A. D. Computers, New Delhi, 8th Edition.
5. R. K. Bansal (2008) "Fluid Mechanics" Lakshmi Publications Pvt. Ltd.

Reference Books:

1. Jagadishlal (1997), "Fluid Mechanics and hydraulics" Metropolitan Book Co-Ltd.
2. Yunus A. Cingel John M.Oimbala (2006), "Fluid Mechanics (SI Units)", Tata MaGrawHill.
3. John F.Douglas, Janul and M.Gasiosek and john A.Swaffield (2006) "Fluid Mechanics by, Pearson Education Asia", 5th edition

Class: **S. Y. B. Tech Civil Engineering**	Semester-**III**
Course Code:**CE2182**	Course Name: **Concrete Technology Lab**

L	T	P	Credits
-	--	2	1

COURSE DESCRIPTION

Concrete Technology Laboratory is one of the core laboratory courses offered at fourth semester of S. Y. B. Tech. Civil undergraduate program. The course comprises of six parts. The first two parts focus on determination of properties of various ingredients of concrete. The third part deals with application of mix design concepts of concrete mixes to produce concretes of required workability, strength and durability. The fourth part consists in performing various tests on produced concrete when it is in plastic stage. The testing of hardened concrete specimen and /or elements of structure to determine their strength and durability properties is covered in fifth and sixth parts respectively. This also includes non-destructive, semi destructive and destructive tests on hardened concrete specimen. This laboratory course will help students to gain hands on experience in performing various tests on concrete specimen as well as elements of concrete structures following standard guidelines and evaluate the quality of concrete.

Prerequisite:

The prerequisite for this course is to have the basic knowledge of different materials or ingredients of concrete.

Course Learning Outcomes:

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

1. Explain standard procedures for testing properties of various ingredients of concrete and concrete mixes/specimens
2. Perform tests on ingredients of concrete and on fresh and hardened concrete to determine their properties using standard procedures
3. Design the concrete mix for a given grade of concrete using 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, Sp. Gravity, Consistency, Initial and Final setting time, Soundness test b) Compressive Strength Test	**2**
2.	**Tests on Fine and Coarse Aggregates** a) **Fine Aggt:** Sieve Analysis, Sp. Gravity, Bulk Density, Water	**2**

	Absorption, Moisture Content, bulking of sand, silt content 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:** **Workability Tests:** Slump, Flow, VeBe Consistometer (with and without chemical admixtures)	**2**
5.	**Tests on Hardened Concrete:** Compressive Strength on Cube & Cylinder, Flexural Test, Split Tensile Strength Test, Tests on fiber-reinforced concrete, Permeability test on concrete,	**2**
6.	**Non Destructive Tests:** Rebound Hammer, UPV, Concrete Scanner, Carbonation test	**2**

References -

1. Gambhir, M.L. (2005). Concrete Technology, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.
2. Bureau of Indian Standard (1970) IS: 383-1970. Indian standard specification for coarse and fine aggregates from natural sources for Concrete. New Delhi, BIS.
3. 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.
4. Bureau of Indian Standards (2000) IS 456: 2000. Indian standard code of practice for plain and reinforced concrete. New Delhi, BIS.
5. Bureau of Indian Standards (1959) IS 1199: 1959. Indian standard code of methods of sampling and analysis of concrete. New Delhi, BIS.
6. Santhakumar, A.R. (2009). Concrete Technology, Published by Oxford University Press, New Delhi.
7. Shetty, M.S. (2008). Concrete Technology, Multicolor Illustrative Edition, S. Chand & Company Ltd., New Delhi.

K.E. Society's

Rajarambapu Institute of Technology, Sakharale

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

T Y B. Tech. Civil Syllabus

To be implemented from **2020-21**

Department of Civil Engineering

Department of Civil Engineering

Class: **T. Y. Civil**	Semester-**V**
Course Code: **CE 3012**	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 standard 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.	**Plastic theory**: Plastic hinge concept, plastic collapse load, plastic moment, shape factor, plastic section modulus. **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:

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

Reference Books:

1. Subramanian, N., Design of Steel Structures, Oxford University Press.
2. Dayaratnam, Design of Steel Structures, Wheeler Publishing.
3. Chandra R., Design of Steel Structures, Standard Book House, Vol. I & Vol. II.
4. Arya, A.S. and Ajamani J.L., Design of Steel Structures, Nemchand and Bros.
5. Vazirani and Ratwani, Design of Steel Structures, Khanna Publishers.
6. Punmia, B. C., Jain & Jain, Design of Steel Structures, Laxmi Publication.

Codes of Practic:

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

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Department of Civil Engineering

Class: **T. Y. Civil**	Semester-**V**
Course Code: **CE3032**	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. Analyse 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:** 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.	**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 phenomena.	**06**
3.	**Compaction:** Definition, standard and modified Proctor compaction tests as per IS-2720, factors affecting compaction, effect of compaction on soil properties, Field	**06**

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	compaction control, field compaction equipment	
4.	**Consolidation:** Definition, Mass-spring analogy, 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	**06**
5.	**Shear Strength of Soils:** Concept of shear strength, Mohr's strength theory, modified Mohr-coulomb theory. Total and effective shear strength parameters, 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 failure, Terzaghi are bearing capacity equations assumptions and limitations. Effect of ground water table. 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, pressure meter test, cone penetration test.	**06**

References –

Text Books: -

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

References Books: -

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

Department of Civil Engineering

Class: **T. Y. B. Tech Civil Engineering**	Semester-**V**
Course Code: **CE3052**	Course Name: **Irrigation & Hydraulic Structures**

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

Course Description

The Hydraulic structures have high importance in civil engineering. This sector can be described as a neglected field in the world. Many engineers, especially civil engineers build fluid retaining structures which stand with different structures. Some of the structures include weirs, canals, aqueducts, and notches.

In general, hydraulic structures deal with different concerns and problems related to water. These areas include dams, piping systems, pumping stations, gabion, irrigation systems, and sewerage systems among many other aspects. These are areas that are very important in society.

Keeping this in view, we introduced core course which covers irrigation and hydraulic structures.

Course Learning Outcomes:

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

1. Discuss aspects of hydrology and ground water flow.
2. Estimate the parameters for water requirements of crop.
3. Explain importance of ground water resources.
4. Design earthen/ gravity dam.
5. Design canal and canal regulator structures.

Course Content

Unit No.	Description	Hrs.
1.	**Hydrology:** Hydrological cycle, precipitation, evaporation, transpiration, infiltration, surface flow, hydrograph, flood frequency analysis, flood routing through a reservoir, channel flow routing-Muskingam method.	**06**
2.	**Ground water flow:** Specific yield, storage coefficient, coefficient of permeability, confined and unconfined aquifers, aquiclude, aquitards, aquifuge, radial flow into a well under confined and unconfined conditions, Ground and surface water resource.	**06**
3.	**Introduction to Irrigation engineering:** Irrigation methods and their efficiencies, Water requirements of crops-Quality of irrigation water, Soil moisture – Consumptive use, Duty-Delta-Base period-Factors affecting duty – Duty for principal types of crops grown in India, Water logging: causes and control, salinity reclamation of saline and alkaline soil.	**06**

4.	**Reservoirs and Planning for Dam reservoirs** Definition and types, Capacity-elevation and area-elevation curves of a reservoir site, storage zones of a reservoir, catchment yield and reservoir yield, determination of field and storage capacity, reservoir sedimentation, reservoir losses. Gravity Dam: Forces acting on a gravity dam (including seismic load) – Stability requirement, Design aspects.	**06**
5.	**Earthen Dams** Different types and their suitability, Causes of failure of earthen dam, Seepage Analysis, Seepage Control. River training: Objectives of river training, methods of river training	**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
Reference Books:

1. Garg, S. K., Water Supply Engineering, Khanna Publishers.
2. Garg, S. K., Hydrology, Flood Control & Ground Water Engineering, Khanna Publishers.
3. Garg, S. K., Irrigation Engineering and Hydraulic Structures, Khanna Publishers.
4. Subramanya, K., Engineering Hydrology, McGraw Hill Education.
5. Modi, P. N., Irrigation Water Resources and Water Power Engineering, Raj sons Publishers Pvt. Ltd.

Department of Civil Engineering

Class: **T. Y. B.Tech. Civil Engineering**	Semester-**V**
Course Code: **CE3072**	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	**06**

	and design of Storm water; Sewage and Sludge, Pollution due to improper disposal of sewage, National River cleaning plans.	
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	**06**

References –

Text Books: -

1. Modi, P. N., Water Supply Engineering, by Standard Book House.
2. Modi, P. N., Wastewater Engineering, by Standard Book House.
3. Punmia, B. C., Jain A. K and Jain A. K. Water Supply Engineering, Laxmi Publishers.
4. Punmia, B. C., Jain A. K and Jain A. K. Wastewater Engineering, Laxmi Publishers.
5. Garg, S. K., Water Supply Engineering, Khanna Publication.
6. Garg, S. K., Wastewater Engineering & Air Pollution, Khanna Publication.

References Books: -

1. Peavy, H.S, Rowe, D.R., Tchobanoglous, G. Environmental Engineering, Mc-Graw -Hill International Editions.
2. Ministry of Urban Development, New Delhi Manual on Water Supply and Treatment.
3. Metcalf and Eddy, Wastewater Engineering, Treatment disposal and reuse, Tata McGraw-Hill.
4. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.
5. Rao, M. N. and Rao, H. N., Air Pollution and Control, M. C. Grew Hill Publication.
6. Manual on Municipal Solid Waste Management by Government of India, Ministry of Urban Development.

Codes of Practice :-

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

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**V**
Course Code: **CE3092**	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 and railway.
2. Determine traffic volume for design of road infrastructure
3. Perform pavement design and different tests on highway materials
4. Design rail transportation system

Prerequisites: Nil

Course Content

Unit No.	Description	Hrs.
1.	**Highway Alignment and Geometric Design** ideal alignment and factors controlling it, highway location survey, 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, gradient and its type, 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.	**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, types of sleepers and ballast, rail gauge	**06**
6.	**Railway Geometric Design** Geometric design of track, sleeper density, Points and Crossing, Signaling, Interlocking, Tracking Power and Resistance	**06**

References

Text Book:

1. Khanna, S.K., Justo C.E.G. and Veeraragavan A., Highway Engineering, NemChand and Brothers.
2. Saxena, S.C., Arora S. P., A Text Book of Railway Engineering, DhanpatRai and Sons.
3. Mundrey, J. S., Railway Track Engineering, Tata McGraw Hill Education.

Reference Books:

1. Yang, H. Huang, Pavement Analysis and Design, Pearson Education.

Codes of Practice:

1. IRC 37 (2018), Guidelines for the Design of Flexible Pavements, Indian Roads Congress, New Delhi, 4th Edition.
2. IRC 58 (2015), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, Indian Roads Congress.
3. MoRTH (2013), Specification for Road and Bridge Works, Ministry of Road Transport and Highways, 5th Revision.

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**V**
Course Code: **CE3112**	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 (Any Ten Experiments)**	**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**
10.	One Dimensional Consolidation Test	**02**
11.	California Bearing Ratio Test (CBR)	**02**
12.	Standard Penetration Test	**02**
13.	Vane Shear Test	**02**
14.	Swell pressure Test	**02**
15.	Field Visit regarding identification of soil	**02**

References –

Text Books: -

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

References Books: -

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

Department of Civil Engineering

Class: **T. Y. B.Tech. Civil Engineering**	Semester-**V**
Course Code: **CE3132**	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 and wastewater treatment plant.
3. Design of water and wastewater treatment plant.

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	**02**
2.	Determination of Acidity and alkalinity of water	**02**
3.	Determination of Chloride Content of water	**02**
4.	Determination of Hardness of water	**02**
5.	Determination of Turbidity of water	**02**
6.	Determination of Residual chlorine in water	**02**
7.	Determination of Total solid of water and wastewater	**02**
8.	Determination of Total dissolved solids through measurement of electrical conductivity	**02**
9.	Determination of Dissolved Oxygen of water and wastewater	**02**
10.	Determination of Most Probable Number	**02**
11.	Determination of Biological Oxygen Demand of wastewater	**02**

12.	Determination of Chemical Oxygen Demand of Wastewater	**02**
13.	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: -

1. Modi, P. N., Water Supply Engineering, by Standard Book House.
2. Modi, P. N., Wastewater Engineering, by Standard Book House.
3. Punmia, B. C., Jain A. K and Jain A. K., Water Supply Engineering, Laxmi Publishers.
4. Punmia, B. C., Jain A. K and Jain A. K., Wastewater Engineering, Laxmi Publishers.
5. Garg, S. K., Water Supply Engineering, Khanna Publication.
6. Garg, S. K., Wastewater Engineering & Air Pollution, Khanna Publication.

References Books: -

1. Peavy, H.S, Rowe, D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw -Hill International Editions.
2. Ministry of Urban Development, New Delhi Manual on Water Supply and Treatment.
3. Metcalf and Eddy Wastewater Engineering, Treatment disposal and reuse, Tata McGraw-Hill.
4. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.
5. Rao, M. N. and Rao H. N., 'Air Pollution and Control' M. C. Grew Hill Publication.
6. Manual on Municipal Solid Waste Management by Government of India, Ministry of Urban Development.

Codes of Practice :-

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

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**V**
Course Code: **CE3152**	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 practical's

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 water absorption by aggregates	**02**
5.	Determination of California Bearing Ratio value of subgrade soil	**02**
6.	Determination of California Bearing Ratio value of subgrade soil by Dynamic Cone Penetrometer Test	**02**
7.	Determination of penetration value of bitumen	**02**
8.	Determination of softening point of bitumen	**02**
9.	Determination of flash and fire point of bitumen	**02**
10.	Estimation of binder content in bituminous mixture by centrifugal extraction method	**02**

11.	Determination of viscosity of bitumen by Saybolt Viscometer	**02**
12.	Estimation of optimum binder content of bituminous mix by Marshall Stability Test	**02**
13.	Design of concrete mix for PQC layer of concrete pavement	**02**

References

Text Book:

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

Reference Books:

1. Yang, H. Huang, Pavement Analysis and Design, Pearson Education.

Codes of Practice:

1. IRC 37 (2018), Guidelines for the Design of Flexible Pavements, Indian Roads Congress, 4th Edition.
2. IRC 58 (2015), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, Indian Roads Congress.
3. MoRTH (2013), Specification for Road and Bridge Works, Ministry of Road Transport and Highways, 5th Revision.

Department of Civil Engineering

Class:- **T.Y. B. Tech**	Semester-**V**
Course Code : **SH 3032**	Course Name : **Aptitude Training-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. Fast calculations have become an integral part of a candidate'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 thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning problems.
2. Understand 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.	**Basic Aptitude** Percentage-Conversion, Single change, Successive change, Product Stability, Applications of percentage. Average-Weighted average, Concept of average speed & Allegation, Ratio and Proportion-Comparison &properties of Ratio & Proportion, HCF & LCM	12
2.	**Logical Reasoning-1** Syllogism-Method Venn diagram, methods of 100 & 50. Numerical Analogy - Verbal and Non-Verbal, Pattern or Step Completion, Series Completion-Number Series, Letter Series, Number-Letter Series (Word, Image)	12
3.	**Business Aptitude** Profit & Loss-Same selling price different Cost Price, Same cost price different selling price, Concept of false scale, Simple & Compound Interest	06

4.	**Time, Rate and Work** Time, Rate and Work-Unitary Method, LCM Method, Calculation of remuneration. Pipes & Cisterns-Concept of negative work, LCM Method	**06**
5.	**Logical Reasoning-2** Direction Sense – Understanding directions, drawing a diagram. Coding Decoding- finding an algorithm of coding	**06**

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

References
Reference Books:

1. Aggarwal, R. S., Quantitative Aptitude, S Chand Publishing.
2. Aggarwal, R. S., Logical Reasoning, S Chand Publishing.
3. Sharma, A., Quantitative Aptitude, McGraw Hill Publishing.
4. Sharma, A., Logical Reasoning, McGraw Hill Publishing.

Department of Civil Engineering

Class: T**.Y. B. Tech. Civil Engineering**	Semester-**V**
Course Code: **CE 3172**	Course Name: **Comprehensive Exam III**

L	**T**	**P**	**Credits**
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Course Description:

Comprehensive Exam I 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

Department of Civil Engineering

Class:- **T.Y. B. Tech**	Semester-**V**
Course Code : **SH 301**	Course Name : **Indian Constitution**

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

Course Description:
The Constitution of India 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 Mechanical Engineering undergraduate programme to have fundamental knowledge of Indian Constitution. It consists 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** 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:

1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; Lexis Nexis.

Reference Books:

1. Pylee, M.V., India's Constitution, New Delhi; S. Chand Pub.
2. Pandey, J.N., The Constitutional Law of India, Allahabad; Central Law Agency.
3. 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
4. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa.
5. Merunandan, K.B., Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications.
6. http://legislative.gov.in/constitution-of-india

PROGRAM ELECTIVE-I

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**V**
Course Code: **CE 3192**	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. Analyse pin jointed truss for deflection by strain energy method.
2. Evaluate horizontal thrust, radial shear and normal of arches.
3. Analyse beam by plastic analysis method.
4. Determine bending stresses in beams due to unsymmetrical bending.
5. Analyse building frames using approximate methods of analysis.
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:** Deflection of determinate trusses. Deflection of indeterminate trusses (with one redundant only).	**06**
2.	**Two hinged and Three hinged arches:** Analysis of Three hinged parabolic and semicircular arch. Analysis of Two hinged parabolic and semicircular arch.	**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:** Unsymmetrical bending of beams of symmetrical sections. Unsymmetrical	**06**

	bending of beams of unsymmetrical sections.	
5.	**Approximate methods of Analysis:** Approximate methods of analysis of multistoried, multi bay rigid jointed frames. 1. Portal frame method 2. Cantilever method 3. Substitute frame method	**06**
6.	**Failure Theories:** 1. Maximum Principal stress theory 2. Maximum Principal strain theory 3. Maximum shear stress theory 4. Total energy theory 5. Distortion energy theory Tresca and von Mises yield criteria.	**06**

References –

Text Books: -

1. Junnarkar, S. B. and Shah H.J., Mechanics of Structures (Vol-I and II), Charotar Publishers.
2. Ramamruthum, S., Theory of Structures, Dhanpatrai & Sons publications.
3. Bhavikatti, S. S., Structural Analysis-II, Vikas Publishing House Pvt, Ltd.

References Books: -

1. Vazirani and Ratwani, Analysis of Structures: Vol. I & II, Khanna Publishers.
2. Wang, C. K., Intermediate Structural Analysis, Indian Edition, Tata McGraw-Hill Education.
3. Gere and Timoshenko, Mechanics of Materials, CBS Publisher Private Limited.

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**V**
Course Code: **CE 321**	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 Fibre 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. Fibre/Matrix Interface, mechanical. Measurement of interface strength, Characterization of systems, carbon fibre/epoxy, glass fibre/polyester, Graphite epoxy etc.	**06**
3.	**Mechanical Properties**: Stiffness and Strength: Geometrical aspects, volume and weight fraction, Unidirectional continuous fibre, discontinuous fibers, Short fiber systems, woven reinforcements. Mechanical Testing: Determination of stiffness and strengths of unidirectional	**06**

	composites; tension, compression, flexure and shear.	
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 fibre, Chemical vapour deposition of carbon on carbon fibre 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:

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

Reference Books:

1. Chawla, K. K., Composite Materials, Springer – Verlag
2. Chawla, Krishan K, Composite Materials, Springer-Verlag New York.
3. Chung, Deborah D. L, Composite Materials Science and Applications, Springer-Verlag London.
4. Clyne, T.W. and Withers, P.J., Introduction to Metal Matrix Composites, Cambridge University Press.
5. Daniel Gay, Suong V. Hoa, Stephen W. Tsai, Composite Materials Design and Applications, CRC Press.
6. George Lubin, Hand Book of Composites, Van Nostrand Reinhold.
7. Isaac, M. Daniel and Orilsha, Engineering Mechanics of Composite Materials, Oxford University Press.
8. Mathews, F.L. and Rawlings, R.D., Composite materials: Engineering and Science, Chapman and Hall
9. Robert, M. Jones, Composite Materials, CRC Press.
10. WD Callister, Jr., Adapted by R. Balasubramaniam, Materials Science and Engineering, An introduction, John Wiley & Sons.

Department of Civil Engineering

Class: **T. Y. B. Tech Civil Engineering**	Semester: **V**
Course Code: **CE 3232**	Course Name: **Construction Safety and Quality 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 equipments (PPE), Roles & responsibility of safety	06

	officers, duties of safety officers, Safety signs and symbols.	
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 equipments- 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:

1. Mishra, R. K., Construction Safety, AITBS Publishers.
2. Bhattacharjee, S. K., Safety Management in Construction, (Principles and Practice), Khanna Publishers.

Reference Books:

1. Construction safety manual (2007), published by National Safety Commission of India.
2. Safety Management in Construction Industry (2013), McGraw Hill Construction, Smart Market Report.
3. Kelar, J. J., OSHA, Construction Safety Handbook.
4. Girimaldi, and Simonds, Safety management, AITBS Publishers.

Department of Civil Engineering

Class: **T. Y. B. Tech Civil Engineering**	Semester-**V**
Course Code: **CE 3252**	Course Name: **Advanced Construction Techniques**

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

Course Description
Construction Technology plays important role in civil engineering .This course caters for imparting application based knowledge in the area of construction technologies used to constructed 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 technique for activity.
3. Justify application of construction technique for particular task.
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, Under water 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:

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

Reference Books:

1. Brien, J.J.J., A. Havers and F.W.Stubbs, Jr., Standard Handbook of Heavy Construction, McGraw-Hill Book Co.
2. Chudley, R.,Construction Technology (Vol.4) Longman Group Limited.

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**V**
Course Code: **CE 327**	Course Name: **Instrumental Monitoring of Environment and Modeling**

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

Course Description

Instrumental Monitoring of Environment and Modeling emphasizes the need for industries to control and monitor the environmental impact of their activities and this requires laboratory analysis of pollutants. This course covers current methods for detecting and monitoring pollution in air, soil and water in the context of legal requirements and industry standards. It provides comprehensive coverage of all the major, broadly applicable methods, from traditional methods to biosensors and remote sensing, giving practical guidance on their use.

Course Learning Outcomes:

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

1. Analyze the principles of volumetric and instrumental analytical methods in environmental monitoring
2. Evaluate statistical methods for evaluating and interpreting data of environmental interest
3. Describe various electrochemical methods
4. Summarize various material characterization techniques and its principles

Prerequisites: Environmental science, Chemistry, Mathematics

Course Content

Unit No.	Description	Hrs.
1.	**Classification of Instrumental Methods** Need of Environmental Instrumentation for monitoring, Concept of ETP, CETP, STP and their monitoring, Performance Characteristics of Instruments (Static And Dynamic)	**06**
2.	**Errors and Uncertainties in Performance Parameters** Noise Reduction - Sensitivity and Detection Limit - Errors -Types - Expression of Errors - Precision and Accuracy - Calibration of Instrumental Methods -	**06**
3.	**Spectrophotometry** Electromagnetic Radiation - Atomic Absorption and Emission Spectrometry - Ultraviolet - Visible Spectrophotometry Principle and Instrumentation - Atomic Absorption Spectroscopy Principle and Instrumentation	**06**

4.	**Flame Photometer**– Fluorimetry - Nephelometry and Turbidimetry - Principles, Chromatography - Principle and Classification - Column Efficiency and Resolution - Quantitative Determination - Column Chromatography - Thin Layer Chromatography - Principle and Application of Ion chromatography	**06**
5.	**Principle and Application of High Precision Equipments** Liquid Chromatography (HPLC) - Ion Chromatography Mass Spectroscopy - Gas Chromatography Mass Spectroscopy (GCMS) - Electro Chemical Methods - Electrochemical Cell - Reference Electrodes	**06**
6.	**Environmental modelling** Water quality modelling, modelling parameters, importance and use in the pollution control, Statistical and dynamic modelling for environmental parameters.	**06**

References:

Text Book:

1. Willard, H. H., Merit, L. L., Dean, J. A. and Settle, F. A., Instrumental Methods of Analysis, CBP Publishers and Distributors.

Reference Books:

1. Skoog, D. A., West, D.M. and Nieman, T.A., Principles of Instrumental Analysis, Thomson Asion (P) Ltd.

Department of Civil Engineering

Class: **T. Y. B. Tech Civil Engineering**	Semester-**V**
Course Code: **CE 3292**	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. Develop method statement for given construction activity,
2. Compare tunnel construction technologies
3. Decides a safety and ventilation system for tunnels,
4. Suggest appropriate location for construction of docks and harbours
5. 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:

1. Bindra, S.P., Docs and Harbour Engineering, DhanpatRai Publications.
2. Srinivasan, R., Harbour Dock and Tunnel Engineering, Charotar Publishing House.

Reference Books:

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

Department of Civil Engineering

Class: **T. Y. B. Tech Civil Engineering**	Semester-**V**
Course Code: **CE 331**	Course Name: **Urban Transportation System**

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 rout 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 transport surveys; sampling and expansion factors; accuracy checks, screen line checks, consistency checks.	**06**

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:

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

Reference Books:

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

SEMESTER VI

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3022**	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, two hinged parabolic arches, portal frames and indeterminate trusses. Various methods of structural analysis like Force methods, Displacement methods and Matrix methods will be utilized for analysis.

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

1. Analyse indeterminate structures using force methods- Consistent deformation method and three moment equation.
2. Apply energy principles/theorems for analysis of indeterminate beams, truss, portal frames and two hinged parabolic arches.
3. Analyse indeterminate structures using displacement methods- Slope-deflection equation and moment distribution method.
4. Analyse 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.	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.	Clayperon's theorem of three moment, application to statically indeterminate beam, sinking of support, beam with different M.I.	**06**
3.	Energy Theorems: Maxwell's reciprocal theorem, Castigliano's theorem, statically indeterminate beam, truss, portal frame, two hinged parabolic arch.	**06**
4.	Slope deflection equation method: Modified slope deflection equation, sinking of support, application to beam, portal frame without and with sway. (Involving not more than two unknowns)	**06**
5.	Moment distribution method: Sinking of support, application to beam, portal frame without and with sway. (Involving not more than two unknowns)	**06**

6.	Flexibility method: flexibility coefficients, development of flexibility matrix, analysis of beam and portal frame (Involving not more than two unknowns) Stiffness method: stiffness coefficients. development of stiffness matrix, analysis of beam and portal frame (Involving not more than two unknowns)	**06**

References

Text Books: -

1. Junnarkar, S. B. and Shah, H.J., Mechanics of Structures (Vol-I and II), Charotar Publishers.
2. Ramamruthum, S., Theory of Structures, Dhanpat Rai& Sons pub.
3. Bhavikatti, S. S., Structural Analysis-II, Vikas Publishing House Pvt, Ltd.

References Books: -

1. Vazirani and Ratwani, Analysis of Structures, Vol. I & II, Khanna Publishers.
2. Wang, C. K., Intermediate Structural Analysis, Indian Edition, Tata McGraw-Hill Education.
3. Gere and Timoshenko, Mechanics of Materials, CBS Publisher Private Limited.

Department of Civil Engineering

Class: **T.Y. B. Tech. Civil Engineering**	Semester- VI
Course Code: **CE 3042**	Course Name: **Estimating and Costing**

L	T	P	Credits
2	--	--	2

Course Description:
Estimating and Costing is one of the core course 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, factory shed, road, canal and culvert.
3. Derive 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 S.S.R. 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: -

1. Rangwala, S. C., Elements of Estimating and Costing –Charotar Publishing House.

References Books: -

1. Dutta, B.N, Estimating and Costing in Civil Engineering–USB Publishers, Distributors Pvt. Ltd.
2. Chakroborty, M., Estimating, Costing, Specification and Valuation in civil engineering –USB Publishers.
3. Patil, B. S., Civil Engineering Contracts and Estimates, Universities Press Private Ltd.

Codes of Practice :-

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

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3062**	Course Name: **Design of Reinforced Concrete Structures**

L	T	P	Credits
4	--	--	4

Course Description:

The course 'Design of Reinforced Concrete Structures' is offered as core course in 6th 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.

It 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 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. Analyze and design singly & doubly reinforced and flanged beams.
2. Analyze and design R.C.C. slab and R.C.C. staircase
3. Analyze and design R.C.C. columns, isolated pad footing and combined footing.

Prerequisite: Knowledge of structural analysis and strength of material.

Course Content

Unit No.	Description	Hrs.
1.	**Design Process and Loads, Singly and Doubly Reinforced beams.** Design process, Structural Design and load path, Methods of analysis and design, Working stress method, Limit state method. Characteristic Strength and Load, Partial Safety Factors. Properties of Material: Concrete and Steel- MS, HYSD. Introduction to IS 875 and IS 456 latest publications. Stress block parameters, modes of failure, properties of singly and doubly reinforced rectangular section, Problems in singly and doubly reinforced section	08
2.	**Design of Flanged Sections, Continuous beams** Properties of flanged sections. Problems in flanged sections. Design of continuous beams.	08
3.	**Shear, Bond and Torsion** Shear in beams, Cracks, Modes of failure, Critical sections for shear, Design for Shear reinforcement. Types of bonds, curtailment in bars. Detailing of reinforcement.	08

4.	**Design of Slabs and Staircase** Design of one way, two way, continuous slabs. Design of Dog-legged staircases, Effective span and loads distribution,	**08**
5.	**Design of columns** Design of short columns, slenderness limit and eccentricity, uniaxial and biaxial bending, interaction diagrams, column with helical reinforcement.	**08**
6.	**Design of footing** Design of isolated pad footings, pressure distribution, check for one way and two way shears. Design of Combined footing.	**08**

References –

Text Books: -

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

References Books: -

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

Codes of Practice :-

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

Department of Civil Engineering

Class:- **T.Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code : SH **302**	**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. Demonstrate the functions of biological systems
3. Analyze biological phenomena with math and physics to gain important insights
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:** Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell-Introduction to biomolecules: definition-general classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome	**06**
2.	**Basic Cell Physiology:** Systemic physiology: Neuromuscular system; Blood and lymph; Circulatory system; Respiratory and Cardiovascular system, Gastro-intestinal system; Kidney and excretory system; Sensory systems- visual, auditory, vestibular; Endocrine- pituitary, adrenal, pancreas, Clinical and technological implications	**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, Medical Measurement constraints, Classification of Biomedical Instruments, Generalized static and dynamic characteristics, Design criteria, Commercial Medical Instrumentation Development process, Regulation of Medical Devices. Biomedical transducers: optical, photo- electric, electrochemical, electrical, mechanical, electromechanical and thermoelectric. Specialty areas in Bioinstrumentation—Confocal, Tunneling, Sequencing, FACS, PCR, MRI, CT,USG, Endoscopy, ECG	**06**
5.	**Biosensors** –Introduction to Biosensors, transducers, amplifiers; Bioimaging-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, High frequency heat therapy, Hemodialysis, Ventilators, Anesthesia machines, Automatic Drug delivery Systems, Electro Surgical units and safety.	**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, Vestibular System	**06**

References –

Text Books:

1. Rajan, S. T., Selvamurugan, N., Rajesh, M. P., Nazeer, R. A., Richard, W. Thilagaraj, S. Barathi, and Jaganathan, M. K., Biology for Engineers, Tata McGraw-Hill.

Reference Books:

1. Berg, J. M., John, L. Tymoczko and Lubert Stryer, Biochemistry, W.H. Freeman and Co. Ltd.
2. Weaver, R., Molecular Biology, MCGraw-Hill.
3. Cooper, J., Biosensorsa Practical Approach, Bellwether Books.
4. Martin Alexander, Biodegradation and Bioremediation, Academic Press.
5. Kenneth Murphy, Janeway's Immunobiology, Garland Science.
6. Kandel, E. R., James H. Schwartz, Thomas M. Jessell, Principles of Neural Science, McGraw-Hill.
7. Phillips, R., J. Kondev, J. Theriot, H. Garcia, Physical Biology of the cell, Garland Science.
8. Philip, N., Biological Physics, W. H. Freeman
9. Jonathan, H., Mechanics of Motor Proteins and the Cytoskeleton, Sinauer Assoc. Inc.

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

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3082**	Course Name: **Estimating & Costing Laboratory**

L	T	P	Credits
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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

Practical No.	Name of Experiment	Hrs.
1.	Assignment based on market rates of civil engineering materials and labours.	02
2.	Detailed estimate of G+1residentialbuilding (Minimum area should be 100 sqm).	12
3.	Preparing detailed estimate for any one of the following: a. Astretchofroadabout1Km.longincludingearthwork. b. Areachofcanalabout1Km.long. c. Culvert d. A factory shed of steel frame.	06
4.	Preparation of bar bending schedule of different building components such as slab, beam, column, staircase, lintel, chajja etc.	04

References

Text Books: -

1. Rangwala, S. C., Elements of Estimating and Costing –Charotar Publishing House.

References Books: -

1. Dutta, B.N., Estimating and Costing in Civil Engineering–USB Publishers, Distributors Pvt. Ltd.
2. Chakroborty, M., Estimating, Costing, Specification and Valuation in civil engineering –USB Publishers.
3. Patil, B. S., Civil Engineering Contracts and Estimates, Universities Press Private Ltd.

Codes of Practice :-

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

Department of Civil Engineering

Class: **T. Y. B. Tech Civil Engineering**	Semester-**VI**
Course Code: **CE 3102**	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 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:

1. Duggal, S.K., Design of Steel Structures, Tata Mc-GrawHill publishing company Ltd.
2. Sairam, K. S., Design of Steel Structures, Pearson publication.
3. Shah, V. L. and Gore, V., Limit State Design of Steel Structures, Structures Publication.
4. Shiyekar, M. R., Limit State Design in Structural Steel, PHI Learning

Reference Books:

1. Subramanian, N., Design of Steel Structures, Oxford University Press.
2. Dayaratnam, Design of Steel Structures, Wheeler Publishing.
3. Chandra, R., Design of Steel Structures, Standard Book House, Vol. I & Vol. II.
4. Arya, A.S. and Ajamani, J.L., Design of Steel Structures, Nemchand and Bros.
5. Vazirani & Ratwani, Design of Steel Structures, Khanna Publishers.

6. Punmia, B. C., Jain & Jain, Design of Steel Structures, Laxmi Publication.

Codes of Practice:

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

Department of Civil Engineering

Class:-T.**Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3122**	Course Name: **Comprehensive Exam IV**

L	**T**	**P**	**Credits**
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Course Description:
Comprehensive Exam IV consists of multiple-choice questions (MCQ) based on following courses.

1. Theory of Structure
2. Estimating and Costing
3. Design of Reinforced Concrete Structures

Department of Civil Engineering

Class:- **T.Y. B. Tech**	Semester-**VI**
Course Code : **SH 3042**	Course Name : Aptitude Training-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.
Concepts of speed and distance, clocks and calendars, seating arrangements have become a routine in one's career. Data Science and analytics completely rely on permutations, combination and probabilities and their applications.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Develop a thorough conceptual understanding and develop a logical approach towards solving Aptitude and Reasoning Problems
2. Understand usage of aptitude terms of speed, time and distance and permutations, probabilities and applications.
3. Understand blood relations and ways of seating arrangements along with various geometrical figures
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 and Distance** Introduction to Speed, Time, Distance, Concept of relative speed. Trains-Crossing a stationary object, Moving object, etc. Boats & Streams-Upstream & Downstream concepts. Races -Two Participant race, three participant race	12
2.	**Logical Reasoning-3** Blood Relations –Drawing family tree, younger & older generations, in law relations. Clocks & Calendar's-Angular measurements of clock, concept of incorrect clock, Gregorian calendar, finding a day of the week. Number Series & Patterns.	12
3.	**Combinatorics** Permutation & Combination -Concept of AND & OR Rule, difference	06

	between permutation & Combination, Important Theorems, Cases. Probability – Basic concept, Conditional Probability, Type of events, formulae	
4.	**Geometry and Mensuration** Geometry-Measurement of plane figures, Important Formulae. Mensuration-Measurement of solid figures, Important formulae	**09**
5.	**Seating Arrangements-** Linear Arrangement - Row & Columns**.** Circular Arrangement - Square, Triangular, Diagonal, etc.	**06**

References:
Reference Books:

1. Aggarwal, R. S., Quantitative Aptitude, S Chand Publishing.
2. Aggarwal, R. S., Logical Reasoning, S Chand Publishing.
3. Sharma, A., Quantitative Aptitude, McGraw Hill Publishing
4. Sharma, A., Logical Reasoning, McGraw Hill Publishing.

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

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-V**I**
Course Code: **CE 3142**	Course Name: **Mini 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 Civil Engineering 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 society& industry. It will help students in developing to achieve sustainable development.

Course Learning Outcomes:

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

1. Develop as an individual and in group leadership quality.
2. Identify and analyse social problems in Civil Engineering.
3. Develop presentation skill through oral and report writing.
4. Acquire theoretical knowledge regarding various problems in Civil Engineering.

Lab Work:

Students should 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 Civil Engineering issues.

Department of Civil Engineering

Class:- **Third Year B. Tech**	Semester-**VI**
Course Code : CE 3162	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
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:

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

Reference Books:

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

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3182**	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.	**Maintenance and Repair Strategies:** Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration, Condition survey.	**06**
2.	**Strength and Durability of Concrete:** Quality assurance for concrete, Strength, Durability and Thermal properties, of concrete, Cracks, different types, causes, Effects due to climate, temperature, Sustained elevated temperature, Corrosion, Effects of cover thickness.	**06**
3.	**Special Concretes (only properties, design considerations)**: Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self-compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made, with industrial wastes.	**06**
4.	**Materials of Repair:** 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,	**06**

	polymer concrete, admixtures of latest origin	
5.	**Techniques for Repair and Protection Methods:** Rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning, Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels.	**06**
6.	**Repair, Rehabilitation and Retrofitting of Structures:** Distressing of structure due to natural agencies, Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake, Engineered demolition techniques for dilapidated structures, case studies.	**06**

References:

Text Books:

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

Reference Book:

1. Denison, C., Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical.
2. Allen, R.T. & Edwards, S.C, Repair of Concrete Structures, Blakie and Sons.
3. DovKominetzky, M.S., Design and Construction Failures, Galgotia Publications Pvt. Ltd.
4. Ravishankar, K., Krishnamoorthy, T.S., Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, Allied Publishers.
5. Champion, S., John Wiley and Sons, Failures and Repair of Concrete Structures.
6. Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India.

Department of Civil Engineering

Program Elective- II

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3202**	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), Future payment compared to uniform series payments (F/A,A/F),Arithmetic gradient, Geometric gradient.	06

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-

Reference Books

1. Blank, L. T. and Tarquin,A. J., Basic Engineering Economy, WCB/McGraw-Hill.
2. Jha, K. N., Construction Project Management, Theory and Practice, Pearson.
3. Peurifoy, R. L., Schexnayder, C. J. and Shapira, A., Construction Planning, Equipment, and Methods, Tata McGraw-Hill.
4. Prasanna, C., Projects: Planning, Analysis, Selection, Financing, Implementation, and Review, McGraw Hill Education.

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3222**	Course Name: **Disaster Preparedness and planning**

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
3.	**Disaster Management:** Efforts to mitigate natural disasters at national and global levels. International	06

	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.	
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-

Reference Books

1. Reiter, L., Earthquake Hazard Analysis: Issues and Insights, Columbia University Press.
2. Mileti, D.S., Disasters by Design: A Reassessment of Natural Hazards in United States; The National Academic Press.
3. Anbalagan, R., Singh B., D. Chakraborthy and Kohli A., - A field manual for landslide investigations, DST, Government of India.
4. Mac Daniels, T.L. and Small M.J. (eds.), Risk Analysis and Society: An Interdisciplinary Characterization of the Field, Cambridge University Press.
5. Carter, W.N., Manila, ADB - Disaster Management: A Disaster Managers Handbook.
6. Singh, R.B. (Ed), Disaster Management, Rawat Publication.

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3242**	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

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

1. Rao, M. N. and Rao H. N., Air Pollution and Contro M. C. Grew Hill Publication.

References Books

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

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3262**	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. Analyse need of modern rail system.
3. Design of runway and taxiway
4. Perform airport planning
5. Create airport layout

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:

1. Saxena, S.C., Arora, S.P., A Text Book of Railway Engineering, Dhanpat Rai and Sons.
2. Khanna, S.K., Arora, M.G., S. S. Jain, Airport Planning and Design, NemChand and Brothers.

Reference Books:

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

Codes of Practice:

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

Department of Civil Engineering

PROGRAM ELECTIVE -III

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3302**	Course Name: **Design of Bridges**

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

Course Description

The course 'Design of Bridges' introduces the fundamental concepts, principles and application of superstructure and substructure analysis and design for the undergraduate students of civil engineering. This course "Design of bridges" goes deeper into the various aspects of Bridge engineering along with bringing out the advanced theories and practical knowledge of Bridge engineering. Each topic will be developed in logical progression with up-to-date information with reference to codal provisions and journals. The topics cover overall analysis of Bridge engineering including Design of super-structure, sub-structure, foundation, and hydrological properties along with details of other bridge components of Reinforced Concrete structures.

Course Learning Outcomes:

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

1. Understand the load distribution and IRC standards.
2. Design the slab and T beam bridges.
3. Design Box culvert, pipe culvert
4. Use bearings, hinges and expansion joints.

Prerequisites: Engineering Mechanics

Course Content

Unit No.	Description	Hrs.
1.	**Introduction to bridges** Introduction to bridges, Classification, Importance of bridges, Components of bridges, Investigation for Bridges, Bridge hydrology- computation of discharge, linear waterway, economic span, afflux, scour depth, Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Effective width, Introduction to methods as per I.R.C.	**06**
2.	**Design Considerations** Standard specification for Road Bridges. I.R.C. bridge code, width of carriage way, clearances, loads to be considered i.e. D.L., L.L., Impact load, wind load, Earthquake load, Longitudinal force, Centrifugal force, buoyancy, Earth pressure, water current force, thermal force etc. General design considerations for R.C.C. bridges.	**06**

3.	**Design of Short Span Bridge** Design of slab for culvert, Design criteria for Box culvert (Single vent only) & Pipe culverts.	**06**
4.	**Design of sub structure** Pigeaud's theory, Courbon's theory, calculation of dead load BM and SF, calculation of live load B M & S F using IRC loading. Design of reinforced concrete deck slab, Design of T beam bridges (up to three girders only), structural design of cross girder.	**06**
5.	**Design of sub structure** Design of Abutments, Piers, Approach slab, Design process of bridge foundations – pile and well	**06**
6.	**Bearings** Different types of bridge Bearing and expansion joints – forces on bearings – Types of bearings, design of unreinforced elastomeric bearings, expansion joints.	**06**

References:

Text Book:

1. Victor, D. J., Essentials of Bridge Engineering, TATA McGraw Hill Publisher.
2. Jagdish & Jayarm, Design of Bridge Engineering, Patrice Hall of India (P) Ltd.
3. Reinforced Concrete Structures – Vol. II by Dr. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications.
4. Raina, V. K., Concrete Bridge Practice, Analysis, Design and Economics, Tata McGraw- Hills Publishing Company Limited.
5. Raju, K. N., Design of Bridges, Oxford & IBH Publishing Co. Pvt. Ltd.

Reference Books:

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

Codes of Practice:

1. Standard Specifications of Road Bridges General Features of Design 5 and 6 (IRC 5 & 6 -2015),.
2. Design criteria for prestressed concrete road (IRC: 18-2000).
3. Recommendations for estimating the resistance of soil: IRC 45-2013.
4. Standard Specifications of Road Bridges General Features of Design (IRC: 78-2000).
5. Standard Specifications of Road Bridges General Features of Design –Bearings (IRC: 83-2005).

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE 3322**	Course Name: **Design of Earthquake Resistant Structures.**

L	T	P	Credits
3	--	--	3

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. As such, the course touches upon pertinent information from engineering seismology, geotechnical engineering, economic, risk and reliability theory, sustainable development, and architecture in addition to advanced topics related to structural dynamics, analysis and design. The focus of the course is on building structures, but general issues are covered related 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. Evaluate responses for single degree of freedom system for free and force vibration by various methods.
2. Evaluate lateral loads developed due to earthquake force by equivalent static method
3. Predict causes of earthquake.
4. Design ductile detailing of RCC structural elements.
5. Apply principles of planning, structural systems for seismic resistant to structures.

Prerequisites: Engineering Mechanics, Differential equations, D' Alembert Principle.

Course Content

Unit No.	Description	Hrs.
1.	**Fundamentals of Theory of Vibration:** Introduction to structural dynamics, definition of basic problem in dynamics, static versus dynamic loads, different types of dynamic loads. Types and causes of vibrations, Free and forced vibration of single degree, Dhuhamel's Integral, response spectra, support motion, Transmissibility, tripartite response spectrum, design response spectrum.	08

2.	**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, relation between magnitude and energy released during earthquake. Earthquake waves, Analysis of earthquake data, seismic zoning, causes of earthquake damage, history of past earthquakes,	**06**
3.	**Structural systems for Seismic Resistance:** 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, Seismic behavior of masonry structures.	**06**
4.	**Computation of Seismic Forces on the Structure:** Clauses given in IS 1893 2016, Computation of lateral loads, shear force diagram bending moment diagram as per IS 1893 2016. .	**06**
5.	**Ductile Detailing of RCC Structures:** Clauses given in IS 13920, Ductile detailing of flexural member, column and shear wall, problems.	**05**
6.	**Advances in Earthquake Engineering:** Base Isolation technique, Seismic dampers, Vibration controlling methods, Field visit, and demonstration of behavior of structures under horizontal and vertical motion.	**05**

References:

Text Book:

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

Reference Books:

1. Mario PAZ, Structural Dynamics Theory and Computation, CBS Publication.
2. Thomson, W. T., Dahleh M. D., Theory of Vibration with Application, Pearson Education.

Codes of Practice:

1. IS 1893 2016 & IS 13920 2016, Ductile detailing of reinforced concrete structures. Part 1.

Department of Civil Engineering

Class: **T. Y. B. Tech Civil Engineering**	Semester-**VI**
Course Code: **CE3342**	Course Name: **Advanced Construction Equipments**

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

Course Description
Construction equipment plays important role in civil engineering projects, it is impossible to complete a project without their use. This course caters for imparting application based knowledge in the area of construction equipment used to construct civil Engineering infrastructure.

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

1. Select equipment base on economic analysis.
2. Justify equipment selection for particular activity.
3. Develop method statement for construction activity using equipments.
4. Draw optimum Layout of construction Plants.

Course Content

Unit No.	Description	Hrs.
1.	**Fundamentals Concept of equipment economics:** Equipment Records Cost of Capital, Evaluating Investment Alternatives, Elements of Ownership Cost, Elements of Operating Cost, Replacement Decisions.	**06**
2.	**Construction Plants:** Brief introduction and layout of construction plants viz: RMC, HMA, Crushers. Plant production.	**06**
3.	**Concreting Equipments:** Introduction, Concrete Mixtures: Concrete Mixing Techniques, Ready-Mixed Concrete, Placing Concrete**:** Manual or Motor-Propelled Buggies, Chutes and Drop Pipes, Belt Conveyors, Concrete Pumps, Consolidating and Finishing: Consolidating Concrete, Finishing and Curing Concrete.	**06**
4.	**Paving Equipments:** Rigid Pavement: Slip form Paving, Roller-Compacted Concrete, Shotcreting Flexible Pavement: Sweeper Broom, Haul Trucks, Asphalt Distributors, Asphalt Pavers, Compaction Equipment	**06**

5.	**Cranes:** Major crane types, Mobil cranes: Crawler cranes, telescoping-boom truck-mounted cranes, lattice-boom truck-mounted cranes, rough-terrain cranes, all-terrain cranes tower cranes: classification, operation, tower crane selection. Rigging: rigging basics, slings.	**06**
6.	**Mechanized Equipment:** Introduction to mechanization: Definition, advantages and limitations of mechanization, Indian scenario and Global scenario. Mechanization in aggregate manufacturing: Natural aggregates and recycled aggregates, Mechanization in rebar fabrication.	**06**

References:

Text Book:

1. Sarkar, S. K. and Saraswati S., Construction Technology oxford university.
2. Peurifoy, R. L., Construction Planning Equipment and Method, Co. Inc. International student edition.

Reference Books:

1. Brien, O. J.J.J, Havers and F.W.Stubbs., Jr., Standard Handbook of Heavy construction. McGraw-Hill Book Co.
2. Chudley, R., Construction Technology (Vol.4) Longman Group Limited.

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE338**	Course Name: **Environment 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 successful completion of the course students will be able to:
1. Apply an environmental policy for an organization.
2. Develop environmental objectives and monitor their implementation.
3. Perform 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 Science

Course Content

Unit No.	Description	Hrs.
1.	**Fundamentals of Environmental Sustainability:** Introduction to sustainability: humanity and environment, the evolution of environmental policy, climate and global change, climate processes: external and internal controls Add monitoring systems	06
2.	**Global Environmental Challenges**: Modern climate change, climate projections, biosphere, soil and sustainability, biodiversity and ecosystem functions, physical resources: water, pollution, minerals, environmental and resource economics, modern environmental management	06
3.	**Environment Management System:** Principles of Environmental Management, Ecosystem Concepts, Environmental Concerns in India, Policy and Legal Aspects of EM, Introduction to Environmental Policies, Environmental Laws and Legislations.	06

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

References :

Text Books: -

1. Modi, P. N., Wastewater Engineering, by Standard Book House.
2. Punmia, B. C., Jain A. K and Jain A. K., Wastewater Engineering, by, Laxmi Publishers.
3. Garg, S. K., Wastewater Engineering & Air Pollution, Khanna Publication.

References Books: -

1. Peavy, H.S, Rowe D.R, Tchobanoglous, G. Environmental Engineering, Mc-Graw - Hill International Editions.
2. Ministry of Urban Development, New Delhi Manual on Water Supply and Treatment.
3. Metcalf and Eddy, Wastewater Engineering, Treatment disposal and Reuse, Tata McGraw-Hill.
4. Rao, M. N. and Rao, H. N., Air Pollution and Control M. C. Grew Hill Publication.
5. Manual on Municipal Solid Waste Management by Government of India, Ministry of Urban Development.

Codes of Practice :-

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

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE3402**	Course Name: **Geographical Information System**

L	T	P	Credits
3	--	--	3

Course Description
This course introduces the hardware and software components of Geographic Information Systems and reviews GIS applications. Topics include data structures and basic functions, methods of data capture and sources of data, and the nature and characteristics of spatial data and objects. Upon completion, students should be able to identify GIS hardware components, typical operations, products/applications, and differences between database models and between raster and vector systems.

Course Learning Outcomes:
After successful completion of the course students will be able to:
1. Apply GIS tool for solving civil engineering industry problem
2. Perform infrastructural planning
3. Analyse spatial data and query analysis
4. Develop base and thematic maps
5. Develop projects and device solution for the area.

Prerequisites: Nil

Course Content

Unit No.	Description	Hrs.
1.	**Fundamentals of GIS** GIS- Definition, advantages of digital maps.- Information Systems, Modeling Real World Features Data. Case study-I	06
2.	**Topology & Techniques** Data Formats – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Database Management – Database Structures, Files; Standard Data Formats, Compression Techniques.	06
3.	**Spatial data & relationship** Types of Errors, Editing and Error Rectification, Types of Topology, Modeling topological Relationships, Tolerances.	06
4.	**Analysis and Modeling** Proximity Analysis, Overlay Analysis, Buffer Analysis, Network Analysis, Spatial Auto Correlation, Gravity Modeling, DTM/DEM, Integration with Remote Sensing data, Case study – II	06

5.	**GIS Project Planning and Implementation** Understanding the Requirements, Phases of Planning, Specifications, Data Procurement, Tendering, Human Resources, Back Up, Monitoring Progress.	**06**
6.	**Interpolation & Various applications of GIS in Civil engineering** Introduction to Interpolation - Global Methods of Interpolation - Local Methods of Interpolation- applications in Planning – Management - Tax Mapping - Emergency evacuation – Environment - Transport/Logistics and Analysis, Case study –III	**06**

References:

Text Books:

1. Elangovan, K., GIS: Fundamentals, Applications and Implementations Handcover publication
2. Fazal, S., GIS basics, New age publication.
3. Mitchell, A., The Esri Guide to GIS Analysis, Volume 2: Spatial Measurements and Statistics Edition, ESRI Publication.

References Books: -

1. Anjireddy, M., Remote sensing and geographical information systems, BS publication.
2. Harmon, J. E. & Anderson, S. J., The design and implementation of Geographic Information Systems, John Wiley & Sons.
3. Lo, C.P. & Albert, K. W.Y., Concepts and Techniques of Geographic Information Systems, Prentice Hall India Pvt. Ltd.

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**VI**
Course Code: **CE3422**	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, Westergaard's theory, contact pressure, approximate stress distribution method.	**06**
3.	**Shallow Foundation:** Definition, types and there selection. Assumptions and limitations of rigid design analysis. Design of isolated, combined, strap footing (rigid analysis), Raft foundation (elastic analysis,), concept of floating foundation.	**06**
4.	**Pile Foundation:** Pile classification, Carrying capacity of pile, static and dynamic methods, pile	**06**

	load test, group action, Rigid block method, Negative skin friction, Settlement of single and group of piles, introduction to well foundation.	
5.	**Lateral Earth Pressure:** Earth pressure on vertical wall, earth pressure at rest, 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, slope failure, modes of failure. Infinite slope in cohesive and cohesion less soil, Taylor's stability number, Friction circle method, Landslides.	**06**

References –

Text Books: -

1. Arora, K. R., Soil mechanics and Foundation engineering, Standard Publishers Distributers.
2. Punmia, B. C., Jain A. K., Jain, A. K., Soil mechanics and Foundation engineering, Laxmi Publications Pvt. Ltd.
3. Singh, A., soil mechanics in theory and practice, Vol. 2 by Asian Publishing House.
4. Ramamurthy, T. N., Sitharam, T. G., Geotechnical Engineering, by S Chand Publications.

References Books: -

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

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil Engineering**	Semester-**V**
Course Code: **CE344**	Course Name: **Intelligent Transport System**

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

Course Description
This course presents the fundamental concepts of Intelligent Transportation Systems (ITS) to students with interest in engineering, transportation systems, communication systems, vehicle technologies, transportation planning, transportation policy, and urban planning. ITS refers to information and communication technologies, as applied to transportation infrastructure and vehicles, that improve transportation safety, productivity, environment, and travel reliability. With accessibility of mobile devices, ITS applications, such as trip planners, help travelers make informed travel choices. ITS is an international program intended to improve the effectiveness and efficiency of surface transportation systems through advanced technologies in information systems, communications, and sensors.

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
3. Calculate the travel demand in future
4. Explain different urban transportation planning and transportation plan preparation methods
5. Predict rout and schedule for mass transit system

Prerequisites: Transportation Engineering

Course Content

Unit No.	Description	Hrs.
1.	**Introduction to Intelligent Transportation Systems** Definition, Objectives, Historical Background, Benefits of ITS -ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection	**06**
2.	**Telecommunications in ITS** Information Management, Traffic Management Centres (TMC). Application of sensors to Traffic management; Traffic flow sensor technologies; Transponders and Communication systems; Elements of Vehicle Location and Route Navigation and Guidance concepts, Digital traffic control in signalling	**06**

3.	**Intersection Management** Video Detection; Virtual Loop Cameras; ANPR; IR Lighting; Integrated Traffic Management; Control Centre; Junction Management Strategies	**06**
4.	**Advanced Transport Management System** Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Advanced Vehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS).	**06**
5.	**Advanced Traveller and Information System** Basic ATIS Concepts; Smart Route System; Data Collection Process; Evaluation of Information; Value of Information; Business Opportunities	**06**
6.	**Intelligent Transportation System Applications** ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; public transportation applications; Automated Highway Systems- Vehicles in Platoons –ITS in World – Overview of ITS implementations in developed countries, ITS in developing countries	**06**

References

Text Book:

1. Sarkar, P. K and Jain, A.K, Intelligent Transport System, Eastern Economy.

Reference Books:

1. Roess, R. P., Prassa E. S., Meshane W. R., Traffic Engineering, Pearson Publication.
2. Chowdhary, M.A. and Sadek A.W., Fundamentals of Intelligent Transport Systems Planning, Artech House.

Class: **Final Year B. Tech Civil Engineering**	Semester-**VII**
Course Code: **CE 4032**	Course Name: **Construction Equipment and Methods**

L	T	P	Credits
3	--	--	3

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.

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

1. Plan equipment utilization for earthwork operation.
2. Perform economic analysis of equipment.
3. Select earthwork equipment based on production and site requirements.
4. Decide plant capacity required for a project.
5. Select Equipment fleet for Project.

Prerequisites: Engineering Mechanics

Course Content

Unit No.	Description	Hrs.
1.	**Equipment economics** Selection of equipment, equipment economics, site access, construction services. Manual Vs Mechanical construction. Planning for construction.	4
2.	**Earth work Equipments** Process of earthwork, equipment for earthwork, cycle time of earth work equipment, Production of Earthwork equipment.	6
3.	**Hard rock excavation** Ripping, definition, process. Drilling equipment, splitting equipments, Excavation by Blasting, Blasting materials.	6
4.	**Construction Plants** Brief introduction and layout of construction plants viz: RMC, HMA, Crushers. Plant production.	6
5.	**Pilling, Dewatering and Groundwater control** Introduction to piling, Pile classification, Pile installation methods. Introduction to dewatering, Methods of dewatering, Installation of dewatering and groundwater control systems.	8
6.	**Formwork** Formwork: Requirement of good formwork, objectives of formwork. Types of formwork: Conventional formwork, Slip formwork, Aluminium formwork; applications, erection, safety. Formwork design parameters, Formwork failure.	6

Text Book:

1. R. L. Purifoy, Construction planning equipment and methods, McGraw Hill Book
2. Frank W. Stubbs, Handbook of Heavy Construction, 1971, McGraw-Hill Professional Publishing;

Reference Books:

1. James J. O'Brien, (1996) "Standard handbook of heavy construction", McGraw-Hill Professional Publishing;
2. Douglas D. Gransberg, Calin M. Popescu and Richard C. Ryan, (2006), "Construction Equipment Management for Engineers, Estimators and owners" CRC Press, Taylor and Francis group

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Class: **Final Year B. Tech**	Semester: **VII**
Course Code: **CE 4092**	Course Name: **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. This elective course deals with analysis of complex structures like beams curved in plan, beams on elastic foundation, beam-column joint, space trusses, cables and suspension bridges. It also covers application of the influence line concept to the 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 beams.
2. Analyze and construct BMD, TMD for beams curves in plan.
3. Analyze beam on elastic foundation under various loads.
4. Analyze beam-column with different support and loading conditions.
5. Determine forces in space truss members.
6. Evaluate various forces developed in cables and stiffening girder.

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

Course Content

Unit No	Description	Hrs.
1	**Influence Lines for Indeterminate Beams** Uses of ILD, Muller Breslau's principle, ILD for propped cantilever, fixed beam, two & three span continuous beams.	06
2	**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
3	**Beams on Elastic Foundation** Analysis of infinite beams, point load, uniformly distributed load and moment, simple, fixed and hinged support.	06
4	**Beam-Column** Governing differential equation, geometric and material nonlinearity, analysis of beam columns, simple and fixed supported at ends with concentrated, uniformly distributed load and moment, magnification factor.	06
5	**Space Trusses** Introduction to space truss, Types of supports, equilibrium conditions in space, Analysis of space truss by tension coefficient method.	06
6	**Cables and Suspension Bridges**	06

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	Equation of cable, cables supported at same level and at different level, length of cable, analysis of three-hinged and two-hinged stiffening girders by using influence lines.	

References -

Text Books:

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

Reference Books:

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

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Class:- **Final Year B. Tech**	Semester-**VII**
Course Code : **CE 4112**	Course Name : **Finite Element Analysis**

L	T	P	Credits
3	--	--	3

Course Description:
Finite Element analysis is the elective course. 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 modeled with relative case. This course consists of understanding of basic concepts of FEM, Development of [k] for 1-D, 2-D and 3-D elements, relevant structural applications. Also it consists of Isoparametric formulation of FEM and axi-symmetrical elements.

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

1. Apply variational and direct approach method for 1D, 2D problems.
2. Develop element stiffness matrix for 1D, 2D & 3D problem.
3. Describe Convergence and compatibility requirements
4. Explain natural and cartesian coordinate system and isometric element.
5. Formulate element stiffness matrix for axisymmetric elements.

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

Course Content

Unit No	Description	Hrs
1	**Introduction** Elementary theory of Elasticity: 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	6
2	**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	6
3	**Development of Stiffness Matrix (Beam,Truss)** Development of element stiffness matrix and nodal load vector for beam and truss elements. Transformation of matrix, 2D elements of triangular shapes for plane stress and plane strain problems. Application of FE method to beam and plane truss.	7
4	**Convergence requirements** Convergence requirements selection of order of polynomial, confirming and non-confirming elements, element aspect ratio, Pascal's triangle.	6

5	**Isoparametric element** 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.	5
6	**3-D elements, Axi symmetric problems** Various 3-D elements, development of element stiffness matrix and nodal load vector for tetrahedron element. Axisymetric problems, Formulation of stiffness matrix of Axi -symmetric elements.	6

References -

Text Books:

1. Zienkiewicz O. C. and Taylor R. L., "The Finite Element Method" Vol.I & II, Tata McGraw Hill Pub.
2. Reddy J.N., "An introduction to the Finite Element Method". Tata McGraw Hill Pub.
3. Cook R. D., "Concept and Application of Finite Element Analysis", John Wiley & sons
4. Hutton D.V., "Fundamentals of Finite Element Analysis", Tata McGraw Hill Pub.
5. Desai C. S. & Abel J. F. , "Introduction to the Finite Element Method", CBS Pub.

Reference Books:

1. Krishnamoorthy C. S., "Programming in the Finite Element Method", Tata McGraw Hill
2. Chandrupatla T. R. and Belegundu, "Introduction to the Finite Element in Engineering" Prentice Hall of India, Pvt. Ltd.
3. Bathe K.J., "Finite Element Procedures", PHI learning Pvt. Ltd.
4. Desai Y. M. and Eldho T. I. , "Finite Element Method with application in Engineering", Pearson, Delhi.

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Class:- **Final Year B. Tech**	Semester-**VII**
Course Code : **CE 4132**	Course Name : **Project Management**

L	T	P	Credits
3	--	--	3

Course Description

Project management is important because it ensures proper expectations are set around what can be delivered, by when, and for how much. Without proper project management, budget estimates and project delivery timelines can be set that are over-ambitious or lacking in analogous estimating insight from similar projects. Ultimately this means without good project management, projects get delivered late, and over budget.

This course focuses on guidelines for managing individual projects and project management related key concepts. It also covers the project life cycle and related processes.

Course Learning Outcomes:

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

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

Prerequisite: Basics construction activities

Course Content

Unit No.	Content	Hours
1	**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	06
2	**Project Identification Process** Introduction, Project Identification Process, Project Initiation, Pre-Feasibility Study, Feasibility Studies, Project Break-even point	06
3	**Project Planning** Introduction, Project Planning, Need of Project Planning, Project Life Cycle, Roles, Responsibility and TeamWork, Project Planning Process, Work Breakdown Structure (WBS)	06
4	**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

5	**Project Close-out** Introduction, Project Close-out, Steps for Closing the Project, Project Termination, Project Follow-up, Analytical Techniques-Regression analysis, Expert Judgment and Trend analysis	**06**
6	**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 Book:

1. Punmia B. C., Khandelwal K. K, "Project Planning & Control with PERT & CPM", Laxmi Publications Pvt Ltd.
2. Harold Kerzner "Project Management: A Systems Approach to Planning, Scheduling, and Controlling" Wiley.

Reference Books:

1. Chitkara K. K. "Construction Project Management", McGraw Hill Education.
2. Sengupta B. and Guha H. "Construction Management and Planning", McGraw Hill Education (India).
3. Chandra Parsanna (2019), "Projects: Planning, Analysis, Selection, Financing, Implementation and Review", McGraw-Hill; Ninth edition

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Class: **B Tech Civil**	Semester-**VII**
Course Code: **CE 4152**	Course Name: **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 mine 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 in a given stress environment. Rock control and support systems utilized in underground and surface excavations and their related safety requirements are discussed.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Describe the theory and analysis of in-situ induced stresses in a rock mass and structurally controlled failure.
2. Apply the principles of rock mechanics and excavation design to develop excavation proposals for given geologic environments
3. Analyze the rock and soil slope stability and rockfall hazards.
4. Explain the principles and techniques of reinforcement design for the primary failure modes in underground rock excavations

Prerequisite:
Basic knowledge of mathematics and fluid mechanics etc.

Course Content

Unit No.	Description	Hrs.
1.	**Introduction:** 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
2.	**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 SPT, Stress Strain models – Elastic model, Elasto plastic model, Visco elastic model.	06
3.	**Engineering Classification of Rock:** RQD, RMR system, Terzaghi's rock load classification, Deere Miller, CMR Sand RSR System. Classification based on strength and modulus, Classification based on strength and failure strain, rock discontinuity qualitative description.	06
4.	**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

5.	**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**
6.	**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 Book:

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

References Books: -

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

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Class: **Final Year B. Tech Civil Engineering**	Semester-**VII**
Course Code: **CE 4172**	Course Name: **Industrial Waste Management**

L	T	P	Credits
3	--	--	3

Course Description
Industrial waste treatment 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 Outcomes:
After successfully completing the course, student will able to:
1. Apply various techniques of wastewater volume and strength reduction
2. Analyze characteristics of Industrial wastewater.
3. Suggest different wastewater treatment options for industrial wastewater.
4. Design Effluent Treatment Plant for Industrial wastewater treatment.

Prerequisites: Basic knowledge of Water Supply Engineering and Wastewater Engineering courses are essential.

Course Content

Unit No.	Description	Hrs.
1.	**Introduction to 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, stream standards and effluent standards.	6
2.	**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
3.	**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
4.	**Treatment techniques for Industrial wastewater** Different types of waste treatment & their selections, Development of treatment flow diagram based on characteristics of waste,	6
5.	**Manufacturing Process of various industries** Manufacturing processes in major industries, water requirements, wastewater sources, composition of waste,. sugar, distillery, dairy, pulps, paper mill, fertilizer, Tannery, chemical, steel industry, power plants, textile Treatment flow	8

	sheets alternative methods of treatment, factors affecting efficiency of treatment plant	
6.	**Environmental legislation and Pollution control** Water pollution control act, organizational set up of central and state boards for water pollution control, classification of river on water use, minimal national standards, socio-economic aspects of water pollution control	**6**

Text Book:

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

Reference Books:

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

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Class: **Final Year B. Tech Civil Engineering**	Semester: VII
Course Code: **CE 4192**	Course Name: **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 practices that are used globally.

Course Outcomes:
After completing the course, the student should be able to: -
1. Suggest suitable materials for different types of pavements.
2. Analyse the pavement components with respect to their material composition.
3. Estimate the stresses induced due to wheel load and temperature.
4. Design the pavement, flexible or rigid, for the conditions prevailing at site.
5. Understand the variation in specification for pavement materials used in other countries.

Prerequisites: Infrastructure Engineering -I

Course Content

Unit No.	Description	Hrs.
1.	**Pavement Material & Characterization:** Pavement Materials: Types and Component parts of Pavements - A brief study on aggregates, bitumen and modified bitumen like cutback, emulsion, polymer modified bitumen - Bituminous mix design methods, specifications and testing – Superpave mix design and material testing.	6
2.	**Analysis & Design of Flexible Pavement:** Stresses and Deflections in Homogeneous Masses - Burmister's 2- layer, 3- layer Theories - Wheel Load Stresses - ESWL of Multiple Wheels - ESAL – VDF - Repeated Loads and EWL factors - Sustained Loads and Pavement behaviour under Traffic Loads - Empirical, Semi-empirical, Analytical and Mechanistic-empirical approaches - Development, Principle, Design steps, Advantages and Applications of different Pavement Design Methods – Mechanistic Empirical Pavement Design – IRC SP 37- Guidelines and examples.	6
3.	**Analysis & Design of Rigid pavements:** Types of Stresses and Causes, Factors influencing the Stresses; General conditions in Rigid Pavement Analysis, ESWL, Wheel Load Stresses, Warping Stresses, Friction Stresses, Combined Stresses - 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, 2017	6

4.	**Construction & Maintenance of Flexible Pavement :** 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, its gradation, compaction and density requirements. Selection of different bituminous mix treatment as per functional and structural requirements of Construction procedure as per specification of MORTH.	6
5.	**Construction & Maintenance of Rigid Pavement :** Earthwork, Granular sub base, drainage layer, Dry lean concrete as per IRC-49, Pavement quality concrete construction requirements as per IRC:15 and IRC:58 and MORTH, Importance of joints and its provision Interlocking Concrete Block Pavement (ICBP) and Its procedure of laying, requirements, Pattern of blocks, Strength requirement as per guidelines of IRC SP 63.	6
6.	**Introduction to New Technology** Recycle aggregate pavement as per IRC:120 (RAP), Cold in place (CIP), Hot in place (HIP), Paver, Plant mix technology, Methodology of construction, Cold mix technology as per IRC SP-100, White topping – Conventional, Ultra-thin white topping as per IRC SP-76, , Stone matrix asphalt as per IRC SP-79, Warm mix asphalt as per IRC SP 101, Micro surfacing ,slurry seal as per IRC SP-81.	6

Text Book:

1. Huang, Y. H. "Pavement Analysis and Design", Pearson Prentice Hall, NJ, USA.
2. Yoder, E. J., and Witczak, M. W. "Principles of Pavement Design", Wiley, NY, USA.

Reference Books:

1. Harold N. Atkins, "Highway Materials, Soils and Concrete", Prentice Hall.
2. Robert D. Krebs "Highway Materials", McGraw Hill Text.
3. IRC: 37-2012, Guidelines for the Design of Flexible Pavements.
4. IRC: 58-2015, Guidelines for the Design of Rigid Pavements.
5. MORTH Specifications for Road and Bridge Works, Indian roads Congress.
6. Mechanistic Empirical Pavement Design Guide, NCHRP, TRB.
7. Justo C. E. G. & Khanna S. K., "Highway Engineering", Nem Chand & Bro. Publication.

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Class: **Final Year B. Tech**	Semester: **VII**
Course Code: **CE 4212**	Course Name: **Advanced Structural Analysis Laboratory**

L	T	P	Credits
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Course Description:
This lab course contains analysis of different structures which is discussed in theory course by using software (ILD, Beams curved in plan, Space trusses, building frames and cables). The procedure for modelling and analyzing complex structures is explained in detail. Further, interpretation and limitation of software results is expected to be covered in this laboratory course.

Course Learning Outcomes:
After successful completion of this course students should be able to:
1. Analyze beams curved in plan, multistoried buildings, space frames using classical methods and software.
2. Compare results of results of classical methods of structural analysis using software results.
3. Critique on the analysis results obtained by software.

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

Course Content

Exp. No.	Name of Experiment	Hrs.
1	A. Analysis of indeterminate by using ILD method.	2
	B. Drawing of ILD by using STAAD Pro.	2
2	A. Analysis of beams curved in plan by classical method of analysis.	2
	B. Analysis of beams curved in plan by using software ETABS/STAAD Pro	2
3	A. Analysis of space frame using tension coefficient method	2
	B. Validation of analysis of space frame using STAAD Pro	2
4	A. Analysis of building frame using any one approximate method.	4
	B. Validation building frame analysis using software ETABS/STAAD Pro	2
5	A. Analysis of cables supported at different and at same level.	4
	B. Validation of analysis results of cables using software.	2

References -
Text Books:
1. Bhavikatti S. S. "Structural Analysis-II", Vikas Publishing House Pvt. Ltd., New Delhi.

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

Reference Books:

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

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Class: **Final Year B. Tech**	Semester: **VII**
Course Code: **CE 4232**	Course Name: **Finite Element Analysis Laboratory**

L	T	P	Credits
--	--	2	1

Course Description:
FEM is a powerful tool used for the numerical analysis of a wide range of engineering complex problems. With advances in computer technology, complex problems can be modeled with relative case. This course consists of understanding of basic concepts of FEM, Development of [k] for 1-D, 2-D and 3-D elements, relevant structural applications.

Course Learning Outcomes:
After successful completion of this course students should be able to:
1. Illustrate terms used in Finite Element Method
2. Analyse 1D & 2D problems
3. Develop solution of 2D & 3D problems using Finite Element software

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

Course Content

Exp. No.	Name of Experiment	Hrs.
1	1. Analysis of following structures by FEM a. Spring and bar elements	8
	b. Beams	
	1. Trusses	
	2. Portal frames	
2	Finite Element Analysis application to civil engineering structures using software (any TWO)	2

References -
Text Books:
1. Zienkiewicz O. C. and Taylor R. L., "The Finite Element Method" Vol.I & II, Tata McGraw Hill Pub.
2. Reddy J.N., "An introduction to the Finite Element Method". Tata McGraw Hill Pub.
3. Cook R. D., "Concept and Application of Finite Element Analysis", John Wiley & sons
4. Hutton D.V., "Fundamentals of Finite Element Analysis", Tata McGraw Hill Pub.
5. Desai C. S. & Abel J. F. , "Introduction to the Finite Element Method", CBS Pub.
Reference Books:
1. Krishnamoorthy C. S., "Programming in the Finite Element Method", Tata McGraw Hill
2. Chandrupatla T. R. and Belegundu, "Introduction to the Finite Element in Engineering" Prentice Hall of India, Pvt. Ltd.
3. Bathe K.J., "Finite Element Procedures", PHI learning Pvt. Ltd.
4. Desai Y. M. and Eldho T. I. , "Finite Element Method with application in Engineering", Pearson, Delhi.

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Class: **Final Year B. Tech Civil Engineering**	Semester-**VII**
Course Code: **CE 4272**	Course Name: **Rock Mechanics Laboratory**

L	T	P	Credits
--	--	2	1

Course Description: The design and analyses of any rock engineering project for civil or mining applications require careful mechanical characterization of the host rock. For this purpose, 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 Outcomes:
After successfully completing the course, student will able to
1. Determine the physical and mechanical properties of rock sample.
2. Identify 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.
1.	Introduction and Identification of Different Types of Rock	2
2.	Determination of Core Recovery and RQD of Rock Sample	2
3.	Determination of Moisture Content and Porosity of Rock Sample	2
4.	Unconfined Compressive Strength Test	2
5.	Point Load Strength Index Test	2
6.	Brazilian Tensile Strength Test	2
7.	Direct Shear Test on Rock Sample	2
8.	Permeability of Rock Sample	2
9.	Triaxial Test on Rock Sample	2
10.	Site Visit	2
11.	Site Investigation Report	2

References –
Text Book:
1. Jaeger, J.C., Cook, N.G.W., Zimmerman, R.W., "Fundamentals of Rock Mechanics", Blackwell Publishing.
2. Mogi Kiyoo, "Experimental Rock Mechanics", Published by Taylor & Francis.

3. Hudson, J.A. and Harrison, "Engineering Rock Mechanics – An Introduction to Principles", J.P., Pergamon.
4. Obert and Duvall, "Rock Mechanics and Design of Structures", John Willey & Sons.
5. Stag and Zienkiewez, "Rock Mechanics in Engineering Practice, John Willey & Sons
6. T. Ramamurthy, "Engineering in Rocks", PHI Learning Pvt. Ltd.

References Books: -

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

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Class: **Final Year. B. Tech. Civil Engineering**	Semester - **VII**
Course Code: **CE 4312**	Course Name -**Pavement analysis Engineering 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 transportation engineering course.

Course Learning Outcomes:
After successful completion of the course, students will be able to-
1. Categorize bituminous materials.
2. Analyse quality control of pavement materials
3. Design bituminous mixes for flexible pavement
4. Design concrete mix for rigid pavement

Prerequisites: Knowledge of transportation Engg.

Course Content		
Expt. No.	**Name of Experiment**	**Hrs.**
1.	Study and use of IRC charts in road design and construction	02
2	Design of concrete mix for rigid pavement- Revise	02
3	Design of bitumen mix for flexible pavement - Revise	02
4	Design of pavement by software method- add IIT KH (IITPave, IIT Layer)	02
5	Measurement of slope of road surface	02
6	Case study and analysis of existing rigid pavement	02
7	Case study and analysis of existing flexible pavement	02
8	Study the different code of practices used for the design of flexible and rigid pavements.	02
9	Visit to the Highway authorities /road research institute and write report on it.	02
10	Visit the flexible/ rigid pavement site and write detailed report on it.	02
11	Structural evaluation of flexible pavements by using **Benkelman Beam Deflection Method-**	04

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Text Book:

1. Huang, Y. H. "Pavement Analysis and Design", Pearson Prentice Hall, NJ, USA.
2. Yoder, E. J., and Witczak, M. W. "Principles of Pavement Design", Wiley, NY, USA.

Reference Books:

1. Harold N. Atkins, "Highway Materials, Soils, and Concrete", Prentice Hall.
2. Robert D. Krebs "Highway Materials", McGraw Hill Text.
3. IRC: 37-2012, Guidelines for the Design of Flexible Pavements.
4. IRC: 58-2015, Guidelines for the Design of Rigid Pavements
5. MORTH Specifications for Road and Bridge Works, Indian roads Congress
6. Mechanistic Empirical Pavement Design Guide, NCHRP, TRB, 2008
7. Practical manual given by jasto Khanna

Class: **Final Year B. Tech Civil Engineering**	Semester- **VII**
Course Code: **CE 4392**	Course Name: **Advanced Structural Design**

L	T	P	Credits
3	--	--	3

Course Description
This course deals advanced design in steel and concrete materials, of building components that range from foundations to the entire superstructure.

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

1. Analyze and design RC structures and their components like building frames, flat slab, retaining walls, water tanks and piles using relevant codes and applying codal provisions.
2. Analyze the slabs of irregular shapes by yield line theory and design rectangular and circular slabs for yield moments.
3. Sketching the detailing of reinforcement in structural components of building frames, flat slab, retaining walls, water tanks and piles.

Prerequisites: Design of Reinforced Concrete Structures, Theory of Structures

Course Content

Unit No.	Description	Hrs.
1.	**Yield line analysis** Introduction, rules governing possible yield line patterns, yield line patterns at collapse of various shapes of slab with different support conditions. Two methods for determining ultimate loads on slab: virtual work method and equilibrium method. Analysis and design of simply supported rectangular and circular slabs.	6
2.	**Flat slab** Introduction, analysis of flat slab panel by direct design method, equivalent frame method, design of flat slab, detailing of reinforcement.	6
3.	**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
4.	**Building frames** Introduction, analysis of building frames by method of substitute frames, design of RC building frames, design of RC portal frames, detailing of connections.	6
5.	**Overhead water tanks** Analysis and design of overhead circular water tanks with flat bottom, spherical and conical tank roofs, ring beams, staging. Detailing of reinforcement in the components of overhead water tank.	6

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6.	**Pile foundation** Introduction to pile foundations, structural design of reinforced concrete piles, design of pile cap. Detailing of reinforcement.	**6**

Text Book:

1. Sinha and Roy "Fundamentals of Reinforced Concrete", S. Chand and Company Ltd, New Delhi
2. A. K. Jain "Reinforced Concrete Design"
3. Karve and Shah "Limit State Theory and Design", Structures Publications, Pune
4. P. C. Varghese "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi
5. IS: 456-2000
6. IS: 3370- 1 to 4- Code of Practice for concrete structures for the storage of liquids.
7. N. Unnikrishna Pillai, Devdas Menon "Reinforced Concrete Design", Tata McGraw-Hill Publishing Company Ltd, New Delhi
8. N. Krishna Raju "Advanced Reinforced Concrete Design", CBS Publishers Distributors Pvt. Ltd.
9. Chu-Kai Wang, Charles G. Salmon "Reinforced Concrete Design", Harper International Edition
10. S. K. Mallick, A. P. Gupta "Reinforced Concrete", Oxford & IBH Publishing Company, Mumbai
11. P. Purushothaman "Reinforced Concrete Structural Elements", Tata McGraw- Hill Publishing Company Limited, New Delhi

Reference Books:

1. Ferguson, Breen, Jivsa "Reinforced Concrete Fundamentals", John Wiley & Sons, New York
2. T. S. MacGinley & B. S. Choo "Reinforced Concrete", E. & F. N. Spon, London
3. P. C. Varghese "Advanced Reinforced Concrete Design", Prentice- Hall of India, New Delhi

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Class: **B. Tech Civil Engineering**	Semester- **VII**
Course Code: **CE 4412**	Course Name: **Pre-Stressed Concrete Structures**

L	T	P	Credits
3	--	--	3

Course Description
Pre-Stressed Concrete Structures 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 the can analyze and design the same.

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

1. Explain the concept and importance of pre-stressing.
2. Analyse 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.
5. Design the pre-stressed concrete beams.

Prerequisites: Engineering Mechanics, SoM, DRCE

Course Content

Unit No.	Description	Hrs.
1.	**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
2.	**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
3.	**Design of pre-stressed concrete sections for flexure** General philosophy of design, design approaches in working stress method and limit stress 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
4.	**Design for shear** 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.	6
5.	**Design of End Blocks** Methods of End block design, End zone stresses in pre-stressed concrete members Pretension transfer bond, transmission length, end block of post-tensioned members	6
6.	**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	6

	transformation and concordancy of cables.	

Text Book:

1. Sinha.N.C. and.Roy.S.K. "Fundamentals of Prestressed Concrete", S.Chand and Co.
2. S. Ramamrutham, "Prestressed Concrete", Dhanpat Rai Publishing Company.
3. N. Rajaopalan, "Prestressed Concrete", Narosa Publishing House.

Reference Books:

1. Krishna Raju, "Prestressed Concrete", Tata McGraw Hill Publishing Co.
2. Lin, T.Y. and Burns, N.H., "Design of Prestressed Concrete Structures", John Wiley and Sons.
3. IS: 1343 – 1980, "Code of Practice of Prestressed Concrete", Bureau of Indian Standards.

Class: **B. Tech Civil Engineering**	Semester-**VII**
Course Code: **CE 4432**	Course Name: **Matrix Methods 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 mainly concerned with the analysis of beam, plane truss, & plane frame subjected to static loads only using matrix methods. This course consists of transformation of matrices, various applications to symmetrical structures. The course also focuses on analysis of structure is developed based on strain energy principles.

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

1. Perform the structural analysis of determinate and indeterminate structures using classical methods, force and displacement methods
2. Explain strain energy system and transformation of matrix
3. Analyze the structures by using the stiffness & flexibility method.
4. Solve multiple degree of freedom two-dimensional problems involving trusses & beams.

Prerequisites: Engineering Mechanics, Engineering Mathematics, Structural analysis, Theory of structures

Course Content

Unit No.	Description	Hrs.
1.	**Generalized measurements :** Degrees of freedom, Constrained Measurements, Behavior of structures, Principle of superposition. Stiffness and flexibility matrices , Stiffness and flexibility coefficients from virtual work.	6
2.	**Strain energy :** Stiffness and flexibility matrices from strain energy, Symmetry and other properties of stiffness and flexibility matrices, Betti's law and its applications, Strain energy in systems and in elements.	6
3.	**Transformation of matrices:** Transformation of element matrices to system matrices, Transformation of system vectors to element vectors, Normal coordinates and orthogonal transformations.	6
4.	**Flexibility method:** Statically determinate and indeterminate structures, Choice of redundants, Transformation of redundants	6
5.	**Indeterminate truss:** Development of the method, Internal forces due to thermal expansion and lack of fit	6
6.	**Applications:** Application to symmetrical structures, Comparison between stiffness and flexibility methods.	6

Text Book:

1.Praveen Nagarajan, "Matrix Methods of Structural Analysis", CRC press, Taylor & Francis group
2. Moshe, F., Rubenstein, "Matrix Computer Analysis of Structures", Prentice Hall, New York.
3. Rajasekaran S, "Computational Structural Mechanics", Prentice Hall of India, New Delhi.
4. R.K. Livesley, "Matrix Methods of Structural Analysis", Elsevier Ltd.

Reference Books:

1. Jean H. Prevost, "An Introduction to Matrix Structural Analysis & Finite Element Methods", World Scientific Pub.
2. Manickaselvam V.K., "Elements of Matrix and Stability Analysis of Structures", Khanna Publishers, New Delhi.
3. Devdas Menon, "Advanced Structural Analysis", Narosa Publishing House.
4. Asslam Kassimali, "Matrix Analysis of Structures", Cole Pub. USA

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Class:- **Final Year B. Tech**	Semester-VII
Course Code : CE 4452	Course Name : **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. Codify materials,
2. Select vendor for material purchase,
3. Manage inventory,
4. Describe employee development and welfare,
5. Design performance appraisal matrix,

Prerequisite: Nil

Course Content

Unit No	Description	Hrs
1	**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
2	**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
3	**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
4	**HRM Basics:** Manpower Planning, functions of HRM, Development and Operation of human resources - Managerial Staffing – Recruitment – Selection - Placement, Training and Development.	06

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5	**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**
6	**Performance Appraisal:** Performance appraisal - Employee hand book and personnel manual - Job descriptions and organization structure and human relations – Productivity of Human resources. Special Human resource problems,	**06**

References -

Text Books:

1. P. Gopalkrishna & M. Sudarsan, "Materials Management, An Integrated approach", PHI
2. A.K. Dutta, "Materials Management-Procedures Texts & Cases", PHI
3. Gopal Krishnan, "Hand Book of Materials Management", PHI
4. Memoria,C.B. "Personnel Management", Himalaya Publishing Co.,.
5. K. Aswathappa "Human resource and personnel management", TATA McGraw Hill publication.

Reference Books:

1. Josy.J. Familaro "Handbook of Human Resources Administration", McGraw-hill International Edition.
2. C. M. Sadiwala, Ritesh C. Sadiwala "Materials and Financial Management", New Age International Publishers.

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Class:- Final Year B. Tech	Semester-VII
Course Code : CE 4472	Course Name : **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 emphasiased the need for the study of principles and techniques of total quality management both by students of management program in universities and management institutions 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. To identify basic requirements for applying TQM in construction.
2. To prepare the TQM framework.
3. To apply seven QC tools of quality assurance
4. To use six sigma techniques to improve quality.

Prerequisite:
Knowledge of construction activities and processes

Course Content

Unit No	Description	Hrs
1.	**Introduction to TQM** Introduction to Quality, dimensions of quality, Managing quality, The quality cycle, Evolution of Theory of constraints(TOC), application of TOC, TQM framework, Benefits of TQM, need of TQM in construction sector.	06
2.	**Principles and philosophies of quality management** Overview of the contributions of Deming, Juran Crosby, Masaaki Imai, Feigenbaum, Ishikawa, Taguchi techniques – introduction, loss function, parameter and tolerance design, signal to noise ratio. Concepts of Quality circle, Japanese 5S principles and 8D methodology.	06
3.	**Management Issues in Quality** Challenges of quality management, Emerging quality management issues, Process management, Measurement and strategic information management, organizing for TQM, Building and sustaining Total Quality Organization..	06
4.	**Tools and techniques for quality management** Quality functions development (QFD) – Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process. Failure mode effect analysis (FMEA) – requirements of reliability,	06

	failure rate, FMEA stages, design, process and documentation. Seven old (statistical) tools. Seven new management tools of quality assurance.	
5.	**Management of Total Quality** Just-In-Time systems, Benchmarking, Business-Process-Reengineering, Supply Chain Management, Six Sigma- Features of six sigma, Goals of six sigma, DMAIC, Six Sigma implementation	**06**
6.	**Quality Management Systems** Introduction, Benefits of ISO registration, ISO 9000 series of standards, ISO requirements, Implementation, Documentation, Quality manuals	**06**

References:

Text Books:

1. K. Shridhara Bhat, "Total Quality Management- Text & Cases", Himalaya Publishing House.
2. Shankar D. Bagade, "Total Quality Management", Himalaya Publishing House.
3. B. L. Hanson & P. M. Ghare. "Quality Control & Application" , Prentice Hall of India.

Reference Books:

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

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Class:- Final Year B. Tech	Semester-VII
Course Code : CE 4492	Course Name : 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. Analyse 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
1	**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
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.	06
3	**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
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**	06

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	Air quality standards – Air quality monitoring – Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment – Methods.	
6	**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**

Text Books:

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

Reference Books:

1. Rao and Rao "Air Pollution", Published by Tata McGraw-Hill Education
2. Peavy & Rowe "Environmental Engineering", Published by New York : McGraw-Hill
3. Stern "Air Pollution", Published by Elsevier Store

Class:- Final Year B. Tech	Semester-VII
Course Code : CE4512	**Course Name : Fundamentals of Urban and Regional Planning**

L	T	P	Credits
3	-	--	3

Course Description:
The course is designed to provide necessary exposures to various planning processes, emerging trends etc. During the course students will be provided the ample opportunities to interact with subject experts, various organization govt.,non govt. NGOs etc. Student will get real time project knowledge from ongoing projects and developments

Course Learning Outcomes:
The students will able
1. To apply international planning and design theories in a development design.
2. To measure the impact of manmade activities on urbanization.
3. To evaluate the impact of urban development plans in regards to sustainable urban development and urban quality.
4. To use tools and techniques of region planning.

Prerequisite:
Good analytical and problem solving skills, interested in social, economic, environmental and cultural issues.

Course Content

Unit No	Description	Hrs
1	Planning – needs of planning, theories of planning, types and levels of Planning , Site planning, transport planning, utility planning, landscape planning, master plans. Urbanization -definition, process, character, function, migration, role of social, economic and demographic aspects on urbanization, major components of a settlement, major urban problems and their solutions to land uses.	6
2	Human Impacts – urban decay – urban blight, impacts of development on environment and urban design Environmental Factors – environment protection and conservation-sustainable urban infrastructure – assessment of microclimate – Concept of Sustainable Development – green cities and ecologically healthy cities	6
3	Origin, development and goals of planning- nature of urban policy - Neighborhoods in planning, Birth and development of the neighborhood idea, The Indian neighborhood, Urban renewal and its aftermath -rise of advocacy planning- role of NGOs in planning-Urban social movements ,Institutional arrangements of urban planning with special reference to India– edicts, laws– New Towns and IDSMT, regional contexts of metropolitan plans, - Proposals of National Commission on Urbanization.	6
4	Basic Concepts in Regions, Defining a region: fluidity and purposiveness, Typology of Regions: Resource Regions, Mega, Macro, Meso, and Micro Regions. Delineation of Regions (Regionalisation), Types and contents of regional planning for block, district, state, national, NCR, resource region, agro–climatic region, topographic region and sectoral planning, major regional problems and their solutions.	6

5	Resource Regions; Corridors as regions; National, Sub-National and State as a region; Macro, Meso and Micro regions in India. Case Studies from India: NCR and Delhi Mega Region, Mumbai Mega Region, Kolkata Metro Region, Chennai Metro Region, and other Metro Regions in India. Western & Eastern Ghats, North Eastern Region, Coastal Regions, and River Valley Regions. Corridors: Golden Quadrilateral, Delhi-Mumbai, Chennai-Bangalore Industrial Corridor, North-South and East-West Corridor Regions; Core, Fringe and Periphery in a Region and its planning. Tools and techniques available for planning regions in India.	6
6	Growth of Mega and Metro Regions: Scale, Complexity and its impact on national and international scenario, convergence and divergence. Regional Economy, competitiveness among regions, backward and leading regions in development. Special Regions: SEZ, Agro Regions, Ecological regions, etc.; Regional Disparity Analysis (through factor analysis); Regional Interdependence Analysis	6

References:

Text books:

1. Kopardekar & Diwan, "Urban and Regional Planning-Principles, Practice and Law" S.H. Kopardekar, Talegaon – dabhade.
2. Kulshrestha S.K., "Dictionary of Urban and Regional Planning", Kalpaz Publications, Delhi.

Reference books

1. Adair, A., J. Berry, W. S. McGreal, W. Deddis, and S. Hirst."Evaluation of Investor Behaviour in Urban Regeneration" Urban Studies.
2. Adams, D., and S. Tiesdell. "Planners as Market Actors: Rethinking State-Market Relations and Land and Property" Planning Theory and Practice
3. Brenner, N., and N. Theodore, eds. "Spaces of Neoliberalism: Urban Restructuring in North America and Western Europe", Oxford: Blackwell.
4. Brenner, N., and N. Theodore. "Neoliberalism and the Urban Condition." .
5. Campbell, H., and S. Feinstein. "Justice, Urban Politics and Policy." In Oxford Handbook of Urban Politics, edited by K. Mossberger, S. E. Clarke, and P. John, Oxford: Oxford University Press.
6. Communities and Local Government. "Barker Review of Land Use Planning: Final Report—Recommendations". London: Stationery Office.
7. Innes, J. "Planning Theory's Emerging Paradigm: Communicative Action and Interactive Practice." Journal of Planning Education and Research.

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Class:- Final Year B. Tech	Semester-VII
Course Code : CE 4532	**Course Name : Solid and Hazardous Waste management**

L	T	P	Credits
3	-	--	3

Course Description:
The course would cover general introduction including definition of solid wastes –municipal waste, biomedical waste, hazardous waste, e-waste; 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, landfilling); 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 successfully completing the course, Student will able to:
1. Determine solid waste properties and quantity for municipal and hazardous waste.
2. Illustrate health effects by municipal, hazardous waste.
3. Design Physicochemical and biological treatment and landfill site for solid waste.
4. Design of landfill design

Prerequisite: Environmental science
Environmental science

Course Content

Unit No	Description	Hrs
1	**Municipal solid and Hazardous waste management fundamentals:** Sources; composition; Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects	6
2	**MSW and Hazardous waste Management** Generation rate, factors affecting generation rate, different methods of collection, collection systems, Storage, transfer and transportation of refuse, economic aspects of refuse collection & transport.	6
3	**Waste Disposal** Introduction, components of land filling, types of land filling, site selection, construction techniques, maintenance and precautions, leachate and its control, control of contamination of ground water, Operation monitoring ,Closure & end-use.	6
4	**Physicochemical Treatment of Solid and Hazardous Waste:** Chemical treatment processes for MSW (combustion, stabilization and solidification of hazardous wastes); physicochemical processes for hazardous wastes (soil vapour extraction, air stripping, chemical oxidation); ground water contamination and remediation	6

5	**Biological treatments and Landfill design** Composting; bioreactors; anaerobic decomposition of solid waste; principles of biodegradation of toxic waste; inhibition; co-metabolism; oxidative and reductive processes; slurry phase bioreactor; in-situ remediation Landfill design for solid and hazardous wastes; leachate collection and removal; landfill covers; incineration	6
6	**Relevant Regulations:** Municipal solid waste (management and handling) rules; hazardous waste (management and handling) rules; biomedical waste handling rules; flyash rules; recycled plastics usage rules; batteries (management and handling) rules	6

References:

Text books:

1. Dr. A. D. Bhide, "Solid Waste Management", Published by Indian National Scientific Documentation Centre, New Delhi.
2. Manual on Municipal Solid Waste Management by Ministry of Urban Development of Govt. of India, 2004.

Reference books:

1. Gorge Tchobanoglous, "Solid Waste Management" , Published by McGRAW-HILL: New York.
2. Pavoni, "Solid Waste Management Hand Book" , Published by A Willy – Interscience Publication.
3. Gottas, "Composting", Published by World Health Organisation, Geneva.
4. Peavy & Rowe, "Environmental Engineering', Published by New York : McGraw-Hill

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Class:- Final Year B. Tech	Semester-VII
Course Code : CE 4552	Course Name : Photogrammetric Surveying

L	T	P	Credits
3	-	--	3

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. 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 equipments 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.
2. Analyse and correct the errors from the topographical survey maps.
3. Illustrate the principles of advanced surveying techniques.

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

Course Content

Unit No	Description	Hrs
1	**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
2	**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
3	**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 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.	06

4	**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**
5	**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**
6	**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.	**06**

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
4. Arora .K.P, "Surveying", Volume 3, Standard Book House.
5. T.P Kanetkar and S.V Kulkarni, "Surveying and Levelling Vol. I and II", Pune Vidhyarthi Gruh.

Reference Books:

1. Bannister .A and Raymond S, "Surveying, ELBS".
2. James M. Anderson and Edward M. Mikhail, "Introduction to Surveying", McGraw Hill Book Company.
3. 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	Semester-VII	L	T	P	Credits
Course Code : CE 4572	**Course Name : Geo-informatics for Engineering**	3	-	--	3

Course Description:
This course introduces the hardware and software components of Geographic Information Systems and reviews GIS applications. Topics include data structures and basic functions, methods of data capture and sources of data, and the nature and characteristics of spatial data and objects. Upon completion, students should be able to identify GIS hardware components, typical operations, products/applications, and differences between database models and between raster and vector systems

Course Learning Outcomes:
After successfully completing the course, Student will able to:
1. Apply GIS tool for solving civil engineering industry problem
2. Develop infrastructural planning
3. Collect data and query analysis
4. Develop base and thematic maps
5. Develop projects and device solution for the area.

Prerequisite. Nil

Course Content

Unit No	Description	Hrs
1	**Fundamentals of GIS** GIS- Definition, advantages of digital maps.- Information Systems, Modeling Real World Features Data. Case study-I	6
2	**Topology & Techniques** Data Formats – Spatial and Non-spatial, Components, Data Collection and Input, Data Conversion, Database Management – Database Structures, Files; Standard Data Formats, Compression Techniques.	6
3	**Spatial data & relationship** Types of Errors, Editing and Error Rectification, Types of Topology, Modeling topological Relationships, Tolerances.	6
4	**Analysis and Modeling** Proximity Analysis, Overlay Analysis, Buffer Analysis, Network Analysis, Spatial Auto Correlation, Gravity Modeling, DTM/DEM, Integration with Remote Sensing data, Case study – II	6
5	**GIS Project Planning and Implementation** Understanding the Requirements, Phases of Planning, Specifications, Data Procurement, Tendering, Human Resources, Back Up, Monitoring Progress	6
6	**Interpolation & Various applications of GIS in Civil engineering**	6

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	Introduction to Interpolation - Global Methods of Interpolation - Local Methods of Interpolation- applications in Planning – Management - Tax Mapping - Emergency evacuation – Environment - Transport/Logistics and Analysis, Case study –III	

References:
Text Books:

1. Shahab Fazal "GIS basics" New age publication Delhi
2. M.Anji reddy "Remote sensing and geographical information systems", BS publication

Reference books:

1. John E. Harmon & Steven J. Anderson., "The design and implementation of Geographic Information Systems", John Wiley & Sons
2. C.P.Lo & Albert K. W.Yeung, "Concepts and Techniques of Geographic Information Systems", Prentice Hall India Pvt.Ltd.
3. K. Elangovan "GIS: Fundamentals, Applications and Implementations" Handcover publication
4. The Esri Guide to GIS Analysis, Volume 2: Spatial Measurements and Statistics Edition 1 Andy Mitchell ESRI Publication 2012.

Class: **Final Yr. B. Tech Civil Engineering**	Semester: VII
Course Code: CE 4592	**Course Name: Docks, Harbours and Airport Engineering**

L	T	P	Credits
3	-	--	3

Course Description
The course covers the fundamental knowledge of various important components of Docks, Harbour and Airport Engineering. It includes the planning, design and construction techniques used in the Harbour and Airports.

Prerequisite. Basic Civil/ ocean / transportation engineering

Course Outcomes:
After successful completion of the course, students will be able to-
1. Analyze theoretical and practical aspects related to docks, harbour and airport management.
2. Apply diverse knowledge of Docks, Harbour and Airport engineering practices applied to real life problems.
3. Categorize port components
4. Design airport components

Course Content

Unit No	Description	Hrs
1	**Waterways introduction** General History, Advantages and disadvantages of water transportation, Modern trends in water transportation, Elements of water transportation, Historical development in India, Ports development in India, Port authorities , Dredging General ,Classification of dredging works, Types of dredgers, Uses of dredged material ,Execution of dredging work	6
2	**Docks & Harbours** Introduction, Natural Phenomena Tides, Wind, Water waves, Currents phenomena, Characteristics and effects on marine structure, Definition of various terms used in docks & Harbour, Types of Docks, dry docks, Wet docks, Repair docks, Lift docks, Floating docks, Slipways, Harbour Planning, site selection, Requirements of harbors and ports, Classification of harbors with examples, Selection of site for harbor, Ship characteristics, Characteristics of good harbour, Size of harbor	6
3	**Components of Port structure** Various components of ports, Break waters- types, comparison, design criteria , methods of construction, Tetra pod, Tri bar, Hexapod, Quay wall, Wharves, Jetties, Types of fenders, Dolphins, Marin railway.	6
4	**Airport in General** Introduction, History ,National airport authority, Aircrafts and its characteristics, Airport classifications ,AirPort Planning, Objective, FAA recommendation for master plan, Regional planning, Data required before site selection, Airport site selection, Surveys for site selection, Estimation of future air traffic needs.	6

5	**Airport components design** RunWay Design, Runway orientation, Wind rose ,Basic runway length, Runway geometric design , Taxiway Design Controlling factors, Geometric design standards, Exit taxiways, Separation clearance, Turnaround or bypass taxiway , Terminal Area Design Building function ,Site location, Passenger and baggage flow chart ,Parking area ,Apron, Hanger.	6
6	**Airport drainage & Lighting** Airport Grading and Drainage Grading –purpose, Computation of earthwork Drainage-requirement, Design surface and subsurface drainage system Visual Aids Airport marking, Airport lighting, Air Traffic Control Need of Air traffic control, Air traffic control network, Air traffic control aids	6
	Technical Visit (Desirable): 1) The visit of any harbour and port structure should be arranged to understand the various structures, its construction and operations. 2) The visit to the Airport site should be arranged to understand the various structures, its construction and operations.	

References:
Text Books:

1. S. P. Bindra, "A Course in Docks and Harbour Engineering", Dhanpat Rai & Sons, New Delhi
2. R. Srinivasan and S. C. Rangwala, "Harbour, Dock and Tunnel Engineering", Charotar Pub House, Anand
3. G.V. Rao "Airport Engineering", Tata McGraw Hill Pub. Co., New Delhi
4. Dr. S. K. Khanna, M.G.Arora and S.S. Jain, "Airport Planning & Design", Nem Chand & Bros. Roorkee.

Reference books:

1. Alonzo Def. Quinn, Design and Construction of Ports and Marine Structure, McGraw - Hill Book Company, New York
2. Ashford N. and Wright P.H., Airport Engineering, John Wiley and Sons, Inc., New York
3. Horonjeff R and Mackelvey F.X., "Planning and Design of Airports", McGraw Hill Book Co., New Delhi

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Class: **Final Year. B. Tech. Civil Engineering**	Semester VII
Course Code: **CE 4052**	Course Name - **Design of Concrete Structures Laboratory**

L	T	P	Credits
-	--	2	1

Course Description

Design of Reinforced Concrete Elements is offered at the seventh 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.

This course deals with design of various structural elements such as R.C. beams, slabs, stairs, columns & footings using modern Limit State Method. Design of these elements is made using guidelines of I.S. 456:2000, a code of practice for plain & reinforced cement concrete.

Course Learning Outcomes:

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

1. Estimate primary and combination design loads on building consulting appropriate standards and handbooks
2. Design the component parts of the building manually
3. Model the same building using any standard software
4. Design the building.
5. Demonstrate effective team membership/leadership through a group project

Prerequisites: Structural Engineering

Course Content		
Expt. No.	**Name of Experiment**	**Hrs.**
	Laboratory Work Analysis and design of RCC framed building- manually and using any standard software, sketching the detailing of the reinforcement.	24

Text Book:

1.Sinha and Roy - Fundamentals of Reinforced Concrete-, S. Chand and Company Ltd, New Delhi
2. A. K. Jain - Reinforced Concrete Design
3. Karve and Shah - Limit State Theory and Design-, Structures Publications, Pune
4. P. C. Varghese - Limit State Design of Reinforced Concrete, Prentice Hall of India, New Delhi

Reference Books:

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1. T. Y. Lin - Prestressed Concrete, John Willey & Sons, Newyork
2. 8 Sinha and Roy - Prestressed Concrete , S. Chand and Company, New Delhi
3. N.Rajgopalan - Prestressed Concrete, Narosa Publishing House, Mumbai
4. N. Krishna Raju - Prestressed Concrete
5. N. Unnikrishna Pillai/ Devdas Menon - Reinforced Concrete Design, Tata
6. McGraw-Hill Publishing Company Ltd, New Delhi

Class:- **Final Year B. Tech**	Semester-**VII**
Course Code : **CE 4372**	Course Name : Capstone Project Phase-II

L	T	P	Credits
-	-	4	4

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

1. Function effectively as an individual and in a group with the capacity to be a leader.
2. Identify gap and analyse 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-II of this semester carries 4 credits. The majority of project work shall be in VII semester. The project group from project phase-I will continue to work on the project selected during VI semester and submit the completed project work to department by the prescribed date usually two weeks before the end of VII semester as mentioned below:

1. Executed project
2. Project report

The capstone project phase-II 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- II will be carried out for 50%. The assessments are carried out as per the rubrics given to the guides.
The ESE evaluation will be done as per schedule given by COE for 50%, where students have to present their entire project work carried out throughout the Sem-VI and Sem-VII. The evaluation will be done by panel of examiner containing guide and a faculty appointed by DPC.

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Class: **Final Year. B. Tech. Civil Engineering**	Semester VII
Course Code: **CE 4072**	Course Name - **Employment Enhancement Skills**

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.

Course Learning Outcomes:

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

1. Develop technical competence in a Soft skill in the Civil Engineering field,
2. Apply the techniques and soft skills for Civil Engineering practice.
3. Develop oral and written presentation skills for soft skill project.
4. Design and interpret data by soft skill Civil Engineering projects.

Prerequisites: Civil Engineering Software's

Course Content		
Expt. No.	**Name of Experiment**	**Hrs.**
	This lab course is offered in Semester VIII of Final Year B.Tech. Student is required to make presentation on the progress of his/her soft skill undertaken work in front of supervisor during the semester. Final presentation only if he has submitted duly completed and certified report by supervisor in front of supervisor and DPC member. Examiners will check whether the work is in full compliance. Soft skill work will be assesed on the basis of quality of work, effort taken by the student, knowledge and skill aquired etc. Student should carry out application oriented project work in a batch for any one software from the following list. Certificate is optional/ ESE evaluation is done by External member 1. STAAD-Pro 2. E-Tab 3. PRIMAVIRA 4. GIS 5. MS project 6. Opticon 7. QE PRO 8. HIT OFFICE 9. TERRA MODEL	24

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%
OE438	Finance for Engineers (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
OE436	Engineering Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
IP4022	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 for IP4022 course, 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 (%)
OE438	Finance for Engineers (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
OE436	Engineering Management & Economics (Online Course)	2	-	-	2	ISE	25	40	40	---	---
						ESE	75	40		---	---
RE4042	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

Sr.No	Course Code	Course	Teaching Scheme			Credits	Evaluation Scheme					
			L	T	P		Scheme	Theory (Marks) Max	Theory (Marks) Min. for passing%		Practical (Marks) Max	Practical (Marks) Min. for passing%
1	**ED4102**	Project Management	2*	-	-	2	ISE	20	40	40		
							UT-1	15				
							UT-2	15				
							ESE	50	40			
2	**ED4042**	Commercial Aspects of the Project	2*	-	-	2	ISE	20	40	40		
							UT-1	15				
							UT-2	15				
							ESE	50	40			
3	**ED4062**	Entrepreneurship Development Program (EDP)	-	-	-	1	ISE				100	50
4	**ED4082**	Entrepreneurship Development Project	-	-	7	7	ISE				50	50
							ESE				50	
Total			**4**	**-**	**7**	**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:
1] * One extra lecture to be allotted to Project Management and Commercial Aspects of the Project course in time table.

Track I: Industry Internship & Projects (IIP)

Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : OE438	Course Name : Finance for Engineers (Online Course)

L	T	P	Credits
2	-	--	2

Course Description:
This course covers the basic concepts needed to understand the financial decision-making process. All types of organizations and also individuals develop and use financial accounting information in conducting their daily activities. Therefore, this course focuses upon financial accounting information The course introduces the basic concepts and principles of accounting for preparing or analyzing the financial statements .The course also deals with the fundamentals of financial statements, how to measure a company's financial health using financial ratios and major topics in modern finance. With a deep understanding of the financial side of the business, you will be in a better position to make informed decisions and plan for the financial future.

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 rules of accounting while recording transactions.
3. Prepare financial statements and analyze financial position of the firm by applying various techniques.
4. Describe the various long term sources of finance available for the business organization.

Prerequisite:
Basics of Mathematics

Course Contents

Unit No	Description	Hrs
1.	**Need for Financial accounting:** Definition & Meaning of Financial Accounting, Need for Accounting, Internal & External Users of Accounting Information, Accounting Principles, Accounting equation	6
2.	**Accounting Mechanics, Process and System:** Rules of Accounting, Preparation of Journal, Ledger, Subsidiary Books, Trial balance.	8
3.	**Preparation of Financial Statement:**	6

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	Components of Horizontal financial statement - Trading, Profit & loss account and Balance sheet, adjustment entries.	
4.	**Analysing Health of a Firm:** Key finance terms, Techniques of Analysing Health of a Firm, Classification of Ratios – Liquidity, Leverage, Activity, Profitability	6
5.	**Preparation of Cash Flow Statement:** Meaning, sources and uses of cash and its usefulness, Preparation of Cash Flow Statement	6
6.	**Long Term Financing:** Long Term Financing: Shares, Debentures, Loan capital, foreign capital, FDI, Euro issues & external borrowings, Venture capital financing.	4

References -
Reference Books:

1. Paul Kimmel, J. Weygandt, D. Kieso, Financial Accounting, 5th edition, WILEY INDIA, 2010
2. S.N. Maheshwari & S.K. Maheshwari, Problems & Solutions in Advanced Accountancy, 6th edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2008
3. M.C. Shukla, T.C. Grewal & S. C. Gupta, Advanced Accounts, 7th edition, S. Chand, 2011
4. Financial Management, M. Y. Khan & P. K. Jain, Tata McGraw-Hill Publishing Company Limited, New Delhi, 6th edition, 2011.
5. Financial Management, Dr. Prasanna Chandra, Tata McGraw-Hill Publishing Company Limited, 8th edition, 2011.

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 : OE436	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

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5.	**Make or Buy Decision** Approaches of make or buy decision-Simple cost analysis, Economic analysis, break-even analysis, Payback analysis	**04**
6.	**Depreciation** Methods of Depreciation- Straight line method, Declining balance depreciation, Sum of years digits method, sinking fund method, service output method	**04**

References -

Text Books:

1. Gilbert Daniel R, Freeman R. Edward and Stoner James A. F. (2007), "Management" Pearson Education, 6th Edition.
2. Harold Kerzner (1992), "Project Management- A system approach to planning, scheduling and controlling", John Wiley & Sons Inc, 4th Revised Edition.
3. Punmia B. C. and Khandelwal K. K. (2017), "Project Planning, Scheduling and controlling with PERT and CPM", Laxmi Publications Pvt. Ltd, 4th Edition.
4. Paneerselvam R. (2013), "Engineering Economics", Prentice Hall India Learning Private Limited, 2nd Revised Edition.

Reference Books:

1. Cannice Mark V, Koontz Harold and Weihrich Heinz (2015), "Management", McGraw Hill Education (I) Pvt. Ltd, 14th Edition.
2. Blank Leland and Tarquin Anthony (2013), "Basics of Engineering Economy", Tata McGraw-Hill, 7th Edition.
3. Mithani D. M. (2016), "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 : IP4022	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 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.

Track II: Undergraduate Research Experience (URE)

Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : OE438	Course Name : Finance for Engineers (Online Course)

L	T	P	Credits
2	-	--	2

Course Description:
This course covers the basic concepts needed to understand the financial decision-making process. All types of organizations and also individuals develop and use financial accounting information in conducting their daily activities. Therefore, this course focuses upon financial accounting information The course introduces the basic concepts and principles of accounting for preparing or analyzing the financial statements .The course also deals with the fundamentals of financial statements, how to measure a company's financial health using financial ratios and major topics in modern finance. With a deep understanding of the financial side of the business, you will be in a better position to make informed decisions and plan for the financial future.

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 rules of accounting while recording transactions.
3. Prepare financial statements and analyze financial position of the firm by applying various techniques.
4. Describe the various long term sources of finance available for the business organization.

Prerequisite:
Basics of Mathematics

Course Contents		
Unit No	**Description**	**Hrs**
1.	**Need for Financial accounting:** Definition & Meaning of Financial Accounting, Need for Accounting, Internal & External Users of Accounting Information, Accounting Principles, Accounting equation	6
2.	**Accounting Mechanics, Process and System:** Rules of Accounting, Preparation of Journal, Ledger, Subsidiary Books, Trial balance.	8
3.	**Preparation of Financial Statement:** Components of Horizontal financial statement - Trading, Profit & loss account and Balance sheet, adjustment entries.	6

4.	**Analyzing Health of a Firm:** Key finance terms, Techniques of Analyzing Health of a Firm, Classification of Ratios – Liquidity, Leverage, Activity, Profitability	6
5.	**Preparation of Cash Flow Statement:** Meaning, sources and uses of cash and its usefulness, Preparation of Cash Flow Statement	6
6.	**Long Term Financing:** Long Term Financing: Shares, Debentures, Loan capital, foreign capital, FDI, Euro issues & external borrowings, Venture capital financing.	4

References -
Reference Books:

1. Paul Kimmel, J. Weygandt, D. Kieso, Financial Accounting, 5th edition, WILEY INDIA, 2010
2. S.N. Maheshwari & S.K. Maheshwari, Problems & Solutions in Advanced Accountancy, 6th edition, Vikas Publishing House Pvt. Ltd., New Delhi, 2008
3. M.C. Shukla, T.C. Grewal & S. C. Gupta, Advanced Accounts, 7th edition, S. Chand, 2011
4. Financial Management, M. Y. Khan & P. K. Jain, Tata McGraw-Hill Publishing Company Limited, New Delhi, 6th edition, 2011.
5. Financial Management, Dr. Prasanna Chandra, Tata McGraw-Hill Publishing Company Limited, 8th edition, 2011.

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 : OE436	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**
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:

1. Gilbert Daniel R, Freeman R. Edward and Stoner James A. F. (2007), "Management" Pearson Education, 6th Edition.
2. Harold Kerzner (1992), "Project Management- A system approach to planning, scheduling and controlling", John Wiley & Sons Inc, 4th Revised Edition.
3. Punmia B. C. and Khandelwal K. K. (2017), "Project Planning, Scheduling and controlling with PERT and CPM", Laxmi Publications Pvt. Ltd, 4th Edition.
4. Paneerselvam R. (2013), "Engineering Economics", Prentice Hall India Learning Private Limited, 2nd Revised Edition.

Reference Books:

1. Cannice Mark V, Koontz Harold and Weihrich Heinz (2015), "Management", McGraw Hill Education (I) Pvt. Ltd, 14th Edition.
2. Blank Leland and Tarquin Anthony (2013), "Basics of Engineering Economy", Tata McGraw-Hill, 7th Edition.
3. Mithani D. M. (2016), "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 : RE4042	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 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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Track III: Entrepreneurship Development (ED)

Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : ED4102	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,	06

	defining the target market, market segmentation, market positioning, 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:

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

Reference Books:

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

Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : ED4042	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,	06

	Capitalization: over, under and fair capitalization. Concept of risk and returns, Time value of money.	
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.
7. Chandra, P., Financial Management, McGraw Hill.
8. Kotler P. & Armstrong, G., Principles of Marketing, Pearson

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Class:- **Final Year B. Tech**	Semester-**VIII**
Course Code : ED4062	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 : ED4082	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