B. Tech. in Civil Engineering with Multidisciplinary Minor

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

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

K.E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

Curriculum Structure and Evaluation Scheme

To be implemented for 2023-27

Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev02/2023-27

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

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

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

Total Contact Hours/week : 29

Total Credits : 22

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

Note: ISE of the Environmental Science course will be the project on application of technology in Environmental concerns. If student fails in ISE (i.e. project) he /she will not be eligible for ESE of the course.

In time table allot 1 hour for theory and 2 hours for Environmental Science -project (Batch wise)

Professional Skills Development and Foreign Languages

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

Note:

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

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Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev02/2023-27

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

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

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

Total Contact Hours/week : 29

Total Credits : 23

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

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

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

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

Note:

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

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Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev02/2023-27

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %) Max	Theory (Marks %) Min. for Passing		Practical (Marks %) Max	Practical (Marks %) Min. for passing
CE3015	Design of Steel Structures	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE3511	Estimations and Costing	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE353	Mechanics of Structure	2#	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective -I	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Open Elective -I	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Multidisciplinary Minor- III	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Multidisciplinary Minor- IV	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
SH3035	Scholastic Aptitude I	2*	-	-	Audit	ISE	100	50 (P/NP)	--	---	---
CE3551	Estimations Costing and Valuation Laboratory	-	-	4	2	ISE	---	---		50	50
						ESE	---	---		50	50
CE377	Construction Site Experience	-	-	2	1	ISE	---	---		100	50
CE3571	Industrial Training	-	-	-	1	ISE	---	---		100	50
CE379	Massive Open Online Course (MOOC)-II	-	-	-	1	ISE	100	50		---	---
	TOTAL	18+1#	-	6	23						
	TOTAL CONTACT HOURS	25									

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

Total Contact Hours/week : 25

Total Credits : 23

Note*: Students should complete 5 days (30 Hours) of Scholastic Aptitude training program organized by the institute.

Note#: One extra lecture to be provided in the time table.

Program Elective Course- I

Sr. No.	Course Code	Course Name	Specialization
1	CE363	Construction Quality Control	Construction Management
2	CE364	Construction Equipment Management	
3	CE365	Advanced Fluid Mechanics	General Engineering
4	CE367	Solid Waste Management	
5	CE369	Public Building Planning and Design	
6	CE371	Engineering Geology	
7	CE373	Matrix Methods of Structural Analysis	Structural Engineering
8	CE375	Earthquake Engineering	

Open Elective I

Sr. No.	Course Code	Open Elective Subject Name	Offered by the department
1	OE3044	Renewable Energy Sources	Robotics & Automation
2	OE3064	Environmental Impact Assessment	Civil Engineering
3	OE3104	Network Administration	Computer Science and Engineering
4	OE3381	Disaster Management	Civil Engineering
5	OE341	Energy Audit & Management	Electrical Engineering
6	OE343	Data Science	Computer Science & Engg. (Artificial Intelligence & Machine Learning)
7	OE365	Distributed Systems	Computer Science and Information Technology
8	OE347	New Product Design & Development	Mechanical Engineering
9	OE349	Non-Conventional Energy Sources	Mechanical Engineering
10	OE351	Hydrogen & Fuel Cell Technology	Mechanical Engineering
11	OE353	Factory Automation	Mechatronics Engineering Dept.
12	OE355	Cyber Physical System	Mechatronics Engineering Dept.
13	OE357	Internet of things	Electronics & Telecommunication Engineering
14	OE359	Drone technology	Electronics & Telecommunication Engineering
15	OE361	Object Oriented Modeling and Design	Computer Science and Information Technology
16	OE363	Robotics Engineering & Applications	Robotics & Automation

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Department of Civil Engineering

Rev: CE Course Structure/RIT/Rev02/2023-27

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min. for passing		Max	Min. for passing
CE352	Geotechnical Engineering	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE354	Construction Practices	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE356	Research Methodology	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE384	Tunnel Docks and Harbors Engineering	3	-	-	3	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		---	---
	Open Elective -II	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Multidisciplinary Minor- V	3	-	-	3	ISE	20	40	40	---	----
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
SH3065	Scholastic Aptitude II	2*	-	-	Audit	ISE	100	50 (P/NP)	--	---	---
CE358	Geotechnical Engineering Laboratory	-	-	2	1	ISE	---	---		50	50
						ESE	---	---		50	50
CE3601	Design of Steel Structures Laboratory	-	-	2	1	ISE	---	---		50	50
						ESE	---	---		50	50
CE362	Software Laboratory	-	-	2	1	ISE	---	---		100	50
CE3144	Capstone project Phase I	-	-	2	1	ISE	---	---		100	50
	TOTAL	20	-	08	24						
	TOTAL CONTACT HOURS	28									

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

Total Contact Hours/week : 28

Total Credits : 24

Note*: Students should complete 5 days (30 Hours) of Scholastic Aptitude training program organized by the institute.

Program Elective II Course List

Sr. No.	Course Code	Course Name	Specialization
1	CE359	Legal practice in Construction	Construction Management
2	CE382	Town Planning	
3	CE3611	Optimization Techniques	
4	CE366	Advanced Hydraulic Engineering	General Engineering
5	CE368	Air Quality Assessment	
6	CE370	Traffic Engineering	
7	CE372	Industrial Waste Management	
8	CE3184	Repair and Rehabilitation of Structures	Structural Engineering
9	CE374	Advanced Structural Analysis	
10	CE376	Composite Materials and Structures	
11	CE378	Finite Element Method	
12	CE380	Fiber Reinforced Concrete	

Open Elective II

Sr. No.	Course Code	Open Elective Subject Name	Offered by the department
1	OE3024	Reliability Engineering	Robotics & Automation
2	OE3084	Materials Management	Civil Engineering
3	OE3182	Industrial Drives	Electrical Engineering
4	OE3284	Supply Chain Management	Mechanical Engineering
5	OE3324	Entrepreneurship Development	Mechanical Engineering
6	OE3401	Cyber Security	Computer Science and Information Technology
7	OE342	Data Mining	CSE(AI&ML)
8	OE344	Supply Chain Analytics	Mechatronics Engineering Dept.
9	OE346	Mobile Robotics	Mechatronics Engineering Dept.
10	OE348	Information Technology Foundation Program	Computer Science and Engineering
11	OE350	Operations Research	Civil Engineering
12	OE352	Image Processing	Electronics & Tele. Engg.
13	OE354	Fuzzy logic and Neural Network	Electronics & Tele. Engg.
14	OE356	Project Management	Mechanical Engineering
15	OE358	Plumbing (Water and Sanitation)	Civil Engineering
16	OE362	Flexible Manufacturing System	Robotics & Automation
17	OE364	AI for Manufacturing	Computer Science and Information Technology
18	OE366	AI for Cybersecurity	Computer Science and Engineering
19	OE368	AI for Agriculture	CSE(AI&ML)
20	OE370	AI for Sustainability	Electronics & Tele. Engg.
21	OE3242	Marketing for Engineers	MBA

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

Course Code	Course	Teaching Scheme L	T	P	Credits	Evaluation Scheme: Scheme	Theory (Marks %) Max.	Min. for passing		Practical (Marks %) Max.	Min. for passing
CE4014	Design of Reinforced concrete Elements	3*	-	-	3	ISE	20	40	40	---	---
						MSE	30			---	---
						ESE	50	40		---	---
CE4034	Construction Management	2	-	-	2	ISE	20	40	40	---	---
						MSE	30			---	---
						ESE	50	40		---	---
CE4054	Environmental Engineering	3	-	-	3	ISE	20	40	40	---	---
						MSE	30			---	---
						ESE	50	40		---	---
	Program Elective -III	3	-	-	3	ISE	20	40	40	---	---
						MSE	30			---	---
						ESE	50	40		---	---
	Program Elective -IV	3	-	-	3	ISE	20	40	40	---	---
						MSE	30			---	---
						ESE	50	40		---	---
CE4074	Design of Reinforced Concrete Structures Laboratory	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
CE4094	Environmental Engineering Laboratory	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
	Program Elective III Laboratory	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
CE4114	Capstone Project Phase II	-	-	6	3	ISE	--	---		50	50
						ESE	--	---		50	50
	TOTAL	14+1*	-	12	20						
	TOTAL CONTACT HOURS	27									

ISE = In Semester Evaluation, MSE = Mid Semester Exam, ESE = End Semester Exam

Total Contact Hours/week : 27

Total Credits : 20

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

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Program Elective Course- III

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

Program Elective Course- IV

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

Program Elective III Laboratory

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

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

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

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

ISE = In Semester Evaluation, ESE = End Semester Exam

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

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

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Model II: Research Internship (RI)

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

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

ISE = In Semester Evaluation, MSE = Mid Semester Exam, ESE = End Semester Exam

Total Contact Hours/week : -
Total Credits : 16

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

Note:

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

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

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

Model III: Entrepreneurial Internship (EI)

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

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

ISE = In Semester Evaluation, MSE = Mid Semester Exam, ESE = End Semester Exam
Total Contact Hours/week : -
Total Credits : 16

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

Note:
1] Weekly Contact hours are not mentioned as student is expected to be in outside research organization regularly for 20 weeks. However, student needs to report to Institute mentors as and when required.
2] For online course, lecture videos of each unit will be made available through college platform to the students. For each unit there will be separate assignment. Students need to submit all assignments within specified time.
Weightage: 25% weightage for unit wise assignments + 75% weightage for final exam. Final exam will be held at college campus.
3] A one week Entrepreneurship Development Program (EDP) will be conducted after completion of 7th semester and before start of 8th semester.

Multidisciplinary Minor

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

Multidisciplinary Minor Baskets					
MDM Basket Name	**Sr. No.**	**Course Code**	**Course Name**	**Semester**	**Offered by Department**
Construction Engineering	1	CEMD201	Building Construction and Planning	III	Civil Engineering
	2	CEMD202	Building Estimation and Valuation	IV	
	3	CEMD301	Infrastructure Engineering	V	
	4	CEMD303	Smart Cities and Sustainable Development	V	
	5	CEMD302	Environmental Engineering	VI	
Software Programming	1	CSMD201	Introduction to Data Structures	III	Computer Science & Engineering
	2	CSMD202	Problem solving using JAVA	IV	
	3	CSMD301	Fundamentals of Database Systems	V	
	4	CSMD303	Object-oriented Programming in Python	V	
	5	CSMD302	Artificial Intelligence	VI	
Electrical Power System	1	EEMD201	Electrical Power Generation	III	Electrical Engineering
	2	EEMD202	Power System	IV	
	3	EEMD301	Electrical Machines	V	
	4	EEMD303	Electrical Technology	V	
	5	EEMD302	Smart Grid	VI	
Electronics	1	ECMD201	Electronics Devices	III	Electronics

System Design			and Applications		&Telecommunication Engineering
	2	ECMD202	Electronics Communication Systems	IV	
	3	ECMD301	Advanced Communication Systems	V	
	4	ECMD303	Electronic Product Design	V	
	5	ECMD302	Industrial Electronics	VI	
Software Development	1	CIMD201	Data Structures	III	Computer Science & Information Technology
	2	CIMD202	Computer Algorithms	IV	
	3	CIMD301	Introduction to DBMS	V	
	4	CIMD303	OOP using Java	V	
	5	CIMD302	Software Engineering	VI	
Product Design and Development	1	MEMD203	Design Thinking	III	Mechanical Engineering
	2	MEMD204	Behavioral Engineering and Design	IV	
	3	MEMD305	Product Design Tools and Techniques	V	
	4	MEMD307	Design and Prototyping	V	
	5	MEMD304	Marketing and Business Fundamentals for New Products	VI	
Mechatronics Engineering	1	MCMD201	Fundamentals of Mechatronics	III	Mechatronics Engineering
	2	MCMD202	Industrial Fluid Power	IV	
	3	MCMD301	Sensor and Instrumentation	V	
	4	MCMD303	Industrial Automation	V	

	5	MCMD302	Industrial Robotics	VI	
Artificial Intelligence	1	AIMD201	Object Oriented Programming	III	Computer Science & Engineering (AI-ML)
	2	AIMD202	Data Structures and Algorithms	IV	
	3	AIMD301	Machine Learning	V	
	4	AIMD303	Business Intelligence	V	
	5	AIMD302	Principles of AI	VI	
Robotics & Automation	1	RAMD201	Fundamentals of Robotics & Automation	III	Robotics & Automation
	2	RAMD202	Sensors and Actuators	IV	
	3	RAMD301	Kinematics & Dynamics of Robots	V	
	4	RAMD303	Robot Programming	V	
	5	RAMD302	Industrial Automation & Control	VI	

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

B. Tech in Civil Engineering with Double Minor degree

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

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

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

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

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

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

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

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

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

Honors with Research and Multidisciplinary Minor

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

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

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

ISE = In Semester Evaluation, ESE = End Semester Exam

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

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

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

ISE = In Semester Evaluation, ESE = End Semester Exam

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

S. Y. B. Tech. Syllabus

To be implemented for 2023-27 and 2024-28 NEP Batch

Department of Civil Engineering

Class:- **S. Y. B. Tech. Civil**	Semester-III
Course Code : **CE231**	Course Name: **Mathematics for Civil Engineer**

L	T	P	Credits
3	-	-	3

Course Description:
The course is offered as the core science course. This course intends to develop the competency in students to apply Mathematical ideas in civil engineering problems. The course consists of topics in Linear Differential Equations, Application of LDE to Civil Engineering Problems, Linear Partial Differential Equations with Constant Coefficients, Fourier Series, Statistics, and Probability Distribution.

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

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

Prerequisite: Engineering Mathematics-I and II

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

	of Curves (Lines and Parabola) by Least Square Principle, Application to Civil engineering	
6.	**Probability Distribution:** Random Variable, Discrete and Continuous Probability Distributions, Binomial, Poisson and Normal Distributions, Application to Civil engineering	06

References -

Textbook:

- B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

Reference Books:

- Erwin Kreyszig, Advanced Engineering Mathematics, Wiley.
- B.V. Raman, Higher Engineering Mathematics, Tata McGraw Hill New Delhi.
- N. P. Bali, A. Saxena, N. Ch. S. N. Iyengar, A Text Book of Engineering Mathematics, Laxmi Publications, New Delhi.
- S. S. Sastry, Introductory Methods of Numerical Analysis.
- Peter V. O'Neil, Advanced Engineering Mathematics, Cole publishing house.
- P. N. Wartikar, J. N. Wartikar, A Text book of Applied Mathematics, Vol. I, Vol. II, Vidyarthi Griha Prakashan, Pune.

Class: **S. Y. B. Tech Civil**	Semester-III
Course Code: **CE2214**	Course Name: **Building Planning and Design**

L	T	P	Credits
3	--	--	3

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

Course Outcomes:
After successful completion of the course, student will be able to,
1. Suggest appropriate materials for building construction applications.
2. Prepare a functional design of components of the building.
3. Design and draw residential building plan using AutoCAD software.
4. Prepare plumbing and electrification plan for the building.
5. Explain building finish materials and procedures.

Prerequisite: Basic knowledge of mathematics.

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Construction Materials:** Properties and applications of Various materials viz. Stone, Aggregate, Brick, Steel, Aluminium, Timber, Glass, Flooring materials, Roofing materials, Cladding materials, Plumbing materials. Mortar, Plain Cement Concrete, Reinforced Cement Concrete and prestressed concrete.	05
2.	**Building Components I:** Types of structures: Load Bearing Structure and Framed Structure, Preparation of sectional view drawing of load bearing and framed structure showing different building components, Concept of Soil Bearing Capacity, Substructure of a building, Components of Substructure of a building, Types of foundation and their suitability, Types of Masonry: Types of brick and stone masonry, bonds in brickwork and stone masonry.	05
3.	**Building Components II:** Building components in superstructure: Column, Beam, Wall, Sill, Lintel, Chajja, Slab, Ventilator, Roofing, Parapet wall, Ramp, ladder, lift and escalator. Doors, Windows, Staircase: Technical terms, classification, functional design and drawing, Use of AutoCAD software to prepare staircase details.	06

4.	**Planning of Buildings and Bye-laws:** Types of buildings, Site Selection criteria, Concept of Planning, Principles of planning. Bye-laws: Definition, Necessity, Procedure for obtaining Development permission/Building permission /Commencement permission, General land development requirements, General building requirements: Setback, Marginal distance, height and FSI as per Unified Development Control and Promotion Regulations for Maharashtra State. Introduction and necessity of building drawings, concept of scale, Types of building drawings-layout plan, site plan, measured, submission, working and perspective drawing. Preparation of building plans using principles of planning and bye-laws. Use of AutoCAD software to prepare plans.	07
5.	**Building Services** Concept of Plumbing & Drainage plan, Plumbing systems, Types of traps, Fittings, Septic Tank, Soak pit, Rainwater harvesting, Preparation of Plumbing layout for building. Electrification for residential buildings- types of wiring, preparation of Electrification layouts for building.	07
6.	**Building Finishes:** Plastering and pointing. Paints-Characteristics of ideal paints, constituents, classification, suitability, applying procedure and applications, defects. Varnishes- Characteristics of good varnish, ingredients, types, suitability, applying procedure and applications. Distemper- ingredients, applying procedure and applications. White washing and colour washing.	06

References –

References Books: -

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

Text Books: -

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

Government Rules & Regulations:-

- Unified Development Control and Promotion Regulations for Maharashtra State (UDCPR 2020), Urban Development Department, Government of Maharashtra.

Class: **S. Y. B. Tech. Civil**	Semester: III
Course Code : **CE2074**	Course Name: Surveying

L	T	P	Credits
3	-	-	3

Course Description:
The course equips students 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 levelling, Profile Levelling and Cross sectioning, Methods of Plotting Contours, Plane table techniques, Calculation of earthwork in cutting and embankment for civil engineering works. The second module focuses on Theodolite traversing and EDM measurements, Tachometry and Layout surveys and hydrographic surveying techniques

Course Outcomes:
After successful completion of the course, students will be able to,
1. Calculate reduced levels and identify the characteristics of contours.
2. Determine the angular and linear measurements by using theodolite.
3. Calculate the data for design of curve and area-volumes.
4. Describe the principles of surveying with advanced techniques.

Prerequisite: Fundamentals of Basic Civil Engineering, Engineering Mathematics.

Course Content		
Unit No.	**Description**	**Hrs**
1.	**Fundamentals of surveying:** Definition, objectives, uses, classification of survey, principles of surveying, introduction to map and map projection, scales and types of scale, error and types of error.	06
2.	**Levelling and Contouring**: Terms and Types of levelling, Equipment used for levelling, calculation of elevation (RL)-methods, corrections in levelling, Contouring, Characteristics of Contours, Uses of Contour Maps, Direct and Indirect methods of contouring	06
3.	**Theodolite Surveying**: Principle, systems of bearings, types of Theodolites, Measurement of Horizontal and Vertical Angles, Theodolite Traversing – closing error, Calculation of latitudes and departures in traverse.	06
4.	**Advanced Surveying Techniques**: Electronic Distance Measurement (EDM) instruments, Surveying using Total Station (TS) –Working principle and use of Total station, Data observations in TS, Basics of Geographical information system (GIS) working principle, types and methodology. Analysis using raster and vector data, Open-source	06

	software, Geographical Positioning system (GPS) - working principle, types and methodology. Different segments: space, control and user segments – satellite, Hand Held and Geodetic receivers.	
5.	**Curves and Computation of Area and Volume:** Types and necessity Curve, Design and data collection for setting out of simple circular curves, areas and volumes calculations for any plotted plan by instrumental and mathematical methods.	06
6.	**Application of surveying:** Setting out work: Setting out building, pipeline surveying, road alignment and culverts, Hydrographic Survey: Introduction, Hydrographic survey Methods, Lead lines, sounding, Civil Engineering Applications. Drone surveying: Working flow, types of drones, data collection, post processing for map preparation.	06

Reference:-

Reference Books:

- Surveying: Theory and Practice by James M. Anderson, Edward M. Mikhail, Tata McGraw Hill.
- Principles of Surveying. Vol. I by J. G. Olliver, J. Clendinning – Van Nostrand Reinhold.
- Plane and Geodetic surveying for Engineers. Vol. I by David Clark, Constable.

Text Books:

- Surveying and Levelling by N. N. Basak , Tata McGraw Hill, New Delhi.
- Surveying Vol. I, II and III - Dr. B.C. Punamia, Laxmi Publishers. New Delhi.
- Surveying and Levelling Vol. I and II - T.P Kanetkar and S.V Kulkarni, Pune Vidhyarthi Gruh.
- Surveying Vol. I and II - S. K. Duggal, Tata McGraw Hill, New Delhi.
- Plane Surveying by A. M. Chandra, New Age International Publishers.

Class: **S. Y. B. Tech. Civil**	Semester: III
Course Code : **CE2034**	Course Name: **Engineering Mechanics**

L	T	P	Credits
2	-	-	2

Course Description:
Engineering Mechanics focuses on the analysis of static bodies. The course helps the students to understand facts, concepts, principles and techniques of scientific investigation in the field of engineering. It develops 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, Fluid Mechanics, Design of Structures etc., which apply engineering concepts in construction of buildings, dams, roadways, railways, bridges, etc.

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

1. Calculate resultant force of coplanar force system.
2. Analyze engineering problems applying conditions of equilibrium
3. Determine centroid & moment of inertia of the geometrical plane lamina.

Prerequisite: Engineering Mathematics, Engineering Physics.

Course Content

Unit No.	Description	Hrs
1.	**Fundamentals of Mechanics and force systems**: Force and classification of force systems. Resultant of parallel, concurrent and non-concurrent coplanar forces.	04
2.	**Equilibrium of force system**: Free body diagram, conditions of equilibrium, types of loads, types of beams, types of supports and reactions. Analysis of simple and compound beams using conditions of equilibrium	04
3.	**Friction:** Introduction to Laws of friction, Surface friction for bodies on horizontal and inclined planes.	04
4.	**Analysis of trusses:** Analysis of simple truss, Method of joints, Method of sections.	04
5.	**Centroid:** Centroid of plane and composite figures.	04
6.	**Moment of Inertia**: Moment of Inertia of plane and composite figures.	04

References:
Text Books:

- Bhavikatti S. S., Rajashekarappa, "Engineering Mechanics", New age International

publication (India) Pvt. Ltd. New Delhi,
- Ramamrutham S., "Engineering Mechanics", Dhanpat Rai Publishing Company Ltd., New Delhi.

Reference Books:

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

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S. Y. B. Tech. Syllabus

To be implemented for 2023-27 and 2024-28 NEP Batch

Department of Civil Engineering

Class:- **S.Y. B. Tech**	Semester-III
Course Code : **SH2174**	Course Name: **Environmental Science**

L	T	P	Credits
1	--	2	2

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. 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 project is designed to make them apply practical knowledge with relevant tools and techniques to solve real life problems related to the environment and industry. This course will help students in developing eco-friendly approach to achieve sustainable development.

Course Outcomes:

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

1. Apply interdisciplinary knowledge from various fields of science and engineering to address environmental issues.
2. Evaluate environmental impacts of human activities on the environment.
3. Use scientific approach to identify and solve environment related problems.
4. Design sustainable solutions to address environmental challenges.
5. Participate in group work to become acquainted with the importance of teamwork, collaboration
6. Develop presentation and report writing skills.

Course Content

Unit No	Description	Hrs
1.	**Natural Resources and Ecosystem** Renewable and Non-renewable resources, Forest resources, water resources, Mineral resources, food resources, Energy resources, alternative energy resources Land resources, Structure and Functions of ecosystem, biotic and abiotic components, food chains, food web Biodiversity, types of biodiversity, conservation of biodiversity.	04
2.	**Environmental Pollution and Health** Environmental Pollution, types of pollution, Air pollution, Water Pollution, Noise Pollution, Soil Pollution, Marine Pollution, Radioactive Pollution, Thermal Pollution (Causes, sources and effects, abatement methods), Pollution Case studies-Bhopal Gas Tragedy, Chernobyl Accident: A nuclear Disaster, Ganga Water Pollution., Solid Waste management	04

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	(Causes, sources, effects & control measures), Hazardous waste management, Plastic waste management, E-waste management. Disaster management and risk analysis.	
3.	**Climate change and Sustainable development** From unsustainable to sustainable development, Urban problems related to energy, Water conservation: Rainwater harvesting, Watershed management, Climate change, Global Warming, Ozone layer depletion, Acid Rain, Consumerism & waste Products, Concepts of Eco-labeled products, Eco-mark, Awareness of Environmental Legislation.	04

Guidelines for Project:

1. The distribution of project group will be done by project coordinator and respective head of the department to the faculty.
2. Project will be the team work consisting min 3 to max 5 students.
3. Project topic should be application oriented and with consideration to Environmental science problems in their respective stream. Selection and finalization will be through project guide.
4. Prepare project report as per guidelines.
5. Project group must provide complete solution to the selected problem with conceptual clarity.
6. The project will be evaluated by respective branch HOD and project guide and senior faculty.
7. The project should be presented before the committee, which shall evaluate for 50 marks.

References –

Text Books:

- D.K.Asthana, Meera Asthana, A Textbook of Environmental Studies, S.Chand Publication Revised edition, 2006.
- S. Deswal & A. Deswal, Basic course in environmental Studies, Dhanpat Rai & Co ltd., Delhi, Second revised edition, 2009.

Reference Books:

- Eldon D Enger, Bradley F. Smith, Environmental science – a study of inter-relationships Wm C Brown Publishers 1989
- Francois Ramade Ecology of Natural resources, John wiley & Sons
- Robert Leo Smith, Ecology and field biology, Harper Collins Publishers
- Gilbert M. Masters, Introduction to Environmental Engineering & Science, Prentice Hall International Inc. Second Edition

Class: **S. Y. B. Tech.**	Semester-**III**
Course Code: **CEMD201**	Course Name: **Building Construction and Planning**

L	T	P	Credits
3	-	-	3

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

Course Outcomes:
After successful completion of the course, student will be able to,
1. Suggest appropriate materials for building construction applications.
2. Prepare a functional design of components of the building.
3. Design and draw residential building using principles of planning and bye-laws.
4. Prepare plumbing and electrification plan for the building.
5. Explain properties of building finishing materials and application procedure.

Prerequisite: Basic knowledge of mathematics.

Course Content		
Unit No.	**Details of Content**	**Hrs.**
1.	**Construction Materials:** Properties and applications of Various materials viz. Stone, Aggregate, Brick, Steel, Aluminium, Timber, Glass, Flooring materials, Roofing materials, Cladding materials, Plumbing materials. Mortar, Plain Cement Concrete, Reinforced Cement Concrete and pre-stressed concrete.	05
2.	**Components of Building I:** Types of structures: Load Bearing Structure and Framed Structure, Preparation of sectional view drawing of load bearing and framed structure showing different building components, Concept of Soil Bearing Capacity, Substructure of a building, Components of Substructure of a building, Types of foundation and their suitability, Types of Masonry: Types of brick and stone masonry, bonds in brickwork and stone masonry.	05
3.	**Components of Building II:** Building components in superstructure: Column, Beam, Wall, Sill, Lintel, Chajja, Slab, Ventilator, Roofing, Parapet wall, Ramp, ladder, lift and escalator. Doors, Windows and Staircase: Technical terms, classification, functional design and drawing.	06

4.	**Planning of Buildings and Bye-laws:** Types of buildings, Site Selection criteria, Concept of Planning, Principles of planning. Bye-laws: Definition, Necessity, Procedure for obtaining Development permission/Building permission /Commencement permission, General land development requirements, General building requirements: Setback, Marginal distance, height and FSI as per Unified Development Control and Promotion Regulations for Maharashtra State. Introduction and necessity of building drawings, concept of scale, Types of building drawings-layout plan, site plan, measured, submission, working and perspective drawing. Preparation of building plans using principles of planning and bye-laws.	07
5.	**Building Services:** Concept of Plumbing & Drainage plan, Plumbing systems, Types of traps, Fittings, Septic Tank, Soak pit, Rainwater harvesting, and Plumbing layout for buildings, Preparation of Plumbing and Electrification layouts for building.	07
6.	**Building Finishes:** Plastering and pointing. Paints-Characteristics of ideal paints, constituents, classification, suitability, applying procedure and applications, defects. Varnishes- Characteristics of good varnish, ingredients, types, suitability, applying procedure and applications. Distemper- ingredients, applying procedure and applications. White washing and colour washing.	06

References –

References Books: -

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

Text Books: -

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

Government Rules & Regulations:-

- Unified Development Control and Promotion Regulations for Maharashtra State (UDCPR 2020), Urban Development Department, Government of Maharashtra.

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Rajarambapu Institute of Technology, Rajaramnagar

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

S. Y. B. Tech. Syllabus

To be implemented for 2023-27 and 2024-28 NEP Batch

Department of Civil Engineering

Class: - **S.Y. B. Tech.**	Semester - III
Course Code: **CSMD201**	Course Name: **Introduction to Data Structures**

L	T	P	Credits
3	-	-	3

Course Description:

The Data Structures and Algorithms course is a comprehensive study of fundamental concepts and techniques essential for efficient problem-solving in computer science. Students will explore various data structures, including arrays, linked lists, stacks, queues, trees, graphs, and hash tables, and learn how to analyze their time and space complexity. The course extensively explores the design and analysis of algorithms, encompassing various topics such as sorting, searching, and graph traversal. Emphasis is placed on understanding algorithmic paradigms and their applications. Through programming assignments and theoretical exercises, students will gain practical experience in implementing algorithms and solving real-world problems. This course serves as a foundation for algorithmic thinking and prepares students for advanced computer science topics.

Course Learning Outcomes:

After successful completion of the course, strudels will be able to:

1. Compare between linear and nonlinear data structures
2. Describe the characteristics of various data structure such as stacks, queues, trees, graphs and Hash tables.
3. Analyze various searching and sorting algorithms and apply it to solve particular problem.
4. Determine a suitable data structure and algorithm to solve a real world problem

Prerequisite: Basic knowledge of C programming, Knowledge of basic mathematical concepts

Course Content		
Unit No	**Description**	**Hrs**
1	**Introduction to Data Structures:** Primitive and non-primitive data structures, Operations on data structures, Algorithms, Abstract Data Types, Complexity Analysis	05
2	**Linear Data Structures:** **Stack:** Definition, Representation and Applications of Stack. **Queue:** Definitions, Representation and Applications of Linear Queue, Circular Queue, and Priority Queue.	06

3	**Linked Lists:** Definition, Representation, Operations and Applications of singly linked list, doubly linked list, circular linked list, Application of linked list-Stack & queue, Introduction to Sparse matrix, representation of sparse matrix using linked list.	08
4	**Searching, Sorting and Hashing Techniques** : Linear search, Binary search, Bubble sort, insertion sort, Merge sort, Quick sort, Selection sort, Radix sort, Heap sort, Complexity of algorithms **Hashing**: Definition, Hash functions, Overflow, Collision, Open Hashing, closed hashing, Rehashing Techniques.	08
5	**Trees:** Basic Technology, Binary Tree, Traversal methods, Binary search tree, AVL Tree, B tree, B+ tree, Heaps - operations and their applications.	05
6	**Graphs:** Basic concepts of graph theory, Storage representation, Operations on graphs, Traversing a graph, Shortest path algorithm.	04

References -

Text Books:

- "Data Structures using C, A Practical Approach for Beginners" by Amol M. Jagtap & Ajit S. Mali
- Data structures -- Seymour Lipschutz (MGH) Schaum's Outlines.
- Introduction to Data Structures in C – Ashok N. Kamthane (Pearson Education).

Reference Books:

- Data structures and Algorithms -- Alfred V. Aho, John E. Hopcroft, J. D. Ullman (Addision- Wesely Series)
- Data Structure using C -- ISRD Group (TMH) ACE series.

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S. Y. B. Tech. Syllabus

To be implemented for 2023-27 and 2024-28 NEP Batch

Department of Civil Engineering

Class:- **S. Y. B. Tech.**	Semester- III
Course Code : **EEMD201**	Course Name: **Electrical Power Generation**

L	T	P	Credits
3	--	--	3

Course Description:

The overarching aim of the course is to allow students to develop an understanding of the fundamental principles and performance of devices / components that are associated with Generation of Electrical Energy. Electricity is a secondary energy source. It is produced through conversion of primary energy sources as coal, hydro, natural gas, nuclear, solar, and wind into electrical energy. Electricity is also a critical energy carrier, facilitating both transfer of energy and conversion to other forms, such as mechanical, chemical, etc. This course is designed with multi-disciplinary approach to embark importance of electrical energy among the students from different programs.

Course Learning Outcomes:

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

1. List the main components of different power plants
2. Describe the operation of various power plants used for electrical power generation.
3. Explain working principles of various power plants
4. Compare different power plants based on advantages, limitations and future prospects
5. Draw layout of electrical power plants.
6. Explore alternate electrical energy resources for future needs and challenges.

Prerequisite: Basic Electrical Engineering, Basic Mechanical Engineering, Basic Civil Engineering, Engineering Physics and Chemistry.

Course Content

Unit No	Description	Hrs
1	**Solar Power Generation:** Solar radiation, solar energy collectors, solar power plant, solar power tower, conversion of solar heat to electricity, PV cells, PV power generation, solar energy storage, solar-hydrogen energy cycle, future prospects of solar energy in India.	06
2	**Wind Power Generation:** Wind speed and power relation, power extracted from wind, components of Wind power system, maximum power operation, operation and layout of standalone and grid connected Wind Turbine Generators (WTG).	06
3	**Thermal Power Plant:** Main equipment, coal handling plant, pulverizing plant, draft system, boiler, super-heater, re-heater, steam turbine, ash handling plant, condenser and	06

	cooling tower, feed water heater, economizer, air preheater, auxiliary supply, layout of thermal power plant. heat balance and efficiency, supercritical technology.	
4	**Hydro Power Plant:** Main components, storage reservoirs, dam, surge tank, penstock, spillway, tailrace, turbines, layout of hydro-power plant, site selection, run-off and its measurement, hydrograph, flow duration curve, mass curve, Hydro potential in India, problems in hydro-power plant development.	06
5	**Nuclear Power Plant:** Fundamentals of nuclear power, layout of nuclear power plant, selection of site, radioactivity & nuclear reactions, nuclear fission chain reaction in reactors, reactor classification, control of reactors, disposal of nuclear waste and effluent, biological effects of radiation, shielding, development of nuclear power plant in India.	06
6	**Alternate Energy Sources:** Fuel Cell: Principle, types of fuel cell, fuel for fuel cells, limitations and future prospects Biomass Energy: Availability of biomass, fluidized bed combustion, biomass power plant. Tidal Energy: Tidal phenomenon, tidal barrage, tidal power schemes Geothermal Energy: General, heat extraction, vapor-turbine cycle, difficulties and disadvantages	06

References -

Text Books:

- Rao, S. and Parulekar, B.B., Energy Technology: Non-Conventional, Renewable and Conventional, Khanna Publishers.
- Viorel Badescu, George Cristian Lazaroiu, Linda Barelli, Power Engineering Advances and Challenges, Part A: Thermal, Hydro and Nuclear Power, CRC Press.
- B. R. Gupta, Generation of Electrical Energy, S. Chand Publication.
- Rai, G.D., Non-Conventional Energy Sources, Khanna Publishers.

Reference Books:

- Twidell, J. and Tony W., Renewable Energy Resources, Taylor & Francis.
- Prabir Basu, Biomass Gasification, Pyrolysis and Torrefaction, Academic Press, Elsevier.
- Yasuo Koizumi, Tomio Okawa and Shoji Mori, Fundamentals of Thermal and Nuclear Power Generation, Elsevier, Publisher.

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To be implemented for 2023-27 and 2024-28 NEP Batch
Department of Civil Engineering

Class : **S. Y. B. Tech.**	Semester : **III**
Course Code : **ECMD201**	Course Name : **Electronics Devices and Applications**

L	T	P	Credits
3	-	---	3

Course Description:
This course introduces analog and digital electronics devices along with their circuits and applications. It deals with fundamentals of analog electronic devices such as R-L-C components, Diodes and its applications, BJT and FET. It focuses on working principles of operational amplifiers, electrical parameters of Op-Amp and its applications. This course also consists of number system, their conversions, logic gates, combinational and sequential logic circuits.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Describe the fundamental concepts of electronics and working principles of different devices.
2. Analyze different analog and digital electronics circuits.
3. Design digital electronics circuits with truth table and logic diagram.

Prerequisite: Fundamental concepts of Mathematics and Physics.

Course Content		
Unit No.	**Description**	**Hrs**
1.	**Introduction to Electronic components** Resistor, Inductor, Capacitor, Transformer, Diodes: P-N Junction Diode, Zener diode, LED, Photo diode. Applications of diodes: Rectifiers, Clippers and Clampers.	06
2.	**Bipolar Junction Transistor & Field Effect Transistor** Introduction to transistors, BJT characteristics, Common Emitter configuration of BJT. Application of BJT: Transistor as a switch, Transistor as an amplifier. Introduction & types of FET.	06
3.	**Operational Amplifiers** Block Diagram of Op-Amp, Characteristics of Op-Amp, Virtual ground concept, Inverting and Non-inverting amplifier. Linear Applications of Op-Amp: Adder, Subtractor. Non-linear Applications of Op-Amp: Schmitt Trigger, Comparator.	06

4.	**Fundamentals of Digital System** Number systems: Decimal, Binary, Octal, Hexadecimal, Binary coded decimal (BCD), Number system conversions, Binary Arithmetic, 1's and 2's complements, Logic gates.	06
5.	**Combinational Logic Circuits** Standard representation for logic functions, K-map, Minimization of logic functions using K-map, Half Adder, Full Adder, Half Subtractor, Full Subtractor, 1-Bit Comparator, Multiplexer, Demultiplexer, Encoder, Decoder.	06
6.	**Sequential Logic Circuits:** S-R flip-flop, D flip-flop, J-K flip-flop, T flip-flop. Applications of flip-flops: Shift registers, Counters: Ripple/asynchronous counters, Synchronous counters, Counters design using flip flops, Ring counter & Twisted ring/ Johnson counter.	06

References

Text Books:

- Boylestad, Robert & Louis, Nashelsky, "Electronics Devices and Circuit Theory", Pearson.
- Ramakant Gayakwad, Op-Amps and Linear Integrated Circuits, PHI
- Anand Kumar, "Fundamentals of Digital Circuits", PHI.

Reference Books:

- Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, Tata
  McGraw Hill.
- R. P. Jain, Modern Digital Electronics, Tata McGraw Hill.

Class:- **S.Y. B. Tech**	Semester-**III**
Course Code : **CIMD201**	Course Name : **Data Structures**

L	T	P	Credits
3	--	--	3

Course Description:
This course considers common data structures that are used in various computational problems. Students will explore various data structures, including arrays, linked lists, stacks, queues, trees, and graphs. This course serves as a foundation for algorithmic thinking and prepares students for advanced computer science topics. The course covers various applications of data structures. The course also focuses on typical use cases for these data structures.

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

1. Describe the basic terminologies of data structures.
2. Examine the linear data structure array with its types.
3. Demonstrate the working of stack, queue performed on data structures.
4. Illustrate the working of linked list.
5. Discuss Tree terminologies and their Applications.
6. Elaborate Graph terminologies with their types.

Prerequisite: Basics of C language

Course Content		
Unit No	**Description**	Hrs
1.	**Introduction to Data Structures** Introduction to data structures, basic terminologies in data structure, Need and Applications, classification of data structures, Operations on data structures, Abstract Data Types.	06
2.	**Array Data Structures** Introduction of Array, Representation of Array, Memory allocation of Array, types of array, operation in array, Applications of Array, Advantages and Disadvantages of Array	04
3.	**Stack and Queue** Stack: Definition, Representation, Operations and Applications of Stack. Queue: Definition, Representation, Operations and Applications of Linear Queue, Circular queue, Deque, Priority Queue.	07

4.	**Linked Lists** Definition, Terminologies, Representation, Operations, Singly linked list, Doubly linked list, Circular linked list, Stack using linked list, Queue using linked list.	07
5.	**Trees Terminology in data Structure** Tree definition, Terminologies and Applications, Binary trees and types. Binary tree traversals, Binary search trees, AVL tree, B tree.	06
6.	**Graphs Terminology in data Structure** Graph Definition, Terminologies and Applications, Types of graphs, Representation of graph using adjacency matrix and adjacency list, Graph traversal Techniques: Depth first and Breath first search.	06

References -

Text Books:

- G. S. Baluja, "Data Structure Through C: A Practical Approach", Dhanpat Rai Publications.
- S. Tanenbaum, Y. Langsam, M. J. Augenstein, "Data Structure using C", (PHI).

Reference Books:

- Alfred V. Aho, John E. Hopcroft, J. D. Ullman, "Data structures and Algorithms", Addision, Welsely Series.
- Ashok N. Kamthane, "Introduction to Data Structures in C", Pearson Education.
- Yashwant P. Kanetkar, "Data Structures through C", BPB Publications.

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Class:- **S.Y. B. Tech.**	Semester-III
Course Code : **MEMD203**	Course Name : **Design Thinking**

L	T	P	Credits
3	--	--	3

Course Description:
Maximizing the success of new products and services can drive growth and shareholder value, lead to significant competitive advantage and leapfrog a company ahead of its competitors. However, innovation is risky and most new products fail in the marketplace. Often, failure is due to an ineffective process. Thus, expertise in the design and marketing of new products is a critical skill for all managers, inside and outside of the marketing department. In this course, we first focus on the tools and techniques associated with analyzing market opportunities and then focus on designing new products and services. This course will introduce the new product development process and cover the two main areas of focus:

- Discovery - opportunity identification
- Design - concept and product design, development and evaluation

Course Learning Outcomes:
This course is designed to familiarize students with the principles and practices in the development, design, Development and introduction of new products and services. After successful completion of the course, student will be able to:

1. Identify the new product opportunities and sources of new product ideas.
2. Elaborate the product life cycle and product design process.
3. Integrate the customer and end-consumer needs into design process.
4. Assimilate the various product characteristics to design a novel product
5. Participate effectively in group work sessions and teams to become acquainted with the importance of teamwork and collaboration that is critical to new product success.

Prerequisite:
Course is open to all Students. The course demands application of creativity, sensitivity towards solving problems and liking for doing something new and creative.

Course Content

Unit No.	Description	Hrs
1.	**Discovery- Opportunity Identification for New products:** Product life cycle, need for new products, strategic planning and new product opportunity, sources of new product ideas, S curves and technology forecasting. Product idea generation, Product Design Process steps.	06
2.	**Creativity and Innovation:** Definition, relevance of Creativity and Innovation in new product design, Improving creativity and innovation, hindrances to creative thinking,	06

	importance and formation of teams.	
3.	**Identifying Customer Needs:** Understanding customer needs, Voice of the customer, Gathering customer needs, organizing and prioritizing needs, Product mission statement, establishing product function.	06
4.	**Establishing Product Specification:** Product Teardown and Experimentation, Benchmarking, Quality Function Deployment (QFD)	06
5.	**Product Portfolios and Portfolio Architecture:** Product Architecture-types, establishing architecture, Modular design-basic clustering method, advanced functional methods	06
6.	**Product Concept Generation, Selection and Testing:** Concept generation process and methods, Concept selection mechanism and techniques, Concept Testing-Purpose, process and methods.	06

References: -

- Ulrich, Eppinger, Anita Goel, Product Design and Development, McGraw Hill Publishing
- Otto & wood, Product Design, Pearson Education, reprint
- Charles Flurscheim, Industrial Design in Engineering, the Design Council, London,
- Devdas Shetty, Design for product success, Society for Manufacturing Engineering,

Class: **S. Y. B. Tech.**	Semester: **III**
Course Code: **MCMD201**	Course Name: **Fundamentals of Mechatronics**

L	T	P	Credits
3	-	--	3

Course Description:
This course aims at providing fundamental understanding about the basic elements of a mechatronics system, interfacing, and its practical applications.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Identify various elements of mechatronics systems.
2. Select appropriate sensor/Actuator/controller/control algorithm for different applications.
3. Develop PLC/ microcontroller-based applications.

Prerequisite: The students should have knowledge of basic electronics.

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Introduction:** Introduction to Mechatronics, Key elements of Mechatronics, Block diagram of mechatronics system, Control systems and Modes of control, Difference between traditional and concurrent design process.	02
2.	**Sensors and transducers:** **Transducers-** classification, Development in Transducer technology **Sensors -** Introduction, Need of Sensors, Classification, Working and Application of- Potentiometer Sensors, Strain Gauge Elements. Capacitive Elements, Eddy Current, Proximity Sensors, Inductive, Proximity Sensors, Light Sensors, Pressure Sensors, Pneumatic Sensors, Pyro electrical Sensors, Piezoelectric Sensors, Shaft Encoders. Selection of Sensors.	08
3.	**Drives and Actuators:** Introduction and Classification of Actuators. Need and Scope. Hydraulic Actuation systems – Linear, Single and Double Acting system, Pneumatic Actuation systems- Gear Motors and Vane Motors. Electrical Actuation Systems – solenoid type Devices, Stepper Motors, and Servo Motor. Selection of Actuators.	06

4.	**Controllers:** **PLC-** Introduction, definitions, PLC block diagram, Difference between Relay panel and PLC, Selection of PLC, Programming formats, Ladder logic programming. **Microcontroller and Microprocessor-** Introduction, Comparison of Microcontroller and Microprocessor, Architecture – Pin configuration of 8051 Microcontroller, Assembly programming	**08**
5.	**Signal Conditioning:** Operational amplifier circuits, filtering circuits, Analog, and Digital signal conversion.	**06**
6.	**Advanced applications in mechatronics:** Mechatronics in automated manufacturing, Artificial intelligence in mechatronics, Fuzzy logic in mechatronics, Case studies of mechatronics systems.	**06**

References -

Textbooks:

- Mechatronics System Design, Devdas Shetty & Richard A. Kolk, PWS Publishing
  Company (Thomson Learning Inc.).
- Mechatronics: A Multidisciplinary Approach, William Bolton, Pearson Education.
- A Textbook of Mechatronics, R.K. Rajput, S. Chand & Company Private Limited
- Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Prentice Hall.

Reference Books:

- Introduction to Mechatronics & Measurement System, David G. Alciatore, Michael B. Histand, McGraw Hill Education.

Class:- **S.Y. B. Tech.**	Semester- **III**
Course Code : **AIMD201**	Course Name : **Object Oriented Programming**

L	T	P	Credits
3	--	--	3

Course Description:
This course introduces object-oriented programming using the Java programming language. Students will learn how to program in Java and use some of its most important APIs. Special importance will be assigned to the object-oriented nature of Java and its use of polymorphism. Hands-on labs and exercises will enable students toward becoming highly skilled Java Application developers.

Course Learning Outcomes:
The course should enable the students to:

1. Understand the basic object oriented programming concepts and apply them in problem solving.
2. Illustrate inheritance concepts for reusing the program.
3. Implement program using loops, decision statements and functions in Python.
4. Plot data using appropriate Python visualization libraries.

Prerequisite: Basic Programming Skills

Course Content		
Unit No	**Description**	Hrs
1	**Oops Concepts and Java Programming** OOP concepts: Procedural and object oriented programming paradigm, Classes and objects, data abstraction, encapsulation, constructors, inheritance, polymorphism and overloading, Java programming: History of java, comments data types, variables, constants, scope and life time of variables, operators, control flow statements, arrays, console input and output, garbage collection, exploring string class.	06
2	**Multiple Inheritance, Interfaces and Packages** Inheritance: Inheritance hierarchies, super and subclasses, preventing inheritance, Polymorphism: dynamic binding, method overriding, Interface: Interfaces VS Abstract classes, implement interfaces, accessing implementations through interface references, Packages: Defining, creating and accessing a package, importing packages.	06
3	**Introduction to Python fundamentals:**	06

	Python introduction, Python syntax, Python comments, Python variables, Python data types, Python numbers, Python casting, Python strings, Python Booleans, Python operators.	
4	**Lists, Tuples, Sets, Dictionaries:** Access, change, add and remove list elements, loop lists, list comprehension, list methods, access, update, unpack tuples, loop tuples, tuple methods, Access, add, remove set items, set methods, access, add, change, remove dictionary items, nested dictionaries, dictionary methods.	06
5	**Python conditional statements:** If-else, while, for, lambda, arrays, Python Iterators, Python scope **Python classes and objects:** Classes, objects, parameterized and non-parameterized init constructor, object methods, self-parameter, association, aggregation and inheritance using python.	06
6	**Python for Machine Learning** Numpy, Pandas, Matplotlib and Seaborn,	06

References -

Text Books:

- Herbert Schildt and Dale Skrien" Java Fundamentals – A comprehensive Introduction", McGraw Hill.
- Herbert Schildt, "Java the complete reference", McGraw Hill, Osborne.
- Charles Dierbach, "Introduction to Computer Science Using Python", Wiley India
- ReemaThareja, "Python Programming using problem solving approach", Oxford University press

Reference Books:

- P. RadhaKrishna , "Object Oriented programming through Java", CRC Press.
- Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", Shroff Publishers

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S. Y. B. Tech. Syllabus

To be implemented for 2023-27 and 2024-28 NEP Batch

Department of Civil Engineering

Class: **S.Y. B. Tech.**	Semester - III
Course Code: **RAMD201**	Course Name: **Fundamentals of Robotics & Automation**

L	T	P	Credits
3	-	--	3

Course Description:

This course provides an in-depth understanding of the fundamental concepts and applications of robotics and automation. It provides an introduction to robotics, it's history and development, various types of end effectors, grippers, kinematic and dynamics of robotics, robot drive systems, sensors and actuators and fundamentals of robot programming and applications. This course also introduces the need for automation, its types and various applications of automation technology in industries.

Course Outcomes:

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

1. Differentiate various robotic configurations and performance metrics.
2. Compare various end effectors, sensors, and drive systems in robotic applications.
3. Illustrate kinematic and dynamic principles applied to robotic systems.
4. Outline robot programming solutions for diverse applications.
5. Distinguish various types and aspects of automation.
6. Relate the knowledge of Programmable Logic Controllers (PLCs) to industrial automation tasks.

Prerequisite: Engineering Science Courses, Engineering Mathematics, Basic Mechanics, Programming Fundamentals

Course Content

Unit No.	Description	Hrs
1.	**Introduction to Robots:** Definition - Historical background - Various generations of robots – Robot Anatomy - Robot configuration: Polar, Cylindrical, Cartesian coordinate, Joint-arm configuration - Degree of freedom - Work volume and Dead zone - Dynamic performance: Speed of response and Stability - Precision of movement: Spatial Resolution, Accuracy, Repeatability and Compliance.	06
2.	**Robot End Effectors, Sensors and Drive Systems:** **End Effectors**: Characteristic features - Types: Mechanical grippers, Magnetic grippers, Vacuum cups, Adhesive gripper, Hooks and Scoops - Tools as end effectors - Robot / End-effectors interface - Consideration in Gripper selection and Design **Sensors**: Transducers and Sensors - Sensors in Robotics: Tactile, Proximity and Range Sensors, Miscellaneous sensors and sensor based systems - Robot Vision System. **Robot Drive System**: Hydraulic, Electric and Pneumatic.	06

3.	**Robot Kinematics & Dynamics:** Representation of objects in 3-D space-position and orientation, representation of orientation using roll, pitch and yaw angles, representation of orientation using Euler angles. Denavit - Hartenberg notations- link and joint parameters-rules for coordinate assignments, forward and inverse kinematics, Introduction to inverse and forward dynamics, determination of inertia tensor, Lagrange-Euler formation for joint torque	06
4.	**Robot Programming and Its Applications:** Lead-through Programming, Walk-through Programming, Use of Teach pendants - Capabilities and limitations. Textural Programming: requirements of robot programming language, problems pertaining to robot programming languages, Common languages/Software used- - Robot program as a path in space Applications: Factors influencing the selection of Robots - Robots for Materials handling, Assembly, Agriculture and Chemical Plants - Advanced applications. Intelligent Robots - Introduction to Mobile Robots, Legged Robots and Remote Controlled Robots, Automated Guided Robots, Micro Robots - Control and Safety Issues.	06
5.	**Introduction to Automation:** Mechanization and Automation - History of Automation - Reasons for automation - Merits and limitations - Automation systems - Types of Automation: Fixed, Flexible and Programmable Automation - Intelligent Industrial Automation - Automation and Robotics.	06
6.	**Introduction to Programmable Logic Controller (PLCs):** Principles of operation of Programmable Logic Controller (PLC), PLC verses computer, PLC hardware components, Scan time of a cycle, Industrial PLC, Application of PLCs.	06

References-

Text Books:

- Mittal R K & Nagrath, "Robotics and Control", 2nd Edition, McGraw Hill Publication TMH.
- S. K. Saha, "Introduction to Robotics", 2nd Edition, TMH, 2014.
- Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G., Ashish Dutta, "Industrial Robotics, Technology, Programming & Applications", Tata McGraw Hill Education Pvt. Ltd. New Delhi.

Reference Books:

- John J Craig, "Introduction to Robotics", Pearson Edu. 2005.
- Fu K.S, "Robotics", McGraw Hill, 2004.
- Niku SB, "Introduction to Robotics – Analysis, Control, Applications", 3rd Edition, John Wiley & Sons Ltd., 2020.

NPTEL Course on Robotics:

- https://onlinecourses.nptel.ac.in/noc19_me74/preview
- https://onlinecourses.nptel.ac.in/noc20_de11/preview

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S. Y. B. Tech. Syllabus

To be implemented for 2023-27 and 2024-28 NEP Batch

Department of Civil Engineering

Class: **S. Y. B. Tech Civil**	Semester-III
Course Code: **CE2234**	Course Name: **Building Planning and Drawing Laboratory**

L	T	P	Credits
-	-	2	1

Course Description:

'Building Construction and Planning Laboratory' course intends to develop the building planning and designing skills of the students. The course gives an overview of construction project work through site visits. It also deals with preparation of submission and working drawings of a residential building using AutoCAD.

Course Outcomes:

After successfully completing the course, student will able to:

1. Design and draw the different types of staircases for a building using AutoCAD.
2. Prepare submission and working drawings of a residential building using AutoCAD.

Prerequisite: AutoCAD software skill.

Laboratory Content		
Expt. No.	**Name of Experiment**	**Hrs.**
1.	Compilation of different types of building drawings with giving their uses.	02
2.	Staircase design and drawing using AutoCAD.	02
3.	Visit to the completed construction site of a residential building and preparation of technical report based on it.	02
4.	Planning and design of a small residential building for the given requirements and preparation of the following drawings using AutoCAD. (Note: Students have to complete this project individually and independently.)	
	a) Municipal submission drawing.	06
	b) Working Drawings:	
	i. Centre line plan	02
	ii. Furniture layout	04
	iii. Plumbing layout	04
	iv. Electrical layout	02

References:

Text Books: -

- S. P. Arora, S.P. Bindra, "A Text Book of Building Construction", Dhanpat Rai

Publications

- B. C. Punmia, "A Text Book of Building Construction", Laxmi Publications.

References Books: -

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

Codes of Practice :-

- Unified Development Control and Promotion Regulations for Maharashtra State (UDCPR 2020), Urban Development Department, Government of Maharashtra.

Class: **S. Y. B. Tech. Civil**	Semester: III
Course Code : **CE2114**	Course Name: **Surveying Laboratory**

L	T	P	Credits
-	-	2	1

Course Description:
The course equips students 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 practical's which focuses on the demonstrations of Levelling, Methods of Plotting Contours, Plane table techniques, Theodolite & tacheometry, Curve setting, setting out of structures in civil engineering.

Course Outcomes:
After successful completion of the course, students will be able to,
1. Determine the reduced levels by using dumpy level.
2. Measure the angular and linear measurements by using theodolite and tachometry.
3. Perform the setting out of the simple curves.
4. Prepare topographical map by using total station and software.

Prerequisite: Fundamentals of Basic Civil Engineering, Engineering Mathematics.

Laboratory Content		
Expt. No.	**Name of Experiment**	Hrs
1	Calculate the elevations by Rise fall and collimation plane method by using Dumpy Level.	2
2	Prepare map by using Radiation Method and Intersection Method of Plane Table Survey.	2
3	Measurement of area of map by using digital Planimeter.	2
4	Measurement of horizontal angle by Repetition method of Theodolite surveying.	2
5	Measurement of horizontal angle by Reiteration method of Theodolite surveying.	2
6	Measurement of Magnetic bearing and vertical angle by using Theodolite	2
7	Tacheometry: Determination of tachometric constants and grade of line	2
8	Setting out of Simple circular curves by Rankine's method	2
9	Demonstration on Measurements by using total station- Angle, Distance and Elevation.	2
10	Traversing or Map preparation by using total station and post procedure software's	2
11	Setting out of building plan on field.	2
12	**Project**	2

	Prepare the Contour map for given area by using total station	

References:

Reference Books:

- Surveying: Theory and Practice by James M. Anderson, Edward M. Mikhail, Tata McGraw Hill.
- Principles of Surveying. Vol. I by J. G. Olliver, J. Clendinning – Van Nostrand Reinhold.
- Plane and Geodetic surveying for Engineers. Vol. I by David Clark, Constable.

Text Books:

- Surveying and Levelling by N. N. Basak , Tata McGraw Hill, New Delhi.
- Surveying Vol. I, II and III - Dr. B.C. Punamia, Laxmi Publishers. New Delhi.
- Surveying and Levelling Vol. I and II - T.P Kanetkar and S.V Kulkarni, Pune Vidhyarthi Gruh.
- Surveying Vol. I and II - S. K. Duggal, Tata McGraw Hill, New Delhi.
- Plane Surveying by A. M. Chandra, New Age International Publishers.

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S. Y. B. Tech. Syllabus

To be implemented for 2023-27 and 2024-28 NEP Batch

Department of Civil Engineering

Class: **S. Y. B. Tech. Civil**	Semester: **III**
Course Code : **CE2134**	Course Name: **Engineering Mechanics and Materials Testing Laboratory**

L	T	P	Credits
-	-	2	1

Course Description:
Engineering Mechanics Laboratory deals with performing experiments, interpreting results, and correlate theoretical and experimental results. This lab focuses verification of Laws of forces, principle of moment, Lami's theorem, and compare coefficient of friction. This course, also deals with the testing of various materials such as steel, different metals, bricks and structural elements.

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

1. Verify law of polygon of forces, principle of moment, Lami's theorem.
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.
5. Identify various types of stresses in various structural elements.
6. Determine various strengths of different construction materials

Prerequisite: Engineering Mathematics, Engineering Physics

Laboratory Content		
Expt. No.	**Name of Experiment**	**Hrs.**
1.	Verify Law of polygon of forces	02
2.	Verify principle of moment using Bell Crank Lever	02
3.	Support Reactions of simple beam and compound beam	02
4.	Verify Lami's Theorem, Equilibrium of connected bodies	02
5.	Compare value of coefficient of Friction for various contact surfaces	02
6.	Analysis of simple truss	02
7.	Centroid of plane & composite figures	02
8.	Tension test on Mild and HYSD steel.	02
9.	Impact test on different metals	02
10	Water absorption & compression test on burnt brick.	02
11	Flexural test on flooring tiles.	02
12	Bending test on timber beam	02

References:

Text Books:

- Bhavikatti S. S., Rajashekarappa, "Engineering Mechanics", New age International publication (India) Pvt. Ltd. New Delhi,
- S. Ramamrutham, "Engineering Mechanics", Dhanpat Rai Publishing Company Ltd., New Delhi.
- H. Shah and S. Junnarkar "Mechanics of Structures", Charotar Publishing House Pvt Limited, New Delhi.
- S. Ramamrutham "Strength of Materials", Dhanpat Rai Publishing Company (P) Limited, New Delhi.

Reference Books:

- S. Junnarkar, "Elements of Applied Mechanics", Charotar Publishing House (India) Pvt. Ltd., Anand (Gujarat)
- R. Vaidyanathan, P. Perumal, P. Lingeswari, "Mechanics of Solids and Structures", Scitech Publications Pvt. Ltd., Chennai.
- Ferdinand L. Singer, "Engineering Mechanics (Statics and Dynamics)" Publications (India) Pvt. Ltd. Noida.
- Timoshenko and Young, "Engineering Mechanics (Statics and Dynamics)", McGraw Hill Publication, New York.

IS Codes:

- IS:1608(2005), IS:432(Part-I)-1982(Reaffirmed 1995) Tensile Testing of Metals
- IS: 1598:1977 Method for Izod impact test of metals
- IS: 1499-1977 Method for Charpy Impact Test (U-notch) for Metals.
- IS:1237-2012 Cement Concrete Flooring Tiles
- IS:3495(Part1 to 4) 1992 Methods of Tests of Burnt Clay Building Bricks
- IS:1077-1992 Common Burnt Clay Building Bricks Specification
- IS:1708-1 to 18 (1986), IS:2408 Methods of testing of timber specimen

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S. Y. B. Tech. Syllabus

To be implemented for 2023-27 and 2024-28 NEP Batch

Department of Civil Engineering

Class: **S. Y. B. Tech Civil**	Semester-III
Course Code: **CE233**	Course Name: **Building Interior Design & Drawing**

L	T	P	Credits
-	-	2	1

Course Description:

Building Interior Design & Drawing' course intends to develop the building interior design & drawing skills of the students. The course gives an overview of building planning principles. It also deals with preparation of furniture, plumbing, electrification, flooring ceiling design and drawing of a residential building using AutoCAD.

Course Outcomes:

After successfully completing the course, student will able to:

1. Design and draw the furniture, plumbing and electrification details of a building using AutoCAD.
2. Design and draw the flooring and ceiling details of a building using AutoCAD.

Prerequisite: AutoCAD software skill, Building Planning and Design

Laboratory Content

Expt. No.	Name of Experiment	Hrs.
1.	Introduction to principles of planning of a building and importance of interior design of a buildings.	02
2.	Furniture design and drawing of a building.	06
3.	Plumbing design and drawing of a building.	06
4.	Electrification design and drawing of a building.	04
5.	Flooring design and drawing of a building.	02
6.	Ceiling design and drawing of a building.	04

References:

Text Books: -

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

References Books: -

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

Class: **S. Y. B. Tech Civil**	Semester-III	L	T	P	Credits
Course Code: **CE2154**	Course Name: **Technical Aptitude-I**	-	-	2	1

Course Description:
Technical Aptitude-I consists of multiple choice questions based on the following courses.
1. Mathematics for Civil Engineer
2. Surveying
3. Engineering Mechanics
4. Building Planning and Design

Choice Based Professional Skills Development and Foreign Languages Programme
for
Second Year B. Tech.
(Sem. III and IV)

Professional Skills Development and Foreign Languages Courses

1. Professional Leadership Skills (SH2634)
2. Interpersonal Skills (SH2614)
3. Innovation Tools and Methods for Entrepreneurs (SH2694)
4. Personal Effectiveness and Body Language (SH2594)
5. German Language - Level III (SH2734)
6. German Language - Level IV (SH2644)
7. Japanese Language - Level III (SH2714)
8. Japanese Language - Level IV (SH2624)

An Important Notes:

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

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S. Y. B. Tech. Syllabus

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Department of Civil Engineering

Class:- **S.Y. B. Tech .**	Semester-**III/IV**
Course Code : **SH2634**	Course Name : **Professional Leadership Skills**

L	T	P	Credits
-	-	2	1

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

Course Outcomes:

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

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

Prerequisite: A Student, who is going to enroll for this course should have -

1. Adequate knowledge of basic grammar of English language.
2. Intermediate level vocabulary of English language.
3. Ability to communicate moderately in English.

Minimum 12 sessions will be conducted from the following list.

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

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

References -

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

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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S. Y. B. Tech. Syllabus

To be implemented for 2023-27 and 2024-28 NEP Batch

Department of Civil Engineering

Class: - **S.Y. B. Tech.**	Semester-III/IV
Course Code : **SH2614**	Course Name : **Interpersonal Skills**

L	T	P	Credits
-	-	2	1

Course Description: This course offers the tips and techniques to lead a life full of success, prosperity and happiness by changing the current mind set to that of positive and harmonious thinking. It further teaches upon important aspects such as priorities in life, how to manage stress, teamwork , laws of nature , human body as a divine computer , power of mind etc.

Course Outcomes:

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

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

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

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

Course Content		
Experiment No	**Description**	**Hrs**
1.	**Importance of Universal Laws of Nature in Human Life.-** Overview, scientific, universal, secular, usefulness in every walk and phase of life, overview of Universal Laws of Nature, determining factor in human life, important laws of nature and its influence on life of individual, family, society and world at large. wisdom, living life in tune with laws of nature	02
2.	**'You are the Architect of your Destiny'** - This unit will make you aware that none else but you alone are responsible and accountable for what you achieve in your life , freedom of decisions, choices to make up your future, guiding powers to make the choices in your life, achieving life full of health, wealth , success , peace and happiness for yourself and all	02
3.	**Setting and Achieving Goals** – Defining your own goals in life , Concept of power of mind , concepts of interaction of conscious and subconscious levels of mind, tips and techniques to harness the amazing power of subconscious mind to achieve goals, Visualization	02

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

References -

1. Spiritual Wisdom in Day-to-day life – Blogs by Mr. Pralhad Wamanrao Pai
2. Towards the goal of beautiful life – Book by Satguru Shri Wamanrao G. Pai
3. Power of your subconscious mind – Dr. Murphy
4. Seven people of highly effective people – Stephen Covey
5. How to win friends and influence people – Dale Carnegie
6. S. Hariharan, et al; *Soft Skills*, MJP Publishers, Chennai (2010)
7. Gopalaswamy Ramesh et al. *The ACE of Soft Skills: Attitude, Communication and*

Etiquette for Success, New Delhi: Pearson Education, 2012. Print.
8. Masters, L. Ann et al. *Personal Development for Life and Work*, New Delhi: Cengage Learning, 2012. Print.

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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

References -

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

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

Class: - **S.Y. B. Tech.**	Semester-**III/IV**
Course Code : **SH2594**	Course Name : **Personal Effectiveness and Body Language**

L	T	P	Credits
-	-	2	1

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

Course Outcomes:

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

1. Develop skills to build self-esteem and positive attitude.
2. Develop interpersonal skills characterized by effective communication and conflict resolution.
3. Demonstrate responsiveness towards time, 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.

Minimum 12 sessions will be conducted from the following list.

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

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

References -

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

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

Class: - **S.Y. B. Tech.**	Semester-III
Course Code : **SH2734**	Course Name : : **German Language - Level III**

L	T	P	Credits
-	-	2	1

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

Course Outcomes:
After successful completion of the course, students will be able to,
1. Interpret the language if the next person is speaking slowly and clearly.
2. Make use of the language in routine life with the routing topics like family, shopping, work etc.
3. Demonstrate the language by self-introduction in German with simple sentences.

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

Course Content

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

8.	Grammar- present perfect tense of separable and non-separable verbs	02
9.	Dativ verbs Exercises related to dativ verbs	02
10.	Dialog between shopkeeper and customer Personal Pronomen in Dativ	02
11.	Orientation in the shopping mall. Understanding the floors and information on notice boards.	02
12.	Revision of the grammar and doubts clearing	02
13.	Test and presentations assigned to students during semester	02

References -

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

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

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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S. Y. B. Tech. Syllabus

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Department of Civil Engineering

Class: - **S.Y. B. Tech.**	Semester- **IV**
Course Code : **SH2644**	Course Name : **German Language - Level IV**

L	T	P	Credits
-	-	2	1

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

Course Outcomes:

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

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

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

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

Course Content

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

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

References -

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

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

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

Class: - **S.Y. B. Tech.**	Semester- III
Course Code : **SH2714**	Course Name : **Japanese Language - Level III**

L	T	P	Credits
-	-	2	1

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

Course Outcomes:
After successful completion of the course, students will be able to,
1) Make use of basic conversations in various situations.
2) Identify the sentence patterns.
3) Explain insights about the communication required for living in Japan.
4) Interpret Japanese work ethics required in their professional career.

Prerequisite: A Student, who is going to enroll for this course, should have following Japanese language abilities:
1) Knowledge of basic grammar of Japanese Language.
2) Communicate moderately using Japanese Language.

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

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

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

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

References -

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

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

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

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Department of Civil Engineering

Class: - **S.Y. B. Tech.**	Semester- **IV**
Course Code : **SH2624**	Course Name : **Japanese Language - Level IV**

L	T	P	Credits
-	-	2	1

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

Course Outcomes:

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

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

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

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

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

Course Content		
Experiment No	**Description**	**Hrs**
1	How to make た forms of the verbs.	02
2	To express "have the experience of " using た forms of the verbs.	02
3	To express two or more than two actions in one list using た forms of the verbs.	02
4	Polite forms & plain forms (Style of speech)	02
5	Conversation in plain forms & polite forms.	02
6	To express ideas or judgements.	02
7	Report speech.	02
8	To express recommendation, suggestion.	02
9	How to seek agreement or confirmation from the listener.	02
10	Noun modification.	02

11	Describing an appointment, errand.	02
12	Rules while using とき	02
13	Verbs used for giving & receiving of things (polite & plain forms)	02
14	Conditional forms of verbs, adjectives & nouns.	02
15	Subject of subordinate clause.	02

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

References -

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

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

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)
Evaluation Method: In every session students will be assessed. Each assessment will be of minimum 10 marks. The best 10 performances of the student will be considered for ISE.

Class: **S. Y. B. Tech. Civil**	Semester: **IV**
Course Code : **CE232**	Course Name: **Strength of Material**

L	T	P	Credits
3	-	-	3

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

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

Prerequisites: Engineering Physics, Engineering Mathematics and Engineering Mechanics

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**Simple Stresses, Strains and Elastic Constants:** Concept of stress and strain, Hooke's law, Stress-Strain behavior of materials, Deformations in composite sections under axial loading, compound bars and temperature stresses. Elastic constants and their relationships.	07
2.	**Principal Stresses:** Concept of principal planes and principal stresses, normal and shear stresses on an oblique plane, magnitude and orientation of principal stresses and maximum shear stress. Concept of Mohr's circle for plane stresses.	05
3.	**Shear Force and Bending Moment:** Concept of shear force and bending moment for determinate beams for various loadings. Relation between shear force, bending moment and loading. Shear force and bending moment diagrams for various boundary conditions and loadings.	06
4.	**Bending and Shear Stresses:** Bending Stresses: Theory of simple/pure bending. Derivation for flexure formula. Bending stress distribution diagrams. Moment of Resistance,	06

	flitched beam Shear Stresses: Derivation of shear stress equation, Shear stress distribution of various shapes cross-sections, average and maximum shear stress.	
5.	**Torsion:** Torsion of circular shafts: Theory of Torsion, assumptions, derivation of torsion formula. Stresses, strains and deformations in determinate shafts of hollow, solid subjected to twisting moments. Power transmitted through shafts.	06
6.	**Strain Energy**: Concept, expression of strain energy for axially loaded members under gradual, sudden and impact loads. Strain energy due to self weight, bending and torsion.	06

References:

Text Books:

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

Reference Books:

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

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Department of Civil Engineering

Class: **S. Y. B. Tech. Civil**	Semester: **IV**
Course Code : **CE2044**	Course Name: **Concrete Technology**

L	T	P	Credits
2	-	-	2

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

Course 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. Select materials for the manufacturing concretes for a given requirement.
3. Explain procedures for conducting various quality control tests on fresh and hardened concrete as per standard codes.
4. Design concrete mixes of given grade using mix design procedures recommended by IS and ACI codes of practices.

Prerequisite: Possess basic knowledge of structural components and construction activities.

Course Content

Unit No.	Description	Hrs
1.	**Cement & Water:** Properties of cement- Fineness, consistency, setting time, soundness, compressive strength, specific gravity. Field testing of cement. Hydration of cement. Types of cement. Water: Specifications of water as per IS 456.	04
2.	**Fine and Coarse Aggregates:** Grading, fineness modulus, and specific gravity, silt content, moisture content, Bulking, Bulk density, shape and surface texture.	04
3.	**Admixtures:**	04

	Chemical admixtures: Types of admixtures and their effects properties of concrete, **Mineral admixtures:** Types of admixtures and their effects properties of concrete.	
4.	**Fresh Concrete:** Manufacturing process of good quality concrete. Workability of concrete and methods of measuring workability, Factors affecting workability, Segregation and bleeding, Temperature effects on fresh concrete.	04
5.	**Concrete Mix Design:** Nominal Mix Concrete, Objectives of mix design, Factors governing mix design, Methods of expressing proportions. Mix design by, IS code method as per 10262 & 456, ACI 211.1-91 method.	04
6.	**Hardened Concrete & NDT:** Hardened Concrete: Strength of concrete, w/c ratio, Gel-space ratio, Effect of maximum size of aggregate, Factors affecting strength of concrete, Characteristic strength - compressive, tensile and flexure strength. Introduction to nondestructive testing of concrete. Introduction to durability of concrete.	04

References:

Codes of Practice:

- Bureau of Indian Standards IS: 10262-2019. Indian standard code of practice for recommended Guidelines of Concrete Mix Design plain and reinforced concrete. New Delhi, BIS.
- Bureau of Indian Standards IS 456: 2000. Indian standard code of practice for plain and reinforced concrete. New Delhi, BIS.
- Bureau of Indian Standards IS 1199: 1959. Indian standard code of methods of sampling and analysis of concrete. New Delhi, BIS.
- ACI 211.1-91.
- Handbook on Concrete Mixes SP 23: 1982, 2001.

Text Books:

- Gambhir, M.L. (2005). Concrete Technology, Tata Mc Graw-Hill Publishing Company Limited, New Delhi.

Reference Books:

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

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Department of Civil Engineering

Class: **S. Y. B. Tech. Civil**	Semester: **IV**
Course Code: **CE2064**	Course Name: **Fluid Mechanics**

L	T	P	Credits
2	-	-	2

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

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

1. Analyze different physical properties of fluid.
2. Calculate various forces acting on submerged and floating bodies.
3. Discriminate fluid kinematics and fluid dynamics.
4. Illustrate flow through pipe and flow through open channels.
5. Analyzes dimensional homogeneity using Buckingham's π theorem

Prerequisites: Engineering Mathematics, Basic civil Engineering

Course Content		
Unit No.	**Description**	**Hrs**
1.	**Fundamental Concepts of Fluid Flow:** Introduction to Fluid mechanics, Properties of fluid (density, unit weight, specific surface, surface tension, capillarity), Pascal's law and its applications, Newtons law of viscosity, Classification of fluids.	04
2.	**Fluid Statics:** Fluid pressure: Absolute, atmospheric, gauge and vacuum pressures, Pressure head, Pressure measuring devices, hydrostatic forces on submerged surfaces (horizontal, vertical and inclined surface)	04
3.	**Fluid Kinematics & Fluid Dynamics:** Displacement, velocity and acceleration of fluid particles, Continuity equation, Introduction to: rotational and irrotational flow, velocity potential and stream function flow net. Euler's equation, Bernoulli's equation.	04
4.	**Flow Through Pipes:** Head loss: Concept of major and minor head loss, Darcy-Wisbech equation for determination of major loss, determination of minor losses, pipes connected in series and parallel, concept of equivalent pipe.	04
5.	**Flow Through Open Channels:** Hydraulically efficient channel cross sections (rectangular, trapezoidal, circular) concept of specific energy, subsequent depths, subcritical and	04

	supercritical flow in rectangular channels.	
6.	**Dimensional Analysis, Similitude and Pumps:** Dimensional homogeneity, Buckingham's π theorem, important dimensional numbers and their significance, geometric, Kinematic, and dynamic similarity, Pumps, types of pumps, efficiency, characteristics of pumps, head calculations, engineering application of pump.	04

Text Books:

- Modi, P.N. and Seth, S.M., Hydraulics and Fluid Mechanics Including Hydraulics Machines. Rajsons Publications Pvt. Ltd.
- Bansal, R. K. A textbook of fluid mechanics. Firewall Media.
- Pritchard, P.J. and Mitchell, J.W. Fox and McDonald's introduction to fluid mechanics. John Wiley & Sons.

Reference Books:

- Jain, A. K. Fluid Mechanics: Including Hydraulic Mechanics. Khanna Publishers.
- Khurmi, R. S. "Hydraulics and Hydraulic Mechanics" S. Chand & Company Ltd. New Delhi.
- J. Lal, "Fluid Mechanics and Hydraulics" Metropolitan Book Co. Ltd.
- Y.A. Cingel L.M. Oimbala, Fluid Mechanics (SI Units)", Tata McGraw Hill.
- R.S. Rajput, "Hydraulic & Hydraulic Mechanics" S. Chand & Company Ltd. New Delhi.

Class: **S. Y. B. Tech. Civil**	Semester: **IV**
Course Code : **CE234**	Course Name: **Water resources and Irrigation Engineering**

L	T	P	Credits
3	-	-	3

Course Description:
This course is designed to provide students with a comprehensive understanding of water management and irrigation practices. Throughout the course, students will explore the processes involved in surface water and groundwater hydrology, addressing the aspects such as runoff, hydrographs, and groundwater movement. Furthermore, students will learn about different irrigation methods suitable for various crops. By the end of this course, students will have gained a strong foundation in water resources and irrigation engineering, enabling them to address real-world challenges in water management effectively.

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

1. Analyze the intricate processes involved in the water cycle and its impact on the distribution of water resources.
2. Utilize advanced techniques to evaluate and interpret rainfall data for making well-informed decisions in water management.
3. Develop and assess various irrigation methods tailored to the specific water requirements and efficiency of different crops.
4. Evaluate the structural stability criteria for gravity dams and identify potential vulnerabilities in earthen dam constructions.
5. Apply statistical flood estimation methods to determine flood discharge and devise effective flood control measures.

Prerequisite: Engineering Physics

Course Content

Unit No.	Description	Hrs
1.	**Introduction to hydrology:** Hydrological cycle and its components; Precipitation-types and forms, measurement, analysis of Precipitation data, mass rainfall curves, intensity-duration curves, and concept of depth area duration analysis, frequency analysis. Evaporation and evapotranspiration- factors affecting and measurement methods.	06
2.	**Surface water hydrology:** Runoff- factor affecting, Rainfall runoff relationship Hydrograph: Component parts of hydrograph, Storm hydrograph, Base flow and Separation of base flow, direct runoff hydrograph, Unit hydrograph, theory, assumptions limitations and use, concept of S-curve hydrograph.	08
3.	**Ground water hydrology:**	04

	Occurrence of ground water Zones of underground water, Infiltration - factors affecting and measurement methods movement of ground water and its velocity.	
4.	**Irrigation engineering:** Irrigation methods and their efficiencies. Crop water requirement: Principal crops and crop seasons in India, Classes and availability of soil water, Duty, delta, base period and their relationship, factors affecting duty, methods of improving duty, Assessment and efficiency of irrigation water. Gross command area, cultural command area and command area calculations based on crop water requirement. Depth and frequency of irrigation.	06
5.	**Dam reservoirs:** Types of dams, selection of site for dams, selection of type of dam, Control levels. Gravity dam: Component parts, Forces acting on dam. Stability requirements Earthen dam: Component parts, Construction and types of earthen dam, plotting of phreatic line, Modes of failure, seepage control measures.	07
6.	**Canals and Canal Regulatory Works:** Types, alignment, typical sections of canals, balancing depth Kennedy's and Lacey's silt theories, canal lining-purpose, types, selection and economics. C.D.Works: Necessity, Types. Canal Regulatory Works: head regulator, cross regulator, canal fall, canal escape, standing wave flume.	05

References:
Reference Books:

- S. K. Garg, Irrigation engineering Vol I. Khanna Publication, Delhi.
- Dr. K. Subramanya, Engineering Hydrology, Tata McGraw Hill, New Delhi.
- Dr. P Jaya Rami Reddy, Hydrology, Laxmi Publications, New Delhi.
- Dr.H. M. Raghunath, Engineering Hydrology, New Age International Publishers.
- R.K.Sharma, Hydrology and water resources, Dhanpatrai and sons, New Delhi.
- A M Michael, Irrigation Theory and practice, Vikas Publications House.
- Varshney Gupta and Gupta, Theory and design of irrigation structures vol. I and II and II, Newchand and Brothers.
- Savindar Singh, Fundamentals of hydrology, Pravalika Publishers Allahabad.

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Department of Civil Engineering

Class: **S. Y. B. Tech. Civil**	Semester-IV
Course Code: **CE236**	Course Name: **Highway Engineering**

L	T	P	Credits
2	-	-	2

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 course imparts knowledge for road transportation, traffic survey, materials used for road & quality control, pavement design, highway construction & maintenance

Course Outcomes:

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

1. Design the geometric components of highway.
2. Determine traffic volume for design of road.
3. Perform different tests on highway materials.
4. Design the highway pavement.
5. Explain about construction and maintenance of highways.

Prerequisites: Nil

Course Content

Unit No.	Description	Hrs.
1.	**Highway Alignment and Geometric Design:** Introduction to highway engineering, highway alignment and factors controlling, IRC, different highway plans, PPP, criteria for geometric design, cross sectional element , Sight distance requirements, super elevation, radius of horizontal curves, extra widening, Horizontal curves, design of vertical alignment, gradient and its type, grade compensation on vertical curves	06
2.	**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	03
3.	**Highway Materials & Quality Control:** Aggregate properties for different layers of road, pavement quality concrete, bitumen and Tar- origin, properties of bituminous road binders, CBR, bituminous emulsions and cutback - preparation, characteristics uses and tests, bituminous mix design.	04
4.	**Flexible pavement design:**	04

	Elements of flexible, Concept of IRC charts, design factors , design of flexible pavement using IRC: 37-2018,	
5.	**Rigid pavement design:** Elements of rigid pavements, design factors, Stresses, dowel & tie bars, design of rigid pavement using IRC: 58-2015	04
6.	**Highway construction and maintenance:** Construction methods, equipments used, work process, maintenance of highways	03

References

Reference Books:

- Khanna, S.K., Justo C.E.G. and Veeraragavan A., Highway Engineering, Tata McGraw Hill Education
- Yang, H. Huang, Pavement Analysis and Design, Pearson Education.

Codes of Practice:

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

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Class:-S. Y. B. Tech	Semester-IV
Course Code : SH202	Course Name : मराठी भाषिक कौशल्यविकास

L	T	P	Credits
2	-	-	2

अभ्यासक्रम वर्णन: सर्वांगीण व्यक्तिमत्व विकासामध्ये विद्यार्थ्यास भाषा, साहित्य आणि कला परिणामकारकतेने समजावून घेणे आजची गरज बनली आहे. जीवनाच्या परिपूर्ण आकलनामध्ये आणि प्रगल्भतेसाठी विद्यार्थ्यांमध्ये भाषिक तसेच साहित्यिक क्षमता अडीच लागणे आवश्यक झाले आहे. या अभ्यासक्रमाद्वारे विद्यार्थी भाषा आणि व्यक्तिमत्व विकास यातील सहसंबंध समजून घेईल. विविध भाषिक कौशल्य आणि भाषा उपायोजनाची विविध अविष्कार रूपे यांची ओळख या अभ्यासक्रमाद्वारे विद्यार्थ्यास होईल. तसेच विद्यार्थी कथा आणि एकांकिका या मराठी साहित्य प्रकारातील लिखाणांचे विश्लेषण करू शकेल.

अभ्यासक्रम शिकण्याचे परिणाम:

हा अभ्यासक्रम यशस्वीपणे पूर्ण केल्यानंतर विद्यार्थी खालील क्षमता प्राप्त करेल:

१. भाषा आणि व्यक्तिमत्व विकास यांमधील सहसंबंध स्पष्ट करू शकेल
२. भाषिक कौशल्यविकास करू शकेल
३. कथा या मराठी साहित्य प्रकाराचे विश्लेषण करू शकेल
४. एकांकिका या मराठी साहित्य प्रकाराच्या विश्लेषणाची क्षमता प्राप्त करेल

पूर्वतयारी: विद्यार्थ्यांने मराठी भाषिक मूलभूत कौशल्य – ऐकणे, बोलणे, वाचन, आणि लेखन आत्मसात केलेली असावीत. तसेच, भाषिक कौशल्य विकासाची स्वयंप्रेरणा विद्यार्थ्यांमध्ये असावी.

अभ्यासक्रम वर्णन		
घटक	तपशील	तास
१.	भाषा आणि व्यक्तिमत्व विकास: सहसंबंध भाषिक कौशल्यविकास - नैसर्गिक: आकलनासह श्रवण	०४
२.	भाषिक कौशल्यविकास – अर्जित : संभाषण, वाचन, लेखन, इ-संवाद कौशल्य प्रगत: सारांशलेखन, सारग्रहण	०४
३.	भाषा उपयोजनाची विविध आविष्कार रूपे संवादलेखन, कल्पनाविस्तार, घोषवाक्य लेखन, भाषांतर	०४
४.	कथा : स्वरूप, घटक, आणि प्रकार (रचनाप्रकार आणि प्रवाह) एकांकिका : स्वरूप, घटक, संहितामूल्य व प्रयोगमूल्य	०४
५.	समकालीन मराठी कथा: १. लाल चिखल - भास्कर चंदनशिव २. कष्टाची भाकरी - सचिन पाटील	०४
६.	मराठी एकांकिका: विठ्ठल तो आला आला - पु. ल. देशपांडे	०४

संदर्भ ग्रंथ -

१. मराठी साहित्य : प्रेरणा आणि स्वरूप, संपादक डॉ. गो. मा. पवार, डॉ. म. द. हातकणंगलेकर, पॉप्युलर प्रकाशन, १९८६.
२. साहित्यमूल्य आणि अभिरुची, डॉ. गो. मा. पवार, साकेत प्रकाशन,
3. कथा : संकल्पना आणि समीक्षा, सुधा जोशी, मौज प्रकाशन, २०००.
४. व्यावहारिक मराठी, पुणे विद्यापीठ प्रकाशन, पुणे.
५. व्यावहारिक आणि उपयोजित मराठी, डॉ. मनोहर रोकडे, स्नेहवर्धन प्रकाशन,
६. मराठी भाषेची संवाद कौशल्ये (पुस्तक क्र. १ ते ८) य. न. म. मुक्त विद्यापीठ, नाशिक.
७. मराठी कथा : विसावे शतक, संपादक के. ज. पुरोहित, सुधा जोशी, मॅजेस्टिक प्रकाशन.
८. समकालीन मराठी कथा , (संपादक) डॉ. शिरीष लांडगे, डॉ. दिलीप पवार, डॉ. संदीप सांगळे. अक्षरबंध प्रकाशन, पुणे, २०१९.
9. मराठी भाषा उपयोजन आणि सर्जन, प्रा. सुहासकुमार बोबडे
१०. मराठी एकांकिका (विठ्ठल तो आला आला – पु. ल. देशपांडे, हंडाभर चांदण्या– दत्ता पाटील) सांपादक प्रा. डॉ. शिरीष लांडगे, प्रा. डॉ. बाळकृष्ण लळीत, प्रा. डॉ. भास्कर ढोक, पद्मगंधा प्रकाशन, पुणे, २०१९.
११. मराठी एकांकिका तंत्र व विकास, श्री. रं. भिडे, सुपर्ण प्रकाशन, पुणे.
१२.एकांकिका विचार आणि सर्वोत्तम एकांकिका, जयंत पवार व इतर, नेहरू सेंटर प्रकाशन, मुंबई १९९३.

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Class: - **S. Y. B. Tech.**	Semester-IV
Course Code : **SH204**	Course Name : हिंदी कथा साहित्य एवं प्रयोजमूलक हिंदी

L	T	P	Credits
2	--	--	2

पाठ्यक्रम परिचय

हिन्दी भारतीय आर्य भाषा परिवार की भाषा है। संस्कृत भाषा से लेकर पालि प्राकृत, अपभ्रंश आदि सोपानों से गुजरती हुई आज संपूर्ण भारत की संपर्क भाषा बन गई है। **हिन्दी भाषा** का विकास अंताक्षेत्रीय भाषा, राष्ट्रभाषा, राजभाषा और अंतर्राष्ट्रीय भाषा के रूप में हो रहा है। हमारे जन-जीवन, सामाजिक, सांस्कृतिक संप्रेषण ज्ञान-विज्ञान और सृजनात्मक साहित्य की **भाषा** के रूप में विकसित हिन्दी भाषा हमारी ही नहीं अपितु पूरे विश्व की शिक्षा व्यवस्थाओ में महत्वपूर्ण स्थान प्राप्त कर चुकी हैं।इसी का परिणाम है कि हिन्दी भाषा अपने देश में मातृभाषा प्रथम भाषा, दूसरी भाषा आदि रूपों में पढ़ी और पढाई जा रही है तथा यह भारत से बाहर अनेक देशों में भी अध्ययन और अध्यापन हो रहा है।स्वतंत्रता प्राप्ति के बाद सन् 1952 में **हिन्दी भाषा** को भारत की राजभाषा होने का गौरव प्राप्त हुआ | उत्तर प्रदेश, हिमाचल प्रदेश, हरियाणा, राजस्थान, मध्यप्रदेश, बिहार, उत्तरांचल, झारखंडता इत्तीसगढ़ राज्यों और दिल्ली एवं अंडमान सत्य राज्य-क्षेत्रों में शासन और शिक्षा की भाषा हिन्दी ही है।हम इस पाठ्यक्रम में हिंदी भाषा के इतिहास के साथ आधुनिक काव्य कहानी तथा व्यवहारिक हिंदी से परिचित कराएंगे

पाठ्यक्रम सीखने के प्रतिफल (Course Learning Outcomes:)

पाठ्यक्रम के सफल पूर्वक अध्ययन समाप्ति के बाद.....

1. विद्यार्थियों में मानवीय संवेदनाओं के विकास के साथ नवीन सामाजिक सांस्कृतिक बोधऔर जीवन मूल्यों का विकास होगा।
2. विद्यार्थियों में साहित्य के माध्यम से कलात्मक गुणों की अभिवृद्धि होगी कला की साहित्यिक विधाओं के प्रति अभिरुचि जागृत होगी तथा रचनात्मक कौशल्य को बढ़ावा मिलेगा।
3. विद्यार्थियों में नए वैश्विक मूल्यों के प्रति सजगता को बढ़ावा मिलेगा एवं मूल्यवादी दृष्टि के प्रति दायित्व बोध उत्पन्न होगा।छात्र व्यवहार में हिंदी भाषा का उचित प्रयोग कर सकेंगे।
4. छात्र व्यवहार में हिंदी भाषा का उचित प्रयोग कर सकेंगे।

Prerequisite: मूलभूत हिंदी भाषा बोलना समझना और लिखना

पाठ्यक्रम विवरण		
इकाई नंबर		घंटे
1.	**आधुनिक काव्य साहित्य** 1. वह तोड़ती पत्थर: सूर्यकांत त्रिपाठी 'निराला' 2. कोशिश करने वालों की हार नहीं होती: मोहनलाल द्विवेदी 3. एक और युद्ध: ओमप्रकाश वाल्मीकि	04
2.	**कहानी साहित्य:** 1. भगत की गत: हरिशंकर परसाई 2. कफन: प्रेमचंद 3. पंचलाइट: कनिस्वरनाथ रेणु	04
3.	**प्रयोजन मूलक हिंदी** 1. प्रयोजन मुलक हिंदी अर्थ परिभाषा स्वरूप 2. पारिभाषिक शब्दावली के रूप में 50 प्रति शब्दों की सूची संलग्न 3. अनुवाद: अर्थ स्वरूप परिभाषा महत्व	04
4.	**कार्यालयीन एवं व्यवसायिक पत्रलेखन:** 1.कार्यालयीन पत्र कार्यालय आदेश, कार्यालय ज्ञापन, कार्यालय परिपत्र, व्यवसायिक पत्र: 2.आवेदन (रिक्त पद, अवकाश) पूछताछ, क्रयादेश 3.शिकायती पत्र (सार्वजनिक)	04
5.	**जनसंचार माध्यम और हिंदी** 1.दूरदर्शन स्वरूप विकास उपयोगिता भाषा 2.इंटरनेट का स्वरूप विकास अनुप्रयोग 3.यूट्यूब स्वरूप विकास महत्व 4.वीडियो कॉन्फ्रेंस स्वरूप प्रक्रिया एवं उपयोग	04
6.	**हिंदी लेखन** 1.फीचर लेखन 2.पटकथा लेखन 3.रेडियो वार्ता लेखन	04

संदर्भ ग्रंथ:

१. अनुवाद के रूपरेखा डॉ सुरेश कुमार
२. अनुवाद के भाषिक पक्ष: विभा गुप्ता
३. भाषा प्रौद्योगिकी एवं भाषा प्रबंधन: सूर्य प्रकाश दीक्षित
४. प्रयोजनमूलक हिंदी प्रयुक्ति और अनुवाद: डॉ. माधव सोनतक्के
५. भारतीय काव्यशास्त्र: डॉ. योगेंद्र प्रताप सिंह
६. आधुनिक हिंदी साहित्य में व्यंग्य: वीरेंद्र मेहंदीरता
७. कार्यालय दीपिका हरिबाबू कंसल
८. आधुनिक पत्रकारिता डॉ अर्जुन तिवारी

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To be implemented for 2023-27 and 2024-28 NEP Batch

Department of Civil Engineering

Class: **S. Y. B. Tech.**	Semester-IV
Course Code: **CEMD202**	Course Name: **Building Estimation and Valuation**

L	T	P	Credits
3	--	--	3

Course Description:

Building Estimation and Valuation 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 Outcomes:

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

1. Explain the types and basic requirements of the estimate.
2. Explain measurement sheet, abstract sheet, and detailed specifications of different construction items.
3. Prepare detailed estimate of load bearing structure and framed structure.
4. Prepare rate analysis and bar bending schedule of different construction items.
5. Explain the tenders and contracts.
6. Describe basic terms of valuation.

Prerequisite: Unit conversions and the fundamental information of different construction materials with their rates.

Course Content

Unit No.	Description	Hrs.
1.	**Introduction SSR:** General introduction to Quantity surveying, Purpose of estimates, Types of Estimates- Approximate and Detailed, Various items to be included in estimates of building, road and culvert with their modes of measurement, 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.	06
2.	**Specifications:** Specification- purpose and types, General specifications for different class of buildings, Detailed specifications of building items like PCC, RCC, brick and stone masonry, plastering, flooring. Measurement sheet, Abstract sheet, Long wall-short wall and center line method for finding quantities and problems.	06

3.	**Detailed estimate of building, road and culvert:** Detailed estimate of load bearing structures and RCC structures.	06
4.	**Rate Analysis and Schedule of Reinforcement:** Importance of rate analysis, Factors affecting the cost of materials, labour, Task work, Transports, Overhead charges, market rates of various materials, labours. Rate analysis preparation of PCC, RCC, brick and stone masonry, plastering, pointing, flooring. Preparation of bar bending schedule for isolated footings, pile footings, beams, columns, slabs, staircase, lintel, chajja.	06
5.	**Introduction of Tender and Contracts:** Tender- Notice, Documents, Procedure and Types, Contract- Types, Conditions, Earnest money, Security deposit, Validity period, Defect liability period, Liquidated and liquidated damage, Arbitration, Escalation of cost, Daily reports maintained on site.	06
6.	**Valuation:** Definition, 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, Methods of valuation, Freehold and leasehold property, types of lease, Mortgage, Mortgage deed and Precautions, Problems based on valuation.	06

References –

References Books: -

- B. N. Dutta, "Estimating and Costing in Civil Engineering", USB Publishers, Distributors Pvt. Ltd. Delhi-110 002.
- M. Chakroborty, "Estimating, Costing, Specification and Valuation in Civil Engineering", USB Publishers, Bhabananda Road, Kolkata-700026.
- B. S. Patil, "Civil Engineering Contracts and Estimates", Universities Press Private Ltd. Hyderguda, Hyderabad. 500029, (A.P), India.
- S. C. Rangwala, "Elements of Estimating and Costing", Charotar Publishing House - opposite Amul dairy, court Road Anand. 388001.India

I. S. Code:-

- Updated I. S. 1200
- Updated S. S. R.

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To be implemented for 2023-27 and 2024-28 NEP Batch

Department of Civil Engineering

Class: - **S. Y. B. Tech**	Semester – **IV**
Course Code: **CSMD202**	Course Name: **Problem Solving using JAVA**

L	T	P	Credits
2	-	2	3

Course Description:

This course introduces object-oriented programming using the Java programming language. Students will learn how to program in Java and use some of its most important APIs. Special importance will be assigned to the object-oriented nature of Java and its use of polymorphism. Hands-on labs and exercises will enable students toward becoming highly skilled Java Application developers.

Course Learning Outcomes:

After successful completion of the course, strudels will be able to:

1. Understand the basic object oriented programming concepts and apply them in problem solving.
2. Apply concept of inheritance for code reusability.
3. Develop Programs using multithreading.
4. Develop data-centric applications using JDBC.
5. Design the basics of java console and GUI based programming

Prerequisites: Concepts of C programming language

Course Content		
Unit No.	**Description**	**Hrs.**
1	**OOPS Concepts and Java Programming:** OOP concepts: Classes and objects, data abstraction, encapsulation, inheritance, polymorphism, Java programming: History of java, comments data types, variables, constants, scope and life time of variables, operators, operator hierarchy, expressions, type conversion and casting, enumerated types, control structure, simple java standalone programs, arrays, console input and output, formatting output, constructors ,methods, parameter passing, static fields and methods, access control, this reference, overloading methods and constructors, recursion, garbage collection.	05
2	**Interfaces and Packages:** Interface: Interfaces VS Abstract classes, defining an interface, implement interfaces, accessing implementations through interface references,	04

	extending interface; Packages: Defining, creating and accessing a package, understanding CLASSPATH, importing packages.	
3	**Exception Handling and Multithreading:** Exception Handling: Benefits of exception handling, the classification of exceptions, exception hierarchy, checked exceptions and unchecked exceptions, usage of try, catch, throw, throws and finally, re-throwing exceptions, exception specification, built in exceptions, creating own exception sub classes. Multithreading: Differences between multiple processes and multiple threads, thread states, creating threads, interrupting threads, thread priorities, synchronizing threads, inter thread communication.	04
4	**Files Handling:** Files: streams, byte streams, character stream, text input/output, binary input/output, random access file operations, file management using file class.	03
5	**Connecting to Database:** Introduction of different types of driver's for database connectivity, querying a database and processing the results, updating data with JDBC.	04
6	**GUI Programming:** GUI Programming with Java: The AWT class hierarchy, introduction to swing, swings Vs AWT, hierarchy for swing components. Containers: JFrame, JApplet, JDialog, Jpanel, overview of some swing components: JButton, JLabel, JTextField, JTextArea, simple applications.Layout management: Layout manager types, border, grid and flow.	04

It should consist of minimum 10 experiments based on the syllabus and experiment list mentioned below.

Course Content		
Exp. No.	**Description**	Hrs.
1.	Implement Arrays, Control and Looping Statements	02
2.	Implement Access Control and Inheritance	02
3.	Implement Polymorphism, Abstraction and Inner class	02
4.	Implement Static and this keyword	02
5.	Implement Creating package for Custom Exception Interfaces and Vectors	02
6.	Implement Class, Object, String classes	02
7.	Implement Multithreading in Java	02
8.	Implement File System interaction	02

9.	Implement GUI Design using AWT	02
10.	Implement GUI Design using Swing	02

References -

Text Books:

- Herbert Schildt and Dale Skrien, "Java Fundamentals – A comprehensive Introduction", McGraw Hill, 2013.
- Herbert Schildt, "Java the complete reference", McGraw Hill, Osborne, 2011.
- T.Budd, "Understanding Object- Oriented Programming with Java", Pearson Education, 1999.

Reference Books:

- P. J. Dietel and H. M. Dietel , "Java How to program", Prentice Hall, 2005.
- P. RadhaKrishna , "Object Oriented programming through Java", CRC Press, 2007.
- S. Malhotra and S. Choudhary, "Programming in Java", Oxford University Press, 2014 .

Class:- **S. Y. B. Tech.**	Semester- **IV**
Course Code : **EEMD202**	Course Name : **Power System**

L	T	P	Credits
3	--	-	3

Course Description:
The power system comprises of generation, transmission and distribution of electric power This course covers economics of power generation using different types of generating sources. Different types of loads in power system, Moreover, this course covers importance of power factor in power system and different types of tariffs. Overview of transmission and distribution systems.

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

1. Write the basic working principles of different generating sources.
2. Analyze different types of loads
3. Explain importance of power factor and tariffs in power system.
4. Identify various components in power transmission and distribution system.
5. Select substation equipments as per requirement.

Prerequisite: Basic Electrical Engineering, Basic Mathematics and Physics.

Course Content		
Unit No	**Description**	**Hrs**
1	**Power Generation :** Structure of power system, generating stations – operation and working of conventional and nonconventional energy sources. Comparison between them	06
2	**Variable load on power stations:** Load curves and types of loads – base and peak loads, cost of electrical energy, depreciation and its methods.	06
3	**Power factor and Electric Tariff:** Power triangle, power factor and causes of low power factor and methods of power factor improvement. Tariff and its characteristics.	06
4	**Electrical and Mechanical Design of Transmission lines:** Construction of transmission lines and its components, line resistance, inductance and capacitance. Sag and its calculation, String efficiency	06
5	**Supply systems:** AC and DC transmission systems and comparison. Overhead and underground system, Construction of cables and types.	06
6	**Substation:** Classification of substations, outdoor and indoor substations. Symbols for equipments in substations and their functions	06

References -
Text Books:

- V.K Mehta, Principles of Power Systems, S. Chand
- Ashfak Husain, Electrical Power System, CBS Publication

Reference Books:

- S.Sivanagaraju and S. Satyanarayana Electric Power Transmission and Distribution, Pearson
- W.D. Stevenson (Jr.), Elements of Power System Analysis, McGraw Hill International

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Department of Civil Engineering

Class:- **S.Y. B. Tech.**	Semester- IV
Course Code : **ECMD202**	Course Name: **Electronics Communication Systems**

L	T	P	Credits
3	-	-	3

Course Description:
Analog and Digital Communication are the fundamental and core subjects in Electronics and Telecommunication Engineering. The course provides knowledge of basic principles of communication, modulation and demodulation techniques, transmission and reception methods in analog as well as digital communication.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Describe different communication systems.
2. Explain applications of analog and digital modulation techniques.
3. Analyze different modulation and demodulation techniques.
4. Explain the use of satellite communication.

Prerequisite: Fundamental concepts of engineering and Mathematics

Course Content

Unit No	Description	Hrs
1.	**Amplitude Modulation & Demodulation** Electromagnetic spectrum, Introduction to communication system, Need for modulation. Amplitude Modulation, Definition, Time domain and frequency domain description, power relations in AM waves. Generation of AM waves, Detection of AM Waves.	06
2.	**Frequency Modulation & Demodulation** Introduction of FM, Description of systems, Mathematical representation of FM, Frequency Spectrum of FM wave, Phase modulation, Intersystem comparisons, Pre-emphasis and de-emphasis, Generation of Frequency Modulation and Demodulation methods, Angle Modulation.	06
3.	**Radio Receivers** Function of AM receiver, receiver parameters: Sensitivity, Selectivity, Dynamic Range, Tracking, Fidelity, Receiver Types- Tuned Radio Frequency(TRF) receiver, AM Receiver- RF section, Mixer, IF Frequencies and Amplifiers, FM Receivers- Common circuits, Comparison with AM receivers, Amplitude Limiting.	06
4.	**Digital Modulation Techniques** And Data Formats Data Formats, ASK, FSK, PSK, coherent and non-coherent reception, BPSK, DPSK, QPSK, 16-QAM, MSK, Waveforms and Comparison of digital modulation	06

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5.	**Satellite Communication:** Basic concepts of Satellite Communications, Satellite subsystems, Satellite Link design, Orbital Mechanics,	06
6.	**Satellite Application:** DBS, VSAT, GPS, Case Studies – Mars Mission, Chandrayan.	06

Text Books:

- K.Sam Shanmugan, Digital & Analog Communication Systems, Wiley India
- RP Singh, S D Sapre, Communication System-Analog & Digital, Tata Mc-Graw Hill
- Kennedy, Davis, Electronics Communication Systems, Tata McGraw Hill

Reference Books:

- Bernard Sklar, Digital Communication-Fundamentals and Applications, Pearson Education
- Tomasi, Electronic Communication Systems Pearson Education.
- Taub, Schilling, Principles of communication systems, Tata McGraw Hill.
- Louis E Frenzel, Communication Electronics Principles & Applications, Tata McGraw Hill

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Class:- **S.Y. B. Tech**	Semester-IV
Course Code : **CIMD202**	Course Name : **Computer Algorithms**

L	T	P	Credits
3	--	--	3

Course Description:

This course introduces students to the design of computer algorithms, as well as analysis of sophisticated algorithms. It contains design and analysis of algorithms to solve wide variety of problems including searching, sorting and graph algorithms. It covers various techniques that can be used to solve new problems you face, like divide and conquer, greedy algorithms, dynamic programming etc.

Course Learning Outcomes:

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

1. Analysing asymptotically the performance of algorithms.
2. Compare and analyse searching and sorting algorithms.
3. Apply different algorithm design techniques to solve problems like job sequencing, knapsack, TSP, finding shortest path etc.
4. Apply backtracking method to solve problems like N-queens, graph coloring, sum of subsets etc.
5. Describe computational complexity theory to classify computational problems according to their inherent difficulty.

Prerequisite: Basic knowledge of Mathematics

Course Content		
Unit No	**Description**	**Hrs**
1.	**Introduction** Introduction, Characteristics of algorithm, Pseudocode conventions, Recursive algorithms, Performance analysis – time and Space complexity, asymptotic notations..	05
2.	**Searching and Sorting Methods** Linear Search, Binary Search, Bubble sort, Quick Sort, Merge Sort, Selection Sort, Insertion sort, Radix Sort, Bucket Sort. Divide and Conquer- General method, Finding the maximum and minimum, Strassen's matrix multiplication.	07
3.	**Greedy Method** General method, Knapsack problem, Job sequencing with deadlines, Minimum-cost spanning trees – Prim's And Kruskal's algorithms, Optimal storage on tapes, Single source shortest paths.	05

4.	**Dynamic Programming** General method, Multistage graphs, All pair shortest paths, 0/1 Knapsack problem, Reliability design, Traveling sales person problem.	07
5.	**Backtracking** General method, n-Queens problem, Subset sum problem, Graph coloring problem, Travelling sales person problem.	06
6.	**Introduction to Complexity Theory** The P and NP Classes, Polynomial, time reductions, NP- Hard and NP-Complete classes. NP-Hard graph problems- Clique decision problem, Vertex cover problem, Travelling sales person decision problem, Randomized algorithms.	06

References -

Text Books:

- Ellis Horowitz, Satraj Sahani, Saguthevar Rajasejaran, "Fundamentals of Computer Algorithms", Universities Press.
- Cormen, Thomas H., Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms" The MIT Press.

Reference Books:

- Sara Baase & Allen VanGelder "Computer Algorithms: Introduction to Design & Analysis", Addision Wesley.
- Alfred V. Aho , "The design and analysis of computer algorithms", Addison-Wesley Pub.

Class:- **S.Y. B. Tech.**	Semester-IV
Course Code : **MEMD204**	Course Name : **Behavioral Engineering and Design**

L	T	P	Credits
3	--	--	3

Course Description:
This course delves into the principles and practices of behavioral engineering and design as applied to the creation of new products, encompassing physical consumer goods as well as software and mobile applications. Through theoretical exploration and hands-on projects, students will learn how to design products that effectively influence user behavior and enhance user experience.

Course Learning Outcomes:
After successful completion of the course, student will be able to:
1. Explain key concepts and theories related to influencing user behavior in product design.
2. Utilize psychological principles to develop product designs that effectively address user needs and preferences.
3. Create products that demonstrate high levels of user engagement, measured through metrics such as adoption rates and user interaction patterns.
4. Develop products that prioritize user satisfaction and usability, as measured through user testing and feedback.
5. Incorporate aesthetic appeal and ergonomic considerations into product designs, assessed through objective criteria such as user comfort and visual appeal ratings.
6. Analyze user feedback and iteratively improve designs to enhance user experience, measured by improvements in user satisfaction scores or usability metrics.

Prerequisite:
Course on Design Thinking

Course Content

Unit No.	Description	Hrs
1.	**Behavioral Engineering and Design for Product Innovation:** Overview of behavioral engineering and its relevance in product design, Key concepts and theoretical frameworks, Understanding the role of psychology in product development, Ethical considerations in designing products for behavior change	06

2.	**Human Behavior and Product Design:** Psychological principles influencing user behavior, Factors affecting consumer decision-making, User experience (UX) design principles for physical and digital products, Designing for emotional engagement and user satisfaction	06
3.	**Applying Behavioral Insights in New Product Development:** Integrating behavioral research into the product design process, Behavioral design techniques for enhancing product adoption and usage, Case studies of successful products leveraging behavioral engineering principles, Hands-on exercises in applying behavioral insights to product ideation and prototyping	06
4.	**Persuasive Design for Consumer Products:** Principles of persuasive design in consumer product development, Creating compelling product experiences through persuasive techniques, Designing for habit formation and behavior change, Ethical considerations in persuasive product design.	06
5.	**Behavioral Engineering in Software and Mobile App Design:** Designing intuitive user interfaces (UI) and user experiences (UX) for software and mobile apps, Leveraging behavioral psychology in app onboarding and user engagement strategies, Gamification and motivational design principles, Usability testing and iteration in software and app development	06
6.	**Aesthetics and Ergonomics in Product Design:** Principles of aesthetic design and its impact on user perception, Integrating aesthetics with functional design requirements, Understanding anthropometrics and ergonomics in product design, Case studies of products exemplifying successful integration of aesthetics and ergonomics	06

References:-

- Nir Eyal, "Hooked: How to Build Habit-Forming Products", Penguin Books Limited
- Don Norman, "The Design of Everyday Things", Basic Books Publication
- Stephen Anderson, "Seductive Interaction Design: Creating Playful, Fun, and Effective User Experiences", New Riders Publication
- William Lidwell, Kritina Holden, and Jill Butler, "Universal Principles of Design", Rockport Publishers
- Mark S. Sanders and Ernest J. McCormick, "Human Factors in Engineering and Design", McGraw-Hill Publication

Class: **S. Y. B. Tech.**	Semester: **IV**
Course Code: **MCMD202**	Course Name: **Industrial Fluid Power**

L	T	P	Credits
3	-	--	3

Course Description:
Fluid power has the highest power density of all conventional power-transmission technologies. Learn the benefits and limitations of fluid power, how to analyse fluid power components and circuits, and how to design and simulate fluid power circuits using Automation Studio for applications.
In this course, you will be introduced to the fundamental principles and analytical modelling of fluid power components, circuits, and systems. You will learn the benefits and limitations of fluid power compared with other power transmission technologies; the operation, use, and symbols of common hydraulic & pneumatic components; how to formulate and analyse models of hydraulic & pneumatic components and circuits; and how to design and predict the performance of fluid power circuits.

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

1. Describe the structure and function of common hydraulic and pneumatic components such as cylinders, valves, pumps, and motors etc.
2. Model and analyze common hydraulic and pneumatic components such as cylinders, valves, pumps, and motors.
3. Create & simulate basic hydraulic and pneumatic circuit diagrams for different applications.
4. Design, develop & analyze simple hydraulic and pneumatic systems for given task.

Prerequisite: Fundamental concepts of fluid mechanics, basic electrical engineering, and engineering mechanics.

Course Content		
Unit No.	**Description**	**Hrs.**
1.	**FLUID POWER SYSTEMS AND FUNDAMENTALS** 1. Introduction to fluid power, Advantages of fluid power. 2. Application of fluid power system. 3. Types of fluid power systems, Properties of hydraulic fluids, General types of fluids. 4. Fluid power symbols. (ISO/JIC) 5. Use of Automation studio to draw circuits.	06
2.	**HYDRAULIC SYSTEM AND COMPONENTS (PUMPS and**	06

	ACTUATORS) 1. Pumping theory, Pump classification. 2. Gear pump, Vane Pump, construction and working of pumps, pump performance, piston pump 3. Variable displacement pumps. 4. Linear hydraulic actuators, Types of hydraulic cylinders, Single acting, Double acting cylinders. 5. Special cylinders like tandem, Rod less, Telescopic - Construction and application. 6.Cushioning mechanism, Mounting of actuators 7. Rotary actuators - Gear, Vane and Piston motors.	
3.	**HYDRAULIC VALVES, ACCUMULATORS AND CIRCUITS** 1. Directional control valve .4/2, 4/3, 5/3-way valves. 2. Shuttle valve check valve 3. Pressure control valve,4. Flow control valve (Fixed and adjustable) 5. Electrical control solenoid valves 6. Types of accumulators, Accumulators circuits 7. Intensifier Circuit and Application, 8. Speed control circuits, synchronizing circuit and industrial application circuits copying circuit and press circuit, regenerative circuit.	06
4.	**PNEUMATIC SYSTEMS, COMPONENTS AND CIRCUITS** 1.Properties of air Compressors. 2.Filter, Regulator, and Lubricator Unit 3. Air control valves, Quick exhaust valves and pneumatic actuators 4. Pneumo-hydraulic circuit 5. Time delay circuits 6. Sequential circuit design for simple applications using cascade method.	06
5.	**FLUID LOGIC CONTROL SYSTEM** 1. Hydro Mechanical servo systems. 2 Electro-hydraulic and Electro-pneumatic systems and proportional valves 3. Electro-hydraulic and Electro-pneumatic systems and proportional valves 4. Introduction to fluidic devices, simple circuits 5. PLC applications in fluid power control 6. Failure and troubleshooting in fluid power systems 8. Pneumatic positioning and servo systems, air hydro boosters.	06
6.	**HYDRAULIC/PNEUMATIC CIRCUIT DESIGN** 1. Steps in hydraulic circuit design, and simulation using Automation Studio. 2. Steps in pneumatic circuit design, and simulation using Automation Studio.	06

References -

Textbooks:

- Fluid Power, Anthony Esposito, Prentice Hall Publications.
- Industrial Hydraulics and Pneumatics, Stewart
- Industrial Hydraulics and Pneumatics, H.P. Garg.
- Oil Hydraulic Systems: Principles and Maintenance by S. R. Mujumdar.

Reference Books:

- Industrial Hydraulics, Vickers Handbook.
- Hydraulics-Basic level TP501 handbook by FESTO.

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Department of Civil Engineering

Class:- **S.Y. B. Tech.**	Semester- **IV**
Course Code : **AIMD202**	Course Name : **Data Structures & Algorithms**

L	T	P	Credits
3	--	--	3

Course Description:
The Data Structures and Algorithms course is a comprehensive study of fundamental concepts and techniques essential for efficient problem-solving in computer science. Students will explore various data structures, including arrays, linked lists, stacks, queues, trees, graphs, and hash tables, and learn how to analyze their time and space complexity. The course extensively explores the design and analysis of algorithms, encompassing various topics such as sorting, searching, and graph traversal. Emphasis is placed on understanding algorithmic paradigms and their applications. Through programming assignments and theoretical exercises, students will gain practical experience in implementing algorithms and solving real-world problems. This course serves as a foundation for algorithmic thinking and prepares students for advanced computer science topics.

Course Outcomes:
The course should enable the students to:
1. Compare between linear and nonlinear data structures
2. Describe the characteristics of various data structure such as stacks, queues, trees, graphs and Hash tables.
3. Analyze various searching and sorting algorithms and apply it to solve particular problem.
4. Determine a suitable data structure and algorithm to solve a real world problem

Prerequisite: Basic knowledge of C programming, Knowledge of basic mathematical concepts

Course Content		
Unit No	**Description**	**Hrs**
1	**Introduction to Data Structures:** Primitive and non-primitive data structures, Operations on data structures, Algorithms, Abstract Data Types, Complexity Analysis	05
2	**Linear Data Structures:** **Stack:** Definition, Representation and Applications of Stack. **Queue:** Definitions, Representation and Applications of Linear Queue, Circular Queue, and Priority Queue.	06
3	**Linked Lists:** Definition, Representation, Operations and Applications of singly linked list, doubly linked list, circular linked list, Application of linked list-Stack & queue, Introduction to Sparse matrix, representation of sparse matrix using linked list.	07

4	**Searching ,Sorting and Hashing Techniques :** Linear search, Binary search, Bubble sort, insertion sort, Merge sort, Quick sort, Selection sort, Radix sort, Heap sort, Complexity of algorithms **Hashing**: Definition, Hash functions, Overflow, Collision, Open Hashing, closed hashing, Rehashing Techniques.	07
5	**Trees:** Basic Technology, Binary Tree, Traversal methods, Binary search tree, AVL Tree, B tree, B+ tree, Heaps - operations and their applications.	06
6	**Graphs:** Basic concepts of graph theory, Storage representation, Operations on graphs, Traversing a graph, Shortest path algorithm.	05

References -

Text Books:

- Data structures -- Seymour Lipschutz (MGH) Schaum's Outlines.

Reference Books:

- Data structures and Algorithms -- Alfred V. Aho, John E. Hopcroft, J. D. Ullman (Addision- Wesely Series)
- Introduction to Data Structures in C – Ashok N. Kamthane (Pearson Education).

Class: **S. Y. B. Tech.**	Semester: **III**
Course Code: **RAMD202**	Course: **Sensors & Actuators**

L	T	P	Credits
3	-	-	3

Course Description: The goal of this course is to give senior and graduate students in engineering a hands-on introduction to the fundamental technology and practical applications of sensors. Various sensors, including capacitive, inductive, ultrasonic, accelerometers, image sensors and others will be covered in the course. Instrumentation techniques incorporating computer control, sampling, and data collection and analysis are reviewed in the context of real-world scenarios. There will be weekly laboratory assignments where students will have hands on experience with various sensors.

The course is based around a custom board equipped with various sensors, such as a high speed camera, touch sensor, humidity sensor, temperature sensor, pressure sensor, accelerometer and position sensor. Additional peripheral sensors using the PMOD interface standard can also be attached to the sensor board. The board interfaces with these sensors via an FPGA device and it can also communicate with a PC via USB 3.0 interface. Students will use Verilog language to program the FPGA and communicate with various sensors and PC.

Course Outcomes:

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

1. Explain the functioning of various sensors and transducers
2. Calibrate the transducers such as accelerometers, microphones and strain gauges.
3. Explain the characteristics of various sensors and transducers
4. Describe the process and need for calibration.
5. Choose the sensor for measurement of few parameters.
6. Use the appropriate sensor and calibrate

Prerequisite: A basic course on Automotive engineering and Electrical machines is recommended as pre-requisites for this course.

Course Content:

Unit No.	Description	Hrs.
1	**Sensors:** Difference between sensor, transmitter and transducer - Primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, backlash, Response time, Dead band. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal. Principle of operation, construction details, characteristics and applications of potentiometer, Proving Rings, Strain Gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance Hygrometer, Photo-resistive sensor.	06
2	**Inductive & Capacitive Transducer:** Inductive transducers: - Principle of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, variable reluctance transducer, Capacitive transducers:- Principle of operation, construction details, characteristics of Capacitive transducers – different types & signal	06

	conditioning- Applications:- capacitor microphone, capacitive pressure sensor, proximity sensor	
3	**Intelligent Sensors:** General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Selftesting & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control.	06
4	**Micro Sensors and Micro Actuators:** Micro Sensors: Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors. Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles	06
5	**Sensor Materials and Processing Techniques:** Materials for sensors: Silicon, Plastics, metals, ceramics, glasses, nano materials Processing techniques: Vacuum deposition, sputtering, chemical vapour deposition, electro plating, photolithography, silicon micro machining, Bulk silicon micro machining, Surface silicon micro machining, LIGA process	06
6	**Actuators:** Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria. Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors- Principle of operation and its application: D.C motors - AC motors - Single phase & 3 Phase Induction Motor; Synchronous Motor; Stepper motors - Piezoelectric Actuator.	06

References –

Text Book:

- DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013
- D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
- S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994.
- Gary Johnson / Lab VIEW Graphical Programing II Edition / McGraw Hill 1997.
- Patranabis. D, "Sensors and Transducers", Wheeler publisher, 1994.
- Sergej Fatikow and Ulrich Rembold, "Microsystem Technology and Microbotics", First edition, Springer –Verlag NEwyork, Inc, 1997.
- Jacob Fraden, "Hand Book of Modern Sensors: Physics, Designs and Application" Fourth edition, Springer, 2010.

Reference Books:

- Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition.
- A.D. Helfrick and W.D. cooper, Modern Electronic Instrumentation & Measurement Techniques, PHI – 2001
- Hermann K.P. Neubert, "Instrument Transducers", Oxford University Press.

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Class: **S. Y. B. Tech. Civil**	Semester-**IV**
Course Code:**CE2184**	Course Name: **Concrete Technology Laboratory**

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 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. Evaluate the quality of concrete specimens / elements using NDT equipment

Laboratory Content

Expt. No.	Name of Experiment	Hrs.
1.	**Tests on Cement** a) Fineness, Sp. Gravity, Consistency, Initial and Final setting time, Soundness test b) Compressive Strength Test	4
2.	**Tests on Fine and Coarse Aggregates** a) **Fine Aggt:** Sieve Analysis, Sp. Gravity, Bulk Density, Water Absorption, Moisture Content, bulking of sand, silt content	4

	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)	4
5.	**Tests on Hardened Concrete:** Compressive Strength on Cube & Cylinder, Flexural Test, Split Tensile Strength Test.	4
6.	**Non Destructive Tests:** Rebound Hammer, UPV, Concrete Scanner, Carbonation test	2
7	**Visit to a concrete construction site/ Plant.** Viz. Building construction, Road construction, Bridge construction, Dam construction, Cement manufacturing plant, RMC plant, Stone crushers etc.	2

References –

Reference Books:

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

Class: **S. Y. B. Tech. Civil**	Semester: **IV**
Course Code: **CE2164**	Course Name: **Fluid Mechanics Laboratory**

L	T	P	Credits
-	-	2	1

Course Description:

Fluid mechanics is a complex mathematical numerical solving method, typically using computer codes and high-end software's. A modern discipline, called computational fluid dynamics (CFD), is devoted to this approach for solving a practical fluid mechanics problem. Experimental methods support to visualize and analyze the pipe and open channel fluid flow in nature. Fluid static studies the conditions of fluid properties and Pascal's law when fluid at rest or body at stable equilibrium conditions. Fluid dynamics studies the fluid flow properties at motion.

Course Outcomes:

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

1. Determine fluid properties.
2. Design most economical open channel section.
3. Measure velocity of flow using wind tunnel.

Prerequisites: Engineering Mathematics, Quantum Physics

Laboratory Content		
Expt. No.	**Name of Experiment**	**Hrs**
1	Use of Pressure measuring devices	02
2	Verification of Bernoulli's Theorem	02
3	Determination of Metacentric height (Stability of Submerged and floating body)	02
4	Determination of coefficient of discharge by using a venturi-meter	02
5	Identify of type of flow using Reynolds apparatus	02
6	Determination of major losses, when fluid is flowing through a closed pipe	02
7	Determination of losses of head due to sudden expansion, contraction, elbow, bend, globe valve etc. (Minor head loss)	02
8	Determination of coefficient of contraction C_c, Coefficient of Velocity C_v and Coefficient of discharge using Orifice.	02
9	Determination of equivalent pipe diameter when flow through parallel and series pipes.	02
10	Calculate coefficient of discharge for V-notch and rectangular notch	02
11	Flow velocity measurement using Wind Tunnel	02
12	Design of pipe water network for small area using EPA net software	02

Text Books:

- Modi, P.N. and Seth, S.M., Hydraulics and Fluid Mechanics Including Hydraulics

Machines. Rajsons Publications Pvt. Ltd.
- Bansal, R. K. A textbook of fluid mechanics. Firewall Media.
- Pritchard, P.J. and Mitchell, J.W. Fox and McDonald's introduction to fluid mechanics. John Wiley & Sons.

Reference Books:
- Jain, A. K. Fluid Mechanics: Including Hydraulic Mechanics. Khanna Publishers.
- Khurmi, R. S. "Hydraulics and Hydraulic Mechanics" S. Chand & Company Ltd. New Delhi.
- J. Lal, "Fluid Mechanics and Hydraulics" Metropolitan Book Co. Ltd.
- Y.A. Cingel L.M. Oimbala, Fluid Mechanics (SI Units)", Tata McGraw Hill.
- R.S. Rajput, "Hydraulic & Hydraulic Mechanics" S. Chand & Company Ltd. New Delhi.

Class: **S. Y. B. Tech. Civil**	Semester-IV
Course Code: **CE238**	Course Name: **Highway Materials Testing Laboratory**

L	T	P	Credits
-	-	2	1

Course Description

The objective of this 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 Outcomes:

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

1. Perform quality control tests on aggregate and bitumen.
2. Suggest suitable material for road construction.
3. Perform quality control tests on bituminous pavement.

Prerequisites: Nil

Laboratory Content

Expt. No.	Name of Experiment	Hrs.
1.	To determine aggregate impact value of aggregates used in road construction	02
2.	To determine crushing value of aggregates.	02
3.	To determine abrasion value of aggregates by Los Angeles Abrasion Test	02
4.	To determine specific gravity and water absorption of aggregates used in road construction	02
5.	To determine penetration value of bitumen	02
6.	To determine softening point of bitumen	02
7.	To determine flash and fire point of bitumen	02
8.	To determine viscosity of bitumen	02
9.	To determine ductility test on bitumen	02
10.	To estimate binder content in bituminous mixture by centrifugal extraction method	02
11.	To determine skid resistance of road pavement	02
12.	To find bearing capacity of soil by Dynamic Cone Penetration Test	02

References

Text Book:

- Khanna, S.K., Justo C.E.G. and A Veeraragavan Highway Engineering, New Chand and Brothers.

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

Codes of Practice:

- IRC 37 (2018), Guidelines for the Design of Flexible Pavements, Indian Roads Congress, 4th Edition.
- IRC 58 (2015), Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, Indian Roads Congress.

Class: **S. Y. B. Tech Civil**	Semester: **IV**
Course Code: **CE240**	Course Name: **Practical Aspects of Construction Supervision**

L	T	P	Credits
-	-	2	1

Course Outcomes:
After successful completion of the course the student will be able to:
1. Read the working drawings and perform the inspection of different work items of building construction as per the given detailing and specifications.
2. Judge the quality of on-site construction materials and the different work items of building construction.
3. Perform independently the supervision work of any building as per the provided drawings and detailed specifications

Pre-requisite: Basic knowledge of engineering drawing and mathematics

Course Content		
Exercise No.	**Description**	**Hrs**
1.	Reading of various drawing/documents of a building	02
2.	Study of various building byelaws, rules and regulations applicable to various plan sanctioning authorities	02
3.	Collecting the rates of different construction materials and labor by market survey.	06
4.	Setting out of the building using centre line plan	02
5.	Field testing of different construction materials for judging their qualities (bricks, sand, aggregates, and cement)	04
6.	Supervising the construction activities of the building and preparing report on it (min. 2days)	08

References:

- Pramod Beri, Building construction and supervision- Practical Handbook (Third Edition), DIT publications.

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Class: Third Year B. Tech. Civil	**Semester: V**
Course Code: CE3015	**Course Name: Design of Steel Structures**

L	T	P	Credits
3	-	-	3

Course Description:

This course is intended to develop a fundamental ability to analyses the design forces in the members of steel structures and design steel tension members, compression members, columns, column bases, etc. and their connections by using IS provisions.

Course Learning Outcomes:

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

1. Analyse and design of connections.
2. Analyse the steel tension and compression members.
3. Design the steel tension and compression members.

Prerequisite: Possess basic knowledge of Statistic, Strength of material

Course Content		
Unit No.	**Description**	**Hrs**
01	**Introduction to Design of Steel Structures:** Advantages of steel as a structural material, permissible stresses, factor of safety, Methods of design, various types of standards rolled sections, introduction to cold formed light gauge steel. Introduction to Limit state Method: Basic concept of Limit state Method, analysis procedure and design philosophy, loads and load combinations, partial safety factors for loads and materials, comparison with working stress method.	06
02	**Tension members:** Types of Tension members and Common sections, behavior of tension members, modes of failure, load carrying capacity, Net area — Net effective sections for Plates, Angles and Tee in tension –Concepts of Shear Lag- Design of plate and angle tension members design of angle sections in trusses, design of bolted and welded connections.	06
03	**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
04	**Design of connections:** Types of connections, bolted and welded, types of simple bolted and welded connections, Relative advantages and Limitations-Modes of failure-the concept of Shear lag-efficiency of joints- Axially loaded bolted connections	06

	for Plates and Angle Members.	
05	**Design of Columns:** Load carrying capacity of simple and built-up sections, Design of Lacing and Battening.	**06**
06	**Design of Column Base:** Design of slab base and gusseted base.	**06**

References:

Text Books (List of books as mentioned in the approved syllabus)

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

Reference books

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

Codes of Practice:

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

Class: **Third Year B. Tech. Civil**	Semester: V
Course Code : **CE3511**	Course Name: **Estimations and Costing**

L	T	P	Credits
3	-	-	3

Course Description:

Estimation and contracts is one of core course offered in fifth semester of civil engineering undergraduate program. It comprises of six modules. 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 and their specifications. Also student will learn types of tenders and their procedures. Thus by studying this course student will be more comfortable to prepare different bills on construction site. The students will learn different methods of valuation.

Course Learning Outcomes:

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

1. Apply standard requirements to prepare detailed estimate
2. Estimate the quantities for building, road, canal and culvert
3. Analyze the rates for construction items
4. Prepare tenders and contracts documents
5. Prepare valuation report of property (Land & Building)

Prerequisite: Mathematics, Building Construction & Drawing, Highway Engg.

Course Content

Unit No.	Description	Hrs
01	**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,	06
02	**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.	06
03	**Detailed Estimate of Structures** Detailed estimate of Buildings and Infrastructures	06

04	**Rate Analysis** Rate analysis of civil engineering items like PCC, RCC, Brickwork, Plastering, Flooring, Painting. Price escalation, Preparation of bar bending schedule for isolated footings, beams, columns, slabs, staircase, lintel, chajja.	06
05	**Tender & Contract Documents** Organization of Public Work Department (PWD), Tender- Notice, Documents, Procedure and Types, Contract- Types, Conditions of contract, Earnest money, Security deposit, Validity period, Defect liability period, Arbitration, Escalation of cost, Daily reports maintained on site	06
06	**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, Problems based on valuation	06

References:

Text Books: -

- Dutta, B.N, Estimating and Costing in Civil Engineering–USB Publishers, Distributors Pvt. Ltd.

References Books: -

- Rangwala, S. C., Elements of Estimating and Costing –Charotar Publishing House.
- Chakroborty, M., Estimating, Costing, Specification and Valuation in civil engineering –USB Publishers.
- Patil, B. S., Civil Engineering Contracts and Estimates, Universities Press Private Ltd.

Codes of Practice:-

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

Class: **T. Y. B. Tech Civil**	Semester-V
Course Code: **CE353**	Course Name: **Mechanics of Structure**

L	T	P	Credits
2#	–	–	2

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

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

COURSE CONTENT		
Unit No.	**Details of Content**	**Hrs.**
1.	**Axially Loaded Columns:** Critical load and buckling, derivation of Euler's formula. Concept of equivalent length for various end conditions, Rankine's formula, safe load on column and limitations of Euler's formula.	**06**
2.	**Combined Direct and Bending Stresses:** Combined direct and bending stresses, eccentric load on short columns, kern of a section, eccentricity of load about both axes of section. Chimneys subjected to wind pressure, simple problems on dams and retaining walls.	**06**
3.	**Slope and Deflection of Beams I:** Slope and deflection of determinate beams – Double Integration method, Macaulay's method.	**06**
4.	**Slope and Deflection of Beams II:** Slope and deflection of determinate beams – Moment area method, Conjugate beam method	**06**

5.	**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.	**06**
6.	**Three hinged arches:** Horizontal thrust, support reaction, bending moment. **Cables:** Analysis of cables under concentrated loads, udl, self-weight.	**06**

References

Text Books:

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

Reference Books:

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

Class: **Third Year B. Tech. Civil**	Semester: **V**
Course Code : **CE363**	Course Name: **Construction Quality Control**

L	T	P	Credits
2	-	-	2

Course Description:

Developing countries like India where lots of infrastructure development is undergoing, knowledge and understanding of quality control & monitoring in construction work is very important in order to achieve good quality product within the stipulated time period. For any civil construction work, day to day monitoring and inspection plays a very important role for durable and sustainable structure. Good quality control and monitoring may increase lives of civil structures by 20 to 30 years without much increase in cost of construction. Lots of infrastructure development works are underway and construction resource materials are depleting, under this circumstances, proper use of natural resources are very essential and necessary. Therefore the study of quality control aspects are essential to civil engineers to perform the job, duties in the field efficiently and effectively.

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Course Learning Outcomes:

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

1. Evaluate the quality in civil construction works.
2. Develop quality checks for construction.
3. Apply provisions of standard codes in civil construction.
4. Prepare quality control documents for construction projects.

Prerequisite: Possess basic knowledge of Construction materials and practices.

Course Content

Unit No.	Description	Hrs.
01	**Introduction :** Quality introduction, Aspects of quality in construction projects, Duties & responsibilities of various stakeholders, qualification of staff in organization, Sample checklists, Case Study / Site Visits.	04
02	**Quality Control Plan :** Prepare Quality Control (QC) program plan : Quality assurance plan, Inspection and Testing- Process, Inspection test report, Concepts of quality policy, Quality standards, Quality manual	04
03	**Quality Control for Construction Materials :** Checklists for Quality of Materials, - Bricks, Timber, Tiles, Plumbing materials, Aggregates, Cement, Concrete etc. (Referring respective codes of practices).	04

04	**Quality Control for Construction Practices :** QC program for earthwork, QC program for Masonry, QC program for concreting etc.	04
05	**Quality References:** Quality standards for construction outputs, products and services, National Building Code of India -2016 (NBC) methods of referring it & application.	04
06	**Quality Management for Construction Projects :** Importance of third party quality audits, CIDC- CQRA quality rating systems, Integrating quality control with project management, Non Conformity reports (NCR), Remedial strategy for reducing NCR's.	04

References:

Text Books :

- James, J.O' Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van No strand, New York,.
- Mantri Handook- A to Z of Construction- Mantri Publication.
- Kwaku, A., Tena, Jose, M. Guevara, Fundamentals of Construction Management and Organisation, Reston Publishing Co., Inc., Virginia,.
- Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, Tata McGraw Hill.
- Hutchins.G, ISO 9000, Viva Books, New Delhi,

Reference Books:

- Rumane, Abdul Razzak, "Quality Management in Construction Projects", ISBN: 9781439838723464p.
- Clarkson H. Oglesby, Productivity Improvement in Construction, McGraw-Hill,.
- John L. Ashford, The Management of Quality in Construction, E & F.N.Spon, New York.
- Steven McCabe, Quality Improvement Techniques in Construction, Addison Wesley Longman Ltd, England.

Class: **Third Year B. Tech. Civil**	Semester: V
Course Code: **CE364**	Course Name: **Construction Equipment Management**

L	T	P	Credits
2	-	-	2

Course Description:

This course deals with the comprehensive exploration of construction equipment management across six units, each with six contact hours. Encompassing topics ranging from construction equipment types and trends to selection, procurement, and life cycle cost analysis, it provides a thorough understanding of the safe operation, productivity, and training. Additionally, the course covers maintenance, troubleshooting, inspections, cost-benefit analysis, environmental impact, and sustainable practices. Through hands-on operation sessions and site visits, students gain practical exposure, acquiring essential skills in the effective management of construction equipment.

Course Learning Outcomes:

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

1. Discuss the suitability of equipment for a specified construction task.
2. Select equipment/plant for a particular task.
3. Perform productivity and economic analysis for equipment.

Prerequisite: Possess basic knowledge of construction activities and equipment used.

Course Content

Unit No.	Description	Hrs
01	**Introduction to Construction Equipment** Overview of construction equipment types, Criteria for equipment selection, Procurement processes and strategies, Emerging trends in construction equipment technology	04
02	**Earthwork equipment:** Fundamentals of earthwork tasks, Earthmoving equipment details and operations. Tasks performed by equipment, and Equipment fleet combinations.	04
03	**Rock excavation equipment:** Methods and practices in rock excavation, Drilling and blasting method, ripping, splitting and mechanical methods of rock excavation and their applications in construction.	04
04	**Construction plants:** Ready mix concrete plants, Hot mix asphalt plants, Aggregate production plants. Operations and production planning.	04
05	**Miscellaneous Equipment**	04

	Equipment for Highrise Construction, Piling Equipment, Trenchless Technology, Cranes, Diaphragm wall construction	
06	**Equipment economics:** Equipment records, Cost of capital, Investment alternatives, Elements of ownership and operating cost, Replacement decisions, Rent or lease.	**04**

References:

Text Books:

- Peurifoy C., R. L. Ledbetter, W. B. and Schexnayder, "Construction Planning, Equipment and Methods", Tata Mc-Graw Hill, Singapore.
- Sharma S. C., "Construction Equipment and Management", Khanna Publishers, New Delhi.
- Deodhar S. V., "Construction Equipment and Job Planning", Khanna Publishers, New Delhi.

Reference Books:

- James O'Brien, John A. Havers and Frank W. Stubbs, "Standard hand book of Heavy Construction", Mc-Graw-Hill Publication.
- Patrick Powers., J., "Construction Dewatering: New Methods and Applications", John Wiley & Sons.
- Jerry Irvine, "Advanced Construction Techniques", California Rocketry.

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T. Y. B. Tech. Syllabus

To be implemented for 2023-27 NEP Batch

Department of Civil Engineering

Class: **T. Y. B. Tech. Civil**	Semester: V
Course Code: **CE365**	**Advanced Fluid Mechanics**

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

Course Description:

This subject deals with the importance of basic laws and forces that need to be considered for the design of hydraulic structures. The course contents are designed to fulfill the requirements of the design of water supply structures based on the projects and the need of water.

Course Learning Outcomes:

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

1. Apply basic laws of fluid mechanics to solve fluid flow numerically.
2. Explain the advection-dispersion phenomenon in groundwater hydrology
3. Explain the application of the Navier-Stokes Equation in pipe flow
4. Determine boundary layer thickness, Prandtl's mixing length and velocity distribution
5. Calculate Pump head and specify the Pump suitability

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

Course Content

Unit No.	Description	Hrs
1	**Governing equations of fluid flow:** Reynolds transports theorem, the law of conservation of mass-continuity equation, the law of conservation of momentum-equation of motion equation, assumptions, and applications. Numericals on the simultaneous application of continuity and momentum equations.	05
2	**Groundwater Contaminant Hydrology:** Groundwater hydrology parameters; specific storage, hydraulic conductivity, Specific discharge, Darcy's velocity; Advection-Dispersion-Diffusion equations and their numerical; Introduction to MODFLOW groundwater modeling software	03
3	**Viscous Flow in Ducts:** Derivation of Navier-Stokes Equation: its application and assumptions, Theory and numerical on Laminar Fully Developed Pipe Flow, Turbulent Pipe Flow, Flow in Noncircular Ducts	03
4	**Boundary Layer Theory:** Types of the Boundary layer, Factors affecting on boundary layer, momentum thickness, displacement thickness, energy	04

	thickness, order of magnitude analysis, Prandtl's boundary layer equation, factors affecting the separation of boundary layer and its control	
5	**Turbulent Flow:** Characteristics of turbulent flow, types of turbulent flow, averaging procedure, Prandtl's mixing length theory for two-dimensional parallel flows, Karman-Prandtl's universal velocity distribution, smooth and rough turbulent flow and their velocity distributions	04
6	**Water power Engineering:** Types of Hydropower Plants, Essential stream flow data for water power studies, storage and pondage, classification of turbines, Elements of Hydroelectric Power Plants, Coefficient of Discharge, Slip, Percentage Slip and Negative Slip of Reciprocating Pump, Water hammer, Types of Pumps and selection of Pumps, Numerical on Pump head calculation	05

References:

Reference Books:

- Fox, W.R., and McDonald, A.T., "Introduction to Fluid Mechanics", Wiley and Sons Inc., New York,
- Jain, A. K., "Fluid Mechanics", Khanna Publishers, New Delhi,
- Streeter, V.L., Bedford, K. and Wylie, E. B., "Fluid Mechanics", McGraw Hill Book Company Ltd., New York,

Text Books:

- White, F. M., "Fluid Mechanics", The McGraw Hill Companies,
- Schlisting, H., Gersten, K., "Boundary Layer Theory", Springer Publication,
- Modi and Seth, "Fluid Mechanics and Hydraulic Machinery",
- Kumar K. L. "Fluid Mechanics", S. Chand publication
- Bansal R. K. "Fluid Mechanics", Laxmi publication Delhi

Class: **T. Y. B. Tech. Civil**	Semester: **V**
Course Code : **CE367**	Course Name: **Solid Waste Management**

L	T	P	Credits
2	-	-	2

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 solid waste.
3. Design optimum route for collection of solid waste.
4. Select suitable processing technique for solid waste management
5. Design sanitary land fill site for solid waste management
6. Explain applications Artificial Intelligence in solid waste management

Prerequisite: Basic knowledge of Environmental Science and Wastewater Engineering course is essential.

Course Content

Unit No.	Description	Hrs
01	**Municipal solid and Hazardous waste management fundamentals** Sources; composition; generation rates; collection of waste; separation, transfer and transport of waste; treatment and disposal options; Functional elements in solid waste management, Characterization of waste; compatibility and flammability of chemicals; fate and transport of chemicals; health effects	04
02	**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	04

	contamination and remediation;	
03	**Collection and Processing of solid waste** Collection methods of solid waste, Transportation of solid waste, transportation vehicle and their capacity, design of route for solid waste collection, Role of rag pickers in solid waste, processing of solid waste-compaction, density separation, incineration, RDF, Pyrolysis etc.	04
04	**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	04
05	**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	04
06	**Applications of AI in solid waste management** Application of Remote Sensing and GIS &, Artificial Neural in solid waste management, Recent developments in solid waste management	04

References:

Text Books:

- Dr. A. D. Bhide. "Solid Waste Management", Published by Indian National Scientific Documentation Centre, New Delhi.
- Pavoni, "Solid Waste Management Hand Book", Published by A Willy – Interscience Publication.
- Gottas, "Composting", Published by World Health Organisation, Geneva.
- Manual on Municipal Solid Waste Management by Ministry of Urban Development of Govt. of India.
- Peavy & Rowe, "Environmental Engineering', Published by New York : McGraw-Hill

Reference Books:

- Gorge Tchobanoglous, "Solid Waste Management" , Published by McGRAW-HILL

Class: **Third Year B. Tech. Civil**	Semester: **V**
Course Code : **CE369**	Course Name: **Public Building Planning and Design**

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

Course Description:
This subject deals with planning and designing of the public buildings following the principles of building planning and development control regulations. Major emphasis in the course is on preparation of line plans, submission and working drawings of the public building.

Course Learning Outcomes:

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

1. Design the various types of public buildings for given requirements following the principles of building planning and development control regulations
2. Prepare the different drawings (i.e. line plans, building plans, sectional elevations etc.) of the public buildings using AutoCAD software

Prerequisite: Possess basic knowledge of Building Planning and Design course.

Course Content		
Unit No.	**Description**	**Hrs**
01	**Principles of building planning and development control regulations for public buildings:** Principles of building planning, development control rules (DCPR), setback distances, minimum plot sizes, open spaces, minimum standard dimensions, built-up area, super built-up area, plinth area, carpet area, floor area and FSI, provisions of lighting and ventilation, provisions for safety from fire and explosions.	**04**
02	**Planning and designing of Educational buildings:** School –Types, Components of school, preparation of line plan. College –Types, Components of college, preparation of line plan.	**04**
03	**Planning and designing of Hostel and Library building:** Hostel –Types, Components of hotel, preparation of line plan. Library–Types, Components of library, preparation of line plan.	**04**
04	**Planning and designing of Post office and Bank Buildings** Post office –Types, Components of post office, preparation of line plan. Bank –Types, Components of bank, preparation of line plan.	**04**
05	**Planning and designing of Hospital and Hotel building:** Hospital –Types, Components of hospital, preparation of line plan.	**04**

	Hotel –Types, Components of hotel, preparation of line plan.	
06	**Planning and designing of Function hall and Cinema theatre:** Function hall –Types, Components of function hall, preparation of line plan. Cinema theatre – Components of cinema theatre, preparation of line plan.	**04**

References:

Text Books: -

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

References Books: -

- Dr. N. Kumara Swami, A. Kameswara Rao, "Building Planning and Drawing", Charotar Publishing House Pvt. Ltd.
- S. S. Bhavikatti, M. V. Chitawadagi, "Building Planning and Drawing", Deamtech Press.
- V. B. Sikka, "A Course in Civil Engineering Drawing", S. K. Kataria and Sons.
- W.B Macay, "Building Construction", Pearson Education
- S.Mantri, "The A to Z of Practical Building Construction and its Management", Satya Prakashan.
- C.M. Kale, M.G. Shah, S.Y. Patki, "Building Drawing And Planning With An Integrated Approach To BuiltEnvironment", Tata McGraw-Hill Education Pvt. Ltd.

Government Rules & Regulations: -

- Unified Development Control and Promotion Regulations for Maharashtra State (UDCPR 2020), Urban Development Department, Government of Maharashtra.

Class: **T. Y. B. Tech Civil**	Semester-V
Course Code:**CE371**	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 earth constituents their genesis and physical & mechanical properties.
2. Recognize geological structures in rock mass, their origin and their impact on civil engineering structures.
3. Analyze and interpret geological reports and information and the latest geological exploration methods for suitable site selection.
4. Describe and compare different geological formation and geological structures required for construction of dam, reservoirs and tunnel.

Course Content

Unit No.	Description	Hrs.
1.	**Introduction to Geology** Definition of geology, scope and subdivisions, Geology and Civil Engineering. Weathering, types of weathering. Interior of the earth, basic seismology, Types of volcanic eruption and products. Geological work of river in the process of erosion, deposition and transportation.	4
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 good building stone, and building stones in India.	5

3.	**Structural Geology** Outcrop, strike and dip, unconformities, Folds, Faults, Joints- Parameters, classification, causes, civil engineering significance. Importance of groundwater investigation in civil engineering projects. Electric Resistivity Method.	5
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.	4
5.	**Geology of Dams, and Reservoirs** Types of dams and geological considerations in the selection of a dam site. Analysis of dam failures of the past. Geological factors influencing water lightness and life of reservoirs.	3
6.	**Tunnels** Purposes of tunneling, Effects of Tunneling on the ground, Role of Geological Considerations in tunneling over break and lining in tunnels.	3

References –

Reference Books

- Prabin Singh, "Engineering and General Geology", S. K. Katariya and Sons Delhi.
- Dr. D. V. Reddy, "Engineering Geology for Civil Engineering", Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- N Chenna Kesavulu, Textbook of "Engineering Geology", Macmillan Publishers India limited Delhi.
- B. S. Sathya Narayanswami, "Engineering Geology", Dhanpat Rai and Co. (P). Ltd.Delhi.
- K. M. Bangar, "Principles of Engineering Geology" - Standard Publishers Distributors 1705-B NaiSarak, Delhi.
- G. W. Tyrrell "Principles of Petrology", B. I. Publication Pvt. Ltd., New Delhi.
- Holmes, "Principles of Physical Geology", ELBS Chapman and Hall, London.
- M. P. Billings, "Structural Geology", Prentice Hall of India Private Ltd., New Delhi.

Text Books

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

Class: **T. Y. B. Tech. Civil**	Semester: **V**
Course Code: **CE373**	Course Name: **Matrix Methods of Structural Analysis**

L	T	P	Credits
2	-	-	2

Course Description:

The matrix method of structural analysis is uses a fundamental principle of matrix in structural analysis. This analysis is carried out, using a stiffness and flexibility matrix. This course mainly concerned with the analysis of beams, 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 matrix methods.
2. Analyze the structures by using the stiffness & flexibility method.
3. Solve multiple degree of freedom two-dimensional problems involving trusses & beams.

Course Content		
Unit No.	**Description**	**Hrs**
01	**Introduction Matrix Methods** Degrees of freedom, Constrained Measurements, Behavior of structures, Principle of superposition. Stiffness and flexibility matrices, Stiffness and flexibility coefficients from virtual work, introduction indeterminate structures.	04
02	**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.	04
03	**Transformation of matrices:** Transformation of element matrices to system matrices, Transformation of system vectors to element vectors, Normal coordinates and orthogonal transformations.	04
04	**Flexibility method:** Statically determinate and indeterminate structures. Choice of redundant, Transformation of redundant	04

05	**Indeterminate truss:** Development of the method, Internal forces due to thermal expansion and lack of fit	04
06	**Applications:** Application to symmetrical structures, Comparison between stiffness and flexibility methods.	04

References:

Text Books:

- Devdas Menon, "Advanced Structural Analysis", Narosa Publishing House, New Delhi.
- Pandit G. and Gupta S., "Structural Analysis: A Matrix Approach", McGraw Hill Education, Delhi.
- Praveen Nagarajan, "Matrix Methods of Structural Analysis", CRC press, Taylor & Francis, New York.
- Rajasekaran S, "Computational Structural Mechanics", Prentice Hall of India, New Delhi.
- Manickaselvam V.K., "Elements of Matrix and Stability Analysis of Structures", Khanna Publishers, New Delhi.

Reference Books:

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

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T. Y. B. Tech. Syllabus
To be implemented for 2023-27 NEP Batch
Department of Civil Engineering

Class: **Third Year B. Tech. Civil**	Semester: **V**
Course Code : **CE375**	Course Name: **Earthquake Engineering**

L	T	P	Credits
2	-	-	2

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

Course Learning Outcomes:

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

1. Explain various concepts related to engineering seismology.
2. Evaluate responses for a single degree of freedom system for free and forced vibration.
3. Apply principles of earthquake resistant structural system for building planning.
4. Calculate lateral loads developed due to earthquake forces by equivalent static method.
5. Explain methods to improve earthquake resisting capacity of the structure

Prerequisite: Differential equation, Engineering mechanics and Structural analysis

Course Content

Unit No.	Description	Hrs
01	**Elements of Seismology:** Terminology used in earthquake engineering, structure of earth, phenomenon of earthquake, earthquake causes, plate tectonic theory, elastic rebound theory, magnitude and intensity of earthquake, earthquake waves, earthquake measuring instrument and seismic zoning.	04
02	**Fundamentals of Theory of Vibration:** Introduction to structural dynamics, static versus dynamic loads, different types of dynamic loads. Mathematical modeling of dynamic system, types of vibration and Equivalent stiffness	03
03	**Single degree of freedom system:** Free and forced vibration of single degree of freedom, support motion,	05

	Transmissibility and response spectra	
04	**Conceptual Design of Earthquake Resistant Structure** Importance of Earthquake Resistant Design, Seismic Forces, behavior of RCC, steel and masonry structure under earthquake loading, Characteristics of earthquake resistant structure, Lateral force path, Requirements of an efficient earthquake resistant structural system.	05
05	**Computation of Seismic Forces on the Structure:** Seismic design philosophy, clauses given in IS 1893, computation of lateral loads by equivalent static method, determination of base shear, lateral distributing of base shear as per IS 1893.	04
06	**Earthquake Resisting Building Systems:** Base isolation technique, seismic dampers, vibration controlling methods and demonstration of behavior of structures under horizontal and vertical motion.	03

References:

Codes of Practice:

- Bureau of Indian standards IS 1893 2016, Indian Standard code of Practice for Criterion for Earthquake Resistant Design of Structure. New Delhi, BIS.
- Bureau of Indian standards IS 13920 2016, Indian Standard code of Practice for Ductile Design and Detailing of Reinforced Concrete Structures subjected to Seismic Forces. New Delhi, BIS.

Text Books:

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

Reference Books:

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

RAJARAMBAPU INST. OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

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

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
T. Y. B. Tech. Syllabus
To be implemented for 2023-27 NEP Batch
Department of Civil Engineering

Open Elective-I

Class: **T. Y. B. Tech.**	Semester- **V**
Course Code: **OE3044**	Course Name: **Renewable Energy Sources**

L	T	P	Credits
3	-	-	3

Course Description:
This course provides a comprehensive introduction to various renewable energy sources, including solar, wind, biomass, hydro, geothermal, and emerging technologies. It explores the fundamental principles, working mechanisms, and applications of these energy sources while emphasizing their role in sustainable development. Students will gain insights into energy storage solutions, smart grids, and the latest advancements in renewable energy integration. The course also covers environmental impacts, economic feasibility, and government policies promoting clean energy adoption. By the end of this course, students will be equipped with the knowledge to contribute to the development and implementation of renewable energy solutions in real-world scenarios.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain fundamental knowledge of various renewable energy sources and their importance.
2. Describe the working principles, technologies, and applications of renewable energy systems.
3. Analyse the environmental impact and economic feasibility of renewable energy solutions.
4. Investigate recent advancements and future trends in sustainable energy technologies.

Prerequisite:
Engineering Physics, Engineering Chemistry, Basics of Mechanical Engineering

Course Content

Unit No	Description	Hrs
1.	**Introduction to Renewable Energy** Overview of global and national energy scenarios, Need for renewable energy and sustainability, Comparison of renewable and non-renewable energy sources, government policies and incentives for renewable energy adoption.	06
2.	**Solar Energy Systems** Basics of solar radiation and measurement, Photovoltaic (PV) systems: Types, working principles, and efficiency, Solar thermal systems: Collectors, solar water heaters, and solar concentrators, Applications of solar energy: power generation, desalination, and space heating, solar	06

	energy prediction models.	
3.	**Wind Energy Systems** Fundamentals of wind energy and wind power generation, Wind turbine types, aerodynamics, and power extraction, Wind farm planning, site selection, and grid integration, Challenges and advancements in wind energy technology, efficiency, wind energy prediction models.	**06**
4.	**Biomass and Bioenergy** Biomass resources and their classification, Conversion technologies: Combustion, gasification, and biogas production, Biofuels: Biodiesel, bioethanol, and their applications, Waste-to-energy technologies and environmental benefits.	**06**
5.	**Hydropower and Geothermal Energy** Principles of hydroelectric power generation, Classification of hydro plants: Small, medium, and large-scale hydropower, Geothermal energy sources and power generation techniques, Direct-use applications of geothermal energy.	**06**
6.	**Emerging Renewable Technologies and Energy Storage** Ocean energy: Tidal, wave, and ocean thermal energy conversion (OTEC), Hydrogen as a renewable fuel: Production, storage, and fuel cells, Energy storage technologies: Batteries, flywheels, and pumped hydro storage, compressed air, Smart grids and future trends in renewable energy integration.	**06**

References:

Text Books:

- Rai, G. D. – Non-Conventional Energy Sources (Khanna Publishers)
- Boyle, G. – Renewable Energy: Power for a Sustainable Future (Oxford University Press)
- Sukhatme, S. P., Nayak, J. K. – Solar Energy: Principles of Thermal Collection and Storage (Tata McGraw-Hill)

Reference Books:

- Twidell, J., Weir, T. – Renewable Energy Resources (Taylor & Francis)
- Duffie, J. A., Beckman, W. A. – Solar Engineering of Thermal Processes (Wiley)
- Godfrey, B. – Wind Energy Handbook (Wiley)
- Sorensen, B. – *Renewable Energy: Physics, Engineering, Environmental Impacts, Economics & Planning* (Elsevier)

Open Elective-I

Class: **T. Y. B. Tech.**	Semester: **V**
Course Code: **OE3064**	Course Name: **Environmental Impact Assessment**

L	T	P	Credits
3	-	-	3

Course Description:
Environmental impact assessment (EIA) is offered as open Elective for Undergraduate course (B. Tech) semester V. It deals with definitions and concepts, rationale and historical development of EIA, EIA in Engineering, Initial environmental examination, environmental impact statement, environmental appraisal, environmental impact factors and areas of consideration, measurement of environmental impact, organization, scope and methodologies of EIA, status of EIA in India.

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

Prerequisite:
Possess basic knowledge of Environmental Science

Course Content

Unit No	Description	Hrs
1.	**Basic concepts of EIA** Environmental Impact Assessment: Introduction, Stages of EIA, Origin of EIA, Establishments of Procedure: Legislative Option, Project Screening for EIA, Methods, Projects thresholds, Sensitive area criteria Matrices. Scope studies for Environmental Impact Studies (EIS). Preparation for EIS Planning, Public Participation and Review of EIS.	**06**
2.	**Methods for impact assessment** Background information, interaction matrix methodologies, network methodologies, mathematical modelling, environmental setting, environmental impact assessment methodology, documentation and selection process, environmental indices and indicators for describing affected environment. Life cycle assessment.	06
3.	**Prediction and assessment of impact for air and noise environment** Basic information of air quality, identification of type and quantity of air pollutant, existing air quality and air quality standards, impact prediction and assessment, mitigation. Basic information of noise, existing noise	06

	levels and standards, prediction of noise levels and assessment of impact, mitigations.	
4.	**Prediction and assessment of impact for water and soil environment** Basic information of water quality (Surface water and ground water), water quality standards, identification of impact, prediction of impact and assessment, mitigations. Background information of soil environment, soil and ground water standards, prediction and assessment of impact for ground water and soil, mitigations.	06
5.	**Prediction and assessment of impact on cultural and socioeconomic environment** Basic information on cultural resources, rules and regulations for cultural resources like archaeological, historical structures, Cultural system, prediction and assessment of impact, mitigations. Basic information of socioeconomic environment, description of existing socioeconomic environment, prediction and assessment of impact, mitigation, resettlement and rehabilitation.	06
6.	**AI applications Decision Methods for Evaluation of Alternative** Categorization of Industries for seeking environmental clearance from concerned authorities, AI tools like Bayesian network, SCREENER, Calyx tm, ORBI, IMPACT, procedure for environmental clearance, procedure for conducting environmental impact assessment report, Rapid and Comprehensive EIA, general structure of EIA document, Environmental management plan, post environmental monitoring.	06

References:

Text Books:

- Canter R.L., Environmental Impact Assessment, McGraw Hill International Edition.
- John G. Rau and David C. Wooten (Ed), Environmental Impact Analysis Handbook, McGraw Hill Book Company.

Reference Books:

- R.R Barthwal, Environmental Impact Assessment, New Age International Publishers
- Abbasi, Environmental Impact Assessment, McGraw Hill International Edition.

Open Elective-I

Class: **T. Y. B. Tech.**	Semester: **V**
Course Code: **OE3104**	Course Name: **Network Administration**

L	T	P	Credits
3	-	-	3

Course Description:
This course is designed for the students from various academic backgrounds who wish to gain a fundamental understanding of network administration. The course covers essential network concepts and practical skills, with an emphasis on real world applications and everyday scenarios.

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

1. Recall and describe the different basic components of computer networks.
2. Explain the functions and interactions of each layer of the OSI model.
3. Distinguish various networking devices with their functions.
4. Analyze different web services and applications.
5. Synthesize the knowledge about cyber security related services and networking maintenance.

Prerequisite: Basic understanding of computer hardware and operating systems, Fundamental knowledge of networking concepts, Familiarity with the OSI model, Basic understanding of TCP/IP protocols.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Computer Networks** Overview of computer networks (Components, Architecture), Importance of networking in various fields, types of networks (e.g. LAN,MAN,WAN), Common network terminologies (Topologies), Recent trends in network administration	6
2.	**Basic Networking Protocols** Operating System installation process (e.g. windows, Linux), Introduction to OSI Model (Application layer, presentation layer, Session layer, Transport layer, network layer, data link layer, physical layer), Networking hardware's (Router, Switches, Hubs), IP Addressing Basics (network class, network, subnet, and device)	6
3.	**Connecting Devices** Introduction to networking devices (e.g. NIC, Modems), Transmission media – Guided media, Unguided media (Wired and Wireless), Cabling and connectors (e.g. Coaxial and fiber optical Cables), Basics of Home Networking (A closer look at the Home Router, Components in a Home Router)	6

4.	**Internet Services and Applications** Introduction to web services (HTTP,HTTP's), Email and messaging protocols (SMTP, IMAP), File Transfer Protocol (FTP)	6
5.	**Network Security Basics** Introduction to cyber security (types of cybercrimes), Password Management (Generation of strong password, Enforces requirements), Firewalls and Antivirus software (Installation process of antivirus), Safe Internet Practices	6
6.	**Troubleshooting and Basic Network Maintenance** Introduction to network monitoring tools (Configuration, performance, cloud infrastructure), Basic troubleshooting techniques (Tips for troubleshooting computers), Regular Network Maintenance Practices, Future trends – Role of network in future - Real world examples	6

References:

Text Books:

- Seffrey S. Beasley and Piyasat Nilkaew "Network Essentials" Pearson Publishing.
- William Stallings "Network Security Essentials" Pearson Publishing

Reference Books:

- Craig Hunt "Network Administration: The Complete Guide to Network Security and System Administration".

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Open Elective-I

Class: **T. Y. B. Tech.**	Semester: **V**
Course Code: **OE3381**	Course Name: **Disaster Management**

L	T	P	Credits
3	-	-	3

Course Description:
This course provides a holistic understanding of disaster management, covering both natural and manmade disasters. Students will delve into the meaning, nature, and various types of disasters, exploring their effects on individuals, communities, and the environment. The course encompasses a global perspective while focusing on the disaster profile of India, considering regional and seasonal variations.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Outline disaster and disaster management cycle.
2. Summarize disaster preparedness and response activities for various types of disaster.
3. Apply various advanced techniques for disaster management.
4. Examine role of various agencies in disaster management.
5. Analyze the disaster management scenario in India.

Prerequisite: Environmental Science

Course Content

Unit No	Description	Hrs
1.	**Natural Disaster** 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 waning, 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. Disasters -A Global View, Disaster Profile of India- Regional, and Seasonal.	06
3.	**Disaster management cycle** Introduction to Disaster Management Cycle: Mitigation, Preparedness, Response and Recovery. Disaster Mitigation, Hazard identification and vulnerability analysis, Mitigation strategies or measures.	06
4.	**Disaster Preparedness, Response and Recovery** Introduction to Disaster Preparedness, Disaster Risk Reduction (DRR),	06

	The Emergency Operation Plan (EOP). Introduction to Disaster Response, Aims of disaster response, Disaster. Response Activities, Modern and traditional responses to disasters, Modern methods of disaster response, Disaster Recovery, The Recovery Plan, Disasters as opportunities for development initiatives.	
5.	**Role of technology in Disaster management** Geographic Information System (GIS) and Disaster Management. GIS applications. Global Positioning System (GPS) and Disaster Management, Applications of GPS to Disaster management. Remote Sensing and its significance in Disaster Management.	**06**
6.	**Role of Multiple Stakeholders in Disaster management** Role of NGO's, Community based organizations, media, Central, State, District and Local Administration, armed forces, Police and other organizations.	**06**

References:

Codes of Practice:

- National Disaster Management Authority (NDMA). National Disaster Management Plan 2019.
- National Disaster Management Authority (NDMA). National Disaster Management Act 2005.

Text Books:

- Coppola, D. P. "Introduction to International Disaster Management", Elsevier USA.
- Singh R. B., "Disaster Management", Rawat Publication.

Reference Books:

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

Open Elective-I

Class: **T. Y. B. Tech.**	Semester- V
Course Code: **OE341**	Course Name: **Energy Auditing and Management**

L	T	P	Credits
3	–	–	3

Course Description:
This course provides basic understanding of energy audit and management. Essential theoretical and practical knowledge about the concept of energy conservation, energy management, and different approaches of energy conservation in industries, economic aspects of energy conservation project and energy audit and measuring instruments in the commercial and industrial sector will be achieved through this course.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Identify the important of Energy Scenario.
2. Use energy audit knowledge to carry out energy audit of a given firm.
3. Examine different rolls in energy action planning
4. Apply project finance and management skills to carry out energy audit
5. Plan for energy monitoring and targeting.

Prerequisite:
Electric Machines, Thermal Systems and Finance Management

Course Content

Unit No	Description	Hrs
1.	**Energy Scenario** Energy Needs of Growing Economy, Long Term Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy and Environment, Air Pollution, Climate Change, Energy Security, Energy Conservation and its Importance, Energy Strategy for the Future, Energy Conservation Act-2001 and its Features.	06
2.	**Energy Management and Audit** Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments, suitable case study for energy audit.	06
3.	**Energy Action Planning** Key elements, Force field analysis, Energy policy purpose, perspective, Contents, Formulation, Ratification, Organizing –location of energy management, Top management support, Managerial function, Roles and responsibilities of energy manager, Accountability. Motivating-motivation	06

	of employees: Information system-designing barriers, Strategies; Marketing and communicating-training and planning.	
4.	**Financial Management** Investment-need, Appraisal and criteria, financial analysis techniques-Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Financing options, Energy performance contracts and role of ESCOs	**06**
5.	**Project Management** Definition and scope of project, technical design, Financing, Contracting, Implementation and performance monitoring. Implementation plan for top management, Planning Budget, Procurement Procedures, Construction, Measurement & Verification	**06**
6.	**Energy Monitoring and Targeting** Defining monitoring & targeting, Elements of monitoring & targeting, Data and information-analysis, Techniques -energy consumption, Production, Cumulative sum of differences (CUSUM). Suitable case study.	**06**

References:

Text Books:

- Amit Kumar Tyagi, Handbook on Energy Audits and Management, TERI Publication.
- Wayne C. Turner, Energy Management Handbook, Wiley Inter Science Publication.

Reference Books:

- P. O'Callaghan, Energy Management, McGraw - Hill Book Company.
- Bureau of Energy Efficiency Study material for Energy Managers and Auditors Examination: Paper I.

Open Elective-I

Class: **T. Y. B. Tech.**	Semester- V
Course Code: **OE343**	Course Name: **Data Science**

L	T	P	Credits
3	-	-	3

Course Description:
The course helps to learn concepts, techniques and tools they need to deal with various facets of data science practice, including data collection and integration. The orientation of course is to understand the basic types of data and basic statistics. The organization of data inline to Vectors, Matrices and Frames are examined. The Conditionals and Control Flow of data over R programming is to be implemented. Additionally, it will assist in identifying the importance of data reduction and data visualization techniques.

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

1. Articulate basic terms what Statistical Inference means
2. Analyze the data using various statistical measures
3. Identify data organization techniques used as foundations for modelling data
4. Utilize R elements for data handling
5. Perform data reduction and apply visualization techniques

Prerequisite: Basic Mathematics, Descriptive statistical techniques

Course Content

Unit No	Description	Hrs
1.	**Introduction** Definition of Data Science- Big Data and Data Science hype – and getting past the hype - Datafication - Current landscape of perspectives - Statistical Inference - Populations and samples - Statistical modeling, probability distributions, Basics of R programming.	06
2.	**Data Types** Types of Data: Attributes and Measurement, what is an Attribute? The Type of an Attribute. The Different Types of Attributes, Describing Attributes by the Number of Values, Asymmetric Attributes, Binary Attribute, Nominal Attributes, Ordinal Attributes, Numeric Attributes, Discrete versus Continuous Attributes.	06
3.	**Statistical Description of Data** Measuring the Central Tendency: Mean, Median, and Mode, Measuring the Dispersion of Data: Range, Quartiles, Variance, Standard Deviation, and Interquartile Range, Graphic Displays of Basic Statistical Descriptions of Data.	06

4.	**Data Organization** Vectors: Creating and Naming Vectors, Vector Arithmetic, Matrices: Creating and Naming Matrices, Matrix Sub setting, Arrays, Factors and Data Frames: Introduction to Factors, Factor Levels, Summarizing a Factor, Introduction to Data Frame.	06
5.	**Conditionals and Control Flow** Relational Operators, Relational Operators and Vectors, Logical Operators, Logical Operators and Vectors, Conditional Statements. Iterative Programming in R, Functions in R.	06
6.	**Data Reduction and Visualization** Overview of Data Reduction Strategies, Principal Components Analysis, Attribute Subset Selection, Data Cube Aggregation. Data Visualization: Pixel - Oriented, Visualization Techniques.	06

References:

Text Books:

- Cathy O'Neil and Rachel Schutt, "Doing Data Science, Straight Talk from The Frontline", O'Reilly.
- Jiawei Han, Micheline Kamber and Jian Pei., "Data Mining: Concepts and Techniques", The Morgan Kaufmann Series in Data Management Systems.
- K G Srinivas, G M Siddesh, "Statistical programming in R", Oxford Publications.

Reference Books:

- Pang-Ning Tan, Vipin Kumar, Michael Steinbanch, "Introduction to Data Mining", Pearson Education.
- Brain S. Everitt, "A Handbook of Statistical Analysis Using R", 4 LLC.
- Dalgaard, Peter, "Introductory statistics with R", Springer Science & Business Media.
- Paul Teetor, "R Cookbook", O'Reilly

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Open Elective-I

Class: **T. Y. B. Tech**	Semester: **V**
Course Code: **OE365**	Course Name: **Distributed Systems**

L	T	P	Credits
3	--	--	3

Course Description:
This course provides elementary introduction to fundamental concepts and principles of distributed systems. It elaborates the architecture, design, and implementation of distributed systems, emphasizing resource sharing, coordination, and communication among networked computers. The course covers system models, networking principles, operating system support, web services, and distributed file systems. It makes students aware about the complexities and challenges involved in designing and managing distributed systems.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Describe the basic principles and characteristics of distributed systems.
2. Explain different models of distributed systems and understand their applications.
3. Apply fundamental networking principles and Analyze internet protocols.
4. Comprehend the role of operating systems in supporting distributed systems, including processes, threads, communication, and virtualization.
5. Develop and secure web services for distributed applications.
6. Analyze distributed file system architecture.

Prerequisite: Basics of Computer Networks.

Course Content

Unit No	Description	Hrs
1.	**Characterization of Distributed Systems** Introduction to distributed system, Examples of distributed systems, Trends in distributed systems, Focus on resource sharing, Challenges.	04
2.	**System Model** Introduction, Physical models, Architectural models – Client-Server model, Peer-to-Peer model, Layered Model, Micro-services Model, Fundamental models – Interaction Model, Remote Procedure Call, Security Model.	06
3.	**Networking and Internetworking** Introduction, Types of networks, Network principles, Internet protocols, Case studies: Ethernet, WiFi and Bluetooth.	06
4.	**Operating System Support** Introduction, Operating system layer, Protection, Processes and threads, Communication and invocation, Operating system architecture, Virtualization at the operating system level.	07
5.	**Web Services**	07

	Web services, Service descriptions and IDL for web services, A directory service for use with web services, XML security, Coordination of web services, Applications of web services.	
6.	**Distributed File System** Introduction, Features of DFS, File service architecture, Applications of DFS, Case study: Sun Network File System, Case study: The Andrew File System, Enhancements and further developments.	**06**

References:

Text Books:

- George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, "Distributed Systems Concepts and Design", Pearson).

Reference Books:

- Andrew S. Tanenbaum, Maarten Van Steen, "Distributed Systems: Principles and Paradigms", Pearson.

Open Elective-I

Class: **T.Y. B. Tech**	Semester- **V**
Course Code: **OE347**	Course Name: **New Product Design and Development**

L	T	P	Credits
3	-	-	3

Course Description:
Maximizing the success of new products and services can drive growth and shareholder value, lead to significant competitive advantage and leapfrog a company ahead of its competitors. However, innovation is risky and most new products fail in the marketplace. Often, failure is due to an ineffective process. Thus, expertise in the design and marketing of new products is a critical skill for all managers, inside and outside of the marketing department. In this course, we first focus on the tools and techniques associated with analyzing market opportunities and then focus on designing, testing, and introducing new products and services. This course will introduce the new product development process and cover the three main areas of focus:

- Discovery - opportunity identification
- Design - concept and product design, development and evaluation
- Delivery - innovative approaches to product launch and introduction.

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

1. Identify the new product opportunities and sources of new product ideas.
2. Elaborate the product life cycle and product design process.
3. Integrate the customer and end-consumer needs into the design process.
4. Apply the concepts and tools like DFMA, VE and QFD in design process
5. Assimilate the various product characteristics to design a novel product
6. Participate in group work sessions and teams to become acquainted with the importance of teamwork and collaboration that is critical to new product success.

Prerequisite: Course is open to all Students. The course demands application of creativity, sensitivity towards solving problems and liking for doing something new and creative.

Course Content

Unit No	Description	Hrs
1.	**Discovery- Opportunity identification for new products** Product life cycle, need for new products, strategic planning and new product opportunity, sources of new product ideas, S curves and technology forecasting. Product idea generation, Product Design Process steps, creativity and innovation.	**06**
2.	**Identifying Customer Needs:** Understanding customer needs, Voice of the customer, Gathering customer needs, Design Thinking (organizing and prioritizing needs), Product	**06**

	mission statement, Benchmarking and establishing product specifications	
3.	**Product Concept Generation, Selection and Testing** Concept generation process and methods, Concept selection mechanism and techniques, Concept Testing-Purpose, process and methods. Product Architecture-types, establishing architecture, Modular design. Prototyping	**06**
4.	**Product Design Tools and Techniques** Design for manufacturing and assembly (DFMA), Product teardown and experimentation, Concurrent engineering, Quality function Deployment (QFD), Value engineering.	**06**
5.	**Product Idealization** Basic elements: Line, texture, color, form, symmetry, balance, scale, mass, unity and variety. Concept of visual language and visual design. Negative space. Use of symmetry. Generation of patterns and textures using simple elements. Color, color combinations and its dimensions: hue, value and Chroma. Color meanings in traditions and psychological use of colors. Ergonomic considerations, Anthropometry.	**06**
6.	**Product Takeoff and Market Entry** Economic analysis, life- cycle costing, sensitivity analysis Pricing, Packaging, Preparing a launch plan, Pricing and Marketing. Intellectual property rights (IPR).	**06**

References:

Text Books:

- Devdas Shetty, Design for product success, Society for Manufacturing Engineering.

Reference Books:

- Ulrich, Eppinger, Anita Goel, Product Design and Development, McGraw Hill Publishing.
- Otto & wood, Product Design, Pearson Education, reprint.
- Charles Flurscheim, Industrial Design in Engineering, the Design Council, London.

Open Elective-I

Class: **T. Y. B. Tech**	Semester: **V**
Course Code: OE349	Course Name **Non-Conventional Energy Sources**

L	T	P	Credits
3	--	--	3

Course Description:
This course provides a comprehensive understanding of non-conventional or renewable energy sources, exploring the principles, technologies, and applications associated with harnessing sustainable energy. The focus is on alternative sources that are environmentally friendly and contribute to reducing dependence on conventional fossil fuels. Students will delve into the latest advancements, challenges, and opportunities in the field of non-conventional energy.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Identify the need of requirement of renewable energy source
2. Summarize the various available energy sources.
3. Illustrate different technologies essential for conversion of renewable energy sources.
4. Evaluate the performance of energy conversion systems for maximum efficiency
5. Compare the various renewable energy technologies.
6. Select appropriate renewable energy technology for specific application

Prerequisite: Nil

Course Content

Unit No	Description	Hrs
1.	**Basics of Energy Sources** World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilization – Renewable Energy Scenario in India and around the World – Potentials - Achievements / Applications – Economics of renewable energy systems	06
2.	**Solar Energy** Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photovoltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications	06
3.	**Bio - Energy** Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Biodiesel – Cogeneration - Biomass Applications	06

4.	**Wind Energy** Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects	**06**
5.	**Hydrogen Energy** Introduction, Hydrogen Production methods, Hydrogen storage, hydrogen transportation, utilization of hydrogen gas, hydrogen as alternative fuel for vehicles. Design principle and operation of fuel cell, Types of fuel cells, conversion efficiency of fuel cell, and application of fuel cells	**06**
6.	**Other Renewable Energy Sources** Tidal energy, Wave Energy – Open and Closed OTEC Cycles , Small Hydro-Geothermal Energy , Stored hydro energy, Principles of hydro power technology	**06**

References:

Text Books:

- S P Sukhatme, Solar Energy, McGraw Hill Education.
- G.D. Rai, Non-conventional energy sources, Khanna Publishers, New Delhi.
- John Twidell , Renewable Energy Resources, Routledge.

Reference Books:

- Godfrey Boyle, Renewable Energy: Power for a Sustainable Future, Oxford University Press, U.K.
- Freris. L.L., Wind Energy Conversion Systems, Prentice Hall, UK.
- David M. Mousdale, Introduction to Biofuels, CRC Press, Taylor & Francis Group, USA.
- B. H. Khan, Non-Conventional Energy, Tata McGraw-Hill, New Delhi.

K.E. Society's

Rajarambapu Institute of Technology, Rajaramnagar

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

T. Y. B. Tech. Syllabus

To be implemented for 2023-27 NEP Batch

Department of Civil Engineering

Open Elective-I

Class: **T. Y. B. Tech**	Semester: **V**
Course Code: **OE351**	Course Name: **Hydrogen and Fuel Cell Technology**

L	T	P	Credits
3	--	--	3

Course Description:
The course is a learning about hydrogen and fuel cells – the cornerstones of hydrogen and fuel cell energy. The focus is on understanding the main driving forces of global changes and earning the basic knowledge of the key technologies leading to alternative energy sources.

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

1. Choose proper energy storage systems hydrogen and applications
2. Explain the different types of fuel cell technologies, fuels and membrane used in it
3. Design and Compare performance of fuel cell.

Prerequisite:
Engineering Chemistry, Fluid Mechanics, Engineering Thermodynamics, Materials science.

Course Content		
Unit No	**Description**	**Hrs**
1.	**Hydrogen energy** Introduction to hydrogen economy, production, storage and transportation systems, hydrogen from fossil fuels, electrolysis of water, thermo chemical cycles, transmission and infrastructure requirements, safety and environmental impacts, economics of transition to hydrogen systems	**06**
2.	**Hydrogen production** methods, types of electrolyzer: proton-exchange membrane, alkaline, solid oxide, alkaline, microbial, efficiency, open circuit voltage, and losses	**06**
3.	**Hydrogen storage and transportation** Methods of storage, solid, liquid, gaseous, Comparison between various methods, limitations, Transportation features, safety norms, methods, on boards and stationary applications	**06**
4.	**Fuel cells** Concept, key components, physical and chemical phenomena in fuel cells, advantages and disadvantages, different types of fuel cells and applications, characteristics, Nernst equation, relation of the fuel consumption versus current output	**06**
5.	**Membranes &Fuels for Fuel Cells** Membranes: Nafion – Polymer blends and composite membranes; assessment of performance – recent developments. Fuels: Hydrogen, methane, methanol – Sources and preparation,	**06**

	reformation processes for hydrogen – clean up and storage of the fuels – use in cells, advantages and disadvantages of using hydrogen as fuel.	
6.	**Fuel cell design and performance** Stoichiometric coefficients and utilization percentages of fuels and oxygen, mass flow rate calculation for fuel and oxygen in single cell and fuel cell stack, total voltage and current for fuel cells in parallel and serial connection, over-potential and polarizations, DMFC operation scheme, general issues-water flooding and water management, polarization in PEMFC	**06**

References:

Text Books:

- J Larminie, A L Dicks, Fuel Cell Systems Explained, Wiley X Li, Principles of Fuel Cells, Taylor and Francis.
- Dell, Ronald M Rand, David A J, 'Understanding Batteries', Royal Society of Chemistry.
- M. AuliceScibioh and B. Viswanathan 'Fuel Cells – principles and applications', University Press, India.

Reference Books:

- F. Barbir, 'PEM fuel cells: theory and practice', Elsevier, Burlington, MA.
- G. Hoogers, 'Fuel cell handbook', CRC, Boca Raton, FL.
- O'Hayre, R.P.S. Cha, W. Colella, F.B.Prinz, Fuel Cell Fundamentals, Wiley, N
- Basu,S.(Ed) Fuel Cell Science and Technology, Springer, N.Y.
- Dincer, H Ishaq, Renewable Hydrogen Production, Elsevier.
- G Naterer, I Dincer, C Zamfirescu, Hydrogen Production from Nuclear Energy, Springer.
- B Sorensen, G Spazzafumo, Hydrogen and Fuel Cells: Emerging Technologies and Applications, Academic Press.

Open Elective-I

Class: - **T. Y. B. Tech**	Semester: V
Course Code: **OE353**	Course Name: **Factory Automation**

L	T	P	Credits
3	-	-	3

Course Description:
To provide a clear view on factory automation types & to learn the various methods involved in automatic control and monitoring & to familiarize with factory automation systems in manufacturing and process industry.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Recognise various automation technologies in manufacturing and process industries.
2. Select various automation tools and methods in the manufacturing industry.
3. Implement various control and automation methods in process industries.
4. Analyse automation systems for manufacturing and process industries.

Prerequisite:
Manufacturing systems, sensors and actuators,

Course Content

Unit No	Description	Hrs
1.	**Introduction** Introduction: Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automation. Flow lines & Transfer Mechanisms, Fundamentals of Transfer Lines.	06
2.	**Material Handling and Identification Technologies** Overview of Material Handling Systems, Principles and Design Consideration, Material Transport Systems, Storage Systems, Overview of Automatic Identification Methods.	06
3.	**Automated Manufacturing Systems** Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and Implementation. Quality Control Systems: Traditional and Modern Quality Control Methods, SPC Tools, Inspection Principles and Practices, Inspection Technologies.	06
4.	**Control Technologies in Automation** Industrial Control Systems, Process Industries versus Discrete Manufacturing Industries, Continuous Versus Discrete Control, Computer Process and its Forms	06

5.	**Computer Based Industrial Control** Introduction & Automatic Process Control, Building Blocks of Automation Systems: LAN, Analog & Digital I/O Modules, SCADA Systems& RTU. Distributed Control System: Functional Requirements, Configurations & some popular Distributed Control Systems	**06**
6.	**Case Study** Factory automation in manufacturing industry and Process Industry.	**06**

References:

Reference Books:

- Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover, Pearson Education.
- Computer Based Industrial Control- Krishna Kant, EEE-PHI,2nd edition,2010
- An Introduction to Automated Process Planning Systems- Tiess Chiu Chang &Richard A.Wysk
- Webb, John W. Programmable Logic Controllers: Principles and Application, Fifth edition, Prentice Hall of India, New Delhi.
- Stuart A. Boyer, SCADA: Supervisory Control and Data Acquisition, ISA Publication.
- Bolton, "Programmable Logic Controllers" Newnes.

Open Elective-I

Class: - **T. Y. B. Tech**	Semester- **V**
Course Code: **OE355**	Course Name: **Cyber Physical Systems**

L	T	P	Credits
3	-	-	3

Course Description:
To study the basic concepts, requirements, principles, and techniques in emerging cyber-physical systems. Provide students hands-on experience in prototyping a cyber-physical system. Address real-world problems through Cyber Physical Systems. The objective of this course is to develop an exposition of the challenges in implementing a cyber-physical system from a computational perspective. The course also aims to provide students of different disciplinary background with necessary knowledge to understand the fundamentals of cyber physical systems.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Understand the need and purpose of the different components of CPS
2. Design physical system depends on its requirements
3. Develop the ability to interact with cyber-physical systems protocols
4. Analyze common methods used to secure cyber-physical systems

Prerequisite: NA

Course Content		
Unit No	**Description**	**Hrs**
1.	**Computational foundation of Cyber Physical Systems** Cyber Physical Systems in Real world, Basic Principle of Cyber Physical Systems, Industry 4.0, IIoT. Introduction Toward Industry 5.0: Cognitive Cyber-Physical System	**06**
2.	**Cyber Physical System Design** Cyber Physical Systems Design Recommendations, CPS system requirements, Cyber Physical System Application, Case study of Cyber Physical Systems.	**06**
3.	**Cyber Physical System Platforms & Models** Hardware platforms for Cyber Physical Systems (Sensors/Actuators, Microprocessor/Microcontrollers), Wireless Technologies for Cyber Physical Systems.	**06**
4.	**Cyber Physical System – Models and Dynamics Behaviors** Continuous Dynamics, Discrete dynamics, Hybrid Systems	**06**

5.	**Concurrent Models of computation** Structure of Models, Synchronous Reactive models, Dataflow models of computation, Timed models of computation	**06**
6.	**Security and Privacy in Cyber Physical Systems** Security and Privacy Issues in CPSs, Cyber Security Laws in India: IT Act (2000), IPC(1980), Companies Act (2013), Local Network Security for CPSs, Security and Privacy for Cloud-Interconnected CPSs, Case Study: Cyber security in Digital Manufacturing/Industry 4.0	**06**

References:

Text Books:

- Principles of Cyber Physical Systems, Rajeev Alur, MIT Press, 2015.
- E. A. Lee, Sanjit Seshia , "Introduction to Embedded Systems – A Cyber–Physical Systems Approach", Second Edition, MIT Press, 2017, ISBN: 978-0-262-53381-2.

Reference Books:

- Guido Dartmann, Houbing song, Anke schmeink, "Big data analytics for Cyber Physical System", Elsevier, 2019
- Houbing song, Danda B Rawat, Sabina Jeschke, Christian Brecher, "Cyber Physical Systems Foundations, Principles and Applications", Elsevier, 2017
- Chong Li, Meikang Qiu, "Reinforcement Learning for Cyber Physical Systems with Cyber Securities Case Studies", CRC press, 2019
- Houbing Song, Glenn A.Fink, Sabina Jesche, "Security and Privacy in Cyber-Physical Systems: Foundations, Principles and Solutions", IEEE Press.

Open Elective-I

Class: - **T. Y. B. Tech**	Semester: **V**
Course Code: **OE357**	Course Name: **Internet of Things**

L	T	P	Credits
3	-	-	3

Course Description:
The Internet of Things (IoT) course explores the interconnected world of smart devices, enabling students to grasp the fundamentals of IoT architecture, protocols, and applications. Through hands-on projects, students develop skills in device integration and data management. The course equips learners with a comprehensive understanding of IoT's transformative potential, preparing them to navigate the evolving landscape of connected technologies and contribute to the advancement of the digital era.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Explain the concepts of network connected embedded devices.
2. Identify and summarize different components required for IOT applications.
3. Analyse the system through Data Analytics tools.
4. Design suitable network architecture and use appropriate protocols for a given IOT application.

Prerequisite: Basic knowledge of microprocessor and microcontroller, communication.

Course Content

Unit No	Description	Hrs
1	**Introduction & Basic of IoT** Definition, Characteristics, Physical and Logical Designs, IOT enabling technologies, IoT levels and deployment templates. Major Components of IoT System	**06**
2	**M2M and IOT management** Introduction, M2M comparison with IOT, M2M architecture, software and development tools IOT management, communication technologies, communication protocols, Web connectivity tools.	**06**
3	**IoT platform design methodology** Design methodology, IoT Device, IoT Platform Design Specification, Building blocks, Hardware and board approach, Useful Softwares and packages	**06**
4	**IOT data storage and Cloud** Data generation, local data storage and Purpose of Cloud, clouds used in IoT application, Cloud Storage Models, Communication APIs	**06**
5	**Iot Security** Vulnerabilities, security requirements, Threat analysis, IoT Security Tomography, Layered Attacker Model, Identity Management,	**06**

	Establishment, Access Control Secure Message Communication, Security Models	
6	**Domain specific IOT** Home automation, Cities, Environment, Agriculture, Health and lifestyle.	**06**

References:

Text Books:

- Arshdeep Bahga, Vijay Madisetti.," Internet of Things – A hands On Approach," 1st Edition, Universities Press.
- Raj Kamal," INTERNET OF THINGS -Architecture and Design Principles" McGraw Hill.

Reference Books:

- Simone Cirani," Internet of Things- Architectures, Protocols and Standards", WILEY,2018.
- Alessandro Bassi," Enabling Things to Talk- Designing IoT solutions with the IoT Architectural Reference Model", Springer.

Open Elective-I

Class: - T. Y. B. Tech	Semester: V
Course Code: **OE359**	Course Name: **Drone Technology**

L	T	P	Credits
3	-	-	3

Course Description:
This course explores the revolutionary and riveting research in the ultramodern domain of drone technologies, drone-enabled applications. It explains the most recent developments in the field, challenges, and future scope of drone technologies. Beyond that, it discusses the importance of a wide range of design applications, drone/ Unmanned Aerial Vehicle (UAV) development.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Elaborate drone technology.
2. Explain fundamentals and design principles of UAV.
3. Discuss the wide range of applications of drone.
4. Classify various propulsion and controlling techniques for drone.

Prerequisite: Basic knowledge of electronics and control.

Course Content		
Unit No	**Description**	**Hrs**
1.	**Introduction** Definitions and Terminology, Types of Drone (based on wings), Physical Structure of Drone, Drone System Stack up of mechanical parts, Classification of UAVs, Military and Civilian Unmanned Aircraft	06
2.	**UAV Design Principles** Introduction to UAV Design Principles, Computational and Experimental Design of a Fixed-Wing UAV, Payload Design of Small UAVs, Small UAV Design Development and Sizing, Systematic Design Methodology and Construction of Micro Aerial Quadrotor Vehicles.	06
3.	**UAV Basic Components** Four basic components: propeller, engine, body, and flight board, Fixed wing drone, main structural elements of drone Kinematics and Dynamics, Dynamics and Control of Flapping Wing MAVs, Principles of Guidance, Navigation, and Control of UAVs.	06
4.	**UAV Propulsion** UAV Propulsion: Introduction, Power Managements of a Hybrid Electric Propulsion System Powered by Solar Cells, Fuel Cells, and Batteries for UAVs.	06
5.	**UAV Control**	06

	Linear Flight Control Techniques for UAV, Nonlinear Flight Control Techniques for UAV, Adaptive Control of UAV: Theory and Flight Tests, Robust and Adaptive Control Methods for Aerial Vehicles.	
6.	**UAV Applications** Drone Usage areas: Agriculture, Environment, Survey of UAVs for Traffic Monitoring, Cooperative Unmanned Aerial Systems for Fire Detection, Barriers to drone Technology: Power Source & Security.	**06**

References:

Text Books

- Kimon P. Valavanis, George J. Vachtsevanos, Handbook of Unmanned Aerial Vehicles, Springer.

Reference Books:

- Neeraj Kumar Singh, Porselvan Muthukrishnan, Industrial System Engineering for Drones, Apress.
- Sachi Nandan Mohanty, J.V.R. Ravindra, Drone Technology: Future Trends and Practical Applications, Wiley.

K.E. Society's
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T. Y. B. Tech. Syllabus
To be implemented for 2023-27 NEP Batch
Department of Civil Engineering

Open Elective-I

Class: **T. Y. B. Tech**	Semester: **V**
Course Code: **OE361**	Course Name: **Object Oriented Modeling and Design**

L	T	P	Credits
3	--	--	3

Course Description:
This course introduces students to the design of software models by the ways of expressing some sort of abstract language or diagrams are used to express the software design. Software analysis and design includes all activities, which help the transformation of requirement specification into implementation. Requirement specifications specify all functional and non-functional expectations from the software. These requirement specifications come in the shape of human readable and understandable diagrams. Object-oriented software design, an object modeling language such as UML is used to develop and express the software design. UML is a standard language for specifying, visualizing, constructing, and documenting the artifacts of software systems.

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

1. Identify object classes and build the domain model using advanced concepts in object, dynamic and functional modeling.
2. Apply different object-oriented design techniques.
3. Design models using UML diagrams for software systems: use case, class, sequence, collaboration, activity, state chart diagrams, component and deployment.
4. Design software systems using open source and advanced modeling tools.
5. Evaluate designs of software systems in mini-projects, projects using Software Modeling & Design concepts.

Prerequisite:
Basics of Software Engineering and Object-Oriented programming.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Object Modeling** Object Oriented development & themes, Modeling as a Design Technique, Objects, classes, links and associations, generalization and inheritance, Aggregation, abstract classes, generalization as extension and restriction, multiple inheritance, metadata, candidate keys and inheritance.	06
2.	**Dynamic & Functional Modeling** Events, states, operations, concurrency, nested state diagrams, advanced dynamic modeling concepts, DFD, Case Study to draw nested state diagrams, Dynamic diagrams and DFD using UML tools.	06

3.	**Design Methodology** Preview of OMT technology, Impact of an object-oriented approach, Analysis, System design with examples, combining models, designing models, Comparing Methodologies using structured analysis and design.	06
4.	**Structural Modeling using UML** Classes, Relationships, Common mechanisms. Diagrams, Class Diagrams, Interfaces, Types and Roles, Packages, Instances and Object Diagram, Case Study on class and object diagrams.	06
5.	**Behavioral Modeling using UML** Interactions, use cases, Use case diagram, Interaction Diagrams and Activity diagrams, Events and signals, State Machines, Processes and Threads, Time and space, State chart diagrams, Case Study on use case, interaction, activity and state chart diagrams.	06
6.	**Architectural Modeling using UML** Components, Deployment, Collaboration, Patterns and Frame works, Component diagrams and Deployment Diagrams, Case Study on Components, Deployment, Collaboration diagrams.	06

References:

Text Books:

- Michael Blaha, James R. Rumbaugh, William Premerlani, James Rumbaugh, "Object-Oriented Modeling and Design with UML" Pearson.
- Grady Booch, JeamsRambaugh, Ivar Jacotson, "The Unified Modeling Language User Guide", Pearson.

Reference Books:

- Andrew High, "Object Oriented Analysis and Design", McGraw Hill Education.
- Mark Priestley, "Practical Object-Oriented Design with UML", McGraw-Hill Education.

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T. Y. B. Tech. Syllabus
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Department of Civil Engineering

Open Elective-I

Class: **T. Y. B. Tech**	Semester- **V**
Course Code: **OE363**	Course Name: **Robotics Engineering & Application**

L	T	P	Credits
3	-	-	3

Course Description:
This course explores the practical applications of robotics in various industries, including manufacturing, healthcare, agriculture, defense, and space exploration. It provides an understanding of robotic systems, sensors, actuators, and AI-driven automation. Students will learn about industrial robots, service robots, autonomous systems, and emerging trends in robotics. The course emphasizes real-world case studies, ethical considerations, and the impact of robotics on society, preparing students for careers in robotics and automation.

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

1. Explain various applications of robotics in industry and society.
2. Describe the concept of automation, robot integration, and their role in Industry 4.0.
3. Investigate the use of robots in healthcare, agriculture, defence, service, and space exploration.
4. Discuss ethical considerations and future trends in robotics applications.

Prerequisite:
Basics of Mechanical Engineering, Basics of Robotics and automation, sensors and Actuators, Control System

Course Content

Unit No	Description	Hrs
1.	**Robotics in Agriculture** Introduction, historical development, Autonomous tractors, drones, and harvesting robots, impact and sustainability of agricultural robots, artificial intelligence and machine learning in agricultural robotics	06
2.	**Industrial Robotics and Manufacturing Applications** Use of robots in manufacturing and assembly lines, Robotics in material handling, welding, painting, and packaging, Integration of robots with CNC machines and flexible manufacturing systems (FMS), Industry 4.0 and smart factories: Role of IoT, AI, and digital twins.	06
3.	**Robotics in Healthcare and Medical Applications** Robotics in surgery, rehabilitation, and prosthetics, Assistive robots for elderly and disabled individuals, Role of AI in robotic healthcare applications, Case studies on robotic-assisted surgery (e.g., Da Vinci Surgical System).	06

4.	**Robotics in Défense, and Space Exploration** Military robots: Unmanned ground vehicles (UGVs), aerial drones (UAVs), and bomb disposal robots, Robotics in space exploration: Rovers, robotic arms, and satellite servicing, Challenges and advancements in space robotics.	06
5.	**Service, Autonomous, and Humanoid Robotics** Service robots: Household, hospitality, and customer service applications, Autonomous robots: Self-driving cars, warehouse automation, and logistics, Humanoid robots and their interaction with humans, Ethical concerns and the impact of robotics on employment, Case Study of Humanoid Robots (Rashmi, Sofiya, Yashnee etc)	06
6.	**Future Trends, Challenges, and Ethical Considerations** Soft robotics and bio-inspired robots, AI and machine learning in robotics, cybersecurity risks and ethical considerations in robotics applications, robo grammer and robo romi, Future challenges and opportunities in robotics engineering. Case study on Ethical Considerations.	06

References:

Text Books:

- Spong, M. W., Hutchinson, S., Vidyasagar, M. – Robot Modeling and Control (Wiley)
- Mukherjee, S. – Robotics and Automation Engineering (Oxford University Press)
- Mittal, R. K., Nagrath, I. J. – Robotics and Control (Tata McGraw-Hill)
- Rajput, R. K. – Robotics and Industrial Automation (S. Chand Publishing)

Class: **Third Year B. Tech. Civil**	Semester: V
Course Code: **CEMD301**	Course Name: **Infrastructure Engineering**

L	T	P	Credits
3	-	-	3

Course Description:

This course provides an overview of infrastructure planning and design, covering roads, airports, railways, and harbors. Explore the history and present status of India's roads, delve into geometric design principles for highways, and learn about diverse pavement types. Gain insights into airport planning, runway layout, lighting, and markings. Conclude with a broad understanding of railway and harbor engineering for comprehensive insights into infrastructure development.

Course Learning Outcomes:

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

1. Apply the knowledge of geometric design in road construction.
2. Identify the quality parameters of pavement materials and various methods of road construction.
3. Discuss the various aspects of airport engineering.
4. Explain design parameters of railway engineering and it's component parts.
5. Summaries the different off shore structures for dock and harbors.

Prerequisite: Physics

Course Content		
Unit No.	**Description**	**Hrs**
01	**Highway Planning** Introduction: Classification of roads, Brief history of road development in India, Present status of roads in India, NHAI, NHDP, PMGSY, MSRDC; Geometric Design of Highways: Terrain classification, Design speed. Highway cross-section elements, Sight distance, Overtaking sight distance, Intersection sight distance;	06
02	**Geometric Design of Roads** Design of Horizontal Alignment: Horizontal curves, Design of super elevation and its provision, Radius at horizontal curves, Widening of pavements at horizontal curves, Methods of extra widening; Design of vertical alignment: Different types of gradients, Grade compensation on curves, summit curves, valley curves	06
03	**Highway Construction** Types of Pavement (Flexible and Rigid); Types of Roads: WBM, WMM,	06

	DBM, SDBC, SMA, PQC, DLC; Highway Drainage: Necessity, sub surface and surace drainage; PPP in Transport Sector	
04	**Airport Engineering** Introduction: Advantage and limitation of air transportation, Aircraft component parts and characteristics, Important terms in Airport planning, Airport layout: Imaginary surfaces, Zoning requirements Runway Location and orientation, Runway configuration, Characteristics of good layout, Basic runway length, Use of wind rose diagram. Airport Lighting and Markings.	**06**
05	**Railway Engineering:** History of Indian Railways; Recent development in railways specifically w.r.t. track structure; Permanent Way; Component parts of railway track; Railway lines classification based on speed; Geometric Design: Alignment, Gradient, Horizontal Curves, Superelevation; Points, Crossing and Turnouts; Signaling and Interlocking: Control of train movements and monitoring, Types of signals, Principal of interlocking; Modernization in Railway and Railway Tracks	**06**
06	**Dock and Harbor Engineering:** Introduction, Planning and layout of ports, Classification, Site Selection, Breakwater, Jetties, Locks, Shore protection works.	**06**

References:

Text Books:

- Khanna and Justo, "Highway Engineering", Nemchand Bros, Roorkee.
- L R Kadiyali, "Highway Engineering", Khanna Publisher.
- S.C. Saxena & S.P. Arora, "A textbook of Railway Engineering", Dhanpat Rai Publications.
- S. K. Khanna, M. G. Arora, "Airport Planning & Design", Nemchand Bros, Roorkee

Reference Books:

- Partha Chakraborty and Animesh Das, "Principles of Transportation Engineering", Prentice Hall of India Ltd., New Delhi.
- Satish Chandra, M. M. Agarwal, "Railway Engineering" Oxford University Press India.

Class: - TY B. Tech	Semester - V
Course Code: **CSMD301**	Course Name: **Fundamentals of Database Systems**

L	T	P	Credits
3	-	-	3

Course Description:
This course serves as an introduction to the fundamental principles and practices of database management. It is designed for individuals seeking to develop a solid foundation in organizing, storing, retrieving, and managing data efficiently. Participants will gain both theoretical knowledge and hands-on experience in working with databases, providing a comprehensive understanding of modern database management systems.

Course Learning Outcomes:
At the end of the course the student should be able to:
1. Describe the purpose and nature of the database system for storing and fast access to thedata
2. Identify various protocols, issues, and techniques related to transaction managementfor a consistent & and stable database
3. Draw E-R models to represent simple database application scenarios
4. Design the queries to manipulate and access data using procedural and non-procedural languages
5. Apply relational database design concepts to remove data redundancy and to retrieve data easily
6. Perform operation on Unstructured data.

Prerequisites:
- Basic understanding of computer science concepts and familiarity with basic programming principles.
- Basic Knowledge of File System & Client server Architecture.

Course Content

Unit No	Description	Hrs
1	**Introduction and Database concepts and Data Model** Purpose of Database Systems, Data abstraction, Data Models, Overall System Design, Entities and Entity sets, Mapping Constraints, E-R Diagram, Reducing ER Diagrams to Tables, Generalization, specialization and Aggregation, Relational Algebra, Tuple Calculus.	06
2	**Structured and Procedural Query Language** Introduction to SQL and PL/SQL, Set operations, Joins, Aggregate operations, Nested queries etc., PL/SQL Cursor, stored procedure and Trigger.	06
3	**Relational Database Design** Domain Constraints, Referential Integrity, Functional Dependencies, Canonical cover, Pitfalls in Relational Database Design, Decomposition andNormalization using Functional Dependencies.	06

4	**Transaction Management and Concurrency Control** Basic concepts, States, Concurrent execution, Serializability, Recoverability, isolation; Concurrency control: Timestamps and locking protocols, Validation based protocols, deadlock handling; Recovery: Log-based recovery, Shadow-paging.	**08**
5	**Database Security and Crash Recovery** Introduction to Database Security, Confidentiality, Integrity, Availability Needs of Database Security SQL injection attack, error recovery and logging undo, redo, undo-redo logging, and recovery methods.	**06**
6	**Introduction to NoSQL Database** Fundamentals of NoSQL (NoSQL Features, Data Models, and Distribution Models), Introduction to MongoDB, MongoDB CRUD operations. (Creating, Reading & Updating Data)	**04**

Text Books

- Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database system concepts", Fifth Edition, McGraw Hill International Edition, ISBN 978-0073523323.
- Raghu Ramkrishnan, Johannes Gehrke, "Database Management Systems", Third Edition, McGraw Hill International Editions, ISBN 978-0072465631.

References

- Ramez Elmasri and Shamkant B. Navathe, "Fundamental Database Systems", Third Edition, Pearson Education, ISBN 978-0321204486.
- Kristina Chodorow, "MongoDB: The Definitive Guide: Powerful and Scalable Data Storage".Third Edition

Class:- **T.Y. B. Tech.**	Semester- **V**
Course Code : **EEMD301**	Course Name : **Electrical Machines**

L	T	P	Credits
3	--	--	3

Course Description:
The Electrical Machines minor course is designed to provide students with a fundamental understanding of the principles, operation, and applications of electrical machines in various engineering systems. This course serves as an introduction to the field of electrical machines, covering both theory and practical aspects. Students will gain insights into the performance, and control of electrical machines, which are essential components in modern electrical and electronic systems.

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

1. Describe behavior of dc machine.
2. Explain the working principle of 1-Phase and 3-Phase transformers.
3. Explain working of different induction motors.
4. Select the relevant electrical machines for different applications
5. Interpret the relevant fractional horse power motor for different applications

Prerequisite: Basic Electrical Engineering, Engineering mathematics and Engineering physics

Course Content

Unit No	Description	Hrs
1	**DC Machine** Fleming's right hand rule, Construction of dc machine with their parts information, Principle of operation of dc generator and Motor, Fleming's left hand rule, Voltage equations of dc motor, Torque equation of dc motor, Characteristics of dc motors, Speed control methods of dc motor, Applications of dc machine	06
2	**Transformer** Construction of 1-Phase and 3-Phase transformer, Principle of operation, EMF equation of transformer, transformation ratio, Types of transformers, Ideal transformer on no load, Practical transformer on no load and on load, Phasor diagram of practical transformer for different loads, Losses in transformer, efficiency of transformer, Applications of transformer	06
3	**Induction Motors** **1-Phase Induction motor:** Resistance start/Split phase induction motor, Capacitor start induction run	06

	motor, Capacitor start capacitor run induction motor **3-Phase Induction motor:** Construction and working of 3-Phase Induction motor, Types of 3-Phase Induction motors, Synchronous speed, rotor speed, Slip, Torque equation of 3-Phase Induction motor, Torque-Slip characteristic of 3-Phase Induction motor, Need and types of starters, Speed Control of 3-Phase Induction motors Applications of induction motors	
4	**Synchronous machines** **Alternator:** Construction and working principle, EMF equation, Types of rotors, Terminal voltage, Armature reaction at various p.f., Voltage regulation **Synchronous Motor:** Construction and working principle, Different torques in synchronous motor, Effect of excitation, Applications of synchronous machines.	**06**
5	**Fractional Horse Power Motors** Permanent Magnet DC Motor (PMDC), Brushless DC Motor (BLDC), Steeper Motors, AC and DC Servo Motor, SRM, Universal motor. Applications of various special purpose motors	**06**
6	**Electric Drives** Introduction to controlled rectifiers, Electric Drives, Advantages of Electrical drives, Parts of electrical drives ,Choice of electrical drives, Status of ac and dc drives, fundamental torque equations, Multiquadrant operation, Classification of drives	**06**

References -

Text Books:

- Ashfaq Husain, Electric Machines, Dhanpat Rai & Co
- V K Mehta, Principle of Electric Machine, S Chand Publication
- D.P. Kothari, I Nagrath , Electric Machines, Tata McGraw-Hill Education.

Reference Books:

- P. S. Bimbhra , Electrical Machinery, Khanna Publishers
- B.L.Theraja and A.K.Theraja, Electrical Technology, S Chand Publication
- Charles I. Hubert, Electric Machines: Theory, Operating Applications, and Controls, Pearson publication

Class: - **T. Y. B. Tech ETC Engg.**	Semester-V
Course Code : **ECMD301**	Course Name : **Advanced Communication Systems**

L	T	P	Credits
3	-	-	3

Course Description:
This course covers the basics of antenna and wave propagation, key antenna parameters, and various antenna types. It includes an overview of 5G communication systems, channel modeling, and the challenges of 5G wireless propagation. Additionally, the course introduces modern communication techniques like fiber optics, GSM, CDMA, LTE, Bluetooth, WiFi, ZigBee, LoRA, and RFID.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain the principles of antenna and wave propagation.
2. Understand basic antenna parameters and their types.
3. Discuss the evolution, requirements, and challenges of 5G communication systems.
4. Understand and compare various communication techniques.
5. Communicate effectively on complex engineering topics related to modern communication techniques.

Prerequisite:
Knowledge of basic analog and digital communication.

Course Content

Unit No	Description	Hrs
1.	**Basics of Antenna and Wave Propagation** Introduction to Antenna and wave propagation, Types of wave propagation, Wave Polarization, Types of Wave polarization.	06
2.	**Antenna Parameters** Basic Antenna parameters: Antenna pattern, Half power beam width, Beam area, Radiation intensity, Beam efficiency, Directivity and Gain, Resolution, Front to Back ratio, Effective height, Reflection coefficient, Impedance bandwidth, and pattern bandwidth.	06
3.	**Types of Antennas** Dipole Antenna, Antenna Array, Wire Antenna, Microstrip Antenna, Aperture antenna, Dish Antenna, Yagi Uda Antenna.	06
4.	**Overview of 5G Communication** Evaluation of mobile technologies 1G to 4G (LTE, LTEA, LTEA Pro), An Overview of 5G requirements, Regulations for 5G, Spectrum Analysis and Sharing for 5G.	06

5.	**The 5G wireless Propagation Channels** Channel modeling requirements, propagation scenarios, and challenges in the 5G modeling, Channel Models for mm-Wave MIMO Systems.	06
6.	**Communication Techniques** Fundamentals of Fiber Optics Communication, GSM, CDMA, LTE, Blue Tooth, WiFi, ZigBee, LoRA, RFID.	06

References -

Text Books:

- Constantine A. Balanis "Antenna Theory: Analysis and Design" Wiley Publication.
- John D. Kraus and Ronald J. Marhefka "Antennas and Wave Propagation" McGraw-Hill Publication.
- Theodore S. Rappaport "Wireless Communications: Principles and Practice" Pearson Publication.
- Martin Sauter "From GSM From GSM to LTE–Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband", Wiley-Blackwell.

Reference Books:

- John D Kraus, Antenna for all Application, TMH publication
- Louis Frenzel, "Communication Electronics Principles and Applications" TMH Publication.
- Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", John Wiley & Sons

Class:- **T.Y. B. Tech**	Semester-V
Course Code : **CIMD301**	Course Name : **Introduction to DBMS**

L	T	P	Credits
3	–	–	3

Course Description:

A database is an organized collection of data. A relational database, more restrictively, is a collection of schemas, tables, queries, views, and other elements. It defines data models, relational models, constraints that can be used in design of the relational database, also it focuses on file structure, transaction management and recovery of databases. The course also provides an overview of SQL which is used for implementation of relational databases. A general-purpose DBMS is a software system designed to allow the definition, creation, querying, update and administration of databases.

Course Learning Outcomes:

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

1. Describe the fundamental elements of relational database management systems.
2. Design ER-models to represent simple database application scenarios.
3. Write SQL query to perform various operations on the database.
4. Analyze principles of integrity constraints, Hashing and Indexing on databases.
5. Illustrate the transaction management, concurrency control and crash recovery.

Prerequisite: Data Structures

Course Content

Unit No	Description	Hrs
1.	**Introduction to Database Concepts** Purpose of Database Systems, Data abstraction, Data Models, Entities and Entity sets, Mapping Constraints, E-R Diagram, Reducing E-R Diagrams to Tables, Generalization and Aggregation.	06
2.	**Relational Model** Structure of Relational Databases, the Relational Algebra, the Tuple Relational Calculus, Structured Query Language (SQL), Joins.	06
3.	**Integrity Constraints and Database Design** Domain Constraints, Referential Integrity, Complex datatypes, Functional Dependencies, Pitfalls in Relational Database Design, Decomposition, Normalization	06
4.	**Data Storage and Indexes** File Organization, Data Dictionary Storage, Indexing: B+ tree indexing and	06

	B tree indexing, Hashing: Static and Dynamic.	
5.	**Query Processing and Basic of Transactions** Overview, Query Interpretation, Concepts of transaction processing, ACID properties, Transaction states, Serializability, Testing for serializability.	**06**
6.	**Concurrency Control and Recovery System** Lock-based protocols, Timestamp - based Protocols, Multiple Granularities, Deadlock handling, Crash Recovery: Failure Classification, Log-Based Recovery, Checkpoints, Shadow Paging	**06**

References -

Text Books:

- Abraham Silberschatz , Hank Korth and S. Sudarshan , "Database System Concepts", McGraw Hill Education.
- Ram Krishnan, Johanses Gehrke, "Database Management Systems", McGraw Hill Education.

Reference Books:

- J.D. Ullman, "Principles of Database Systems", Galgotia Publications.
- Jio Wiederhold, "Database Design", McGraw Hill International.
- Kristina Chodorow, "MongoDB: The Definitive Guide: Powerful and Scalable DataStorage".

Class: - **T.Y. B. Tech.**	Semester-V
Course Code: **MEMD305**	Course Name: **Product Design Tools and Techniques**

L	T	P	Credits
3	--	--	3

Course Description:
This course introduces students to the fundamental and advanced tools and techniques used in product design, focusing on engineering principles, design for manufacturability, value engineering, concurrent engineering, reverse engineering, and prototyping. The course will combine theoretical foundations with practical applications, including case studies.

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

1. Explain the basic principles of engineering design.
2. Design products for ease of manufacturing and assembly.
3. Apply value engineering and concurrent engineering principles in product design.
4. Apply reverse engineering on a product.
5. Apply various prototyping techniques, including rapid prototyping technologies.

Unit No	Description	Hrs.
1.	**Principles of Engineering Design:** Introduction to engineering design, Introductory principles – Iteration, Compromise, Complexity, Responsibility, Simplification., Problem identification, Creativity, Concept selection, Embodiment, Modelling, Detail design, Design management, Information gathering.	06
2.	**Design for Manufacturability, Assembly and Sustainability:** Overview of DFM and DFA principles, Case studies of DFM and DFA, Techniques and Tools for DFM and DFA, Techniques to simplify manufacturing processes, Tools for assessing and optimizing assembly processes, Environmental Considerations in Manufacturability and Assembly, Introduction to sustainable design and environmental impact, Tools for environmental assessment, including life-cycle analysis.	06
3.	**Value Engineering:** Introduction, Nature and Measurement of Value, The Value Analysis Job Plan, Steps to Problem-Solving and Value Analysis, Value Analysis Tests, Value Engineering Idea Generation Check-list, Cost Reduction Through Value Engineering, Case Study on Tap Switch Control Assembly, The Methodology, Benefits of Value Engineering, Material and Process Selection in Value Engineering.	06
4.	**Concurrent Engineering:** Introduction to Concurrent Engineering, Fundamentals of CE, Need and basic principles of CE, Benefits of implementation of CE, Introduction to various	06

	integrating mechanisms, forming of CE team. Teamwork: Interfacing of manufacturing and design, selection of key techniques and methodologies, selection of CE tools.	
5.	**Reverse Engineering:** Scope and tasks of RE, Process of duplicating, Definition and use of Reverse Engineering, Reverse Engineering as a Generic Process, Cognitive approach to RE, Integration of formal and structured methods in reverse engineering.	**06**
6.	**Modern Prototyping Techniques:** Traditional prototyping methods, additive manufacturing (3D printing), subtractive manufacturing (CNC machining), Rapid prototyping applications. AM process chain, Classification of AM processes, Design for AM, Post Processing	**06**

References:-

Text books:-

- Engineering Design Principles, Kenneth S. Hurst, Butterworth-Heinemann.
- Katheryn, A. Ingle, Reverse Engineering, McGraw-Hill.
- Product Design for Manufacture and Assembly, G. Boothroyd, CRC Press Inc.
- Product Design and Manufacturing, A.K. Chitale and R.C. Gupta, PHI Learning Private Limited, Delhi.
- Chua Chee Kai, Leong Kah Fai, Rapid Prototyping: Principles & Applications, World Scientific.

Reference Books:

- Linda Wills, Reverse Engineering, Kluiver Academic Publishers.
- Larry W. Zimmerman, Glen D. HartVan Nostrand Reinhold, Value Engineering: A Practical Approach for Owners, Designers, and Contractors, SAVE International.

Class: - **T.Y. B. Tech**	Semester-V
Course Code: **MCMD301**	Course Name: **Sensor and Instrumentation**

L	T	P	Credits
3	-	--	3

Course Description:
This course provides an in-depth understanding of sensors and instrumentation used in mechatronics systems. Students will learn the principles of various sensors and their applications in measuring physical quantities. The course will cover topics such as sensor types, signal conditioning, data acquisition, and integration of sensors into mechatronics systems with real life applications.

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

1. Understand the fundamental principles of various sensors and transducers.
2. Analyze the characteristics, advantages, and limitations of different sensor types.
3. Apply appropriate signal conditioning techniques to improve sensor output accuracy and integrate sensors into mechatronic systems for real-time data acquisition and control.
4. Select appropriate sensors for specific mechatronic systems used in real life applications.

Prerequisite:
1. Basic knowledge of mechatronics systems.
2. Familiarity with electronics and electrical circuits.

Course Content

Unit No	Description	Hrs
1	**Introduction to Mechatronics and Sensors:** Definition and scope of mechatronics, Role of sensors in mechatronic systems, Classification of sensors based on transduction principles, Sensor Characteristics and Performance Parameters such as sensitivity, accuracy, precision, resolution, hysteresis, etc., Calibration and compensation techniques.	06
2	**Temperature Sensors:** Thermocouples, Resistance Temperature Detectors (RTDs), Thermistors, Infrared (IR) temperature sensors. **Position and Displacement Sensors:** Potentiometers, LVDT (Linear Variable Differential Transformer), Optical encoders, Inductive sensors.	06
3	**Force and Pressure Sensors:** Strain gauges, Load cells, Pressure transducers, Piezoelectric, Piezoresistive, and Capacitive Pressure Sensors, Ultrasonic Sensors	06

	Motion and Velocity Sensors: Accelerometers, Gyroscopes, Proximity sensors, Hall Effect Sensors.	
4	**Light and Imaging Sensors:** Photodiodes, Phototransistors, Image sensors (CMOS, CCD) **Wireless and IoT Sensors:** Bluetooth, Wi-Fi, Zigbee, and other wireless protocols, Integration of sensors into IoT platforms.	**06**
5	**Sensor Interfacing and Signal Conditioning:** Amplification and filtering, Analog-to-Digital Conversion (ADC), Sensor interfaces, Noise reduction and error compensation **Data Acquisition and Processing:** Sampling theorem and Nyquist frequency, Data acquisition systems (DAQ) Analog and digital signal processing, Sensor fusion techniques	**06**
6	**Case Studies and Real-World Applications:** Robotics and automation systems, Autonomous vehicles, Biomedical applications, Health care, defense applications, agricultural applications, automobile sector, communication devices, home security.	**06**

References -

Text Books:

- Principle of Industrial Instrumentation by D. Patranabis, Tata McGraw Hill, 2nd Ed.
- Instrumentation and Measurement Principles by . D.V.S. Murty, PHI, New Delhi, 2nd Ed.
- Electrical and Electronics Measurement and Instrumentation by A.K. Sawhney,
- Dhanpat Rai & Co, 2nd Ed.
- Process control instrumentation technology by Curtis D. Johnson, PHI learning Pvt. Ltd, 07th Ed

Reference Books:

- Measurement Systems by E.O. Doebelin, McGraw Hill, 06th Ed.
- Process Measurement & Analysis by B.G. Liptak, CRC press, 04th Ed.
- Instrumentation Devices and Systems by C. S. Rangan, G. R. Sharma and V. S. Mani,
- Tata McGraw-Hill Publishing Company Ltd., New Delhi, 02nd Ed.
- Mechanical and Industrial Measurements by R. K. Jain, Khanna Publishers, 02nd Ed.

Class:- **T. Y. B. Tech.**	Semester- **V**
Course Code: **AIMD301**	Course Name: **Machine Learning**

L	T	P	Credits
3	-	-	3

Course Description:

The students will understand the basics of Machine Learning. They will learn to apply different machine-learning algorithms to various datasets.

Course Learning Outcomes:

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

1. Utilize machine learning techniques and understand the basic theory underlying machinelearning.
2. Articulate supervised, unsupervised and reinforcement learning
3. Identify the basic concepts of learning and decision trees.
4. Utilize Bayesian techniques for problems appear in machine learning
5. Perform statistical analysis of machine learning techniques.

Prerequisites:

- Basic knowledge of Probability theory and python programming

Course Content		
Unit No	**Description**	**Hrs**
1	**Introduction:** Learning in the context of ML, three phases of performing ML, Algorithms and Models in ML. Logical, Geometric and Probabilistic models, Underfitting, Overfitting and Right models, Practical ML examples, Types of ML problems, Classification of ML algorithms.	**06**
2	**Decision Trees** Purpose and uses, Constructing a decision tree, Gini Index, Gain ratio, ID3, C4.5, CART, Benefits of decision tree, Random Forest.	
3	**Regression-Based Learning:** Regression Analysis, Covariance, Correlation Coefficient, Regression Methods, Simple liner regression, Regression Model, Multiple Regression, Polynomial regression, Generalized linear models, Logistic regression	**08**
4	**Instance Based Learning and kernel-methods based learning:** KNN algorithm, Determining K, distance measures in KNN, Case based Reasoning, Support vector Machines (SVM).	**06**

5	**Clustering Based Learning:** Types of clustering, K-means clustering algorithm, Advantages and dis-advantages of K-means clustering, Distance measures.	06
6	**Bayesian learning:** Classical, Empirical, Subjective methods, Types of events, Types of probabilities, Normal Distribution, Bayes' Theorem, Naïve Bayes'classifier.	06

References -
Text Books:

- Sunila Gollapudi "Practical Machine Learning" PACKT Publishing
- Mitchell, Tom. M., "Machine Learning", McGraw-Hill Education.
- John Paul Mueller and Luca Mueller, "Machine Learning for Dummies"

Reference Books:

- Stephen Marsland, "Machine Learning An Algorithmic Perspective", CRC Tylor andFrancis Publication

K.E. Society's

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

T. Y. B. Tech. Syllabus

To be implemented for 2023-27 NEP Batch

Department of Civil Engineering

Class: **T.Y. B. Tech.**	Semester-V
Course Code: **RAMD301**	Course Name: **Kinematics & Dynamics for Robots**

L	T	P	Credits
3	-	-	3

Course Description:

This course provides an opportunity for the students of other engineering programs to learn kinematic and dynamic analysis of the robots. The fundamental concepts of mechanisms and methods of mechanism design and selection are introduced. The course covers the concepts of kinematic and dynamic analysis of robots such as forward kinematics, inverse kinematics and robot dynamics. The robot gripers, manipulators, their dynamic analysis and workspace analysis is also covered in the course. The course outcomes will ultimately help to perform synthesis of mechanisms and kinematic and dynamic analysis of different robots for various applications.

Course Outcomes:

After completion of this course student will be able to -

1. Select the type of mechanism for the robotic applications
2. Perform kinematic analysis and synthesis of mechanisms.
3. Perform forward and inverse kinematics of robots
4. Perform workspace analysis for different types of robots
5. Design robot manipulators based on dynamic analysis
6. Perform forward and inverse dynamics of robots

Prerequisite: Kinematics of Machines, Dynamics of Machines

Course Content:

Unit No	Description	Hrs
1.	**Fundamental Concepts** Kinematic Links, kinematics pair, types of constrained motion, Kinematic chain, Degrees of freedom, mechanisms, inversion of mechanism, position and orientation of rigid body, Linear and angular velocity of links, Velocity propagation, synthesis of mechanisms	06
2.	**Forward Kinematics** Robot kinematics, D-H representations and displacement matrices for standard robot configurations, The ARM equation, Forward kinematics of manipulators up to 6 degrees of freedom, representation of forward kinematic equations. Direct kinematic analysis for Four axis, SCARA Robot and three, five and six axis Articulated Robots.	06
3.	**Inverse Kinematics** Inverse kinematic analysis of robot with standard configurations, methods for solution of non-linear simultaneous equations, singularity analysis, Inverse kinematic solution of Robots - Inverse kinematics of four axis SCARA robot and three and five axis Articulated robot.	06
4.	**Workspace Analysis**	06

	Workspace analysis, work envelope of a Four axis SCARA robot and five axis articulated robot, workspace fixtures, the pick and place operations, Joint space technique – continuous path motion, Interpolated motion, straight line motion and Cartesian space technique in trajectory planning,	
5.	**Robot End Effectors** Classification of the Robot End effectors- tools and grippers, selection and Design consideration of the gripper, mechanical grippers, vacuum grippers, magnetic grippers, adhesive grippers, RCC grippers, gripper force analysis, Materials for hostile operation of gripper. Tools used as end effectors- welding gun, spray gun, drilling tool etc., Tool center point (TCP)	06
6.	**Manipulator Dynamics** Kinetics of rigid bodies – Work energy principle, Linear and angular momentum, conservation laws, Forward Dynamics and Inverse Dynamics, Spatial description and transformations, Dynamic parameters identification, Newton-Euler formation, Lagrange-Euler formation, Dynamic model of simple manipulator structures , Dynamic model of a Two-axis planar robot	06

References:

Text Book-

- Groover M.P., Weiss M., Nagel R.N., Odrey N.G., "Industrial Robotics Technology- Programming and Applications", McGraw Hill Book Co
- S. K. Saha, Introduction to Robotics 2nd edition, TATA McGraw Hills Education, 2014.
- S.S.Ratan , Theory of Machines, Tata McGraw Hill

Reference Books-

- Robert J. Schilling, Fundamentals of Robotics Analysis and Control, PHI Learning, 2009.
- Richard D. Klafter, Thomas. A, Chri Elewski, Michael Negin, Robotics Engineering: An Integrated Approach, PHI Learning., 2009.
- Francis N-Nagy Andras Siegler, Engineering foundation of Robotics, Prentice Hall Inc., 1987.
- Bernard Hodges, Industrial Robotics, Second Edition, Jaico Publishing house, 1993.
- Tsuneo Yohikwa, Foundations of Robotics Analysis and Control, MIT Press., 2003.
- John J. Craig, Introduction to Robotics Mechanics and Control, Third Edition, Pearson, 2008.
- Hartenberg and Denavit, "Kinematics and Synthesis of Linkages", McGraw Hill Book Co.
- J. E. Shigley and J.J.Uicker Jr., Theory of Machines and Mechanism, McGraw Hill
- Kelly R, Santibanez V and Loria A, —Conrol of Robot Manipulators in Joint Space, Springer, 2005.
- John J. Craig, Introduction to Robotics, 3rd Edition, Addison Wesley, ISE 2008

Class: **Third Year B. Tech. Civil**	Semester: V
Course Code: **CEMD303**	Course Name: **Smart Cities & Sustainable Development**

L	T	P	Credits
2	-	-	2

Course Description:

This course will introduce students to the concepts of smart cities and different ideologies of smart cities and sustainable development. Different approaches of different countries all over the world toward smart cities and sustainable development will be studied and evaluated. The current smart city mission in India its plans and provisions and different aspects will also be studied and critically evaluated. Measurement of sustainability and its assessing framework will also be studied under this course. Present condition of sustainability in India its needs, issues and challenges will also be studied

Course Learning Outcomes:

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

1. Discuss the concept of smart cities and ideologies of sustainable Development.
2. Analyze the different approaches toward smart cities on global level.
3. Evaluate the present state and approach of Smart city Mission in India.
4. Comprehend the concept of resilience and sustainable development and its measurement.
5. Study the present status of sustainable development in India.

Prerequisite: Basics of civil engineering

Course Content		
Unit No.	**Description**	**Hrs**
01	**Introduction** Smart cities concept, origin, ideology. Typologies and different meanings, Wired city, Virtual city, Intelligent city, Information city, Digital city. Characteristics of smart cities: smart economy, smart people, smart governance, smart mobility, smart environment, smart living Strategies and policies.	**04**
02	**Critical evaluation of Smart City Concept** Approaches towards smart cities in various countries. Smart city planning in advanced economies, economic, financial viability, social implications. Financial and economic viability of smart city. Critical evaluation of smart city development projects in India	**04**
03	**Smart City Mission in India** Smart city mission: Objectives, features, coverage and duration. Preconditions	**04**

	and criteria for the selection of smart city, actions and tools for smart cities Strategies, retrofitting, redevelopment, Greenfield, Brownfield, pan-city. Governance and management special purpose vehicles.	
04	**Resilience and Sustainable Development** Sustainable Development Introduction, Origin, Definition, three pillars of Sustainable Development, Critiques on Sustainable Development. The concept of resilience: need and significance in the contemporary time, city preparedness, adaptations, risk reduction and mitigation. Climate change and resilience.	**04**
05	**Measurement of Resilience and Sustainability.** The Theory and Measurement of Sustainability: Ideologies and Ethos of Sustainability, Indicators, Indicator Framework for Assessing Sustainability, Measurement Systems for Sustainable Urban Development: Concept Level (Broad) Measurement Systems,	**04**
06	**Sustainability in India** Sustainability in India: Need, Issues and Challenges, Urbanization in India, Sustainable Development in India, Sustainability Measurement and Rating Systems and Initiatives in India	**04**

References:

Text Books:

- Sharma P. and Rajput S., "Sustainable Smart Cities in India", Springer International Publishing.
- Srinivasan R., Sookoor T., Jeschke S., "Smart Cities: Foundations, Principles, and Applications", John Wiley Publishing.

Reference Books:

- Mora L., Deakin M., "Untangling Smart Cities", Elsevier Science.
- Dag R. Bennett, Diana Pérez-Bustamante Yábar, "Sustainable Smart Cities", Springer International Publishing.
- Ministry of Environment and Forests, "Sustainable Development in India: Stocktaking in the run up to Rio+20", Government of India.

Class:- **T.Y. B. Tech**	Semester-V
Course Code: **CSMD303**	Course Name: **Object-oriented Programming in Python**

L	T	P	Credits
1	--	2	2

Course Description:
This course is designed to introduce students to the Python programming language, providing a solid foundation in its syntax, principles, and applications. Through hands-on coding exercises and projects, students will gain practical experience, enabling them to apply Python to various programming tasks and problem-solving scenarios. The course emphasizes good coding practices, algorithmic thinking, and an understanding of key programming concepts.

Course Learning Outcomes:
At the end of the course the student should be able to:

1. Demonstrate a comprehensive understanding of Python syntax, data types, and basic operations.
2. Make use of common Python libraries for data manipulation.
3. Implement lists, tuples, sets, and dictionaries for effective data handling.
4. Apply principles of OOP, including classes, objects, inheritance, and polymorphism.

Prerequisites: Basic understanding of programming concepts.

Course Content		
Unit No	**Description**	**Hrs**
1	**Introduction to Python fundamentals:** Python introduction, Python syntax, Python comments, Python variables, Python data types, Python numbers, Python casting, Python strings, Python Booleans, Python operators, Loops and Conditional Statement If-else, while, for, lambda, arrays, Python Iterators, Python scope	02
2	**Lists, Tuples, Sets, Dictionaries:** Access, change, add and remove list elements, loop lists, list comprehension, list methods, access, update, unpack tuples, loop tuples, tuple methods, Access, add, remove set items, set methods, access, add, change, remove dictionary items, nested dictionaries, dictionary methods.	02
3	**Classes and Objects:** Classes, objects, parameterized and non-parameterized init constructor, object methods, self-parameter, association, Access modifiers: Private, public, protected	02
4	**OOP Concepts:**	02

	Inheritance, Encapsulation, Polymorphism: overloading and overriding, abstraction: interface and abstract class	
5	**File handling and Exception:** File handling syntax, read files, write/create files, delete files, handing runtime exception and custom exception.	02
6	**Modules and Libraries** Introduction, modules, using dir() function, Numpy, Pandas, Matplotlib, Seaborn, markers, line, labels, grid, subplots, scatter, bars, histograms, pie-charts	02

References -

Text Books:

- "Python Programming: A Modular approach" by Sheetal Taneja, Naveen Kumar
- "Python Programming: Using Problem Solving Approach" by Reema Thareja

Reference Books:

- "Learning Python: by Mark Lutz
- "The Complete Reference: Python" by Martin C. Brown

RAJARAMBAPU INSTT. OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

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

T. Y. B. Tech. Syllabus

To be implemented for 2023-27 NEP Batch

Department of Civil Engineering

Class:- **T.Y. B. Tech.**	Semester-V
Course Code : **EEMD303**	Course Name : **Electrical Technology**

L	T	P	Credits
1	-	2	2

Course Description:
This laboratory course emphasis on imparting the practical knowledge and understanding of basic principles, characteristic, performance and testing of electrical systems. In this lab course, students will be familiar with the use of different electrical equipment and safety precautions on work place.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Demonstrate speed control methods of electrical machines.
2. Analyze performance of DC motor and induction motor for speed control applications.
3. Implement power electronic circuits for given application.
4. Measure electrical quantities using electrical and electronic instruments.

Prerequisite: Basic Electrical Engineering, Basic Electronics Engineering

Course Content

Unit No	Description	Hrs
1	**Power Electronic Devices:** Power diode, BJT, Thyristor, MOSFET, IGBT: Structure, Symbol, Working Principle, Comparison.	02
2	**Power Electronic Circuits:** Rectifier: single phase full wave diode rectifier, Chopper: basic step-down and step-up Chopper, Inverter: single phase full bridge inverter.	02
3	**Electrical and Electronic Measurements:** Electrical instruments, characteristics of measuring instruments, standards of measurement, voltmeter, ammeter and wattmeter, digital multi-meter, power analyzer. Comparison of analog and digital meters.	02
4	**Transducers:** Introduction, Classification of Transducers, Advantages and Disadvantages of Electrical Transducers, Transducers Actuating Mechanisms, Measurement of weight, speed, temperature, pressure and flow.	02
5	**Solar and Wind Energy Systems:** Solar cell fundamentals, V-I characteristics of a PV panel, principles of wind energy conversion, components of wind energy conversion system, classification of wind turbines- horizontal axis and vertical axis. Wind power integration into grid-power system , grid connected PV systems	02
6	**Electric Vehicle:** What Is an Electric Vehicle? Engineering philosophy of EV development, Pure	02

	Electric Vehicle, Hybrid Electric Vehicle, Gridable Hybrid Electric Vehicle, Fuel-Cell Electric Vehicle, Overview of EV Technologies.	

Expt. No.	Description	Hrs
1	Study of different starters of DC Motors.	2
2	Perform speed control of DC Shunt Motor by Armature Voltage and Field Current Control Method.	2
3	Perform polarity test on single-phase Transformer.	2
4	Perform speed control of an Induction Motor.	2
5	Measurement of active & reactive power for three phase supply.	2
6	Measurement of Electrical parameters by Power Analyzer.	2
7	Study of Single-Phase Full Wave Rectifier	2
8	Study the effect of wind speed on wind power generation.	2
9	Plot I-V and P-V characteristics of PV modules.	2
10	Study of Electric Vehicle and Battery Management System.	2

References -

Text Books:

- Ashfaq Husain, Electric Machines, Dhanpat Rai & Co
- V K Mehta, Principle of Electric Machine, S Chand Publication

Reference Books:

- P. S. Bimbhra . Electrical Machinery, Khanna Publishers
- B.L.Theraja and A.K.Theraja, Electrical Technology, S Chand Publication

Class: - **T. Y. B. Tech ETC Engg.**	Semester-V
Course Code : **ECMD303**	Course Name : **Electronic Product Design**

L	T	P	Credits
2	-	-	2

Course Description:
This course aims to introduce various methods, processes and protocols in product design. In this course student will develop a strong fundamental base for the design of electronic product.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Elaborate product design processes.
2. Explain various aspects of PCB design.
3. Differentiate product-testing methods.
4. Create various documents for the product.

Prerequisite:
Knowledge of basics analog and digital electronics and communication.

Course Content		
Unit No	**Description**	**Hrs**
1.	**Product Design and Development** Introduction, Product Development Basics, Product Development Stages, Identification of the Customer Requirements, Techno-Commercial Feasibility of a Product, Pilot Production Batch , Product Assessment, Availability, Screening Test of Component, Redundancy, Ergonomic and Aesthetic Design Considerations	**04**
2.	**Noise and Heat Management** Power Supply Protection Devices, Transient Voltage Suppressor, Fuses, Line Filters, Noise Consideration of a Typical System, Noise in Electronic Circuits, Grounding, Shielding, Guarding. Thermal Management.	**04**
3.	**PCB Design** Introduction to PCBs, Layout, Issues Related to PCB Size, Design Issues Related to Supply and Ground Conductors, Multilayer Boards, Component Assembly Techniques, Comparison of PCBs.	**04**
4.	**Hardware and software Design and Testing Methods** Introduction, Signal Integrity, Software Design and Testing Methods, Phases of Software Design, Selection of Language for Software Development, Assemblers, Compilers, Simulators, Emulators.	**04**
5.	**Electronic Product Testing** Introduction, Environmental Testing, Temperature Testing, Thermal	**04**

	Modeling of Components, Humidity Testing, Electrical Overstress Testing, Altitude Testing, Special Testing, Environmental Test Chambers and Rooms, Various Tests on Enclosures, EMI and EMC Related Testing, Importance of Standards, List of Some Standards.	
6.	**Product Documentation** Introduction, Types of Documentation, How to Prepare an Effective Document, PCB Documentation, Bill of Material: A Documentation of Part List, Manual Types.	04

References -

Text Books:

- R.G.Kaduskar, V.B.Baru, Electronic Product Design, Wiley Publication

Reference Books:

- Walter C Bosshart, Printed Circuit Board design and technology, Tata McGraw Hill
- Clyde Coombs ,Handbook of Printed Circuit, MCGraw Hill publication
- M.G. Loveday, Electronic testing and fault diagnosis, Longman publication

Class:- **T.Y. B. Tech**	Semester-V
Course Code : **CIMD303**	Course Name: **OOP using Java**

L	T	P	Credits
1	--	2	2

Course Description:
Object Oriented Programming is pillar of software development. The strong knowledge of object-oriented programming helps to create the better software. The main aim of this course is to cover the object-oriented concepts with java programming language. This course lets students to write computer programs using Java Development Kit and using the principles of Object-Oriented paradigm. The course covers Object-Oriented concepts, Java classes, array, exception handling, string API in Java. Students will develop desktop applications by using object-oriented concepts with use of Java Standard Edition. This course is also useful for learning the advanced java courses such as JSP, Servlet, Struts, and spring frameworks.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain the concepts and terminologies in object-oriented concepts and java programming language.
2. Apply object-oriented programming features and concepts for solving given problem.
3. Develop the java application using the collection framework to solve real word problem.
4. Apply the concepts exception handling to develop error free codes.
5. Utilize the concepts of package to develop efficient codes.

Prerequisite: Basic knowledge of C Programming

Course Content

Unit No	Description	Hrs
1.	**Introduction to Java Programming** Java buzzwords, Features of Java, JDK, JRE and JVM, Variables and data types, I/O statements in Java, Conditional and looping statements, Arrays.	02
2.	**Introduction to Object-Oriented Programming** Features of object-oriented programming, Class and objects, Constructors, Method and constructor overloading, Nested classes.	02
3.	**Features of Object-Oriented Programming** Polymorphism: Method overloading (Compile time Polymorphism), Method overriding (Run time Polymorphism), Inheritance, super, this, static and final keywords, Abstraction, Interface, Garbage collection.	02

4.	**Collection and String** Collection, Collection Framework, List: ArrayList, LinkedList, Vector and Stack, Queue: Deque and Priority Queue, Set: TreeSet and HashSet, Map: Hash Table and Hash Map, Java String.	02
5.	**Exception Handling** Exceptions & Errors, Types of Exception, Control Flow in Exceptions, JVM reaction to Exceptions, Exception keyword. In-built and User Defined Exceptions, Checked and Un-Checked Exceptions.	02
6.	**Packages** Organizing Classes and Interfaces in Packages, Package as Access Protection Defining Package, CLASSPATH Setting for Packages, Naming Convention for Packages.	02

Course Content		
Experiment No.	**Description**	**Hrs.**
1	Introduction to Java Programming	02
2	Classes, Object, and Method	04
3	Constructor	02
4	Inheritance	02
5	Method overloading and method overriding	02
6	Interface	02
7	Nested classes and abstract classes	02
8	Collection frameworks	04
9	Exception handling	02
10	Packages	02

References -

Text Books:

- M.T. Somashekara, D.S. Guru, K.S. Manjunatha, "Object Oriented Programming with Java", Kindle Edition, PHI Publication.
- Rajkumar Dr. Buyya, "Object Oriented Programming with Java: Essentials and Applications".
- Dr. Ms. Manisha Bharambe, Ms. Manisha Gadekar, "OBJECT ORIENTED PROGRAMMING USING JAVA 1", Kindle Edition, Nirali Publication.

Reference Books:

- Deitel and Deitel, "Java How to Program", Prentice Hall, Seventh Edition.
- Niemeyer & Leuck, "Learning Java", O'REILLY (SPD), Fourth Edition.

Class: - **T. Y. B. Tech.**	Semester- V
Course Code: **MEMD307**	Course Name: **Design and Prototyping**

L	T	P	Credits
2	--	--	2

Course Description:
This course provides students with practical experience in computer-aided design (CAD), focusing on sketching, part design, and the simulation and execution of additive manufacturing processes. Students will engage in hands-on activities that culminate in the 3D printing of their designed components.

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

1. Use CAD software to create detailed CAD models and designs.
2. Explain the workflow and settings for effective additive manufacturing.
3. Simulate the 3D printing process to identify and correct potential issues before actual printing.
4. Print a 3D component based on CAD models.

Prerequisites:
Basic knowledge of engineering drawing and design principles

Course Content

Unit No	Description	Hrs.
1.	**Introduction to CAD and Sketcher Basics:** Overview of CAD software, Basic operations and navigation, creating simple sketches and applying dimensions.	02
2.	**Advanced Sketching Techniques:** Using geometric constraints, Parametric sketching techniques, Practice exercises on complex shapes.	02
3.	**Basic Part Design:** Extruding and revolving sketches, Introduction to editing features like fillets, chamfers, and shells.	02
4.	**Advanced Part Design:** Applying advanced features and reference geometries, Transformation feature- Patterning, Scaling, Mirror, Creating assemblies from multiple parts.	02
5.	**Introduction to Simulation in Additive Manufacturing:** Basic principles of simulation for 3D printing, Setting up a simulation from a CAD model.	04
6.	**Simulation for Material Optimization and Strength:** Using simulation to predict material usage and optimize print parameters,	04

	analyzing results and making adjustments.	
7.	**Preparing for 3D Printing:** Converting CAD models to printable files (slicing), Selection of materials, Hands-on setup and initialization of 3D printers, sample 3D Printing of Components, Techniques for cleaning and finishing 3D printed parts.	**02**
8.	**Project - 3D Printing of Components:** Selection of component, CAD design, simulation, 3D printing of designed parts, Post-Processing and Evaluation of Printed Components.	**06**

References:-

Text books

- Engineering Design and Graphics with SolidWorks by James D. Bethune
- Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing by Ian Gibson, David Rosen, and Brent Stucker.

Reference Books:

- The 3D Printing Handbook: Technologies, design and applications" by Ben Redwood, Filemon Schöffer, and Brian Garret.

Class: - **T.Y. B. Tech**	Semester-V
Course Code: **MCMD303**	Course Name: **Industrial Automation**

L	T	P	Credits
2	-	--	2

Course Description:
To provide a clear view on Programmable Logic Controllers (PLC) & to learn the various methods involved in automatic control and monitoring & to familiarize with the communication protocol this course has been inducted.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explore the architecture of PLC and its functions.
2. Execute the various instructions and logic in PLC.
3. Develop the PLC program for various applications.
4. Design and develop the SCADA, DCS system for various applications.

Prerequisite:
Knowledge of fundamentals of Mechatronics

Course Content

Unit No	Description	Hrs
1.	**PROGRAMMABLE LOGIC CONTROLLERS** Introduction - Parts of PLC - Principles of operation - PLC sizes - PLC hardware components - I/O section - Analog I/O modules - digital I/O modules CPU processor memory module - PLC programming Simple instructions - Output control devices - Latching relays PLC ladder diagram,	04
2.	**INSTRUCTIONS** Timer instructions ON Delay, OFF Delay and Retentive Timers-UP Counter, DOWN Counter and UP down Counters.	04
3.	**APPLICATION OF PLC** Traffic light control, 24-hour clock design, Automatic stacking process, temperature control, Automatic control of warehouse door,	04
4.	**NETWORKING OF PLC AND SCADA** Networking of PLCs-Data Communication-Fieldbus, PROFI bus, and Mod bus-OSI. Supervisory Control and Data Acquisition-Architecture.	04
5.	**DISTRIBUTED CONTROL SYSTEM** Architectures - Comparison - Local control unit, Operator interfaces - Low level and high-level operator interfaces - - Low level and high-level engineering interface	04
6.	**APPLICATIONS OF DCS** Pulp and paper environment -Power plant - Petroleum - Refining environment,	04

	Wireless control system in challenging environments like welding shops, Introduction to Soft PLC.	

References -

- Petruzella Frank D, Programmable Logic Controllers, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
- Lucas, M.P., Distributed Control System, Van Nonstrandreinhold Co. NY.
- Webb, John W. Programmable Logic Controllers: Principles and Application, Fifth edition, Prentice Hall of India, New Delhi.
- Stuart A. Boyer, SCADA: Supervisory Control and Data Acquisition, ISA Publication. Bolton , "Programmable Logic Controllers" Newnes.

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To be implemented for 2023-27 NEP Batch

Department of Civil Engineering

Class:- **T. Y. B. Tech.**	Semester- V
Course Code: **AIMD303**	Course Name: **Business Intelligence**

L	T	P	Credits
2	-	-	2

Course Description:

This course is very useful as it aims in applying statistical techniques for analyzing data to help managerial people make informed decisions. It covers data preprocessing, modeling and visualization tasks thoroughly to give insight into the life cycle of a BI task. It makes students explore various analysis techniques which are also studied in various advanced data management related courses.

Course Learning Outcomes:

1. Articulate data pre-processing techniques
2. Analyze the data modeling required for business intelligence related tasks
3. Determine the role of statistical techniques in data analysis tasks
4. Identify big data analysis techniques
5. Utilize different reporting/visualization tool

Prerequisites: Database Management Systems

- Basic Probability and Statistics

Course Content

Unit No	Description	Hrs
1	**Introduction** What is business intelligence (BI)? Need for BI. Drawing insights from data: DIKW pyramid, levels of decision making (strategic, tactical and operational BI). Examples of business analyses–funnel analysis, distribution channel analysis and performance analysis.	05
2	**Data Preprocessing** Notion of data quality. Typical preprocessing operations: combining values into one, handling incomplete/ incorrect / missing values, recoding values. sub setting, sorting, transforming scale, determining percentiles, removing noise, removing in consistency es, transformations, standardizing, normalizing - min-max normalization, score standardization.	04
3	**Inferential Statistics** Role of probability in analytics, probability distributions and their characteristics. Need for sampling, generating samples, sampling and non-sampling error. Sampling Distribution of Mean, Central Limit Theorem, Standard Error. Estimation: Point and Interval Estimates, Confidence	04

	Intervals, level of confidence, sample size.	
4	**Data Warehousing** What is a data warehouse, need for a data warehouse, architecture, data marts, OLTP vs OLAP, Multidimensional Modeling: Star and snow flake schema, Data cubes, OLAP operations, Data Cube Computation and Data Generalization, Data Lake	04
5	**Enterprise Reporting** Metrics, Measurement, Measures, KPIs, Dashboards, Reports, Scorecards	03
6	**Hypothesis Testing** Basic concepts, Errors in hypothesis testing, Power of test, Level of significance,p-value, general procedure for hypothesis testing. Parametric and non-parametric tests – z test, t test, chi-square test. Two tailed and one-tailed tests. Chi-square test for independence and goodness of fit. ANOVA	04

References -

Text Books:

- Business Analytics by James R Evans, Pearson
- Data Mining: Concepts and Techniques", Jiawei Hanand Micheline Kamber, Morgan Kaufman, ISBN 978- 81-312-0535-8, 2nd Edition for overview of data mining, OLAP andcube technology, data preprocessing
- Fundamentals of Business Analytics", by R. N. Prasad, Seema Acharya, ISBN: 978-81- 256-3203-2, Wiley-India – Types of Digital Data, OLTP-OLAP, Introduction to BI
- Business Analytics for managers, Wolfgang Jank–exploring and discovering Data ModelinG

Reference Books:

- Business Intelligence for Dummies
- Applied Business Statistics: Making Better Business Decisions(English) 7 th Edition byKen Black. Wiley India
- Forecasting: Principles and Practices, Rob JHyndman, George Athanasopoulos, Otext

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RAJARAMNAGAR CIVIL ENGG. DEPT.

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Rajaramnagar Autonomous 415414

Class: **T. Y. B. Tech.**	Semester: **V**
Course Code: **RAMD303**	Course: **Robot Programming**

L	T	P	Credits
1	--	2	2

Course Description:
This course provides a comprehensive introduction to robot programming techniques and control strategies. Students will learn how to program robots to perform various tasks autonomously and interact with their environment using a robot operating system.
This course covers Robot programming fundamentals, motion planning and control, Robot simulation and testing.

Course Outcomes:
After the successful completion of this course, the student should be able to:
1. Explain Robot programming ecosystem.
2. Create reusable code for robot powered applications.
3. Design a custom robot using programming.
4. Simulate and control the robot using ROS.

Prerequisite: Knowledge in C++ and/or Python Programming language. Linux, Robot kinematics and Dynamics.

Course Content

Unit No	Description	Hrs
1.	**Introduction** Robot Programming: Methods of robot programming, Lead through method. Robot program as a path in space, Methods of defining positions in space, Motion interpolation, branching.	03
2.	**Robot programming languages** Categories of Robot programming languages. Modes of operation of robot programs. Requirements for a standard robot language, Robot programming Language Structure, Elements of Robot programming Language. Functions in Robot programming Language.	03
3.	**Robot Operating System (ROS):** ROS functionalities, ROS structure, Distribution, Tools, Architecture, Philosophy, workspace, Nodes, Packages, Topics. The ROS Graph.	03

4.	**Block-based coding** Working of block-based coding, features of block-based coding, designing interface, block-based coding with robots. Block based programming languages. Robot Programming using teach Pendant for various applications	**03**

List of experiments (Any 10)

Course Content		
Expt. No.	**Description**	**Hrs.**
1.	Introduction to Robot Programming (ROS).	**02**
2.	ROS Nodes, Topics, Services, Parameters, Launch Files	**02**
3.	ROS Workspace and ROS Package.	**02**
4.	Unified Robotic Description Format (URDF) for robot	**02**
5.	Links, Joints, Collisions, Inertia tags in the URDF file	**02**
6.	Launch file to Start the Robot State Publisher with URDF (XML)	**02**
7.	XML using Python launch files	**02**
8.	Make the URDF Compatible with Xacro.	**02**
9.	Functions with Xacro Macros.	**02**
10.	Motion in ROS.	**02**
11.	Computer vision in ROS with open CV	**02**
12.	Connecting Hardware with ROS	**02**

References Books:

1. Robot Operating System for Absolute Beginners by Lentin Joseph
2. Programming Robots with ROS Morgan Quigley, Brian Gerkey, and William D. Smart.
3. M. P. Groover, Automation, Production systems and Computer Integrated Manufacturing, Prentice-Hall.
4. S. K. Saha, Introduction to robotics, The McGraw Hill Company.
5. K.S. Fu; Gonzalez, R.C. & Lee, C.S.G, Robotics-Control, Sensing, Vision and Intelligence, McGraw Hill.

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Class:- **Third Year B. Tech**	Semester-V
Course Code: SH3035	**Course Name:** Scholastic Aptitude I

L	T	P	Credits
2*	-	-	Audit

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.	**Number System, HCF, LCM** Basics, Base System, Exponents, LCM and HCF, Factors, Cyclicity, Different Methods to find LCM-HCF, HCF-LCM relation, Applications of HCF --LCM	03
2.	**Percentage** Understand Conversion, Single change, Successive change, Product Stability, Applications of percentage.	02
3.	**Average, Allegations** Weighted average, Concept of average speed & allegation, Applications of Average & mixture allegation.	02

4.	**Ratio & Proportion** Comparison of Ratio & fraction, Properties of Ratio & Proportion, Mean Proportion. Joint ratio	02
5.	**Profit & Loss** Same selling price different Cost Price, Same cost price different selling price Concept of false scale.	02
6.	**Simple interest -Compound interest** Basics, Difference between SI CI, Conversion Periods, Depreciation.	02
7.	**TRW, Pipes & Cisterns** Time, Rate and Work-Unitary Method, LCM Method, Calculation of remuneration. Pipes & Cisterns -Concept of negative work, LCM Method.	02
8.	**Blood Relations** Blood Relations -Symbols, generation of tree diagram, types of questions-pointing towards person, tree based, coded blood relation	02
9.	**Numerical Analogy** Basics, Relation between two numbers, numerical	02
10.	**Pattern, Step Completion** Image completion, Mirror images, Water images, input-Output	02
11.	**Series Completion** Types of series, Number series pattern, Letter series, Alphanumeric series,	02
12.	**Direction Sense** Basics, shadow based concept, Concept of local time zone (IST,GMT, Longitude, Latitude), Problems on local time difference, Coded direction sense	02
13.	**Coding Decoding** Letter-Letter, Letter- Number, Number-Number, Letter-Symbol, Mixed Coding,	03
14.	**Syllogism** Basics , Types of Statements, Different diagram for different statements, Types of Questions-Based on Conclusion, Based on Statements	02
	Total Hrs.	**30**

Reference Books:

- R. S. Aggarwal, "Quantitative Aptitude", S Chand Publishing, New Delhi.
- R. S. Aggarwal, "Logical Reasoning", S Chand Publishing, New Delhi.
- Arun Sharma, "Quantitative Aptitude", McGraw Hill Publishing, New Delhi 7th Edition.
- Arun Sharma, "Logical Reasoning", McGraw Hill Publishing, New Delhi 3rd Edition

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Department of Civil Engineering

Class: **Third Year B. Tech. Civil**	Semester: V
Course Code : **CE3551**	Course Name: **Estimations Costing and Valuation Laboratory**

L	T	P	Credits
-	-	4	2

Course Description:

Estimations costing and valuation laboratory comprises of seven modules. In this course student will be equipped with the ability to estimate the quantities of item of works involved in buildings, canal works, road works and Industrial sheds, and also to do rate analysis, valuation of properties and preparation of reports for estimation of various items.

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.
4. Carry out valuation of immovable properties.

Prerequisite: Mathematics, Building Construction & Drawing, Highway Engg.

Course Content

Unit No.	Description	Hrs
01	Market survey for civil engineering materials and labour rates.	04
02	Prepare a detailed specification of any one item of the building and any one item from the civil engineering structures (Road, Canal, Industrial shed etc)	02
03	Detailed estimate of G+1 residential building (Min.area should be 100 sqm).	16
04	Preparing detailed estimate for any one of the following: 1. A stretch of road about 1 Km. long including earth work. 2. Culvert 3. A stretch of canal about 1 Km. long 4. A factory shed	16
05	Preparation of bar bending schedule of different building components such as slab, beam, column, staircase, lintel, chajja etc	04
06	Preparation of rate analysis of PCC, RCC Brick work, stone masonary, Plastering Pointing items.	04
07	Preparation of valuation report for building	02

References:

Text Books: -

- Dutta B.N, Estimating and Costing in Civil Engineering–USB Publishers, Distributors Pvt. Ltd.

References Books: -

- Rangwala, S. C., Elements of Estimating and Costing –Charotar Publishing House.
- Patil, B. S., Civil Engineering Contracts and Estimates, Universities Press Private Ltd.

Codes of Practice:-

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

Class: **Third Year B. Tech Civil**	Semester: V
Course Code: **CE377**	Course Name: **Construction Site Experience**

L	T	P	Credits
-	-	2	1

Course Outcomes:
After successful completion of the course the student will be able to:
1. Analyse the roles, responsibilities, and coordination strategies of managerial personnel for effective construction project management.
2. Analyse tender documents, planning and scheduling processes, and site layout management for effective project execution.
3. Prepare a professional site visit report demonstrating observation skills, managerial insights, and recommendations for improvements.

Pre-requisite: Basic knowledge of engineering drawing and mathematics

Course Content

Exercise No.	Description	Hrs
1.	**Site Orientation and Managerial Roles:** Understanding roles of project manager, planning engineer, quality engineer, and safety officer.	04
2	**Tender Documents and Bidding Process:** Study of tender documents, BOQ, technical specifications, general and special conditions of contract, and bidding evaluation process.	04
3	**Contract Management Practices:** Observation of contract administration, work order issuance, variations, billing procedures, and claims management at site.	04
4	**Project Planning and Scheduling:** Observation of baseline schedules (bar charts/CPM) and monitoring techniques used at site.	02
5	**Site Layout Planning and Logistics Management:** Analysis of site layout, material storage, equipment placement, and labour circulation from a managerial perspective.	04
5.	**Site Visit to construction project:** Visit to an ongoing construction project to observe managerial practices and submit a detailed report.	06

References:
Text Books: -
- Dutta B.N, Estimating and Costing in Civil Engineering–USB Publishers, Distributors Pvt. Ltd.

References Books: -
- Rangwala, S. C.. Elements of Estimating and Costing –Charotar Publishing House.
- Pramod Beri, Building construction and supervision- Practical Handbook (Third Edition), DIT publications.
- Patil, B. S., Civil Engineering Contracts and Estimates, Universities Press Private Ltd.

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

Class: **T.Y. B. Tech. Civil**	Semester-V
Course Code: **CE3571**	Course Name: **Industrial Training**

L	T	P	Credits
--	--	--	1

Course Description

The students are required to undergo rigorous field training in Civil Engineering for 28 days. Field training work will be commenced at the end of semester V. Student shall contact to supervisor and site for field training to be given by supervisor. Students shall submit the report of the field training taken and necessary certificate from the organization where such training is undertaken in semester V.

Course Learning Outcomes:

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

1. Apply academic concepts in civil engineering into practical situations encountered during the internship.
2. Develop effective communication skills, both written and verbal, through interactions with colleagues, clients, and project stakeholders within the civil engineering industry.
3. Exhibit proficiency in planning, organizing, and executing tasks related to civil engineering projects, showcasing effective time management and resource utilization during the internship.
4. Cultivate teamwork, ethical conduct, and professional behavior within the civil engineering workplace, emphasizing the importance of integrity and collaboration in the industry setting.

Course Details:

The students are required to undergo rigorous field training in Civil Engineering for 6 week. Field training work will be commenced at the end of semester III. Student shall contact to supervisor and site for field training to be given by supervisor. Students shall submit the report of the field training taken and necessary certificate from the organization where such training is undertaken in semester IV.

The Site Work shall consist of:

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

The report shall consist of:

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

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

Class: T. Y. B. Tech Civil	Semester - V
Course Code: **CE379**	Course Name: **Massive Open Online Course (MOOC)- II**

L	T	P	Credits
-	-	-	01

Course Description:
Massive Open Online Courses (MOOCs) are introduced in the undergraduate Civil Engineering curriculum to expose students to advanced, multidisciplinary, and industry-oriented learning opportunities beyond the traditional classroom. These courses, offered by reputed online platforms such as NPTEL, SWAYAM, Coursera, edX, NASSCOM and others, enable students to gain global perspectives, strengthen core technical knowledge, and explore emerging areas like sustainability, smart infrastructure, construction technology, data analytics, and environmental engineering. By integrating MOOCs, students can learn at their own pace, access high-quality resources, and enhance lifelong learning skills in alignment with the National Education Policy (NEP-2020).

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Demonstrate the ability to learn independently using online platforms and apply acquired knowledge to civil engineering domains.
2. Develop enhanced conceptual and practical understanding in specialized/emerging areas of civil engineering.
3. Integrate multidisciplinary and global perspectives into engineering problem-solving and project execution.
4. Apply digital literacy and self-paced learning strategies to pursue lifelong learning in line with professional and societal needs.

Note:
1. Student will get the credits of respective course in following conditions,
   In case of course selected from NPTEL/SWAYAM/NASSCOM platforms, students have to complete the timely assignments, pass the exam and secure the certificate.
2. While selecting online course, following points must be taken care of,
   a. Selected course must be approved by Departmental Programme Committee (DPC).
   b. Duration of each online course must be of at least FOUR weeks for NPTEL/SWAYAM & minimum 12 to 20 hours for NASSCOM.

References-
1. **NPTEL (National Programme on Technology Enhanced Learning)**
https://nptel.ac.in
2. **SWAYAM (Study Webs of Active Learning for Young Aspiring Minds)**
https://swayam.gov.in
3. **MOOCs on NASSCOM**
www.nasscom.in

Class: **T. Y. Civil**	Semester-**VI**
Course Code: **CE352**	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:** Origin & formation of soil. Clay mineralogy and soil structure, phase systems, weight volume relationships. Index Properties of Soils: methods of determination and its significance, activity of clay. Classification of soil: particle size classification system, unified soil classification system (UCS) and IS classification system - Plasticity chart and its importance. Textural classification	06
2.	**Permeability and Seepage:** Introduction to Darcy's law, factors affecting on permeability. Coefficient of permeability and its determination (Laboratory and field methods), permeability of stratified soils, seepage velocity & discharge velocity, seepage analysis, general flow equation, flow net and its application. Effective Stress on Soil: concept-total pressure and effective stress, quick sand phenomena, capillary 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

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

References –

Text Books: -

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

References Books: -

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

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Department of Civil Engineering

Class: **Third Year B. Tech. Civil**	Semester: **VI**
Course Code: **CE354**	Course Name: **Construction Practices**

L	T	P	Credits
3	-	-	3

Course Description:

This course provides a comprehensive overview of essential construction practices, focusing on key techniques, equipment, and processes commonly employed in the construction industry. Students will explore various aspects of construction, including piling, dewatering, formwork, trenchless technology, offshore construction, equipment selection, earthwork operations, and equipment productivity analysis.

Course Learning Outcomes:

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

1. Discuss applications of various construction practices.
2. Select appropriate equipment for construction task.
3. Develop method statement for construction task.
4. Analyze equipment selection based on productivity.

Prerequisite: Basic civil engineering

Course Content

Unit No.	Description	Hrs
01	**Piles and Pile driving equipment** Introduction to piling, Pile types, functions, construction of driven and bored piles. Pile installation methods and equipment. Construction using Sheet piles, Cassian-Construction and applications.	06
02	**Construction dewatering** Introduction to dewatering, Methods of dewatering. Installation of dewatering and groundwater control systems. Cofferdams and deep well construction.	06
03	**Trenchless Technology** Introduction to Trenchless technology, concept, methods used in trenchless technology, equipment and applications of trenchless technology.	06
04	**Offshore Construction** Dredging operation: Applications of dredging, mechanical and hydraulic dredging - operations and equipment.	06
05	**Formwork** Formwork: Requirement of good formwork, objectives of formwork. Types of formwork: Conventional formwork, Slip formwork, Aluminum formwork; applications, erection, safety. Formwork failure.	06
06	**Construction equipment** Introduction to construction equipment, various types, economics of	06

	construction equipment, construction equipment productivity analysis and selection.	

References:

Text Books:

- R. L. Purifoy, "Construction planning equipment and methods", McGraw Hill Book
- Frank W. Stubbs, "Handbook of Heavy Construction", McGraw-Hill Professional Publishing.
- Jerry Irvine, "Advanced construction Techniques," CA Rocketr

Reference Books:

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

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Class: **Third Year B. Tech. Civil**	Semester: **VI**
Course Code: **CE356**	Course Name: **Research Methodology**

L	T	P	Credits
2	-	-	2

Course Description:

This course offers the techniques and procedures used to identify and analyze information regarding a specific research topic. This course explains the scope, research design, data collection, sampling technique; methods followed in carrying out the research, the techniques used and the limitations of the study and make effective use of computers and computing tools to search information, analysis of information and prepare technical report. Also, it includes a process to file the patents, right to use the Intellectual Property for the purposes of making money from the invention.

Course Learning Outcomes:

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

1. Formulate a research problem by using literature review process.
2. Analyse the data related research information.
3. Prepare and present research proposal/paper by following research ethics.
4. Make effective use of computing tools to analyse the data and prepare report.
5. Describe nature and processes involved in development of intellectual property rights.

Prerequisite: Possess basic knowledge of Statistic, Construction Materials.

Course Content

Unit No.	Description	Hrs
01	**Introduction to research:** Meaning of Research, Sources of research problem, Criteria and Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem, Research Process, Problem definition, Objectives of Research, Research Questions, Research design, Approaches to Research, Types of Research, Quantitative vs. Qualitative Approach, Exploratory vs. Confirmatory Research, Experimental vs Theoretical Research, Importance of reasoning in research.	04
02	**Literature review:** Problem Identification & Formulation, Research Question, Investigation Question, Measurement Issues, Hypothesis, Qualities of a good Hypothesis, Null Hypothesis & Alternative Hypothesis. Hypothesis Testing, Logic & Importance, Research gap, Problem statement.	04
03	**Data Collection and Analysis:** Effective literature studies approach, Research ethics, Plagiarism,	04

	Development of Hypothesis, Approaches of investigation of solutions for research problem, Data/Variable Types & Classification, Data collection, Data analysis with software, interpretation, Numerical and Graphical Data Analysis: Sampling, Observation, Surveys Necessary instrumentations, Validity of experiments.	
04	**Research Design:** Concept and Importance in Research - Features of a good research design - Exploratory Research Design - concept, types and uses, Descriptive Research Designs - concept, types and uses. Experimental Design: Concept of Independent & Dependent variables	04
05	**Technical writing:** Effective technical writing, how to write technical report and paper, Tables and illustrations, Guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript. References, Citation and listing system of documents, Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.	04
06	**Intellectual Properties and their rights:** Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. Procedure for grants of patents, Patenting under PCT, Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Administration of Patent System, New developments in IPR; IPR of Biological Systems, Computer Software etc., Traditional knowledge Case Studies,	04

References:

Reference Books:

- Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students" Juta & Co. Ltd.
- Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", Juta Academic.

Text Books:

- Ranjit Kumar, "Research Methodology: A Step-by-Step Guide for beginners", SAGE Publication.
- C.R. Kothari, Research Methodology, New Age International (P) Limited, Publishers.

Class: **T. Y. B. Tech Civil**	Semester-**VI**
Course Code: **CE384**	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	06

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

References:

Text Book:

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

Reference Books:

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

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Class: **Third Year B. Tech. Civil**	Semester: **VI**
Course Code : **CE359**	Course Name: **Legal Practice in Construction**

L	T	P	Credits
3	-	-	3

Course Description:

One of the main sectors of the construction business is construction contracts. One of the most crucial components of becoming a civil engineer is being aware of the numerous facets of the Indian Contract Act 1872. A graduate in civil engineering must be sufficiently knowledgeable about the various clauses of the Indian Contract Act of 1872. These provisions will come in handy when the construction job is being carried out.

Course Outcomes:

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

1. Explain the fundamental principles of construction laws and their application in the construction industry.
2. Discuss types of contracts and provisions of Indian contract act.
3. Explain compliance with legal requirements related to building acts, arbitration and labor laws throughout the construction process.
4. Acquire the ability to draft, negotiate, and manage various types of construction contracts, ensuring adherence to legal requirements and effective project execution.
5. Discuss the ethical and professional responsibilities of construction professionals, including compliance with codes of conduct and regulatory standards.

Prerequisite: Nil

Course Content		
Unit No.	**Description**	**Hrs**
01	**Contract** The standard forms of building contracts, the rights of building owners, adjoining owners and third parties. The Indian Contract Act: key provisions relevant to construction, The Sale of Goods Act. Professional ethics. Injunction: Types, Temporary, perpetual, mandatory	06
02	**Industrial Act and Labor Laws** Industrial Dispute Acts, Payment of wages act, Minimum Wages Act, Indian Trade Union Act, Limitation Act, and Workmen's Compensation Act.	06
03	**Arbitration, Bailment, Indemnity and Guarantee** **Arbitration**-Awards & Dispute Resolving boards – Indian Arbitration Act, arbitration agreement, conduct of arbitration, power and duties of arbitrator. Case studies on arbitration in construction projects	06
04	**Indemnity and Guarantee**-Difference between the two contracts, consideration for guarantee, surety's liability, discharge of surety. **Bailment-**	06

	Nature of transactions, delivery of bailee, Duties and rights of bailor and bailee, Bailee's responsibility, Termination, Bailment of pledges.	
05	**Building Acts.** Apartment Ownership Act 1989, Real Estate (Regulation and Development) Act (RERA): need and scope, Important provisions and enforcement of RERA. Unified Development Control And Promotion Regulations.	**06**
06	**Special Clauses** Nominated Subcontractors, Staff And Labour, Plant, Materials And Workmanship, Commencement, Delays And Suspension, Tests On Completion, Defects Liability, Measurement And Evaluation, Termination By Employer, Interpretation and practical application in FIDIC/CPWD contracts.	**06**

References:

Reference Books:

- Clough R. H, "Construction contracting", Willey
- Saraf B. P, "Law of Arbitration & Conciliation", Snow White
- Dr. Roshan Namawati, "Professional practice with Elements of Estimating Valuation Contract and Arbitration", Lakhani Book Depo
- B. S. Patil, "Building and Engineering Contract" CRC, Press

Class: **Third Year B. Tech. Civil**	Semester: **VI**
Course Code : **CE382**	Course Name: **Town Planning**

L	T	P	Credits
3	-	-	3

Course Description:

A properly planned city/town infrastructure helps in utilizing the land capability and its resources to its maximum. These structures include schools, hospitals, market, parks etc., Town residents seeks that all the facilities are in most nearby locations. The town planning includes all these things and suitable selection of land area which is most appropriate for the residential, good environment, location and connecting distance with the roads & highways. The civil engineer must have the insight knowledge about city/town planning leading towards the development of a modern town. The course will provide understanding of the basic planning of urban region and the built environment, and their applications and relationships to the planning and management of urban and regional environments and associated land use.

Course Learning Outcomes:

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

1. Describe different concepts of town planning.
2. Illustrate surveying and zoning methods pertaining to town planning.
3. Critique on the policies, norms, bylaws, and housing schemes in the Indian context.
4. Summarize the concept, necessity, and components of a master plan, including layout planning for city development and re-planning of existing towns.
5. Outline various legislative acts pertinent to town planning.

Prerequisite: Possess basic knowledge of Building planning.

Course Content

Unit No.	Description	Hrs
01	**Introduction :** Introduction: Objects of town planning, principles of town planning, Origin and growth of towns development of towns, Modern town planning in India, Socio-Economic aspects of town planning, Selection of site for an ideal town.	05
02	**Surveys & Zoning:** A) Surveys & Planning: Various types of surveys to be conducted for town planning project, Data's to be collected in different types of town planning survey, Types of planning, -a brief note on urban, rural and regional planning. b) Zoning: Definition – objects and principles of zoning, Advantages of zoning, Special Economic Zone (SEZ), Maps for zoning.	06
03	**Housing & Slums:** A) Housing: Classification of residential building as per HUDCO norms, Housing in villages, Low Cost Housing, Housing policy, different types of housing agencies involved in housing, Investment in Housing, Housing	07

	Problems in India B) Slums: Causes, growth, characteristics, effects, slum clearance and re-housing, prevention of slum formation, financial assistance for slum clearance.	
04	**Public buildings & amenities:** Public buildings & Industries: Classification, location, Design Principles of public building, Effects of Industries on towns and cities, classification of industries, regulation of their location. Recreation measures: Parks- park ways, Playgrounds, Theme parks, boulevards and their space standards.	**05**
05	**Master Plan:** A) Master Plan: Meaning – Definition, objects and necessity of master plan, Data and Drawings required for master planning, Building byelaws, Preparation of a layout plan for a residential area showing LIG, MIG and HIG houses and other amenities (not to scale). B) Re-planning Existing Towns: General - Objects of re-planning, Analyzing the defects of existing towns, difficulties in Master Planning of existing towns / cities, Urban renewal projects, merging of sub urban areas, Decentralization - Satellite Towns, Smart cities- definition and features.	**05**
06	**Acts of Town Planning:** A) Town and Country Planning Act, Improvement Trust Act, Urban Planning and Development Authorities Act, objectives, contents, procedures for preparation and implementation of Regional Plans, Master Plans and Town Planning Schemes, Various Acts related to urban governance. B) MRTP Act, Provisions of Land Acquisition Act, Urban Land Ceiling Act, Conservation Act.	**08**

References:

Text Books:

- S.C. Rangwala, Town Planning, Charotar Publishing House Pvt. Ltd...
- Arthur B. Gallion, The Urban Pattern - City Planning & Design, Simon Eisner John Wiley & Sons.
- G.K. Hiraskar, Town Planning, Dhanpat Rai Publications.
- A. Bandopadhyay, Text book of town planning, Books and Allied, Calcutta.
- N. K. Gandhi, Study of Town and Country Planning in India: A Pragmatic Approach to Planning and Development, Indian Town and Country Planning Association.

Reference Books:

- Maharashtra Regional and Town Planning Act of 1966 (MRTP Act- 1966).
- Land Acquisition Act – 1894.
- Simon Eisner, Urban Pattern, John Willey & Sons, New York.
- Misra S.N., Rural development Planning – Design and method, Satvahan Publications New Delhi.
- Todaro Michael, Economic development in Third world, Orient Longman Publication, New Delhi.

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Class: **Third Year B. Tech. Civil**	Semester: **VI**
Course Code : **CE3611**	Course Name: **Optimization Techniques**

L	T	P	Credits
3	-	-	3

Course Description:

Both the theoretical and practical worlds value optimisation because it helps achieve goals in the most efficient manner by determining the optimum course of action to take in terms of time and quantity of actions. The goal of this course is to give students the knowledge necessary to understand how different advanced optimisation techniques are used in organisations to make decisions. In order to help students become more adept at making decisions, this course will explore contemporary optimisation tools and methodologies.

Course Outcomes:

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

1. Discuss the fundamentals of optimization in engineering.
2. Identify the necessity and scope of optimization techniques.
3. Analyze the managerial problem through mathematical models and arrive at an optimal solution or decision.

Prerequisite: Possess basic knowledge of mathematics

Course Content		
Unit No.	**Description**	**Hrs**
01	**Introduction:** Introduction to Optimization, Optimal Problem formulation, Design variables, Constraints, Objective function, Variable bounds, Optimization algorithms.	**06**
02	**Linear Programming Problem:** Formulation of LPP, Solution by Graphical Method, Simplex Method,	**06**
03	**Transportation Problem:** Transportation Problem, NW corner method, Row minima method, Column minima method, Least cost method, Vogel's approximation method	**06**
04	**Assignment Problem:** Assignment problem and its variants- Maximization and Minimization	**06**
05	**Single Variable Optimization Algorithms I:** Bracketing Methods, Region-Elimination Methods.	**06**
06	**Single Variable Optimization Algorithms II:** Gradient based methods: Newton-Raphson Method, Bisection Method.	**06**

References:

Reference Books:

- Er. Prem Kumar Gupta, Dr. D. S. Hira, "Operations Research" S. Chand publications.
- Taha, H.A., "Operations Research - An Introduction", Prentice Hall.

- J. K. Sharma, "Quantitative Techniques-for managerial decisions", Macmillan Business books.
- Singiresu S. Rao, "Engineering Optimization", New Age International Publishers.

Class: **T. Y. B. Tech. Civil**	Semester: **VI**
Course Code: **CE366**	Course Name: **Advanced Hydraulic Engineering**

L	T	P	Credits
3	-	-	3

Course Description:
This subject is mainly focusing on the design of water distribution components. This course is designed to fulfill the demands of design and assessment methods practiced onsite. It also deals with the mitigation strategy for natural calamities occurred in nature and optimum techniques and operations for the management of natural resources.

Course Learning Outcomes:

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

1. Explain the water balance and continuity equation for watershed
2. Determine the depth and velocity of flow in an open channel
3. Design of equivalent pipe flow and Flood forecasting
4. Analyses flood protection systems and reservoir operation system
5. Prepare DPR for urban water requirement

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

Course Content		
Unit No.	**Description**	**Hrs**
01	**Introduction of Hydraulic:** Introduction to water resources system and planning, Systems approach its advantages and limitations. Types and importance of water sources, Classification of the watershed, Stream classifications, watershed hydrology, Surface water assessment, Water balance, and continuity equation for catchment and lake	05
02	**Morphology and Hydraulics of Alluvial River:** Alluvial streams and their hydraulic geometry, bed level variation of alluvial streams, variation in plan form of alluvial streams, Analytical models of river morphology, SCS Method for Abstractions, Flow Depth and Velocity in open channel, Hydrologic River Routing, morphology of some Indian rivers.	06
03	**Design of Pipe flow:** Equivalent pipe, parameters in distribution system analysis, parameters interrelationship, Formulation of equation, Water conveyance and control, introduction to Hardy Cross method, and Newton-Raphson method:	07

	assumptions, limitations, determination of the network flows and demands, alignment of network components,	
04	**Hydrologic design:** Hydrologic Design Scale, Selection of the design level, First Order Analysis of Uncertainty, Design of Flood Control Reservoir, Lumped flow routing, distributed flow routing models, Hydrologic statistics, Flood forecasting, and flood frequency analysis	06
05	**Flood Control and Assessment:** Floods in major Indian river basins, Types of Floods, Different methods of Flood control, Types and design of flood forecasting and protection systems, Comparison of levees with bypass channels and off-stream storage, reservoir operation for flood control and management,	05
06	**Urban Water Issues:** Water requirement, water availability, water budget, water balance, Zero liquid discharge concept and implementation, Life cycle cost of water distribution network. rehabilitation, and restoration of urban water bodies, Preparation of DPR	05

References:

Reference Books:

- Bhave,P.R., and Gupta R., "Analysis of Water Distribution Networks", Alpha Science International Ltd.
- Central Public Health and Environmental Engineering Organization (CPHEEO), Manual on Sewerage and Sewage Treatment Part A: Engineering, Ministry of Housing and Urban Affairs (Previously known as Ministry of Urban Development), New Delhi
- Vir Singh, R., Watershed Planning and Management, Yash Publishing House, Bikaner,

Text Books:

- Chow, V. T., Maidment, D. R., and Mays, L. W., "Applied Hydrology", McGraw Hill International editions, New Delhi.
- Subramanya, K., "Engineering Hydrology", Fourth Edition, Tata McGraw-Hill Publishing company Ltd., New Delhi,
- Rossmiller,R.L., "Storm water design for sustainable development", Mc.Graw-Hill Education,
- Ojha, C. S. P., Bhunya, P., and Berndtsson, P., "Engineering Hydrology", Oxford University Press, Noida,
- Raghunath, H. M., "Hydrology Principles, Analysis and Design", New Age International Pvt. Ltd., New Delhi.
- Singh, V. P., "Elementary Hydrology", Prentice Hall, New Delhi
- Fox, W.R., and McDonald, A.T., "Introduction to Fluid Mechanics", Wiley and Sons Inc., New York.

Class: **T Y B. Tech. Civil**	Semester: **VI**
Course Code : **CE368**	Course Name: **Air Quality Assessment**

L	T	P	Credits
3	-	-	3

Course Description:
Air Quality assessment is offered as program Elective for Undergraduate course (B. Tech) semester VI. 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 using AI applications.

Course Learning Outcomes:

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

1. Describe structure of the atmosphere and Scales of air pollution.
2. Interpret on sources of air pollution natural and artificial, air pollution Episodes.
3. Explain effect of different air pollutants on man, animals and plants.
4. Analyse the dispersion of air pollution in the atmosphere.
5. Design of air pollution control mechanism

Prerequisite: Possess basic knowledge of Environmental Science

Course Content		
Unit No.	**Description**	**Hrs**
01	**Air-pollution-definition, sources, classification:** Introduction to air pollution, types of air pollutants, sources & classification of air pollutants and air pollution effects (the impacts of air pollution on human health, materials and ecosystem)	**06**
02	**Air pollution monitoring, standards and regulations** Ambient air quality monitoring techniques, Selection of monitoring locations, Air pollution indices, standards, norms, rules and regulations and air quality management plan	**06**
03	**Air pollution meteorology** Composition and structure of the atmosphere, atmospheric energy balance, humidity, condensation, lapse rate and atmospheric stability, Wind rose diagram, Potential temperature	**06**
04	**Dynamics of pollutant dispersion and disposal** Basic understanding of chemical and physical processes that transform and transport pollutants in the atmosphere, mechanism that lead to the formation and emissions of air pollutants, dispersion of air pollutants and Gaussian plume models.	**06**
05	**Air pollution control and removal** Methods for monitoring and control; selection of control equipment's, engineering control concepts; process	**06**

	change, fuel change; pollutant removal and disposal of pollutants; control devices and systems, removal of dry particulate matter, liquid droplets and mist removal, gaseous pollutants and odor removal, control of stationary and mobile sources.	
06	**AI applications in Air Quality Assessment**: Air quality modelling using AERMOD software (case study), Neural Networks (NN), Support Vector Machines (SVM), and Random Forest (RF), SHAP (SHapley Additive exPlanations) and LIME (Local Interpretable Model-agnostic Explanations)	**06**

References:

Text Books:

- Wark, Warner and Devis, Air Pollution and its control, Addison-Wesley
- Martin Crawford, Air Pollution Control Theory, McGraw-Hill Inc.,US

Reference Books:

- Ross, R. D., Air Pollution and Industry, Van Nostrand, NY. NY
- M Rao, H.V.N. Rao, Air Pollution, McGraw Hill Education, Uttar Pradesh

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Class: **Third Year B. Tech. Civil**	Semester: **VI**
Course Code : **CE370**	Course Name: **Traffic Engineering**

L	T	P	Credits
3	-	-	3

Course Description:

Knowledge and understanding of the basic concept of Traffic Engineering is highly essential for the engineers designing and executing the road laying projects in order to make road transport system safe and workable. This course enables the students to perform various traffic surveys, analyze data and interpret the results and design of traffic control device appropriately in order to apply their knowledge in designing efficient and safe road transport systems.

Course Learning Outcomes:

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

1. Illustrate the traffic and its components, factors affecting road traffic for traffic planning.
2. Design traffic intersections and signals considering traffic regulations.
3. Summarize the basic principles behind the design and placement of traffic control devices for traffic management.
4. Select the suitable techniques necessary for maintaining road environment.
5. Suggest preventive measures to avoid road accidents by analyzing traffic conditions.

Prerequisite: Possess basic knowledge of Transportation Engineering.

Course Content

Unit No.	Description	Hrs
01	**Traffic Planning and Characteristics:** Road Characteristics-Road user characteristics, Objectives and scope of traffic engineering PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Concepts of passenger car units for mixed traffic flow, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.	05
02	**Traffic Surveys:** Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Statistical applications in traffic studies and traffic forecasting, Level of service- Concept, applications and significance.	07
03	**Traffic Design and Visual Aids:**	06

	Intersection Design- channelization, Rotary intersection, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks.	
04	**Traffic Management:** Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management.	**07**
05	**Road Environment and Arboriculture :** Street Lighting: Methods of light distribution. Design of street lighting system. Definitions- Luminaire, foot candle, Lumen, utilization and maintenance factors, Types of light sources, Fundamental factors of night vision. Arboriculture- Definition, objectives, factors affecting types of selection of trees, maintenance of trees- protection, care of road side trees.	**06**
06	**Traffic Safety :** Road accidents, Types, Causes, effect, Measures to prevent accidents and cost, Reporting and recording of accidents, Collision and condition diagram, Legislation and law enforcement, Intelligent Transportation System to avoid accidents.	**05**

References:

Text Books :

- Kadiyali, L.R., Traffic Engineering & Transport Planning, Khanna Publishers, New Delhi
- Jotin Khisty, S.C. and Kent Lall, B., Transportation Engineering – An Introduction, Prentice-Hall, NJ
- S.C. Saxena Traffic Planning And Design .Dhanpat Rai Pub, NewDelhi

Reference Books:

- Hutchison, B.G., Introduction to Transportation Engineering, & Planning, McGraw Hill Book Co.
- John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Pub. Co.
- Vukan R. Vuchic, Urban Public Transportation System & Technology, Prentice Hall, Inc.
- Papacostas, C.S., Fundamentals of Transportation System Analysis, PHI
- Jotin Khisty, C. and Kent Lall, B., Transportation Engineering – An Introduction, Prentice-Hall, NJ

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Class: **Third Year B. Tech. Civil**	Semester: VI
Course Code : **CE372**	Course Name: **Industrial Waste Management**

L	T	P	Credits
3	-	-	3

Course Description:

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

Course Learning Outcomes:

After successfully completing the course, student will able to:

1. Apply various techniques of wastewater volume and strength reduction
2. Analyze characteristics of Industrial wastewater.
3. Suggest different wastewater treatment option for industrial wastewater.
4. Design Effluent Treatment Plant for Industrial wastewater treatment.
5. Prepare Report for Industrial Wastewater Management using AI tools.

Prerequisite: Basic knowledge of Environmental Science and Wastewater Engineering course is essential.

Course Content

Unit No.	Description	Hrs
01	**Introduction of Industrial wastewater:** Use of water in industry, sources of wastewater, quality and quantity variations in waste discharge, water budgeting, characterization and monitoring of wastewater flow, Concept of Zero discharge, stream standards and effluent standards.	06
02	**Wastewater volume and strength reduction** Waste volume and strength reduction, in-plant measure, good housekeeping, process change, leakage prevention, segregation and recycling Neutralization, equalization and proportioning of waste	06
03	**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	06
04	**Treatment techniques for Industrial wastewater** Different types of waste treatment & their selections, Development of	06

	treatment flow diagram based on characteristics of waste, Recent development in Wastewater Treatment: Sequential Batch Reactor Technology, MBR and MMBR	
05	**Manufacturing Process of various industries** Manufacturing processes in major industries, water requirements, wastewater sources, composition of wastes, sugar, distillery, dairy, pulps, paper mill, fertilizer, Tannery, chemical, steel industry, power plants, textile Treatment flow sheets alternative methods of treatment, factors affecting efficiency of treatment plant	06
06	**AI applications in Industrial Waste Management**: Water pollution control act 1974, organizational set up of central and state boards for water pollution control, MoEF. Applications of SCADA and Fuzzy logic, ANN for Industrial Waste Management	06

References:

Text Books:

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

Reference Books:

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

Class: **Third Year B. Tech Civil**	Semester-VI
Course Code: **CE3184**	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 CO2 & 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. Various materials used in carrying out repair works forms the important aspect of this course. It also includes preventive measures on various aspects and provides the information on inspection, assessment procedure for evaluating a damaged structure, causes of deterioration and testing techniques and methods for strengthening the existing structures.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Identify the causes of distress and deterioration of concrete structure
2. Explain the stages of condition assessment of buildings.
3. Interpret and evaluate of ND test result data.
4. Describe the procedures of various repair and strengthening techniques.
5. Design for strengthening of structural member/elements

Prerequisite: Basic concepts and principles of Concrete Technology, Structural Analysis,Design of Reinforced Concrete structure

Course Content		
Unit No.	**Description**	**Hrs**
1.	**Introduction:** Need for Repair and Rehabilitation of structures, distress in structures. Definitions and terminologies, deterioration of RC structures, physical, chemical and other causes.	**06**

2.	**Condition Assessment of Structures:** Condition assessment of concrete structures, exposure conditions, stages visual inspection, on situ and laboratory testing of concrete, Interpretation and reporting of NDT results, preparation of report, Case studies of condition assessment of distressed due to corrosion, fire, leakage, earthquake,landslide.	06
3.	**Fiber Reinforced Polymer Composites:** Introduction to composite, types and phases of composites, Fiber reinforced polymer composites, types of fibers and their properties, stress- strain relationship, applications. Types of resins and their characteristics.	06
4.	**Repair Techniques:** Repairs using mortars, Dry pack and Epoxy bonded dry pack, preplaced aggregate concrete, gunite or shotcrete, grouting, polymer impregnation, resin injection, routing and sealing, stitching, surface patching. shoring and underpinning.	06
5.	**Strengthening Techniques:** section enlargement, composite construction, posttensioning, flexural and shear strengthening of beam, strengthening of columns, footings.	06
6.	**Design Approach:** Flexural Strengthening, Shear Strengthening	06

References:

Text Books:

- Modi Poonam I., Patel Chirag N., "Repair and Rehabilitation of Concrete Structures", PHI Learning Pvt. Ltd.
- Shetty M.S., "Concrete Technology", S. Chand &Company Ltd.

Reference Books:

- Vidivelli B., "Rehabilitation of Concrete Structures", Standard Publisher.
- Ravishankar K., Krishnamurthy T.S., "Structural Health Monitoring, Repair andRehabilitation of Concrete Structures", Allied Publishers.
- Handbook on repair and rehabilitation of RCC buildings, CPWD, Government of India.

Class: **T. Y. B. Tech. Civil**	Semester-VI
Course Code: **CE374**	Course Name: **Advanced Structural Analysis**

L	T	P	Credits
3	--	--	3

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

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Analyse indeterminate structures using force methods- Consistent deformation method and three moment equation.
2. Analyse indeterminate structures using displacement methods- Slope-deflection equation and moment distribution method.
3. 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.	**A. Indeterminacy** Concept of degree of static and kinematic indeterminacy, degree of freedom, **B. Consistent Deformation Method** Analysis of Fixed beam and propped cantilever with uniform section, yielding of support.	07
2.	**Three Moment Theorem** Clapeyron's theorem of three moments, application to statically indeterminate beam, sinking of support. beam with different M.I.	05
3.	**Slope Deflection Method** Slope deflection equation. modified slope deflection equation, sinking of support, application to beam. portal frame without and with sway. (Involving not more than two unknowns)	06
4.	**Moment Distribution Method** Sinking of support, application to beam, portal frame without and with sway. (Involving not more than two unknowns)	06

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

References

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

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

Class: **Third Year B. Tech. Civil**	Semester: **VI**
Course Code: **CE376**	Course Name: **Composite Materials and Structures**

L	T	P	Credits
3	-	-	3

Course Description:
This course offers the different types of composite materials and design of composite structural members according to the limit state design concept as per IS provisions. It includes also design methods for laminated structures, sandwich structures and the design of composite column, beam and slab.

Course Learning Outcomes:

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

1. Describe the properties and uses of composite materials in civil engineering fields.
2. Analyse and design of composite column and beam.
3. Analyse and design of composite slab.

Prerequisite: Possess basic knowledge of Statistic, construction Materials etc.

Unit No.	Description	Hrs
	Course Content	
01	**Composite Materials:** Introduction, Definitions, Composites, Reinforcements and matrices, Types of reinforcements, Types of matrices, Types of composites, Carbon Fiber composites, Properties of composites in comparison with standard materials, Applications of metal, ceramic and polymer matrix composites.	06
02	**Laminated Plates:** Governing differential equation for a general laminate, angle ply and cross ply laminates. Failure criteria for composites.	06
03	**Sandwich Constructions:** Basic design concepts of sandwich construction -Materials used for sandwich construction - Failure modes of sandwich panels.	06
04	**Design of Composite Beams:** Introduction to composite construction, basic concepts, types of composite constructions, Steel concrete composite, analysis, and design of simply supported composite beams with solid steel.	06
05	**Design of Composite Columns:** Design of steel concrete composite columns, columns subjected to axial loads and moments, encased composite construction of beams and columns, concepts and design, introduction to of IS: 11384 and their applications.	06
06	**Design of Composite Slab:**	06

	Introduction, Advantages and Basic Concepts, Types of composite slab, Design of steel concrete slab.	

References:

Reference Books:

- Calcote, L R. "The Analysis of laminated Composite Structures", Von – Noastrand Reinhold Company, New York.
- Jones, R.M., "Mechanics of Composite Materials", McGraw-Hill, Kogakusha Ltd., Tokyo.
- Handbook of Composite Construction Engineering, Gajanan M. Sabnis and Van Nostrand Reinhold Inc., U.S.
- Composite Structures of Steel and Concrete: Beams, Slabs, Columns and Frames for Buildings, Roger P. Johnson, 4th Kindle Edition.
- The Institute for Steel Development & Growth (INSDAG) course Material
- Lubin, G., "Handbook on Advanced Plastics and Fibre Glass," Von Nostrand Reinhold Co., New York

Text Books:

- Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York,.
- Design and Construction of Precast Concrete Structures, Ramachandra Murthy D. S., Dipti Press OPC Private Limited, Chennai.
- Precast Concrete Structures, Hubert Bachmann and Alfred Steinle, Earns and Sohn.
- Steel-concrete Composite Structures, Narayanan R, Vol. 7, CRC Press.

Indian Standards:

- IS 15916: 2010, Code of Practice for Building Design and Erection using Prefabricated Concrete, Bureau of Indian Standards, New Delhi.
- IS 11384: 1985, Code of Practice for Composite Construction in Structural Steel and Concrete, Bureau of Indian Standards, New Delhi
- IS 3935: 1966, Code of practice for composite construction, Bureau of Indian Standards, New Delhi.

Class: **Third Year B. Tech. Civil**	Semester: **VI**
Course Code: **CE378**	Course Name: **Finite Element Method**

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

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

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

Prerequisite: Engineering Mechanics, Strength of Materials and Mechanics of Structures

Course Content

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

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

References:

Text Books:

- Y.M. Desai, T. I. Eldho, A.H.Shah, "Finite Element Method with application in Engineering", Pearson, Delhi
- J.N.Reddy, "An introduction to the Finite Element Method", Tata McGraw Hill Pub.
- S.S.Bhavikatti, "Finite Element Analysis", New Age International Publishers

Reference Books:

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

Class: **Third Year B. Tech. Civil**	Semester: **VI**
Course Code: **CE380**	Course Name: **Fiber Reinforced Concrete**

L	T	P	Credits
3	-	-	3

Course Description:

This course on Fiber-Reinforced Concrete (FRC) is structured into six units, covering the introduction and types of fibers, their properties and behavior, mix design principles, construction techniques, characteristics, and diverse applications. Students will gain a comprehensive understanding, from the basics to advanced topics, preparing them for informed decision-making and practical applications in the field of Fiber-Reinforced Concrete.

Course Learning Outcomes:

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

1. Compare types of fibres used in Fiber-Reinforced Concrete with respect to their properties and applications.
2. Evaluate the effect of fibers on the properties of Fiber-Reinforced Concrete.
3. Illustrate the characteristics of Fiber-Reinforced Concrete in the fresh and hardened state.
4. Design Fiber-Reinforced Concrete mixes.Illustrate applications and advancements in Fiber-Reinforced Concrete.

Prerequisite: Possess basic knowledge of concrete Technology.

Course Content

Unit No.	Description	Hrs
01	**Introduction to Fiber-Reinforced Concrete** Overview of Fiber-Reinforced Concrete (FRC), Types of fibers: steel, synthetic, glass, and natural fibers, Benefits and challenges of using fibers in concrete	06
02	**Fiber Properties and Behavior** Mechanical properties of fibers, Fiber-matrix interaction, Effect of fibers on fresh and hardened concrete properties	06
03	**Construction Techniques with FRC** Casting and finishing techniques for FRC, Best practices for placing and consolidating FRC, Curing methods to optimize fiber performance	06
04	**Characteristics of FRC** Performance of FRC, Standard test methods for FRC, Strain softening and strain hardening	06
05	**Mix Design Principles for FRC** Mix design methodologies for FRC, Influence of fiber type, content, and	06

	aspect ratio on mix design, Proportioning aggregates, cement, and fibers for desired performance	
06	**Applications and Advanced Topics** Structural applications: beams, slabs, and columns, Pavement and overlay applications, Repair and rehabilitation using FRC, High-performance FRC.	**06**

References:

Text Books:

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

Reference Books:

- Harvinder Singh, "Steel Fiber Reinforced Concrete Behavior, Modelling and Design", Springer Nature.
- Mehta, P. K. and Monteiro, P.J. M., Concrete Microstructure, Properties and Materials., Third Edition, Mc Graw Hill Publications
- Irving Kett, Engineered Concrete- Mix Design and Test Methods, Second Edition, CRC Press Taylor & Francis Group.

Codes:

- Bureau of Indian Standard New Delhi, BIS, IS: 10262-2019 Indian standard code of practice for recommended Guidelines of Concrete Mix Design pl, Bureau of Indian Standard New Delhi, BIS, 2009
- Bureau of Indian Standard New Delhi, BIS, IS 456: 2000. Indian Standard Code of practice for plain and reinforced concrete, 2000
- Bureau of Indian Standard New Delhi, BIS, IS 1199: 1959. Indian standard code of methods of sampling and analysis of concrete
- ACI PRC-544.4-18: Guide to Design with Fiber-Reinforced Concrete
- ACI PRC-544.2-17: Report on the Measurement of Fresh State Properties and Fiber Dispersion of Fiber-Reinforced Concrete

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
T. Y. B. Tech. Syllabus
To be implemented for 2023-27 NEP Batch
Department of Civil Engineering

Open Elective-II

Class: **T.Y. B. Tech Mech.**	Semester: **VI**
Course Code: **OE3024**	Course Name: **Reliability Engineering**

L	T	P	Credits
3	--	--	3

Course Description:
The concepts of Reliability Engineering are applicable to almost every engineering system to ensure that reliable products are designed and manufactured. Therefore, this course is introduced as an Open Elective for Third Year students. This course aims at making the students capable of analyzing the reliability of engineering systems and ensure that they study the techniques to determine and improve the reliability of different engineering systems. The course introduces fundamental concepts of reliability engineering, techniques to calculate the reliability of different types of systems, methods to improve the reliability, system reliability modelling, reliability analysis methods, reliability testing and software reliability.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain the fundamental concepts and applications of Reliability Engineering.
2. Determine the reliability of simple and complex systems.
3. Apply different reliability allocation techniques for reliability analysis.
4. Apply the principles and techniques for reliability design and improvement.
5. Apply different techniques for reliability analysis of engineering systems.
6. Explain the methods of testing for hardware and software reliability.

Course Content

Unit No.	Description	Hrs
1.	**Introduction to Reliability Engineering** Reliability Engineering and Applications, failures and failure modes, reliability function, MTTF, MTBF, MTTR, repairable and non-repairable items, reliability economics, safety and reliability, quality and reliability, cost and system effectiveness, life characteristic phases, IoT in reliability analysis	06
2.	**System Reliability Modeling** Discrete probability distribution, Continuous Probability Distributions, Reliability Block Diagram, Hazard rate and failure density, constant hazard rate model, increasing hazard rate models, decreasing hazard rate model, Series system, Parallel system, Series-Parallel system, Complex system, k-out-of-m systems	06
3.	**Reliability Allocation** Definition, reliability allocation techniques, equal apportionment, AGREE method, ARINC method, feasibility of objectives apportionment technique, minimum effort method	06
4.	**Design for Reliability** Reliability design process, reliability considerations in design, stress-strength	06

	interaction, factor of safety, margin of safety, loading roughness, redundancy, reliability improvement techniques, types of redundancy, Markov models, single unit, two unit and three unit Markov models	
5.	**Techniques for Reliability Analysis** Failure modes, effects and criticality analysis (FMECA), fault tree analysis, minimal cut set method, minimal tie set method, Ishikawa diagram, case study,	06
6.	**Reliability Testing** Introduction to reliability testing, Accelerated Life Testing and Highly Accelerated Life Testing (HALT), Highly Accelerated stress Screening (HASS), software reliability: fundamental concepts, comparison and prevention, software testing	06

References:

Text books:

- L. S. Srinath, Reliability Engineering, East-West Press, 4th Edition.
- Elsayed A. Elsayed, Reliability Engineering, Addison Wesley, 1996.
- Kailash C. Kapur, Reliability Engineering, 2012

Reference Books:

- Ebeling C.E., Introduction to Reliability and Maintainability Engineering", Overseas Press. Pvt Ltd.
- B. S. Dhillon, Maintainability, Maintenance and Reliability for Engineers, CRC Press.
- L. S. Srinath, Reliability Engineering, EWP, 3rd Edition 1998
- Roy Billinton and Ronald N Allan, Reliability Evaluation of Engineering Systems, Springer, 2007
- Roger D Leitch, Reliability Analysis for Engineers: An Introduction, Oxford University Press, 1995
- S S. Rao, Reliability Based Design, Mc Graw Hill Inc. 1992
- E. E. Lewis, Introduction to Reliability Engineering, John Wiley and Sons.
- Basu S. K, Bhaduri, Terotechnology and Reliability Engineering, Asian Books Publication.
- Dr. A. K. Gupta, Reliability, Maintenance and Safety Engineering.
- John D. Musa, Software Reliability Engineering, Tata McGraw Hill..

Open Elective-II

Class: **T. Y. B. Tech Mech.**	Semester: **VI**
Course Code: **OE3084**	Course Name: **Materials Management**

L	T	P	Credits
3	--	--	3

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

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply management principles to material management.
2. Develop and apply codification and standardization process.
3. Derive material procurement plan and evaluate vendors.
4. Develop stores layout for optimum stores management.
5. Apply inventory control techniques for material management.
6. Apply M.R.P. logic and systems to material management.

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

Course Content

Unit No	Description	Hrs
1.	**Introduction to Material Management** Importance of materials management, Materials function, Need of Integrated Concept, Scope of material management, Organizations for materials management, span of Control.	06
2.	**Codification and Standardization** Standardization and simplification, Aim, Pro's and Con's and scope of Standardization, Classification and levels of standards. Codification, Nature, process, methods and advantages of codification.	06
3.	**Purchasing and vendor development** Functions, steps, purchasing cycle. Types of buying, Details of International buying, Procedure, Relevance of Good Supplier Need for Vendor Evaluation- Goals of Vendor Rating-Advantages of Vendor Rating, Negotiation.	06

4.	**Warehousing and stores management** Layout of stores and warehouse, material handling in stores, physical control of stocks: obsolete, surplus and scrap management, accounting and record keeping of stores	06
5.	**Inventory Management and Control** ABC analysis- advantages, mechanism, purpose, objectives Importance & Scope of Inventory Control, Types of Inventories, Costs Associated with Inventory, Inventory Control, Selective Inventory Control, Economic Order Quantity, Safety Stocks	06
6.	**Materials Requirement Planning (MRP)** Introduction, objectives, Terminology, Functions served by MRP, MRP Logic, systems and output, Management information form, Lot size consideration, Introduction to Manufacturing resource planning (MRP II)	06

References:

Text Books:

- Gopalkrishna & Sudarsan, 1. Materials Management, An Integrated approach, 3, PHI.
- Waters, Inventory Control and Management, Wiley.

Reference Books:

- C. M. Sadiwala, Ritesh C. Sadiwala, 1. Materials and Financial Management, 2, New Age International Publishers.
- J. R. Tony Arnold, Stephen N. Chapman and Lloyd M. Clive, Introduction to Materials Management, 6, Pearson Publication.
- Materials Management-Procedures, Texts & Cases, A.K. Dutta, Pearson.
- Bailey/Farmer/Crocker/Jessop– Pearson, Procurement Principles & Mgt.
- Inventory Management – Principles and Practices –Narayan/Subramanian– Excel.
- Martand Telsang, Industrial engineering and production management- -S. Chand publication.

Open Elective-II

Class: **T. Y. B. Tech Mech.**	Semester: **VI**
Course Code: **OE3182**	Course Name: **Industrial Drives**

L	T	P	Credits
3	--	--	3

Course description:
This course deals with the basics of electrical machines and power electronic drives. This course provides the knowledge about AC Drives, DC Drives and special purpose drives used in various industries. The operating principles as well as control of each drive systems is also covered in the syllabus.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Analyze stability, moment of inertia, speed and torque in industrial drive system.
2. Elaborate energy conservation in industrial drive system.
3. Identify various sensors required for industrial drives.
4. Compare various control strategies for AC and DC drives.
5. Select special motors for industrial applications.

Prerequisite:
Basic Electrical Engineering.

Course Content

Unit No.	Description	Hrs.
1.	**Introduction to industrial drives** Basic electric drives and its components, Types of loads, coupling systems, factors for choice of drives, Fundamental torque equation, speed torque conventions, equivalent values of drive parameters, thermal modelling of motor, classes of motor duty.	06
2.	**Energy conservation in industrial drives** Concept of energy conservation, losses in drive system, Measures for Energy Conservation in industrial drives, use of efficient converters, use of efficient motors, improvement of quality of supply, improvement of p.f. maintenance of drive system, safety and maintenance aspects in industrial drives	06
3.	**Sensors for Industrial drives** Introduction to sensors, Force measuring sensor, Load cells, Torque measurement, speed measurement, tachometers and angular speed detectors, piezoelectric transducer, hall Effect transducers, case study of sensors.	06
4.	**Control of AC and DC Drives** Introduction to converters for electrical drives, Modes of operation, closed loop torque and speed control, closed loop control of multi-motor, converter & chopper fed DC motor drives, rotor resistance & V/f control of AC drives, Types of braking	06

5.	**Stepper-Motor and Switched-Reluctance Drives** Introduction to stepper motors, construction and working principle, control of stepper motor, Introduction to switched reluctance motor drives, torque characteristics, Voltage impulse control, Current control, Torque control converter topologies, SRM drive design factors, Industrial applications.	**06**
6.	**BLDC and Servo Motor Drives** Principle of operation of BLDC Machine, Sensing and logic switching scheme, Speed control of BLDC drive, Low-Cost Brushless DC Motor Drives, Introduction to servo mechanism, types of servo motors, servo motor drive, Brushless DC Motor Drive for Servo Applications, Industrial applications.	**06**

References:

Text Books:

- Gopal K Dubey, Fundamentals of Electrical Drives, Narosa publication.
- Vedam Subrahnyam, Electrical Drives Concepts and applications, Tata McGraw Hill publication.

References:

- Sawhney. A.K, A Course in Electrical and Electronics Measurements and Instrumentation, Dhanpat Rai & Company Private Limited.
- B.K. Bose, Modem power Electronics and A.C. Drives, Pearson Education.

Open Elective-II

Class: **T. Y. B. Tech**	Semester: **VI**
Course Code: **OE3284**	Course Name: **Supply Chain Management**

L	T	P	Credits
3	--	--	3

Course Description:
In a typical supply chain, raw materials are procured and items are produced at one or more factories, shipped to warehouses for intermediate storage, and then shipped to retailers or customers. Consequently, to reduce cost and improve service levels, effective supply chain strategies must take into account the interactions at the various levels in the supply chain. In this course, students will be able to present and explain concepts, insights, practical tools, and decision support systems important for the effective management of the supply chain. This course will help the students to develop an understanding of the following key areas and their interrelationships:

- The strategic role of a supply chain
- The key strategic drivers of supply chain performance
- Supply chain network design and analytical methodologies for supply chain analysis

This course will help the students to learn the strategic importance of good supply chain design, planning, and operation for every firm. The students will be able to understand how good supply chain management can be a competitive advantage, whereas weaknesses in the supply chain can hurt the performance of a firm.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Identify the role and key issues in supply chain management.
2. Select appropriate SC strategies under given situations.
3. Design the inventory system and level at various locations in supply chain.
4. Specify the distribution and transportation requirements.
5. Develop appropriate strategic alliances for enhancing the performance of SC
6. Describe different strategies used to mitigate risk in global supply chain.

Prerequisite: Nil.

Course Content

Unit No	Description	Hrs
1.	**Understanding of Supply Chain** Objectives of a supply chains, decision phases, stages of supply chain, supply chain process view, cycle view of supply chain process, push/pull view of supply chain processes, key issues in SCM	06
2.	**Supply chain drivers and obstacles** Four drivers of supply chain- inventory, transportation, facilities and information; A framework for structuring drivers in supply chain, supply	06

	chain strategies, strategic fit, Obstacles to achieve strategic fit, value of information, Bullwhip effect and reduction	
3.	**Role of Inventory Management in supply chain** Role of forecasting, characteristics of forecast, Components of forecast, Basic approach to demand forecasting, Role of cycle inventory, Economics of scale to exploit fixed costs and discounts, cycle time related costs, Safety inventory, single stage inventory model, risk pooling, centralized and decentralized systems of planning inventory in supply chain	**06**
4.	**Network Planning and supply chain Integration** Network design, warehouse location, service level requirements, integrating inventory positioning and network design, supply chain integration. Push-pull and pull-push type systems, demand driven strategies, Impact of internet on supply chain strategies, Transportation in a supply chain, facilities affecting transportation decision, modes of transportation and their performance characteristics.	**06**
5.	**Distribution strategies and strategic alliances** Introduction, centralized vs. decentralized control, direct shipment, cross docking, push based vs. pull based supply chain, third party logistics (3PL), Retailer-Supplier relationship issues, requirements, success and failures, distributor integration types and issues, role of pricing and revenue management in supply chain. Role of sourcing in supply chain, supplier scoring and assessment.	**06**
6.	**Global logistics and Risk management** Agile supply chains, Introduction to global SCM, risk management, issues in international SCM, regional differences in logistics, design for logistics, supplier integration in to new product development, pricing issues and smart pricing. IT and Business processes in supply chain.	**06**

References:

Text Books:

- Supply Chain Management: Strategy, Planning, and Operation, Sunil Chopra and Peter Meindel, Prentice Hall.

Reference Books:

- Logistics and Supply Chain Management,Christopher Martin, Pearson Education Asia.
- Marketing logistics: A supply chain Approach, Kapoor KK; KansalPurva, Pearson Education Asia.
- Designing And Managing Supply Chain Concepts, Strategies And Case Studies, David Simchi-Levi, Ravi Shankar; McGraw Hill Publication.

Open Elective-II

Class: **T. Y. B. Tech**	Semester: **VI**
Course Code : **OE3324**	Course Name : **Entrepreneurship Development**

L	T	P	Credits
3	--	--	3

Course Description:
Nowadays all engineers run behind campus interviews and secure job. Very few of them think seriously about their career as entrepreneurs. Instead of becoming job seekers, they should become job creators. Nation also expects same thing from young technocrats. Therefore, startup India & Make in India mission are in progress. Technopreneurs should take advantage of these missions to start their career as entrepreneurs. Up till now belief was Entrepreneurs are born and cannot be created. But research by David Mc Leland& Entrepreneurship Development Institute of India, Ahmedabad, has proved that with proper guidance & training successful entrepreneurs can be created. With reference to guide lines provided by EDI Ahmedabad, NIESBUD, NIMSME, syllabus for course is designed

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Identify, analyze & select business opportunity to suit his personality based on SWOT analysis.
2. Make market research & survey for selected business.
3. Prepare and apprise detailed Project Report.
4. Formulate plan for financial management of project.
5. Apply managerial inputs for starting & establishing his own business.

Prerequisite:
Students from any branch of engineering with strong passion for Entrepreneurship.

Course Content

Unit No	Description	Hrs
1.	**Entrepreneurial motivation** Entrepreneur-Definition, Concept, importance, nature, types, entrepreneurial culture, growth, entrepreneurial traits & motivations. **Entrepreneurship** Aspects, Barrier to entrepreneurship, Entrepreneur competencies, Industrial Economics.	06
2.	**Project identification** Concept of Project & classification, searching for business idea, opportunity finding, Scanning Business Idea & development. Selection of Product/ Service, core competence, product life cycle, new product development process, creativity and innovation in product modification/development. **Process selection:** Technology life cycle, forms and cost of transformation,	06

	factors affecting process selection. Factors affecting selection of location for an industry. Importance of material handling and its relevance with facility location. Calculate capacity of plant and its relation with economies of scale. Including flexibility.	
3.	**Design Thinking** Steps in design thinking, application, case study. **Business Canvas:** Importance, construction and application with case study. **Marketing:** Market survey, 4 P of marketing, USP, Branding. **JBTD**: Jobs to be done.	**08**
4.	**Setting Up of Enterprise** Steps for starting small scale industry, whom to approach for what, incentives and subsidies, Role of state development, finance corporations, nodal agencies, Role of consultancy Organization, Lead Bank, various clearances & certificate required for a particular industry, Start Up India & Make in India program. Factory design and Layout.	**04**
5.	**Costing and Accounting** Financial appraisal, Direct and Indirect costs, financial projections, Balance Sheet, Profit and loss account, Income tax, GST, Excise Tax, Long term loan, short term loan, over drafts, letter of credit, working capital management.	**04**
6.	**Project Report** Project Report preparation, Preliminary Project Report, feasibility report, marketing research, Project appraisal, statement of cash flow, accounting ratios, Break-even analysis.	**08**

References:

Text Books:

- Dynamics of Entrepreneurial Development and Management -By Vasant Desai, Himalaya Publishing House.
- Management of small-scale Industries, -By Vasant Desai; Himalaya Publishing House, Delhi.
- Small Scale Industries and Entrepreneurship, -By Vasant Desai, Himalaya Publishing House, Delhi.

Reference Books:

- Entrepreneurship Development and Management -By Neeta Bopodikar, Himalaya Publishing House, Delhi.
- Project Profiles for S.S.I. Mechanical Products.
- E.D.P. Study Material by by Dr. Dinesh Awasthi, Mr. Raman Jossi V Padmananal E.D.I Ahamadabad.
- E.D.P. Study Material by MITCON Pune.& E.A.P. Study Material by Mr. Raman Gujaral E.D.I. Ahmadnagar.

RAJARAMBAPU INSTT. OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

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

Open Elective-II

Class: **T. Y. B. Tech.**	Semester: **VI**
Course Code: **OE3401**	Course Name: **Cyber Security**

L	T	P	Credits
3	--	--	3

Course Description:
Cybersecurity is the practice of protecting systems from cyber-attacks. It is important because effective cybersecurity reduces the risks of cyber-attacks. Cybersecurity is a high-demand but changing field. Since hackers are trying to find new ways to access, change, or delete sensitive information and extort money, users must be aware of cyber threats and comply with basic cybersecurity principles. This course will help in understanding cybercrimes, their laws & and various techniques for investigating different cybercrimes. This course also focuses on advanced issues in e-banking and financial crimes.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Describe fundamental terms in cybercrime legislation.
2. Compare various cyber-attacks & offences.
3. Analyze the Indian IT Act 2000 & amendments in the IT Act.
4. Asses social networks and security issues related to social media platforms.
5. Apply a strategy for creating awareness about cyber security for e-banking and legal issues among the social community.
6. Devise the best practices and policies in various layers of cyberspace.

Prerequisite:
Basic Computer Technology.

Course Content

Unit No	Description	Hrs
1.	**Introduction to Cybersecurity** Defining Cyberspace and Overview of Computer and Technology, Architecture of cyberspace, Communication and web technology, Internet, World Wide Web, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	06
2.	**Cyber Crime and Cyber Law** Classification of cybercrimes, Common cybercrimes - cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, viruses and worms, Cybercriminal's modus-operandi, Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime.	07

3.	**The Indian IT Act** Cybercrime and Legal landscape around the world, cyber laws, challenges faced in designing cyber laws, IT Act: Cyber Crime (Section 65-74), Amendments to the Indian IT Act 2000.	**05**
4.	**Social Media Overview and Security** Introduction to Social Networks. Types of social media, social media platforms, social media monitoring, Hashtag, Viral content, social media marketing, social media privacy, Challenges, opportunities and pitfalls in online social networks, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, best practices for the use of social media, Case studies.	**06**
5.	**E-Commerce and Digital Payments** Definition of E-Commerce, Main components of E-Commerce, Elements of E-Commerce Security, E-Commerce threats, E-Commerce security best practices, Introduction to digital payments, Components of digital payment and stakeholders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act,2007.	**06**
6.	**Digital Devices Security, Tools and Technologies for Cyber Security** End Point device and mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third-party software, Device security policy, Cyber Security best practices, Significance of host firewall and Ant-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.	**06**

References:

Text Books:

- Sumit Belapure and Nina Godbole, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Pvt. Ltd.
- Henry A. Oliver, "Security in the Digital Age: Social Media Security Threats and Vulnerabilities ", Create Space Independent Publishing Platform. (Pearson, 13th November, 2001).

Reference Books:

- James Graham, Ryan Olson, "Cyber Security Essentials", Rick Howard CRC Press, Taylor & Francis Group.
- Cyber Crime Impact in the New Millennium, by R. C Mishra, Auther Press.
- Kumar K, "Cyber Laws: Intellectual Property & E-Commerce Security" Dominant Publishers.

Open Elective-II

Class: **T. Y. B. Tech.**	Semester: **VI**
Course Code: **OE342**	Course Name: **Data Mining**

L	T	P	Credits
3	-	-	3

Course Description:
The course helps to learn concepts, techniques and tools they need to deal with various facets of data mining process, including data collection and its preprocessing. The orientation of course is to understand the data mining concepts. The course helps to learn Data mining techniques and algorithms. It assists in comprehending the data mining environments inline to supervised and unsupervised learning patterns. The organization of web data inline to structured/unstructured will be examined. Moreover, a holistic view data mining applications will be surveyed.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Compare various conceptions of data mining as evidenced in both research and application.
2. Apply Classification and Clustering techniques for real time problems.
3. Characterize the various kinds of patterns that can be discovered by association rule mining.
4. Analyze web mining techniques for structured/un-structured data patterns.
5. Evaluate mathematical methods underlying the effective application of data mining.

Prerequisite:
Basic Mathematics, Descriptive statistical techniques.

Course Content

Unit No	Description	Hrs
1.	**Introduction** Data Mining Tasks, Data Mining Functionalities, Classification of Data Mining Systems, Major Issues in Data Mining, Data Pre-processing: Why Preprocessing, Cleaning, Integration, Transformation, Reduction, Discretization	06
2.	**Classification** Decision Trees, Bayesian Classification, Rule-Based Classification, Neural Network-Based Algorithms, Support Vector Machines, Classification by Association Rule Analysis, Nearest Neighbor Classifier	06
3.	**Clustering** Classification of clustering algorithms, Hierarchical Algorithms, Agglomerative Algorithms, Divisive Clustering, K-Means Clustering, Clustering Large Databases	06

4.	**Association Rules** What is an Association Rule?, Methods to Discover Association Rules, A Priori Algorithm, Partition Algorithm, FP-Tree Growth Algorithm, Generalized Association Rule	06
5.	**Web Mining** Web Mining, Web Content Mining, Web Structure Mining, Web Usage Mining, Text Mining, Unstructured Text, Text Clustering	06
6.	**Applications** Applications and Trends in Data Mining, Data Mining Applications, Social Impacts of Data Mining, Trends in Data Mining	06

References:

Text Books:

- Margaret H. Dunham," Data Mining Introductory and Advanced Topics", Prentice Hall.
- Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, The Morgan Kaufmann Series in Data Management Systems.

Reference Books:

- Arun K Pujari, Data Mining Techniques, University Press.
- P. Tan, M. Steinbach and V. Kumar, "Introduction to Data Mining", Addison Wesley.

Open Elective-II

Class: **T. Y. B. Tech**	Semester: **VI**
Course Code: **OE344**	Course Name: **Supply Chain Analytics**

L	T	P	Credits
3	- -	-	3

Course Description:
In a typical supply chain, raw materials are procured, and items are produced at one or more factories, shipped to warehouses for intermediate storage, and then shipped to retailers or customers. Consequently, to reduce cost and improve service levels, effective supply chain strategies must consider the interactions at the various levels in the supply chain. In this course, students will be able to present and explain concepts, insights, practical tools, and decision support systems important for the effective management of the supply chain. This course will help the students to develop an understanding of the following key areas and their interrelationships:

- The strategic role of a supply chain
- The key strategic drivers of supply chain performance
- Supply chain network design and analytical methodologies for supply chain analysis

This course will help the students to learn the strategic importance of good supply chain design, planning, and operation for every firm. The students will be able to understand how good supply chain management a competitive advantage can be, whereas weaknesses in the supply chain can hurt the performance of a firm.

Course Learning Outcomes:
After successful completion of the course, the students will be able to,
1. Identify the role and key issues in the supply chain management.
2. Explain the important supply chain drivers and their significance in strategic planning.
3. Estimate the demand using suitable demand forecasting method.
4. Design the inventory system and level at various locations in supply chain.
5. Design the supply chain network using appropriate network design methodology for the given problem.
6. Describe the importance of handling uncertainty in supply chain using decision tree.

Prerequisite:
Write prerequisite required to study this course.

Course Content		
Unit No.	**Description**	**Hrs**
1	**Understanding of Supply Chain** Introduction to Supply Chain Management, Evolution of Supply Chain Management, Analytics in Supply Chain Management, Supply Chain	**06**

	Planning, Different views of Supply Chain.	
2	**Supply chain drivers and obstacles** Four drivers of supply chain- inventory, transportation, facilities and information; A framework for structuring drivers in supply chain, supply chain strategies, strategic fit, Obstacles to achieve strategic fit, value of information.	**06**
3	**Demand forecasting in Supply chain** Bullwhip Effect and Time Series Analysis, Exponential Smoothing Method of Forecasting, Measures of Forecasting Errors, Tracking Signal and Seasonality Models, Forecasting using multiple characteristics in Demand Data and Inventory Management in Supply Chain.	**06**
4	**Inventory Management in supply chain** Inventory Management in Supply Chain, Role of cycle inventory, Economics of scale to exploit fixed costs and discounts, cycle time related costs, levels of safety, single stage inventory model, risk pooling, centralized and decentralized systems of planning inventory in supply chain, Multi echelon Inventory Management.	**06**
5	**Network Design and analytics in supply chain** Network design, warehouse location, service level requirements, integrating inventory positioning and network design, supply chain integration, Optimal Level of Product Availability in Supply chain. Time Value of money in Supply Chain, Different types of Analytics in Supply Chain.	**06**
6	**Handling uncertainty and future trends of Supply chain** Using Decision Tree for handling Uncertainty, Example of using Decision Tree incorporating Uncertainty in Single Factor, Example of using Decision Tree incorporating Uncertainty in two Key Factors, Modelling Flexibility in Supply Chain, Trends, Challenges and Future of Supply Chain.	**06**

References:

Text books:

- Supply Chain Management: Strategy, Planning, and Operation, Sunil Chopra and Peter Meindel, Prentice Hall.

Reference Books:

- logistics and supply chain management, Christopher martin, Pearson Education Asia.
- Marketing logistics: A supply chain Approach, Kapoor KK; Kansal Purva, Pearson Education Asia.
- Designing and managing supply chain concepts, strategies and case studies, David Simchi-Levi, Ravi Shankar; McGraw Hill Publication.

Open Elective-II

Class: - **T. Y. B. Tech.**	Semester: **VI**
Course Code: **OE346**	Course Name: **Mobile Robotics**

L	T	P	Credits
3	-	-	3

Course Description:
Mobile robotics refers to the field of robotics that focuses on the design, construction, operation, and use of robots that are capable of autonomous movement. Unlike stationary robots, mobile robots have the ability to navigate and operate in various environments, both indoor and outdoor, without being confined to a fixed location.
Key components and aspects of mobile robotics include1. Sensors 2. Actuators 3. Control Systems 4. Power Systems 5. Communication 6. Autonomy. One of the defining features of mobile robots is their ability to operate autonomously, meaning they can make decisions and navigate without direct human intervention. This autonomy can range from simple behaviors, like obstacle avoidance, to complex tasks such as mapping an unknown environment. Applications of mobile robotics are diverse and include Autonomous Vehicles: Self-driving cars, drones, and other autonomous vehicles are examples of mobile robots used for transportation and surveillance.
Warehouse Automation: Mobile robots are employed in warehouses for tasks such as inventory management, order picking, and transportation of goods.
Search and Rescue: Mobile robots equipped with sensors and cameras can be deployed in disaster-stricken areas to search for survivors or assess the situation.
Agriculture: Agricultural robots can be used for tasks like planting, harvesting, and monitoring crops.
Healthcare: Mobile robots can assist in hospitals for tasks like delivery of supplies, patient assistance, or disinfection.
Mobile robotics is an interdisciplinary field that combines elements of computer science, mechanical engineering, electrical engineering, and other related disciplines to create intelligent and adaptable robotic systems capable of navigating and performing tasks in dynamic environments. Advances in mobile robotics continue to drive innovation in various industries, making these systems increasingly capable and versatile.

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

1. Identify and explain the main components of a robot, including sensors, actuators, and control systems.
2. Solve forward and inverse kinematics problems for mobile robots.
3. Apply basic motion planning algorithms such as A* and Dijkstra's algorithm.
4. Apply Simultaneous Localization and Mapping.
5. Implement inter-robot communication and human-robot interaction.

Prerequisite:
Basics of algebra, kinematics.

Course Content		
Unit No	**Description**	**Hrs**
1.	**Robot locomotion** Types of locomotion, hopping robots, legged robots, wheeled robots, stability, maneuverability, controllability.	**06**
2.	**Robot components and applications** Sensors and actuators in mobile robots, robot control architecture, introduction to microcontroller science embedded systems.	**06**
3.	**Kinematics and Dynamics** Robot kinematics -forward and inverse kinematics, Robot dynamics-Newton-Euler equations, Lagrange's equations. holonomic and nonholonomic constraints, kinematic models of simple car and legged robots, dynamics simulation of mobile robots.	**06**
4.	**Motion Planning and Path following** Basics of motion planning, path planning algorithms based on A-star, Dijkstra, Voronoi diagrams, probabilistic roadmaps (PRM), rapidly exploring random trees (RRT), Markov Decision Processes (MDP), stochastic dynamic programming (SDP), trajectory generation and control for robots. Localization and Mapping-sensor based localization simultaneous localization and mapping (SLAM), types of maps in mobile robots	**06**
5.	**Perception for Mobile Robots** Computer vision for mobile robots, sensor fusion, object detection and recognition. Control system for mobile robots-PID control, model predictive control (MPC), reactive and deliberative control strategies.	**06**
6.	**Mobile Robot Communication** Wireless communication for mobile robots, inter robot communication, human robot interaction.	**06**

References:

Textbooks:

- R. Siegwart and I. R. Nourbakhsh, Introduction to Autonomous Mobile Robots, The MIT Press.
- Bruno Siciliano and Lorenzo Sciavicco, Robotics: Modelling, Planning and Control, Springer.
- Sebastian Thrun, Wolfram Burgard, and Dieter Fox, Probabilistic Robotics, The MIT Press.

Reference Books:

- Peter Corke, Robotics. Vision, and Control: Fundamental Algorithms in MATLAB, Springer Tracts in Advanced Robotics, Springer.

Open Elective-II

Class: **T. Y. B. Tech.**	Semester: **VI**
Course Code: **OE348**	Course Name: **Information Technology Foundation Program**

L	T	P	Credits
3	-	-	3

Course Description:
This Course represent basic Knowledge of Information Technology subject to entry level Engineers from different background and discipline to deliver world class projects to global customer. The purpose of this course is to trained to entry level engineer to help them make industry ready.

Course Learning Outcomes:
After successful completion of the course, students will be able to:
1. Solve the real-world problem using Programming Concept.
2. Apply Data Structure Algorithm to solve Computational Problem.
3. Make use of an ER model for a given problem domain.
4. Relate the relationship between project integration, scope, cost and time Management System to improve quality of projects.

Prerequisite:
Basic Knowledge of Computer System and Programming language

Course Content

Unit No	Description	Hrs
1	**Problem Solving Techniques** Introduction to Logic, Problem Solving, Algorithms, and Flowcharts.	6
2	**Fundamentals of C and Data Structures** Introduction to C, Basic Programming, Selection Control Structure, Iteration Control Structure, Demonstration of 1D and 2D arrays, Function, Strings. Introduction to basic data structures, Searching and Sorting Algorithms.	6
3	**Programming Paradigm** Introduction of Programming Paradigm, Coding Standards, Best Practices, , Introduction to code optimization, Modular approaches through Functions, Testing and Debugging.	6
4	**Object Oriented Concepts** Introduction to Object Oriented Programming, C versus C++, Features of OOP, Constructor, Destructor, Inheritance, Polymorphism.	6
5	**Relation Database Management** Introduction, ER modelling, SQL Queries.	6

6	**Project Management** Project Management Concepts, Project Management Activities, Project Estimation, Project Planning and Scheduling, Project Risk Management, Project Execution and Monitoring, Project Communication Management, Project Management Tools, Project Monitoring and Tools.	6

References:

Text Books

- Aho-Ullman, Addison wesely. "Data Structure and algorithm'. Perrson Publication.
- E Balagurusamy, Object-Oriented Programming with C++ ,McGraw,Publication.
- Henorykorth, Database system concepts',MGM International.
- Information Technology Project Management, Kathy Schwalbe, Thomson Course Technology, Fourth Edition.

Open Elective-II

Class: **T. Y. B. Tech.**	Semester: **VI**
Course Code: **OE350**	Course Name: **Operations Research**

L	T	P	Credits
3	-	-	3

Course Description:
This course is intended to provide students with a knowledge that can make them appreciate the use of various research operations tools in decision making in organizations. Operations Research is the study of scientific approaches to decision-making. Through mathematical modelling, it seeks to design, improve and operate complex systems in the best possible way. The mathematical tools used for the solution of models are either deterministic or stochastic, depending on the nature of the system modelled. In this class, we focus on basic deterministic models and methods in Optimization Techniques.

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

1. Identify the necessity and scope of operation research in decision making.
2. Formulate and solve linear programming problems using mathematical models and various optimization techniques.
3. Apply quantitative analysis methods to real-world decision-making scenarios in various industries.
4. Evaluate and improve decision-making processes under uncertainty

Prerequisite: Possess basic knowledge of mathematics.

Course Content

Unit No	Description	Hrs
1	**Introduction:** Introduction: Importance of optimization techniques, Applications of Optimization techniques in construction industry, Operations Research models, Phases of OR, Limitations of OR Linear programming	06
2	**Linear Programming Problem:** Formulation of LPP, Solution by Graphical Method, Simplex Method, Sensitivity analysis	06
3	**Transportation Problem:** Transportation Problem and its variants- Unbalanced, Maximization, Restrictions on route.	06
4	**Assignment Problem:** Assignment problem and its variants- Non-Square, Maximization, prohibited assignments, Alternate possible solutions.	06

5	**Decision Strategies:** Decision strategies – decision making under certainty – decision making under risk – decision making under uncertainty–formulation – decision criterion	**06**
6	**Game Theory:** Game Theory, Characteristics of game, Game model, Rules for game theory, Mixed Strategies (2×2 games), (2×n).	**06**

References:

Reference Books:

- Er. Prem Kumar Gupta, Dr. D. S. Hira, "Operations Research" S. Chand publications.
- Taha, H.A., "Operations Research - An Introduction", Prentice Hall.
- J. K. Sharma, "Quantitative Techniques-for managerial decisions", Macmillan Business books.
- Singiresu S. Rao, "Engineering Optimization", New Age International Publishers.

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
T. Y. B. Tech. Syllabus
To be implemented for 2023-27 NEP Batch
Department of Civil Engineering

Open Elective-II

Class: **T. Y. B. Tech**	Semester: **VI**
Course Code: **OE352**	Course Name: **Image Processing**

L	T	P	Credits
3	-	-	3

Course Description:
Image Processing has fundamental importance to fields where images are enhanced, manipulated, and analyzed. They play a key role in remote sensing, medical imaging, inspection, surveillance, autonomous vehicle guidance, and more. Students will benefit from the direct visual realization of image processing concepts, and learn how to implement efficient algorithms to perform or design applications for various tasks.

Course Learning Outcomes:
After completion of this course, students will be able to:
1. Explain different concepts and processes in digital image processing.
2. Apply different image processing operations on an image.
3. Analyze various operations on image using different tools.
4. Compare various filtering, enhancement, segmentation and classification techniques used in image processing.
5. Design various applications in Image Processing.

Prerequisite: Basic knowledge of Linear Algebra and programming language

Course Content

Unit No	Description	Hrs
1	**Digital Image Fundamentals** Components of image processing system, human and computer vision, hierarchy of image processing system, applications, image formation and digitization, binary, gray scale and color images.	**06**
2	**Image Enhancement & Image Filtering** Gray level transformation function: Image Negatives, Log Transformations, Power Law Transformation, Piecewise Linear Transformation Functions, Histogram equalization, Basics of spatial filtering, smoothening and sharpening spatial filter.	**06**
3	**Morphological Image Processing** Dilation and erosion, opening and closing operation, Hit or miss transformation, Edge Detection, Applications of Morphological Image Processing.	**06**
4	**Image Segmentation** Thresholding, Role of illumination, global and adaptive thresholding, pixel-based segmentation, region-based segmentation and edge-based segmentation.	**06**

5	**Image Shape and Classification** Shape representation, Feature space, Clusters and classification techniques, Supervised and Unsupervised classification, Basic algorithms: Boundary extraction, region filling, thinning and thickening, skeletons.	**06**
6	**Real Life Applications and Case Studies** Face recognition, Object detection, Object Classification, various case studies and applications of Digital Image Processing.	**06**

References:

Text Books:

- R.C. Gonzalez & R.E. Woods, Digital Image Processing, Pearson.
- Pratt W.K, Digital Image Processing, John Wiley & Sons.

Reference Books:

- R.C. Gonzalez & R.E. Woods, Digital Image Processing using MATLAB, Pearson.
- Georgy Gimel' farb, Patrice Delmas, Image Processing and Analysis: A Primer, World Scientific.

Open Elective-II

Class: **T. Y. B. Tech**	Semester: **VI**
Course Code: **OE354**	Course Name: **Fuzzy Logic and Neural Network**

L	T	P	Credits
3	--	--	3

Course Description:
This comprehensive course delves into the core principles of Soft Computing, covering topics such as fuzzy sets and operations, relations and composition, and fuzzification and defuzzification. Students will gain a solid understanding of soft computing methodologies, including the distinctions between soft and hard computing, and the role of biological neural networks in computational models. The course further explores neural network fundamentals, including various learning mechanisms and architectures, paving the way for advanced topics such as recurrent neural networks and their applications.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Develop a comprehensive understanding of fuzzy sets, operations, and their applications in problem-solving scenarios.
2. Solve problems related to relations and composition.
3. Design, implement various neural network architectures.
4. Analyze various neural network architectures for real-world applications.

Prerequisite: Basic knowledge of probability and control system.

Course Content

Unit No	Description	Hrs
1.	**Foundations of Fuzzy Sets** Fuzzy sets and membership, Universe of discourse, Classical sets operations and properties, Fuzzy sets operations and properties, Mapping of Classical Sets to Functions, Problems based on Fuzzy sets operations and properties.	06
2.	**Fuzzy Relations and Operations** Cartesian product, Cardinality of Crisp Relation, crisp relations, fuzzy relations, Operations on Fuzzy Relations Properties of Fuzzy Relations, membership functions, Composition, Fuzzy Cartesian Product and Composition, Value Assignments, Problems based on relation and composition.	06
3.	**Membership Functions, Fuzzification and Defuzzification** Features of the Membership Function, Fuzzification, Defuzzification to Crisp Sets, λ-Cuts for Fuzzy Relations, Defuzzification to Scalars, Problems based on λ-Cuts and Fuzzy Relations, Fuzzy Control system.	06

4.	**Introduction to Soft Computing and Neural Networks** What is soft computing? Differences between soft computing and hard computing, Biological Neural Networks, The Journey of Neural Networks, Activation Function, Soft Computing constituents.	**06**
5.	**Neural Networks and Learning Mechanisms** Learning, Supervised Learning, Unsupervised Learning, Supervised mechanism, Unsupervised Mechanism, Reinforcement Learning, Learning Rules, The Perceptron learning, Architecture of Neural Networks, Feedforward Networks, Multilayer feedforward network.	**06**
6.	**Advanced Neural Networks and Applications** Recurrent Neural Network or Feedback Network, Backpropagation Networks, Radial Basis Function Network, applications of neural networks to pattern recognition systems such as character recognition, face recognition, application of neural networks in image processing.	**06**

References:

Text Books:

- Kuntal Barua and Prasun Chakrabarti, Fundamentals of Soft computing, BPB Publications.
- S.N. Shivanandam, Principle of soft computing, Wiley.
- Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, Neuro-Fuzzy and Soft Computing, Prentice-Hall of India.
- James A. Freeman and David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Pearson publication.

Reference Books:

- Mitchell Melanie, An Introduction to Genetic Algorithm, Prentice Hall.
- David E. Goldberg, Genetic Algorithms in Search, Optimization & Machine Learning, Addison Wesley.

Open Elective-II

Class: **T. Y. B. Tech**	Semester: **VI**
Course Code: **OE356**	Course Name: **Project Management**

L	T	P	Credits
3	--	--	3

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. Explain concept of project Management.
2. Prepare project analysis.
3. Prepare technical appraisal of selected project.
4. Prepare financial appraisal of selected project.
5. Apply different techniques for project management.

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

Course Content		
Unit No	**Description**	**Hrs**
1.	**Overview of Project appraisal** 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.	**07**
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.	**Project Planning** Planning fundamentals, project master plan, work breakdown structure & other tools of project planning, work packages project organization structures & responsibilities, responsibility matrix , Time and cost estimates with AON and AOA conventions, Budget estimates, Network analysis,	**06**

	Float analysis, crashing concepts.	
4.	**Project 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
5.	**Commercial Appraisal** Economic feasibility and commercial viability, market analysis, Market Research, Industry Analysis, Competitor analysis, defining the target market, market segmentation, market positioning, building a marketing plan, market strategy. **Financial Appraisal** Pro-forma income statements, financial projections, working capital requirement, funds flow and Cash flow statements; Ratio Analysis.	06
6.	**PERT, CPM, Resource allocation** Tools & techniques for scheduling development, crashing of networks, time-cost relationship, and resource levelling multiple project scheduling. Computer applications and Software for Project Management	05

References:

Text Books:

- Dwivedi, A.K.: Industrial Project and Entrepreneurship Development, Vikas Publishing House.
- Prasanna Chandra: Project Planning estimation and assessment.
- Gray and Larson: Project Management the Managerial Process, Third edition, Tata McGraw-Hill.

Reference Books:

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

Open Elective-II

Class: **T. Y. B. Tech**	Semester: **VI**
Course Code: **OE358**	Course Name: **Plumbing (Water and Sanitation)**

L	T	P	Credits
3	-	-	3

Course Description:
This subject deals with the Plumbing system and its codes for civil engineering practices. This course is designed to fulfill the requirements of plumbing systems for residential, and industrial building construction. This course will help to select appropriate fixtures, fittings, and treatments based on the user's requirements. A major emphasis in the course is on water plumbing and sanitary fittings.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain the scope and purpose of building industry codes and standards
2. Explain different plumbing fixtures and its working.
3. Prepare layout of sanitary drain and storm drain.
4. Calculate water requirement and suggest layout for water supply.
5. Discuss functions of WTP and STP in plumbing system.

Prerequisite: Possess basic knowledge of construction activities, Environmental engineering, Building planning and design.

Course Content

Unit No	Description	Hrs
1.	**Importance of Codes, Architectural and Structural Coordination** Codes and Standards: Scope, purpose; codes and standards in the building industry, UIPC-I, NBC and other codes, Local Municipal Laws, approvals, general regulations, standards. **Architectural and Structural Coordination** Provisions for plumbing systems, coordination during the planning stage, various agencies involved and their roles, space planning for plumbing systems, plumbing shafts, basements and terraces planning, sunken toilets, location of columns and beams, slabs position, the importance of ledge walls, protection of pipes and structures, waterproofing.	06
2.	**Plumbing Terminology** **Plumbing Fixtures:** readily accessible, aerated fittings, flood level rim, floor sink, flushometer valve, flush tanks, lavatories, macerating toilet, plumbing appliances: Traps, Drainage, Valves and Water supply meter.	06
3.	**Plumbing Fixtures and Fittings** Introduction to Drainage Fixture Units (DFU): pipes, water closets, bidets, urinals, flushing devices, washbasins, bath/shower, toilets for differently abled, kitchen sinks, water coolers, drinking fountain, clothes washer,	06

	dishwasher, mop sink, overflows, strainers, prohibited fixtures, floor drains, floor slopes, hot water temperature controls, installation standard dimensions in plan and elevation, introduction to vent size and vent requirement, the purpose of venting, vent connections, vent stacks, cleanouts, venting of interceptors,	
4.	**Sanitary Drainage and Storm Drain** One pipe and Two pipe systems, different pipe materials and jointing methods, special joints, hangers and supports, protection of pipes and structures, alternative materials, workmanship, prohibited fittings and practices, T and Y fittings, cleanouts, pipe grading, fixtures below invert level, sizing case study as per NBC, safety,	**05**
5.	**Water Supply, Grey and Reclaimed Water** Sources of water, potable and non-potable water, reclaimed water, calculating daily water requirement and storage, hot and cold water distribution system, backflow prevention, air gap, cross connection control, controls and thermal expansion fixtures its installation and testing, protection of underground pipes, introduction to Water Supply Fixture Units (WSFU) and sizing.	**05**
6.	**Introduction to WTP and STP** Need to reduce and reuse, 24x7 water supply, metering and sub-metering, typical daily water and wastewater calculations for a project. Sources, utility and treatment of water, parameters of water quality, parts of water treatment plant (WTP), disinfection methods, storage conditions, RO water systems, rainwater harvesting treatment, desalination. Grey water and black water, characteristics of domestic sewage, sewage treatment methods, aerobic and anaerobic treatment, level of treatment, reclaimed water.	**08**

References:

Codes of Practice:

- Bureau of Indian Standards IS 17650 Part 1 and Part 2 for Water Efficient Plumbing Products, BIS, New Delhi
- National Building Code (NBC) of India
- Uniform Illustrated Plumbing Code-India (UIPC-I) An IPA and IAPMO (India) Publication
- Water Efficient Products-India (WEP-I), An IPA and IAPMO (India) Publication
- Water Efficiency and Sanitation Standard (WE. Stand) An IPA and IAPMO (India) Publication

Reference Books:

- Berry, "Water Pollution", CBS Publishers.
- An IPA and IAPMO (India), "A Guide to Good Plumbing Practices", An IPA and IAPMO (India) Publication.
- O.P. Gupta, "Elements of Water Pollution Control Engineering", Khanna Book Publishing, New Delhi.

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
T. Y. B. Tech. Syllabus
To be implemented for 2023-27 NEP Batch
Department of Civil Engineering

Open Elective-II

Class: **T. Y. B. Tech.**	Semester- **VI**
Course Code: **OE362**	Course Name: **Flexible Manufacturing Systems**

L	T	P	Credits
3	-	-	3

Course Description:
A flexible manufacturing system (FMS) gives manufacturing firms an advantage to quickly change a manufacturing environment to improve process efficiency and thus lower production cost. However, upfront costs may be greater for installing specialized equipment that allows for flexibility and customization. This course imparts knowledge of FMS evolution, objectives, applications and focuses on FMS layout, processing stations material handling systems etc.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Apply the concepts to the development of FMS.
2. Discuss the control structure used in manufacturing systems.
3. Discuss the Scheduling & Loading Of FMS.
4. Identify hardware and software components of FMS.
5. Summarize the concepts of Cellular Manufacturing.
6. Summarize the concepts of Additive Manufacturing.

Prerequisite: Nil

Course Content

Unit No	Description	Hrs
1.	**Introduction** Flexible and rigid manufacturing, F.M. Cell and F.M. System concept, Types and components of FMS, Tests of flexibility, Group Technology and FMS, unmanned factories, Economic and Social aspects of FMS. Advantages and disadvantages of FMS Group technology	06
2.	**Control structure of FMS** Architecture of typical FMS, Automated work piece flow, Control system architecture – Factory level, Cell level; hierarchical control system for FMS, LANs - characteristics, transmission medium, signaling, network topology and access control methods.	06
3.	**Scheduling & Loading Of FMS** Introduction, Scheduling of operations on a single machine, 2 machine flow shop scheduling, 2 machine job shop scheduling, scheduling 'n' operations on 'n' machines, scheduling rules, loading problems, Tool management of FMS, material Handling system schedule. Problems.	06

4.	**FMS hardware and software** FMS computer hardware and software, general structure and requirements, PLCs, FMS installation and implementation, acceptance testing Characteristics of JIT pull method, small lot sizes, work station loads, flexible work force, line flow strategy. supply chain management.	**06**
5.	**Cellular Manufacturing** Group Technology (GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing. Various case studies of implementation of FMS at industries.	**06**
6.	**Additive Manufacturing** Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM - Classification of AM processes-Benefits- Applications.	**06**

References:

Text Books:

- Shivanand H. K., Benal M. M., and Koti V., *Flexible Manufacturing System*, New Age International (P) Limited, New Delhi.
- Mikell P. Groover, Automation, Production Systems and Computer Integrated Manufacturing, PHI.

Reference Books:

- Kalpakjian, Manufacturing Engineering and Technology, Addison-Wesley Publishing Co.
- N. Viswanadham and Y. Narahari, Performance Modelling of Automated Manufacturing Systems, PHI.
- Michael Pinedo and Xiuly Chao, Operations Scheduling with Applications in Manufacturing and Services, McGraw Hill International Editions.
- A. K. Kamrani and E. A. Nasr, Rapid Prototyping: Theory and Practice, Springer.

Open Elective-II

Class: **T. Y. B. Tech**	Semester- **VI**
Course Code: OE364	Course Name: **AI for Manufacturing**

L	T	P	Credits
3	--	--	3

Course Description:
This course introduces the applications of Artificial Intelligence in the manufacturing sector. It explores AI Industry use cases and techniques like quality monitoring, predictive maintenance, and demand forecasting. The course also discusses AI's ethical concerns, AI project cycle and its usability in manufacturing applications.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Describe Artificial Intelligence and its potential impact in manufacturing.
2. Apply AI techniques to solve problems in the manufacturing sector.
3. Demonstrate the use of AI techniques for robotic perception, environment understanding, and intelligent decision-making.
4. Illustrate key AI techniques used for fault detection and prediction in mechanical and industrial systems.
5. Explain the principles and techniques of demand forecasting in the context of manufacturing operations.
6. Examine ethical concerns of AI to create Responsible AI.

Prerequisite:
Basics of Manufacturing, Python Programming.

Course Content		
Unit No	**Description**	**Hrs**
1.	**Introduction to AI for Manufacturing** Domains of AI, how can AI contribute to Manufacturing, Different AI opportunities in the manufacturing sector, popular use cases in the manufacturing, AI project life cycle and its use in manufacturing sector.	**06**
2.	**AI Modeling and Evaluation** Data acquisition, Data analysis and Preprocessing, Model Training, Evaluation, and deployment, Platforms for AI project deployment.	**05**
3.	**Computer Vision and Robotics Process Automation** Basic of computer vision. Use of computer vision in manufacturing process, AI for robot perception and decision-making, AI-driven robots and cobots, Path planning and motion control using ML, Human-robot collaboration, Real-world applications: welding, assembly, pick-and-place.	**07**
4.	**Predictive Maintenance** Predictive maintenance in manufacturing, AI techniques for fault prediction in mechanical systems, Use cases of AI in equipment maintenance, Vibration	**06**

	analysis and failure prediction.	
5.	**Inferencing on Edge and Demand Forecasting** Edge inferencing, edge inferencing in manufacturing, demand forecasting, solving problem in manufacturing using demand forecasting.	**06**
6.	**AI Ethics and Responsible AI** AI Ethics, Importance of AI Ethics in manufacturing, Responsible AI, frameworks for developing responsible AI.	**06**

References:

Text Books:

- Masoud Soroush, Richard D Braatz, "Artificial Intelligence in Manufacturing: Concepts and Methods", Academic Press, Paperback ISBN: 9780323991346
- Andrew Ng, "Machine Learning Yearning", https://info.deeplearning.ai/machine-learning-yearning-book
- Xiaofei Wang, Yiwen Han, Victor C. M. Leung, Dusit Niyato, Xueqiang Yan, Xu Chen, "Edge AI: Convergence of Edge Computing and Artificial Intelligence", Springer Singapore.
- Vincent C. Muller. "Ethics of Artificial Intelligence and Robotics", Metaphysics Research Lab, Stanford University.

Reference Books:

- George Chryssolouris, Kosmas Alexopoulos, Zoi Arkouli, "A Perspective on Artificial Intelligence in Manufacturing", Springer, Kindle Edition.
- Kim Phuc Tran, "Artificial Intelligence for Smart Manufacturing: Methods, Applications, and Challenges", Springer International Publishing AG.

Open Elective-II

Class: **T. Y. B. Tech**	Semester: **VI**
Course Code: **OE366**	Course Name: **AI for Cybersecurity**

L	T	P	Credits
3	-	-	3

Course Description:
This course explores the integration of AI and cybersecurity, covering key concepts, frameworks, and machine learning techniques for threat detection, malware analysis, and network security. Students will gain hands-on experience with AI tools for penetration testing, log analysis, and security automation, while also learning about responsible AI use and future trends in cybersecurity.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Describe fundamental concepts of cybersecurity, AI, and key frameworks.
2. Use Python and machine learning tools for basic malware and anomaly detection tasks.
3. Examine and differentiate AI techniques for threat detection, intrusion detection, and network security operations.
4. Design and evaluate AI-driven solutions for vulnerability management, log analysis, and security dashboard development.

Prerequisite:
Basic knowledge of networks, Machine learning concepts and cybersecurity concepts.

Course Content

Unit No	Description	Hrs
1.	**Foundations of AI-Driven Cybersecurity** Overview of Cybersecurity and AI concepts, Intersection of Cyber Security and Artificial Intelligence (AI), Applications of AI for solving real-world challenges, CIA Triad Modelling-Addressing trade-offs and conflicting priorities, Cybersecurity Framework Prevention, detection, and response, NIST AI Risk Management Framework, Traditional cyber threats, Introduction to OWASP Frameworks and risks documentation	6
2.	**Machine Learning and Generative Models for Cybersecurity** AI applications in cybersecurity, AI project cycle, future trends in AI-cybersecurity integration, Python Libraries Scikit-learn, TensorFlow and scripting for cybersecurity tasks. Supervised Learning: Basics, malware detection, anomaly detection for critical infrastructure, threat detection models. Unsupervised Learning: Anomaly detection (hands-on), clustering for threat analysis. Generative Adversarial Networks (GANs), threat detection/prevention using generative AI. Hands-On: Implementing generative AI tools	6

3.	**AI-Powered Threat Detection and Malware Analysis** Security Innovation for Threat Detection, Behavioral Analytics with AL, AI for Intrusion Detection systems (IDS), Threat Hunting and Detection Intelligence, Adversarial Attack Detection and Mitigation, Basics of malware analysis techniques, Automated malware detection and classification, Introduction to tools using AI for malware analysis, Dynamic and Static Analysis, AI-Powered Sandboxing	6
4.	**AI in Network Security** AI-driven network traffic analysis, Identifying network intrusions and attacks, AI-enhanced Network Access Control (NAC),AI-based firewalls and network segmentation, Secure Software-Defined Networking (SDN),Introduction to AI-based SOAR (Security Orchestration, Automation, and Response),Introduction to SIEM (Security Information and Event Management) systems, Investigation, containment, remediation, recovery, and reporting with AI, Hands-on: Data dashboarding for security operation reports, Hands-on: AI-powered spam detection, Automated security management techniques	6
5.	**AI in Vulnerability Management** Key requirements to Penetration Testing with AI, Automated OSINT and Social Engineering with AI, Vulnerability scanning and prioritization, Dashboard development for vulnerability intelligence, Introduction to Open-source bug hunting barriers, Applications of AI Fuzzing in bug bounty, AI-Assisted Exploitation and Attack Simulations, AI applications in CAPTCHA development and decoding.	6
6.	**Future Trends in Log Management and AI Security** Log Analysis in Cybersecurity, Log Management using extended detection and response (XDR), Augmenting log analysis with AI tools, Hands-on: Use ELK Stack (Elasticsearch, Logstash, Kibana) for log analysis, Governance through responsible AI frameworks in cybersecurity, The future of AI security challenges and mitigations, Role of advanced threat detection systems in data protection, Apply cybersecurity and AI concepts in practical, dashboarding project	6

References:

Text Books:

- Alessandro Parisi, Hands-On Artificial Intelligence for Cybersecurity, Packt Publishing.
- Mark Stamp, Introduction to Machine Learning for Security Professionals, Wile.

Reference Books:

- Ishaani Priyadarshini, Rohit Sharma , Artificial Intelligence and Cybersecurity: Advances and Innovations, Routledge.

Open Elective-II

Class: **T. Y. B. Tech**	Semester: **VI**
Course Code: **OE368**	Course Name: **AI for Agriculture**

L	T	P	Credits
3	-	-	3

Course Description:
Course introduces students to the intersection of Artificial Intelligence (AI) and agriculture. It focuses on applying AI techniques such as data analysis, computer vision, NLP, and generative AI to solve real-world agricultural problems. Students will explore ethical concerns, sustainable development goals (SDGs), and AI project development. The course includes case studies and practical use cases to enhance experiential learning.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Specify AI fundamentals, domains, and ethical aspects in agriculture.
2. Identify agricultural problems and apply data acquisition techniques.
3. Develop and evaluate AI models for agricultural applications.
4. Use statistical and generative AI methods for agri-analysis.
5. Analyze AI policies, ethical issues, and future agri-trends.

Prerequisite: Basic Statistics and Probability, Fundamentals of Artificial Intelligence and Python Programming.

Course Content

Unit No	Description	Hrs
1.	**Introduction to AI in Agriculture** Role of AI in agriculture, types and domains of AI, relevance to SDGs, overview of AI Project Cycle, introduction to AI Ethics.	06
2.	**Problem Scoping and Data Acquisition** Problem scoping in agriculture, challenges in Agri-domain, data types, sources, data acquisition, data handling and visualization, AIoT.	06
3.	**AI Modeling and Deployment** Introduction to modeling, training and testing datasets, model evaluation metrics, deployment, practical examples of AI models in Agri-apps.	06
4.	**Statistical AI Techniques in Agriculture** Statistical data analysis, regression and classification techniques, crop yield and damage prediction, introduction to generative AI for data.	06

5.	**AI Applications: CV and NLP in Agriculture** CV techniques and use cases (e.g., crop/rice/livestock), NLP applications (chatbots, market intelligence), ethical implications, generative AI in CV/NLP.	**06**
6.	**Policy, Ethics, and Future Trends in AI for Agriculture** Ethical considerations in deploying AI solutions in agriculture, privacy and data protection issues, AI policy frameworks, government initiatives, global and national regulations, future trends and opportunities in AI-driven agriculture.	**06**

References:

Text Books:
- Abhishek Ghosh & Manju Khari, "Artificial Intelligence for Agriculture", CRC Press.
- Melanie Mitchell, "Artificial Intelligence: A Guide for Thinking Humans", Penguin.
- J. Zhou, J. Guo, "Artificial Intelligence in Precision Agriculture", Springer.

Reference Books:
- Rohit Sharma, "AI and IoT for Sustainable Development in Agriculture", Springer.
- Niall Adams, "Data Science for Agriculture and Environmental Research", CRC Press.
- Rajalingappaa Shanmugamani, "Deep Learning for Computer Vision", Packt Publishing.

K.E. Society's
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T. Y. B. Tech. Syllabus
To be implemented for 2023-27 NEP Batch
Department of Civil Engineering

Open Elective-II

Class: **T. Y. B. Tech**	Semester: **VI**
Course Code: **OE370**	Course Name: **AI for Sustainability**

L	T	P	Credits
3	-	-	3

Course Description:
This course introduces the fundamental concepts of artificial intelligence (AI) and sustainability and applications for sustainable development. The course aims to enable learners to understand the potential of AI for addressing environmental, social and economic sustainability challenges through case studies and real life solutions. Students will explore environmental, social and economic dimensions of sustainability and identify AI appropriateness in each context. They will also evaluate the impact of AI projects in different dimensions and discuss crucial critical consideration.
The course will be Open Elective choice for all students

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain fundamentals of Artificial Intelligence and Sustainability
2. Analyze the potential and impacts of AI to address environmental, social and economic challenges
3. Develop critical thinking skills for evaluating and comparing AI solutions in sustainable context
4. Apply AI, IOT and other technologies to prototype sustainable solutions for real-world challenges

Prerequisite: Basic knowledge of Environmental and Sustainability knowledge, Basics of Mathematics and Programming skills

Course Content

Unit No	Description	Hrs
1.	**Introduction to AI and Sustainability** Introduction to Sustainability, Approaches to Sustainability, Dimensions of Sustainability, Introduction to AI and Domains of AI, AI Ethics, AI Contributing to Green Skills, AI's role in achieving sustainability goals	**06**
2.	**AI Foundations** Supervised, unsupervised, reinforcement learning, Introduction to Neural networks and deep learning, Tools and frameworks for AI: Python, TensorFlow, Scikit-learn	**06**
3.	**Environmental Sustainability** Introduction to Environmental Sustainability, Business Approach for Environmental Sustainability, AI for Environmental Sustainability, Environmental Challenges for AI, AI in Clean water and sanitation, AI in Climate Action, AI in Affordable and Clean Energy	**06**

4.	**Social Sustainability** Introduction to Social Sustainability, Business Approach for Social Sustainability, AI for Social Sustainability, Social challenges for AI, AI in Zero Hunger, Good Health and Well-being, AI in Accident Detection	06
5.	**Economic Sustainability** Introduction to Economical Sustainability, Business Approach for Economical Sustainability, AI for Economical Sustainability, Economical Challenges for AI, AI in Decent Work and economic growth, AI in Industry Innovation and Infrastructure, AI in Intelligent Recycling	06
6.	**Case Studies and AI Projects** Steps in AI Project Development, AI in Quality Education, Transportation, healthcare chatbot, Fraud Detection Predictive Maintenance, Sentiment Analysis for social media	06

References:

Text Books:
- Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson.
- Margaret Robertson, "Sustainability Principles and Practice", Routledge.
- S. Suresh, "Artificial Intelligence for Sustainable Development", Wiley.

Reference Books:
- Francisco J. Martin and Uwe Meinberg, "Artificial Intelligence for a Better Future: An Ecosystem Perspective on the Ethics of AI and Emerging Digital Technologies", Springer
- Klaus Schwab "The Fourth Industrial Revolution", Crown Publishing Group
- Peter Dauvergne "AI in the Wild: Sustainability in the Age of Artificial Intelligence", MIT Press
- Srikanta Patnaik, Siddhartha Bhattacharyya, Nilanjan Dey (Eds.), "Smart Intelligent
- Computing and Applications", Springer

Open Elective-II

Class: **T. Y. B. Tech**	Semester: **VI**
Course Code: **OE3242**	Course Name: **Marketing for Engineers**

L	T	P	Credits
3	-	-	3

Course Description:
Marketing is the core of operating any business. Marketing defines & guides companies for interfacing with customers, competitors, collaborators, and the environment. Marketing helps you plan and execute the creating a value proposition by determining pricing, promotion, and distribution of ideas, goods, and services. It begins with needs and wants determination, assessing the five forces existing in the competitive environment. Selecting the most appropriate customer targets and developing marketing strategy and implementation program for an offering that satisfies consumers' needs better than the competition. Marketing is the art and science of creating customer value in exchange it benefits the organization and its stakeholders.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Assess market opportunities by analyzing customers, competitors, collaborators, and the strengths and weaknesses of a company.
2. Develop effective marketing strategies to achieve organizational objectives.
3. Design a strategy implementation program to maximize its chance of success.
4. Examine how marketing strategies impact the profitability of an organization
5. Communicate and defend your recommendations to your classmates both quantitatively and qualitatively.

Prerequisite: Nil.

Unit No	Description	Hrs
1.	**Introduction to Marketing** Core concept of marketing, Marketing Process, Function of Marketing Environment, Analyzing needs & trends in micro, macro business environment.	06
2.	**Market Segmentation, Targeting & Positioning** Basis for market Segmentation, Targeting, Positioning. Marketing Mix, Significance of competitive environment.	06
3.	**New Product Development** Product and product line decisions. Product life cycle (PLC), Managing PLC, Test marketing and the new product, Branding and Packaging decisions.	06
4.	**Pricing & Distribution** Price determinants, policies, Methods. Channel Management, Channel	06

	conflict and resolutions.	
5.	**Promotion** Promotion mix, Advertising, Media decisions, Sales Promotion, Personal selling, Managing sales force. Global Marketing.	**06**
6.	**Strategy** An Introduction, Dealing with competition, Porter's five force model, Strategy, Strategy execution.	**06**

References:

Text Books:

- Philip Kotler, Kevin Lane Keller, "Marketing Management", Pearson Publications.
- Rajan Saxena, "Marketing Management", The McGraw-Hill Companies Publication.

Reference Books:

- Vijay Prakash Anand, *Marketing Management – An Indian Perspective*, Wiley India Pvt. Ltd.
- Joel R. Evans, Berry Berman, *Marketing Management*, 1st Edition, 2018.
- James C. Anderson, James A. Narus, Das Narayandas, *Business Market Management: Understanding, Creating, and Delivering Value*, Prentice Hall.
- Stephen Wunker, *Capturing New Markets: How Smart Companies Create Opportunities Others Don't*, McGraw-Hill Education.

Class: **T. Y. B. Tech. Civil**	Semester: **VI**
Course Code : **CEMD302**	Course Name: **Environmental Engineering**

L	T	P	Credits
3	-	-	3

Course Description:

Environmental Engineering course offered as MDM in 6^{th} semester, which focuses on water supply engineering and wastewater treatment, solid waste management and air pollution. The course enables students to work as a consultant or contractor for infrastructure projects related to water supply and waste management projects. This course intends to build the competency in the students to identify water source, to check water quality, to design of water supply scheme and wastewater treatment plant. Also this course enables student to control environmental degradation by using AI tools.

Course Learning Outcomes:

After successfully completing the course, student will able to:

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

Prerequisite: Basic knowledge of Environmental Science.

Course Content		
Unit No.	**Description**	**Hrs**
01	**Introduction to Public Health Engineering** Introduction to Water Supply Engineering (WSE) Sources of Water and quality issues, water quality requirements for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design.	**06**
02	**Water Treatment Process** Layout of Water Treatment Plant, Aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes, design problems on water treatment process, application of SCADA for water treatment plant	**06**
03	**Sewage and Storm Water Collection system** Domestic and Storm water, Quantity of Sewage, Sewage flow variations.	**06**

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

References:

Text Books:

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

Reference Books:

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

Class:- **T.Y. B. Tech**	Semester-**VI**
Course Code: **CSMD302**	Course Name: **Artificial Intelligence**

L	T	P	Credits
3	--	--	3

Course Description:
In this course students will learn the basic concepts and techniques of Artificial Intelligence. These students will be able to develop AI algorithms for solving practical problems.

Course Learning Outcomes: on completing this course, students will be able to

1. Understand the basic concepts and techniques of Artificial Intelligence.
2. Apply AI algorithms for solving typical practical problems.
3. Describe appropriate knowledge representation schemes in AI.
4. Apply reasoning schemes in AI.
5. Analyze the planning schemes for goal stack.
6. Evaluate performance of solution for constraint satisfaction problem.

Prerequisites:

- Basic knowledge of logical reasoning and Probability theory.

Course Content

Unit No	Description	Hrs
1	**Introduction** Artificial Intelligence and its applications, Definitions of AI, Intelligent Agents, Concept of rationality, PEAS description of the task, Simple reflex agents, Model based agents, Learning Agents, advantages, Impact and Examples of AI, Application domains of AI.	06
2	**Problem solving techniques** State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, Constraint satisfaction problem, Mean-end analysis, Game playing, Min-Max Search, Alpha-Beta Pruning, Iterative deepening.	06
3	**Logic and Knowledge Representation schemes in AI** Propositional logic, predicate logic, Resolution, Resolution in proportional logic and predicate logic, Clause form, unification algorithm.	06
4	**Reasoning schemes in AI** Introduction to non-monotonic reasoning, default reasoning, statistical reasoning, probability and Bayes' theorem, combining uncertain rules.	06
5	**Planning** The Planning problem, planning with state space search, blocks world approach, Goal stack planning.	06
6	**Understanding** Level of interactions among components, understanding as a constraint	06

	satisfaction, Line labeling, The Waltz algorithm.	

References:

Text Books:

- Artificial Intelligence by Rich and Knight, The McGraw Hill publication
- Artificial Intelligence: A modern approach by Stuart Russel, Peter Norvig, Third Edition, Pearson Education, 2010

References:

- https://www.edx.org/course/artificial-intelligence-ai
- https://www.udemy.com/course/artificial-intelligence-az/

Class:- **TY B. Tech**	Semester- **VI**
Course Code: **EEMD302**	Course Name: **Smart Grid**

L	T	P	Credits
3	0	0	3

Course Description:
This course covers the fundamental aspects of the smart grid, various technologies, communication and applications of renewable sources for developing smart grid. It introduces state of the art smart grid technologies like electric vehicles, microgrids, energy storage, phasor measurement unit and cyber security, etc. In addition, it discusses the architecture of smart gird, various distributed energy sources, smart metering and distribution automation equipment.

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

1. Summarize the concept and future of smart grid
2. Develop smart grid architecture
3. Compile various smart grid technologies
4. Identify communication and information technologies for smart grid
5. Elaborate distributed generation and storage technologies
6. Recommend smart metering and distribution automation

Prerequisite:
Fundamentals of Power system.

Course Content

Unit No	Description	Hrs
1	**Introduction to smart grid:** Basics of power systems, definition of smart grid, need for smart grid, smart grid domain, enablers of smart grid, smart grid priority areas, regulatory challenges, smart-grid activities in India, comparison between smart grid and micro grid, Grid Codes.	06
2	**Smart grid architecture:** Smart grid architecture, standards-policies, smart-grid control layer and elements, network architectures, centralized, distributed and hierarchical control strategies, power line communications, supervisory control and data acquisition system.	06
3	**Communication technology in smart grid:** Introduction to communication technology, Home Area Network (HAN), Neighborhood Area Network (NAN) and Wide Area Network (WAN), two-way digital communications paradigm, synchro-phasor measurement units (PMUs) – wide area measurement systems (WAMS), Introduction to Internet of things (IoT)- Applications of IoT in Smart Grid.	06

4	**Information technology in smart grid:** Data communication, dedicated and shared communication channels, switching techniques- circuit switching, message switching, packet switching, virtual packet switching, datagram packet switching, standards for information exchange, information security for the smart grid,	06
5	**Distributed generation and storage:** Introduction to distributed energy sources, solar PV system, wind energy system, micrograds, microgrid architecture, AC micro grid, DC microgrid, storage technologies- battery, super capacitor, compressed air energy storage, pumped hydro energy storage, introduction electric vehicles- vehicle to grid (V2G), grid to vehicle (G2V), vehicle to vehicle (V2V) and vehicle to home (V2H) operation in smart grid.	06
6	**Smart metering & distribution automation:** Evolution of electricity metering, key components of smart metering, overview of the hardware used, communications infrastructure for smart metering and protocols for smart metering, equipment's used in smart grid - current transformers, voltage transformers, intelligent electronic device, bay controller, remote terminal units, components for fault isolation and restoration, fault location.	06

References -
Text Books:

- Janaka Eknayake, "Smart Grid- Technology and applications", Wiley publications.
- A.G. Phadke and J.S. Thorp, "Synchronized Phasor Measurements and their Application", Springer.

Reference Books:

- S. Borlase, "Smart Grids, Infrastructure, Technology and Solutions", CRC Press.
- G. Masters, "Renewable and Efficient Electric Power System", Wiley–IEEE Press.
- T. Ackermann, "Wind Power in Power Systems, Hoboken", N J, USA, John Wiley.

Class: -**T.Y. B. Tech ETC Engg**	Semester-**VI**
Course Code : **ECMD302**	Course Name : **Industrial Electronics**

L	T	P	Credits
3	-	-	3

Course Description:
This course provides basics of power electronic devices with switching on/off techniques. It also deals with power converters such as AC to DC, DC to DC and DC to AC with their analysis and performance parameters. This course also gives introduction to PLC.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Identify basics Power Electronics devices and components.
2. Illustrate use of Power Electronics.
3. Develop PLC logic using ladder programming.
4. Analyze industrial electronics applications.

Prerequisite:
Knowledge of basic electronics and programming.

Course Content

Unit No	Description	Hrs
1.	**Power Electronic Components** Applications of power electronics, Power Electronic System, Power semiconductor devices: power diode, power BJT, Power MOSFET, IGBT, SCR, Diac, TRIAC, Ratings, control characteristics of power devices, Characteristics and specifications of switches, Types of power electronic circuits.	06
2.	**Power Converters** AC-DC Converters (Rectifiers), DC-DC converters (choppers), DC-AC converter (Inverters). AC-AC Converters (1-phase, 3-phase) Cycloconverters	06
3.	**DC and AC Drives** Basic characteristics of DC motor, operating modes, DC motor control using choppers and rectifiers, Torque-speed characteristics of induction motor, speed control techniques of AC motor: stator-voltage, rotor resistance, and v/f control, basic equations, characteristics.	06
4.	**Introduction to PLC** Introduction about industrial automation, History of industrial automation Need of automations in industries, Automation control circuit and power circuit, Control system in Industry, Types of PLCs	06

5.	**PLC Programming** Types of Programming Languages, Introduction about PLC Programming software, Ladder logic diagram, Structure of program, Procedure for creating ladder diagram, Logical function done by ladder program in software.	**06**
6.	**Applications** Industrial conveyor systems, Automatic Bottle Filling System, Traffic Light Control system, UPS, Battery charging circuits and management Systems, Induction heating and dielectric heating.	**06**

References -

Text Books:

- M. H. Rashid, Power Electronics Circuits Devices And Applications, PHI
- C. D. Johnson, Introduction to process technologies, PHI

Reference Books:

- M. D. Singh and K. B. Khanchandani, Power Electronics, TMH
- P. C. Sen, Power Electronics, S. Chand publication

Class:- **T.Y. B. Tech**	Semester-VI
Course Code : **CIMD302**	Course Name: **Software Engineering**

L	T	P	Credits
3	–	–	3

Course Description:
This course deals with various concepts of Software Engineering. It includes concepts such as software requirements, software process models, function-oriented and object-oriented design. Software engineering covers the basic concepts such as data analysis, modeling and design required for developing software. It also covers concepts such as Objects, classes, links and associations, generalization and inheritance, aggregation, abstract classes and advanced modeling concepts in UML.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Describe fundamental concepts in software engineering and project management
2. Practice software process models for the undertaken software problems
3. Design function-oriented and object oriented models using modern tools.
4. Identify classes and build the domain model using advanced concepts in object, dynamic and functional modeling.
5. Analyze existing software systems using function and object-oriented analysis.
6. Design models using UML diagrams for software systems: use case, class, sequence, collaboration, activity, state chart diagrams, component and deployment.

Prerequisite: Fundamentals of Computers

Course Content

Unit No	Description	Hrs
1.	**Software Requirements, Analysis and Specification** Software requirement analysis and specification, problem analysis, Requirement Specification, Validation, effort estimation, risk management, software testing types	**06**
2.	**Software Process Models** Waterfall model, V model, Prototyping, Spiral model, Agile software development	**07**
3.	**Function–oriented Design** Design principles, module level concepts, Design notation and specification, structured design methodology, Verification	**05**
4.	**Structural Modeling using UML** Classes, Relationships, Common mechanisms. Diagrams, Class Diagrams, Interfaces, Types and Roles, Packages, Instances and Object Diagram	**06**

5.	**Behavioral Modeling and Architectural Modeling using UML** Interactions, Use cases, Use case diagram, Activity diagrams, Events and signals, State Machines, Components, Deployment, Collaboration, Patterns and Frame works, Component diagrams and Deployment Diagrams	**06**
6.	**Case studies:** A. Case study on DFD for Hospital Management System, Library Management System, Railway Reservation System and Online Shopping System. B. Case study design using UML on Banking system, College management system, online food ordering system.	**06**

References -

Text Books:

- Pankaj Jalote, "An Integrated Approach to S/W Engineering.", Narosa Publication House, Eleventh edition, 2011
- Grady Booch, Jeams Rambaugh, Ivar Jacotson, "The Unified Modeling Language User Guide" (Addison Wesley)

Reference Books:

- Roger S. Pressman, "Software Engineering – Practitioner's Approach", TATA McGraw-Hill, Seventh Edition, 2014

Class: - **T. Y. B. Tech.**	Semester-**VI**
Course Code: **MEMD304**	Course Name: **Marketing and Business Fundamentals for New Products**

L	T	P	Credits
3	--	–	3

Course Description:
In this course, students will learn and understand essential principles and strategies required for successfully launching new products in today's competitive market landscape. From understanding consumer behavior to developing effective branding strategies, students will gain the knowledge and skills necessary to navigate the complexities of bringing innovative products to market.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain product positioning and branding strategies for new products
2. Analyse market trends and consumer behaviour to identify opportunities for new product development.
3. Develop pricing strategies and cost estimation techniques for new products
4. Explain the basics of intellectual property rights and patents in the context of new product development
5. Design distribution channels and sales strategies designed for a new products
6. Create effective marketing communication plans and launch strategies for new products.

Course Content

Unit No	Description	Hrs.
1.	**Product Positioning and Branding Strategies:** Understanding the concept of product positioning, Identifying target markets and audience segmentation, Crafting a compelling brand identity, Developing brand positioning strategies, Case studies and real-world examples of successful branding campaigns.	**06**
2.	**Market Analysis and Segmentation:** Conducting market research to identify opportunities and threats, Analysing market trends and consumer behaviour, Segmentation techniques for targeting specific market segments, Assessing market competition and differentiation strategies, Utilizing data analytics tools for market analysis	**06**
3.	**Pricing Strategies and Cost Estimation:** Factors influencing pricing decisions, Cost estimation methods for new product development, Pricing strategies: skimming, penetration, value-based pricing, etc., Pricing psychology and consumer perceptions, Pricing models and simulations	**06**
4.	**Basics of Intellectual Property Rights and Patents :** Understanding intellectual property rights (IPR), Overview of patents, trademarks, copyrights, and trade secrets, Importance of protecting intellectual	**06**

	property for new products, Patent application process and requirements, Case studies on patent infringement and legal implications	
5.	**Distribution Channels and Sales Strategies:** Exploring various distribution channels: direct vs. indirect, Channel selection and management, Developing sales strategies and distribution plans, Sales forecasting and performance measurement, Building partnerships and alliances for distribution	**06**
6.	**Marketing Communication and Launch Strategies:** Crafting effective marketing messages and communication channels, Integrated marketing communication (IMC) strategies, Planning and executing product launches, Leveraging digital marketing tools and social media platforms, Measuring the success of marketing campaigns and adjusting strategies accordingly	**06**

References: -

Textbooks:

- Saxena, Marketing Management: Text and Cases.
- Rao, V.S.P., & Saxena, Marketing Management: Indian Cases.
- Beri, G.C. Indian Marketing: Text and Cases.
- Gandhi, M.K., Kumar, A., & Mowen, J.C. Marketing: Concepts and Cases.

Reference Books:

- Kotler P. and Keller K.L, Marketing Management.
- Crawford C.M. and Di Benedetto C.A, New Products Management.
- Armstrong G. and Kotler P, Principles of Marketing.
- Ries, The Lean Startup: How Today's Entrepreneur use Continuous Innovation to Create Radically Successful Businesses.
- Boone L.E. and Kurtz D.L, Contemporary Marketing.

Class: - **T.Y. B. Tech**	Semester-**VI**	L	T	P	Credits
Course Code: **MCMD302**	Course Name: **Industrial Robotics**	3	-	-	3

Course Description:
Industrial robots are nearly on the verge of revolutionizing Manufacture as they end up noticeably more intelligent, quicker, and less expensive, they are being called upon to accomplish more. They are going up against more "human" abilities and attributes, for example, detecting, expertise, memory, and trainability. Accordingly, they are going up against more employments for example, picking and packaging, testing, or investigating items, or assembling minute gadgets.

Course Learning Outcomes:
After successful completion of the course, students will be able to,
1. Explain the basic concepts of Robots.
2. Select an end effector and sensor for application.
3. Explain drives and controls for robotic system.
4. Develop program for robot to perform tasks in industrial applications.

Prerequisite: Sensor and Instrumentation

Course Content

Unit No.	Description	Hrs.
1	**Fundamentals of Robotics:** History of Robotics, Definitions of Industrial Robot, Type and Classification of Robots, Robot configurations-cartesian, cylinder, polar and articulate. Robot wrist mechanism, Precision and accuracy of robot.	06
2	**Grippers for Robotics:** Grippers, Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper systems.	06
3	**Sensors for Robotics:** Types of Sensors used in Robotics, Touch Sensors-Tactile sensor – Proximity and range sensors. Force sensor-Light sensors, Pressure sensors, Application of Sensors, Characteristics of Sensing devices, Selection for Particular application Case study.	06
4	**Drives and Control for Robotics:** Types of Drives, Types of transmission systems, Actuators and its selection while designing a robot system, Types of Controllers, Introduction to closed loop control.	06
5	**Programming and Languages for Robotics:** Methods of robot programming, WAIT, SIGNAL and DELAY commands, subroutines, Programming Languages: Generations of Robotic Languages, Introduction to various types such as VAL, RAIL, AML, ROS.	06
6	**Application of Robotics in Industry:** Application of robot in welding, machine tools, material handling, and assembly operations, parts sorting and parts inspection, AI in robotics, Introduction to Cobots, Future Application and Challenges and Case Studies.	06

References -
Text Books:
- Richaerd D Klafter, Thomas Achmielewski and Mickael Negin, Robotic Engineering - An Integrated Approach, Prentice Hall Department of Industrial Design Detail Syllabi 318NIT Rourkela India, New Delhi.
- Mikell P Groover, Industrial Robotics - Technology, Programming and Applications, McGraw Hill.
- Introduction to Robotics- John J. Craig, Addison Wesley Publishing,.

Reference Books:
- James A Rehg, Introduction to Robotics in CIM Systems, Prentice Hall of India.
- Deb S R, Robotics Technology and Flexible Automation, Tata McGraw Hill, New Delhi.
- Janaki Raman P A, Robotics and Image Processing, Tata McGraw Hill
- Robotics for Engineers -YoramKoren, McGraw Hill International.

Class: - T.Y B. Tech	Semester – VI
Course Code: **AIMD302**	Course Name: **Principles of Artificial Intelligence**

L	T	P	Credits
3	-	-	3

Course Description:

In this course students will learn the basic concepts and techniques of Artificial Intelligence. These students will be able to develop AI algorithms for solving practical problems.

Prerequisite:

- Basic knowledge of logical reasoning
- Probability theory.

Course Learning Outcomes:

After completing this course, students will be able to

1. Articulate basic concepts and techniques of Artificial Intelligence.
2. Apply AI algorithms for solving typical practical problems.
3. Designate appropriate knowledge representation schemes in AI.
4. Analyze reasoning schemes in AI.

Course Content

Unit No	Description	Hrs
1	**Introduction** The four categories of definitions of AI, Concept of rationality, The AI Problems, Artificial Intelligence Technique, Tic-Tac-Toe game and its data structure, Question-Answering and its one typical data structure, Sample few examples of the state-of-art AI applications.	06
2	**Intelligent Agents** PEAS description of the task, Simple reflex agents, Model based agents, Learning Agents, advantages, Impact and Examples of AI, Application domains of AI.	06
3	**Problem solving techniques** State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search.	06
4	**Constraint satisfaction problem** Mean-end analysis, Game playing, Min-Max Search, Alpha-Beta Pruning. Iterative deepening.	06

5	**Logic and Knowledge Representation schemes in AI** Propositional logic, predicate logic, Resolution, Resolution in proportional logic and predicate logic,Clause form, unification algorithm.	06
6	**Reasoning schemes in AI** Introduction to nonmonotonic reasoning, default reasoning, statistical reasoning, probability and Bayes' theorem, combining uncertainrules.	06

References -

Text Books:

- Artificial Intelligence by Rich and Knight, The McGraw Hill publication
- Artificial Intelligence: A modern approach by Stuart Russel, Peter Norvig, Pearson Education

Reference:

- Artificial Intelligence | Electrical Engineering and Computer Science | MIT OpenCourseWare

Class: **T. Y. B. Tech.**	Semester-**VI**
Course Code: **RAMD302**	Course Name: **Industrial Automation & Control**

L	T	P	Credits
3	-	-	3

Course Description:
This course offers a comprehensive overview of industrial automation systems, emphasizing their design, components, and applications in various industries. Students will learn about fundamentals of industrial automation, programmable logic controllers (PLCs), PLC programming, material handling and distributed control systems (DCS).

Course Outcomes:
After successful completion of the course, students will be able to-
1. Explain need, basic elements, and systems of industrial automation.
2. Develop PLC programming for various applications.
3. Discuss various material handling and identification technologies.
4. Explain basics of DCS and its interfacing.

Prerequisite: NIL

Course Content

Unit No.	Description	Hrs
1.	**Fundamentals of Industrial Automation** Need of automation, Types of Automation: fixed /programmable /flexible automation, Automation principles and strategies. Basic elements of automated systems: power, program and control, Advanced automation functions: Safety monitoring, Maintenance and Repair diagnostics, Error detection and recovery, Levels of automation.	06
2.	**Transfer Lines and Automated Assembly** Fundamentals, Configurations, Transfer mechanisms, storage buffers, control, applications, Analysis of transfer lines with and without storage buffers. Assembly Automation: Types and configurations, Parts delivery at workstations.	06
3.	**Fundamentals of PLC** Programmable Logic Controller (PLC)- Block diagram of PLC, PLC architecture and programming languages (Ladder Logic, Function Block Diagram, etc.), Basic instruction sets, Input/output modules. Networking of PLC, Overview of safety of PLC with case studies.	06
4.	**PLC Programming** Basic instructions (AND, OR, NOT, Timer, Counter, etc.), Programming techniques (branching, looping, etc.), Program control instructions, PLC applications like motor control, light control etc.	06

5.	**Material handling and Identification Technologies** The material handling function, Types of Material Handling Equipment, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing. Product identification system: Barcode, RFID etc.	06
6.	**Distributed Control System** Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.	06

References –

Text Books:

- M. P. Groover, Automation, Production systems and Computer Integrated Manufacturing, Prentice-Hall.

Reference Books:

- Webb, John W. Programmable Logic Controllers: Principles and Application, Prentice Hall of India, New Delhi.
- Petruzella Frank D, Programmable Logic Controllers, Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
- Lucas, M.P., Distributed Control System, Van Nonstrandreinhold Co. NY.
- Amber G.H & P.S. Amber, Anatomy of Automation, PrenticeHall.

RAJARAMBAPU INSTITUTE OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

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

Class:- **Third Year B. Tech**	Semester-VI
Course Code: SH3065	**Course Name:** Scholastic Aptitude II

L	T	P	Credits
2*	-	-	Audit

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.	**Speed Time Distance** Average Speed, Special Cases of Average Speed, Relative Speed, Cases of relative speed Circular motion, Applications of STD	03
2.	**Trains** Stationary Object with Negligible length, Stationary Object with considerable length, Moving object with negligible length, Moving object with considerable length, Including-Excluding Stoppages.	02
3.	**Boat & Streams** Upstream case, Downstream case , Perpendicular movement	02

4.	**Races** Head Start , Dead heat,defeat,3 man participating in race, ratio related examples,	02
5.	**Permutation & Combination** Difference between P & C, Theorems of Permutation Theorems of Combination, Counting numbers of squares & rectangles, Triangle	02
6.	**Probability** Introduction, Range of Probability, Sum & Product Rule, Coins, Dice, Cards, Bags & Balls	02
7.	**Geometry** Triangles, Quadrilaterals, Circles, Polygons	02
8.	**Mensuration** Cube, Cuboid, Cylinder, Cone Sphere, Prism	02
9.	**Clock** Basic, Time lag constant, Standard time of coincidence, Various concepts of hour and minute hand, Questions on strikes of clock, Find time in the mirror, Questions based on faulty clock, Time gains or loss	02
10.	**Calendar** Leap year, Odd day concept, Month code, century codes, Same Calendar concept, Finding day or date (Box method)	02
11.	**Seating Arrangement** Type of arrangements, Types of information, Data extraction, Linear-Non Linear movement, Advance movement	02
12.	**Analytical Reasoning I** Figure Counting,Pattern Completion / Figure Matrix,Embedded Figures / Hidden Figures,	03
13.	**Analytical Reasoning II** Water images , Mirror Images , Cubes and Dice , Paper Folding and Cutting	02
14.	**Statements & Conclusion** Understanding the Premise, Identifying Logical Deductions, Cause and Effect	02
	Total Hours	**30**

Reference Books:

- R. S. Aggarwal, "Quantitative Aptitude", S Chand Publishing, New Delhi.
- R. S. Aggarwal, "Logical Reasoning", S Chand Publishing, New Delhi.
- Arun Sharma, "Quantitative Aptitude", McGraw Hill Publishing, New Delhi 7th Edition.
- Arun Sharma, "Logical Reasoning", McGraw Hill Publishing, New Delhi 3rd Edition.

Class: **T. Y. B. Tech. Civil**	Semester-**VI**
Course Code: **CE358**	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.	Standard Penetration Test	02
12.	Vane Shear Test	02
13.	Field Visit regarding identification of soil	02

References –

Text Books: -

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

References Books: -

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

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
T. Y. B. Tech. Syllabus
To be implemented for 2023-27 NEP Batch
Department of Civil Engineering

Class: **Third Year B. Tech. Civil**	Semester: **VI**
Course Code: **CE3601**	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 according to the limit state design concept as per IS provisions. It 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. The behavior and design of tension members, compression members, and design of connections. Students are expected to design industrial steel shed and to prepare structural drawings.

Course Learning Outcomes:

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

1. Analyse and design steel industrial shed by manual process and software/ tool.
2. Interpret the results obtained from the software.
3. Prepare structural drawing of steel industrial shed.tic

Prerequisite: Possess basic knowledge of Statistic, Strength of material

Course Content

Unit No.	Description	Hrs
01	A mini project: - Detail design and drawing of industrial steel shed with manually and Software tool. Every student must select one project of industrial steel shed. He must take a size of shed and complete the geometrical design. The it includes the truss analysis, preparation of DL, LL, WL diagrams, analysis and design of tension and compression members, column, column base and gantry girder. At the end of design every student should prepare the structural drawings for designed shed.	24

References:

Text Books (List of books as mentioned in the approved syllabus)

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

- Shiyekar, M. R., Limit State Design in Structural Steel, PHI Learning

Reference books

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

Codes of Practice:

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

Class: **Third Year B. Tech. Civil**	Semester: **VI**
Course Code: **CE362**	Course Name: **Software Laboratory**

L	T	P	Credits
-	-	2	1

Course Description:

This course aims to offer wide range of soft computing tools to help civil engineers throughout design and construction processes. Software can help in every project stage, including drafting & documenting, designing, visualizing & analyzing. This course introduces basic skills required to develop computer programs using modern computer systems, assuming little or no previous experience.

Course Learning Outcomes:

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

1. Develop technical competency in software in the Civil Engineering field.
2. Solve civil engineering problems by using software.
3. Develop presentation skills for project/case study.
4. Design and interpret data by soft skill Civil Engineering projects.

Prerequisite: Basics of civil engineering course for which software is being used.

Course Content

Unit No.	Description	Hrs
01	This lab course is offered in Semester VI of Third Year B. Tech. Student need to select and undergo one of the software as per his/her interest. Student learns the software and needs to complete the assigned work of selected software course during the semester and submit the same in the required format to course in charge. Student should carry out application-oriented project work in a batch for selected software from the following list. In Semester Evaluation is based on the assigned work. 1. E-Tab 2. PRIMAVERA P6/ MS project 3. MATLAB (Artificial Intelligence Applications in Civil Engineering) 4. Google Sketch up 5. Arc-GIS/GRASS 6. Rivet Architectural 7. Road Master	24

Class: **Third Year B. Tech. Civil**	Semester: **VI**
Course Code: **CE3144**	Course Name: **Capstone Project Phase I**

L	T	P	Credits
-	-	2	1

Course Description:

Capstone project phase-I equips students with essential skills for crafting a robust and well-structured proposal for their final-year engineering project. Students will delve into critical aspects such as problem definition, literature review, project planning, and effective communication of their proposed projects. Emphasizing innovation, feasibility, and ethical considerations, the course fosters a comprehensive understanding of project management principles and technical communication. Through peer collaboration and final presentations, students showcase their ability to address real-world challenges, contributing meaningfully to the engineering domain.

Course Learning Outcomes:

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

1. Perform a comprehensive literature review to identify gaps and gain insights into existing solutions within the chosen engineering field.
2. Define clear problem statements and establish project objectives of the engineering project proposal.
3. Develop detailed project plans encompassing tasks, timelines, and resource allocation, applying effective project management principles.
4. Effectively communicate the proposals in both written and verbal formats, ensuring adherence to industry standards for documentation.

General Guidelines:

The Capstone Project Phase-I for this semester carries weightage of one credit. During this phase, project groups are required to be formed as per the guidelines given by department, and their collaboration will extend into Semester VII. It is mandatory for each group to submit a comprehensive synopsis report detailing their project work to the department before the semester concludes. The evaluation process involves both individual and group assessments, focusing on the quality of work, concept novelty, submitted reports, and presentation skills. This evaluation will follow the academic calendar closely, with students expected to present synopsis and work carried out throughout Semester VI. The assessment will be conducted by a panel of examiners, comprising the project guide and a faculty member appointed by the DPC. Students should familiarize themselves with the rubrics provided for assessment, adhere to submission deadlines, and actively engage in presentations to ensure a comprehensive evaluation of their Capstone Project Phase-I.