Date: - 03/07/2025

To,
Dean Academics
RIT, Sakharale

Subject: - About submission of revised curriculum structure (2024-28) and syllabus of S. Y. B. Tech Civil engineering (2024-28) for approval.

Dear Sir,

We are submitting herewith a hard copy of curriculum structure and syllabus as per following details for your approval.

1. Curriculum structure - (2024-28)
2. S. Y. B. Tech Civil engineering syllabus (2024-28) to be implemented from academic year 2025-26.

Kindly acknowledge the same.

Thanking You,

RAJARAMBAPU INSTT. OF TECHNOLOGY
RAJARAMNAGAR
CIVIL ENGG. DEPT

HEAD,
Department of Civil Engineering,
Rajarambapu Institute of Technology,
Rajaramnagar, Dist. Sangli.

Encl:-

1. Curriculum structure - (2024-28)
2. S. Y. B. Tech Civil engineering syllabus (2024-28) to be implemented from academic year 2025-26.

Approved

K E Socity's

Rajarambapu Institute of Technology, Rajaramnagar

Department of Civil Engineering

Undertaking for Structure & Syllabus Approval

Date: 4/7/2025

To,

Dean Academics,

RIT, Rajaramnagar

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

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

BOS Secretory

RAJARAMBAPU INSTT. OF TECHNOLOGY
RAJARAMNAGAR CIVIL ENGG. DEPT.

Head of the Department

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 2024-28 NEP Batch
Department of Civil Engineering

B. Tech. in Civil Engineering with Multidisciplinary Minor

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Rajarambapu Institute of Technology, Rajaramnagar

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

Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Civil Engineering

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min. for passing		Max.	Min. for passing
CE231	Mathematics for Civil Engineer	3	-	-	3	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15			----	---
						ESE	50	40		----	----
CE2214	Building Planning and Design	3	-	-	3	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15			----	----
						ESE	50	40		----	----
CE2074	Surveying	3	-	-	3	ISE	20	40	40	----	----
						UT1	15			----	----
						UT2	15			----	----
						ESE	50	40		----	----
CE2034	Engineering Mechanics	3	-	-	3	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
	Professional Skills Development and Foreign Languages	-	-	2	1	ISE	----	----		100	50
	TOTAL	**16**	**-**	**12**	**22**						
	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 : 22

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

Professional Skills Development and Foreign Languages

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

Note:

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

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Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Civil Engineering

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

Course Code	Course	Teaching Scheme				Evaluation Scheme				
		L	T	P	Credits	Scheme	Theory (Marks %)		Practical (Marks %)	
							Max	Min. for passing	Max	Min.for passing
CE232	Strength of Materials	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE2044	Concrete Technology	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE2064	Fluid Mechanics	3	-	-	3	ISE	20	40	---	---
						UT1	15		--	---
						UT2	15		---	---
						ESE	50	40	---	---
CE234	Water Resources and Irrigation Engineering	3	-	-	3	ISE	20	40	---	---
						UT1	15		--	---
						UT2	15		---	---
						ESE	50	40	---	---
CE236	Highway and Railway Engineering	3	-	-	3	ISE	20	40	---	---
						UT1	15		--	---
						UT2	15		---	---
						ESE	50	40	---	---
	Multidisciplinary Minor- II	3	-	-	3	ISE	20	40	---	---
						UT1	15		---	---
						UT2	15		---	---
						ESE	50	40	---	---
CE2184	Concrete Technology Laboratory	-	-	2	1	ISE	---	----	50	50
						ESE	---	----	50	50
CE2164	Fluid Mechanics Laboratory	-	-	2	1	ISE	---	----	100	50
CE238	Highway Materials Testing Laboratory	-	-	2	1	ISE	---	----	50	50
						ESE	---	----	50	50
CE240	Practical Aspects of Construction Supervision	-	-	2	1	ISE	---	----	100	50
	Professional Skills Development and Foreign Languages	-	-	2	1	ISE	---	----	100	50
	TOTAL	**18**	**-**	**10**	**23**					
	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 : 23

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.

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 – IV	SH2644
6.		Japanese Language – IV	SH2624

Note:

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

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Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Civil Engineering

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max	Min. for Passing		Max	Min. for passing
CE3014	Design of Steel Structures	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE351	Estimations and Costing	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE353	Mechanics of Structure	3	-	-	3	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)	--	---	---
CE355	Estimations Costing and Valuation Laboratory	-	-	4	2	ISE	---	---		50	50
						ESE	---	---		50	50
CE357	Summer Internship	-	-	-	2	ISE	---	---		100	50
	TOTAL	**19**	**-**	**4**	**23**						
	TOTAL CONTACT HOURS	**23**									

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

Total Contact Hours/week : 23

Total Credits : 23

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

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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Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Civil Engineering

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
CE360	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	CE361	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

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Curriculum Structure and Evaluation Scheme

To be implemented for 2024-28 NEP Batch

Department of Civil Engineering

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

Course Code	Course	Teaching Scheme				Evaluation Scheme					
		L	T	P	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
							Max.	Min. for passing		Max.	Min. for passing
CE4014	Design of Reinforced concrete Elements	3*	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE4034	Construction Management	2	-	-	2	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE4054	Environmental Engineering	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective -III	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
	Program Elective -IV	3	-	-	3	ISE	20	40	40	---	---
						UT1	15			---	---
						UT2	15			---	---
						ESE	50	40		---	---
CE4074	Design of Reinforced Concrete Structures Laboratory	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
CE4094	Environmental Engineering Laboratory	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
	Program Elective III Laboratory	-	-	2	1	ISE	--	---	---	50	50
						ESE	--	---	---	50	50
CE4114	Capstone Project Phase II	-	-	6	3	ISE	--	---		50	50
						ESE	--	---		50	50
	TOTAL	**14+1***	**-**	**12**	**20**						
	TOTAL CONTACT HOURS	**27**									

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

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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Department of Civil Engineering

Model II: Research Internship (RI)

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

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

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

Total Contact Hours/week : -
Total Credits : 16

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

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

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

Model III: Entrepreneurial Internship (EI)

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

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

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

Total Contact Hours/week : -
Total Credits : 16

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

Note:

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

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

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

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

Multidisciplinary Minor

- 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 System Design	1	ECMD201	Electronics Devices and Applications	III	Electronics &Telecommunication

	2	ECMD202	Electronics Communication Systems	IV	Engineering
	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 Lab.	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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K.E. Society's Rajarambapu Institute of Technology Rajaramnagar Autonomous 415414

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					
							Theory (Marks %)			Practical (Marks %)	
		L	T	P	Credits	Scheme	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					
							Theory (Marks %)			Practical (Marks %)	
		L	T	P	Credits	Scheme	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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Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
S. Y. B. Tech. Syllabus
To be implemented for 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 of Curves (Lines and Parabola) by Least Square Principle, Application to	06

	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.

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(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
S. Y. B. Tech. Syllabus
To be implemented for 2024-28 NEP Batch
Department of Civil Engineering

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.

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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 2024-28 NEP Batch
Department of Civil Engineering

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.

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(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
S. Y. B. Tech. Syllabus
To be implemented for 2024-28 NEP Batch
Department of Civil Engineering

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

L	T	P	Credits
3	-	-	3

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.	06
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	06
3.	**Friction:** Introduction to Laws of friction, Surface friction for bodies on horizontal and inclined planes.	06
4.	**Analysis of trusses:** Analysis of simple truss, Method of joints, Method of sections.	06
5.	**Centroid:** Centroid of plane and composite figures.	06
6.	**Moment of Inertia**: Moment of Inertia of plane and composite figures.	06

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 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	04

	Disaster, Ganga Water Pollution. Solid Waste management (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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(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)

S. Y. B. Tech. Syllabus

To be implemented for 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 Introduction to Data Structures 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, students will be able to,

1. Describe the characteristics of various data structures such as stacks, queues, trees, and graphs.
2. Explain the operations and applications of linear data structures.
3. Compare linear and non-linear data structures with respect to their structure, operations, and applications.
4. Determine and justify appropriate data structures for solving real-world problems effectively.

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 (ADT).	06
2	**Stack:** Definition & Concepts, Operations on Stack, Applications of Stack, Polish expressions, Reverse Polish Expression and conversions, Recursion.	06
3	**Queue:** Queue and its sequential representation, Simple Queue, Circular Queue, Double Ended Queue, Priority Queue, Applications of Queue.	06
4	**Linked List:** Definition and structure of singly linked list, doubly linked list and circular linked list. Operations: creation, traversal, insertion, deletion.	06

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

5	**Tree:** Definitions and concepts, Terminology, Binary trees, Binary Tree Representations, Binary Tree Traversals, Binary Search Tree, Insertion and Deletion in BST, Applications of Tree.	06
6	**Graph:** Definition and concepts, Graph Representation, Graph Terminology, Graph Traversals – Depth First Search and Breadth First Search. Applications of Graph.	06

References -

Text Books:

- Data structures , Seymour Lipschutz (MGH), Schaum's Outlines.
- Data Structures using C, A Practical Approach for Beginners by Amol M. Jagtap & Ajit S. Mali.

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.
- Introduction to Data Structures in C – Ashok N. Kamthane (Pearson Education).

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S. Y. B. Tech. Syllabus
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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 cooling tower, feed water heater, economizer, air preheater, auxiliary supply,	06

	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.

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

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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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S. Y. B. Tech. Syllabus
To be implemented for 2024-28 NEP Batch
Department of Civil Engineering

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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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

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

RAJARAMBAPU INSTT. OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

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

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.

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S. Y. B. Tech. Syllabus
To be implemented for 2024-28 NEP Batch
Department of Civil Engineering

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** Prepare the Contour map for given area by using total station	2

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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Rajarambapu Institute of Technology, Rajaramnagar

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

S. Y. B. Tech. Syllabus

To be implemented for 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

RAJARAMBAPU INSTT. OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

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

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

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

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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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**

RAJARAMBAPU INSTT. OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

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

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.

RAJARAMBAPU INSTT. OF TECHNOLOGY RAJARAMNAGAR CIVIL ENGG. DEPT.

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

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.

Class: - **S.Y. B. Tech.**	Semester-**III/IV**
Course Code : **SH2694**	Course Name : **Innovation Tools and Methods for Entrepreneurs**

L	T	P	Credits
-	-	2	1

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

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

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

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

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

Minimum 12 sessions will be conducted from the following list.

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

	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.

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

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.

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

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.

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.

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

L	T	P	Credits
3	-	-	3

Course Description:
Concrete Technology is one of the core courses offered in the fourth semester of the Civil Engineering undergraduate program, comprising 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 of the 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 behaviour of this versatile composite material from the stage of its design, manufacture, to the stage of its placement in 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. Select ingredients for sustainable concrete by analyzing their properties, cost, and environmental impact.
2. Evaluate quality control tests for concrete and its ingredients' compliance with relevant standards.
3. Recommend construction practices and precautions to minimize defects in concrete.
4. Design concrete mixes for specified grades using IS 10262 and ACI 211.1-91 methods.
5. Analyze advancements in concrete technology for modern applications.

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

Course Content

Unit No.	Description	Hrs
01	**Cement & Water:** Cement: Manufacturing processes, Field Tests, Physical properties of cement such as fineness, consistency test, Initial and final setting time, soundness, compressive strength, and specific gravity. Hydration of cement, chemical compounds of cement. Grades of cement, Types of cement of Ordinary Portland, Portland pozzolana, Rapid Hardening Portland Cement, Quick setting cement, Sulphate resisting cement, Super sulphated cement,	08

	Expansive cement, Rediset cement, High strength cement, High Alumina, Low heat, White, Coloured, Oil well, Hydrophobic cement, LC3 cement etc. Water: Specifications of water as per IS 456 – 2000.	
02	**Aggregate:** Physical properties such as sieve analysis and fineness modulus, specific gravity and water absorption, silt content, Bulking of sand, Bulk density, moisture content, Flakiness index, Elongation index. Mechanical properties such as Crushing, Impact and Abrasion value, Alkali–Aggregate reaction, Grading of Aggregate, Artificial and recycled aggregate.	**05**
03	**Admixtures:** Types of admixtures, Plasticizers and superplasticizers and their effects on workability, Air entraining agents, Retarders, and their effects on the mix proportions. Pozzolanic admixtures, Fly ash, fly ash on fresh concrete, Silica fume, metakaolin, Ground Granulated Blast Furnace Slag.	**05**
04	**Fresh Concrete:** Batching, Mixing, Transportation, Placing of concrete, including pumping and compaction techniques for good quality concrete, Workability of concrete and methods of measuring workability, Factors affecting workability, Segregation and bleeding, Curing of concrete, Different methods of curing, Temperature effects on fresh concrete.	**06**
05	**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 and acceptance criteria.	**07**
06	**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, Relation between compressive & tensile strength. Modulus of elasticity, Relation between modulus of elasticity & strength. Shrinkage of concrete. Nondestructive testing: Schmidt's rebound hammer – Mechanical & digital, Ultrasonic pulse velocity method, techniques of measuring & factors affecting the measurement of pulse velocity, Corrosion meter, Cover meter.	**05**

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.

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

L	T	P	Credits
3	-	-	3

Course Description:
Fluid mechanics is the branch of physics that studies the mechanics of fluids (liquids and gases) and the forces on them. Fluid mechanics has a wide range of applications, including for civil engineering, mechanical engineering, chemical engineering, geophysics, astrophysics, and biology. Fluid mechanics consists 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. Prepare dimensional analysis using different theories and models.
6. Explain the concept of hydraulic pumps.

Prerequisites: Engineering Mathematics, Engineering Mechanics

Course Content

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

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

Text 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.
- S. Nagarathanam, "Fluid Mechanics" Khanna Publication, Delhi.
- John F.Douglas, Janul and M. Gasiosek and John A.Swaffield "Fluid Mechanics" by Pearson Education Asia".

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.

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
S. Y. B. Tech. Syllabus
To be implemented for 2024-28 NEP Batch
Department of Civil Engineering

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

L	T	P	Credits
3	-	-	3

Course Description
Transportation plays important role in the development of the country. Efficient road, railway and air transport network is essential to cater the increased need of the passengers and goods trips. Study of this course imparts knowledge for road transportation, traffic survey, materials used for road & quality control, pavement design, highway construction & maintenance. Railway engineering is a multi-faceted engineering discipline dealing with the design, construction and operation of all types of rail transport systems

Course Outcomes:
After successful completion of the course, students will be able to,-
1. Design the geometric components of highways.
2. Determine traffic volume for design of road.
3. Design the flexible and rigid pavement.
4. Explain design parameters of railway and it's component parts.

Prerequisites: Nil

Course Content

Unit No.	Description	Hrs.
1.	**Highway Development and 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, Intermediate sight distance.	06
2.	**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
3.	**Traffic Engineering:** Traffic studies on flow, speed, Travel time - Delay and O-D study, PCU, Peak hour factor, Parking study, Accident study and analysis. Traffic signs and signals. Types of intersections and channelization, Highway capacity and level of service of rural highways and urban roads.	05

4.	**Flexible Pavement Design:** Highway material properties and its characteristics, Elements of flexible pavement, Concept of IRC charts, Design factors, Design of flexible pavement using IRC: 37-2018. Highway construction and maintenance.	**07**
5.	**Rigid Pavement Design:** Elements of rigid pavements, Design factors, Stresses, dowel & tie bars, Design of rigid pavement using IRC: 58-2015.	**06**
6.	**Railway Engineering:** Development of railways in India, Permanent way and railway track components, Different gauges in India, Railway lines classification, Introduction to railway line components, Function and types of rails, Geometric Design: Alignment, Gradient, Horizontal Curves, Superelevation.	**06**

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.
- Mundrey, J. S., "Railway Track Engineering", Tata McGraw Hill Education.
- Rangwala Abdulla S., "Railway Engineering", Charotar Publishing House.
- Saxena, S.C., Arora S. P., "A Text Book of Railway Engineering", Dhanpat Rai and Sons.

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.

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.

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 lab course provides practical exposure to the fundamentals of Java programming and object-oriented principles such as classes, objects, inheritance, and polymorphism. Students will gain hands-on experience in implementing concepts such as abstraction, interfaces, packages, exception handling, and file operations. By practicing structured problem-solving using Java, students will be able to write modular, reusable, and robust code. The course promotes skill development through real-world coding exercises and mini-projects.

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

1. Describe the fundamental concepts of Java programming including variables, data types, control structures, arrays, and memory management.
2. Apply object-oriented principles such as classes, objects, constructors, access modifiers, and static members to develop Java programs.
3. Implement Inheritance, Polymorphism, Interfaces, Abstraction, and Nested Classes to build modular Java applications.
4. Manage packages and handle runtime errors using exception handling mechanisms.
5. Design and develop file-based Java applications using file handling classes and methods to perform basic CRUD operations.

Prerequisite:
Basics of C programming, Fundamentals of Data Structures

Course Content		
Unit No	**Description**	**Hrs**
1	**Fundamentals of Java:** Java: Overview, Features, JVM, JDK, JRE, Environmental Setup, Hello World Program, User Input, Comments, Variables, Data Types, Type Casting, Operator, Expression, Control loops and Statements, Arrays, Garbage Collection	4
2	**Introduction to Object Oriented Programming:** Introduction to OOP, Class & Object, Methods and Variables, Constructor, this keyword, Access Modifiers, static keyword	4
3	**Inheritance & Polymorphism:** Inheritance, super keyword, Polymorphism: Method Overloading and Overriding	4

4	**Interfaces & Abstraction:** Abstraction, Encapsulation, Interface, Final keyword, Nested Classes	4
5	**Package and Exception Handling:** **Package**: Organizing Classes and Interfaces in Packages, CLASSPATH setting for Packages, Naming Convention for Packages, **Exception Handling**: Exception and Errors, Types of Exception, Try-Catch Block, finally, throw and throws keyword, Java Built Exception and Custom Exception	4
6	**File Handling** **File Handling**: CRUD Operations on File, File Methods	4

It should consist of 10 to 12 experiments based on the syllabus and experiment list mentioned below.

Experiment List		
Experiment No	**Description**	**Hrs**
1.	Write a program using input, data types, type casting, loops, and arrays.	**02**
2.	Implement a class with methods, constructor.	**02**
3.	Demonstrate the use of access modifiers, static and this keyword in a program.	**02**
4.	Write a program for inheritance and its types.	**02**
5.	Demonstrate method overloading and overriding in Java.	**02**
6.	Create a program using abstract classes and encapsulated attributes.	**02**
7.	Implement interface and final keyword in a real-time use case.	**02**
8.	Create user-defined packages and access them with correct classpath settings.	**02**
9.	Handle built-in and custom exceptions using try-catch-finally.	**02**
10.	Perform file creation, read, write, and delete operations using File class.	**02**

References -

Text Books:

- E. Balagurusamy, Programming with Java, , McGraw Hill
- Herbert Schildt, Java: The Complete Reference, , McGraw Hill

Reference Books:

- Kathy Sierra and Bert Bates, Head First Java, O'Reilly
- Joshua Bloch, Effective Java, Addison-Wesley
- Official Oracle Java Documentation – https://docs.oracle.com

K.E. Society's
Rajarambapu Institute of Technology, Rajaramnagar
(An Empowered Autonomous Institute, affiliated to Shivaji University, Kolhapur)
S. Y. B. Tech. Syllabus
To be implemented for 2024-28 NEP Batch
Department of Civil Engineering

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

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

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

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:- **Second Year 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, user interaction patterns, user satisfaction and usability.
4. Incorporate aesthetic appeal into product designs, assessed through objective criteria such as visual appeal ratings.
5. Incorporate ergonomic considerations into product designs assessed through objective criteria such as user comfort.

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.	**Aesthetics:** Principles of aesthetic design and its impact on user perception, Integrating aesthetics with functional design requirements	06
6.	**Ergonomics in Product Design:** 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.

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).

K.E. Society's
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Department of Civil Engineering

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.

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 b) **Coarse Aggt.:** Sieve Analysis, Sp. Gravity, Bulk Density, Water Absorption, Moisture Content, Flakiness and Elongation Index	4

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.

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Rajarambapu Institute of Technology, Rajaramnagar
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To be implemented for 2024-28 NEP Batch
Department of Civil Engineering

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.