



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 2025-29 & 2026-30 Batch
Department of Computer Science and Engineering

B.Tech. in Computer Science & Engineering with Multidisciplinary Minor



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Curriculum Structure and Evaluation Scheme
 To be implemented for 2025-29 & 2026-30 Batch
 Department of Computer Science and Engineering

Class: S. Y. B. Tech

Semester: III

Course Code	Course	Teaching Scheme						Evaluation Scheme					
		L	T	P	TW-SL	Total Hr.	Credits	Scheme	Theory (%Marks)		Practical (%Marks)		
									Max	Min. for passing	Max.	Min. for passing	
CS225	Digital Logic and Computer Organization	3	-	-	54	90	3	ISE	20	40	40	----	----
								UT1	15			----	----
								UT2	15			----	----
								ESE	50			----	----
CS2035	Data Structures and Algorithms	3	-	-	54	90	3	ISE	20	40	40	----	----
								UT1	15			----	----
								UT2	15			----	----
								ESE	50			----	----
CS2074	Discrete Mathematics	3	-	-	54	90	3	ISE	20	40	40	----	----
								UT1	15			----	----
								UT2	15			----	----
								ESE	50			----	----
CS227	Operating System	3	-	-	54	90	3	ISE	20	40	40	----	----
								UT1	15			----	----
								UT2	15			----	----
								ESE	50			----	----
	Multidisciplinary Minor-I	3	-	-	54	90	3	ISE	20	40	40	----	----
								UT1	15			----	----
								UT2	15			----	----
								ESE	50			----	----
SH2175	Environmental Science	1	-	2	24	60	2	ISE	50	40	40	--	---
								ESE	50			40	--
CS229	Data Analysis using Python	1	-	2	24	60	2	ISE	----	----	----	50	50
								ESE	----			50	50
CS2135	Data Structures and Algorithms Lab	-	-	4	12	60	2	ISE	----	----	----	50	50
								ESE	----			50	50
CS231	UI/UX Lab	-	-	2	6	30	1	ISE	---	----	----	100	50
	Professional Skills Development and Foreign Languages	-	-	2	6	30	1	ISE	-	-	-	100	50
	TOTAL	17	-	12	342	690	23						
	TOTAL CONTACT HOURS	29											

ISE: In Semester Evaluation, UT-I: Unit Test-I, UT-II: Unit Test-II, ESE: End Semester Exam, TW: Term Work, SL: Self Learning

Total Contact Hours/week : 29

Total Credits : 23





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Department of Computer Science and Engineering

Sr. No.	Subject Name		Course Code
1.	Professional Skills Development and Foreign Languages	Professional Leadership Skills	SH2635
2.		Interpersonal Skills	SH2615
3.		Innovation Tools and Methods for Entrepreneurs	SH2695
4.		Personal Effectiveness and Body Language	SH2595
5.		German Language – Level III	SH2735
6.		Japanese Language – Level III	SH2715

Note:

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



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Department of Computer Science and Engineering

Class: S. Y. B. Tech

Semester: IV

Course Code	Course	Teaching Scheme						Evaluation Scheme					
		L	T	P	TW-SL	Total Hr.	Credits	Scheme	Theory (%Marks)			Practical (%Marks)	
									Max	Min. for passing		Max	Min. for passing
CS2005	Computer Network	3	-	-	54	90	3	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50			---	---
CS234	Software Engineering and Project Management	3	-	-	54	90	3	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50			---	---
CS236	Database Management System	3	-	-	54	90	3	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50			---	---
CS238	Design and Analysis of Algorithm	3	-	2	60	120	4	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50			---	---
	Multidisciplinary Minor-II	3	-	-	54	90	3	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50			---	---
CS240	Object Oriented Programming using JAVA	2	-	-	36	60	2	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50			---	---
CS242	Web Design Lab	1	-	2	24	60	2	ISE	---	----		100	50
CS244	Database Management System lab	-	-	2	6	30	1	ISE	----	----		50	50
								ESE	----	----		50	50
CS246	Object Oriented Programming using JAVA Lab	-	-	2	6	30	1	ISE	----	----		50	50
								ESE	----	----		50	50
CS250	MOOCS-I**	-	-	-	30	30	1	ISE	---	----		100	50
	Professional Skills Development and Foreign Languages	-	-	2	6	30	1	ISE	-	-	--	100	50
	TOTAL	18		10	384	720	24						
	TOTAL CONTACT HOURS	28											

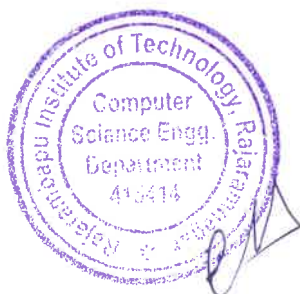
ISE: In Semester Evaluation, UT-I: Unit Test-I, UT-II: Unit Test-II, ESE: End Semester Exam, TW: Term Work, SL: Self Learning

Total Contact Hours/week : 28

Total Credits : 24

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

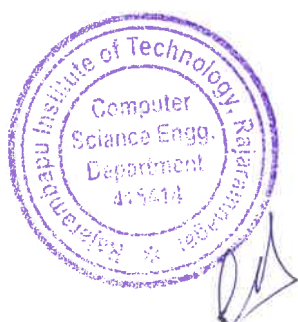
Note:** MOOCS-I course certification marks will be carried out for the credits





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Department of Computer Science and Engineering

Sr. No.	Subject Name		Course Code
1.	Professional Skills Development and Foreign Languages	Professional Leadership Skills	SH2635
2.		Interpersonal Skills	SH2615
3.		Innovation Tools and Methods for Entrepreneurs	SH2695
4.		Personal Effectiveness and Body Language	SH2595
5.		German Language – Level IV	SH2645
6.		Japanese Language – Level IV	SH2625



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 Department of Computer Science and Engineering

Class: T. Y. B. Tech

Semester: V

Course Code	Course	Teaching Scheme						Evaluation Scheme					
		L	T	P	TW-SL	Total Hr.	Credits	Scheme	Theory (%Marks)		Practical (%Marks)		
									Max	Min. for Passing	Max	Min. for passing	
CS343	Finite Automata and Formal Languages	3	-	-	54	90	3	ISE	20	40			
								UT1	15				
								UT2	15				
								ESE	50				
CS371	Cloud Computing	2	-	-	36	60	2	ISE	20	40			
								UT1	15				
								UT2	15				
								ESE	50				
CS347	Machine Learning	3	-	-	54	90	3	ISE	20	40			
								UT1	15				
								UT2	15				
								ESE	50				
	Program Elective -I	2	-	-	36	60	2	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50			40	---
	Open Elective-I	3	-	-	54	90	3	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50			40	---
	Multidisciplinary Minor-III	3	-	-	54	90	3	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50			40	---
	Multidisciplinary Minor-IV	1	-	2	24	60	2	ISE	--	--	--	50	50
								ESE	--	--	--	50	50
SH3036	Scholastic Aptitude-I	2*	-	-		Audit		ISE	100	50 (P/NP)	--	--	--
CS365	Full Stack Web Lab	1	-	2	24	60	2	ISE	---	---	--	100	50
CS367	Machine Learning Lab	-	-	2	6	30	1	ISE	---	----	--	50	50
								ESE	---	----	--	50	50
CS371	Mini Project	-	-	6	18	90	3	ISE	--	----	--	50	50
								ESE	---	----	--	50	50
CS377	Industrial Trainings	-	-	-	30	30	1	ISE	---	---	---	100	50
CS369	MOOCS-II**	-	-	-	30	30	1	ISE	---	----	---	100	50
	TOTAL	18+2*	-	12	420	780	26						
	TOTAL CONTACT HOURS		30+2*=32										

ISE: In Semester Evaluation, UT-I: Unit Test-I, UT-II: Unit Test-II, ESE: End Semester Exam, P = Pass, NP = Not Pass, TW: Term Work, SL: Self Learning

Total Contact Hours/week : 32

Total Credits : 26

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

Note:** MOOC-II course certification marks will be carried out for the credits



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Department of Computer Science and Engineering

Program Elective-I

Sr. No	Course Code	Domain	Course
1	CS349	System Engineering	Parallel Algorithm and Design
2	CS373	Data Engineering	Advanced Database System
3	CS361	Networking	Network and System Administration
4	CS375	Advanced Technologies	Blockchain Technologies

Open Elective I

Sr. No.	Course Code	Open Elective Subject Name	Offered by the department
1	OE3411	Energy Audit and Management	Electrical Engineering
2	OE3431	Data Science	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
3	OE3105	Network Administration	Computer Science and Engineering
4	OE3065	Environmental Impact Assessment	Civil Engineering
5	OE3382	Disaster Management	Civil Engineering
6	OE3651	Distributed Systems	Computer Science and Information Technology
7	OE3611	Object Oriented Modeling and Design	Computer Science and Information Technology
8	OE3471	New Product Design & Development	Mechanical Engineering
9	OE3491	Non-Conventional Energy Sources	Mechanical Engineering
10	OE3045	Renewable Energy Sources	Robotics & Automation
11	OE3631	Robotics Engineering & Applications	Robotics & Automation
12	OE3531	Factory Automation	Mechatronics Engineering
13	OE3551	Cyber Physical System	Mechatronics Engineering
14	OE3571	Internet of Things	Electronics & Telecommunication Engineering
15	OE3591	Drone Technology	Electronics & Telecommunication Engineering
16	OE3511	Hydrogen Fuel Cell Technology	Mechanical Engineering

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Class: T. Y. B. Tech

Semester: VI

		Teaching Scheme						Evaluation Scheme					
Course Code	Course	L	T	P	TW-SL	Total Hr.	Credits	Scheme	Theory (%Marks)		Practical (%Marks)		
									Max	Min. for passing	Ma x	Min. for passing	
CS346	Deep Learning	3	-	-	54	90	3	ISE	20	40	40		
								UT1	15				
								UT2	15				
								ESE	50	40			
CS324	Research Methodology	2	-	-	36	60	2	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50	40		---	---
CS342	Higher-Level Coding	2	-	-	36	60	2	ISE	---	---		100	50
	Program Elective-II	3	-	-	54	90	3	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50	40		---	---
	Open Elective-II	3	-	-	54	90	3	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50	40		---	---
	Multidisciplinary Minor-V	3	-	-	54	90	3	ISE	20	40	40	---	---
								UT1	15			---	---
								UT2	15			---	---
								ESE	50	40		---	---
SH3066	Scholastic Aptitude-II	2*	-	-	-	Audit		ISE	100	⁵⁰ (P/NP)	--	--	--
CS3383	Mobile Application Development-I	1	-	2	24	60	2	ISE	---	---		100	50
CS366	Deep Learning Lab	-	-	2	6	30	1	ISE	---	---		50	50
								ESE	---	---		50	50
CS364	Minor Project	-	-	12	36	180	6	ISE	--	---		50	50
								ESE	--	---		50	50
	TOTAL	17+2*	-	16	354	750	25						
	TOTAL CONTACT HOURS	33+2*=35											

ISE: In Semester Evaluation, UT-I: Unit Test-I, UT-II: Unit Test-II, ESE: End Semester Exam, P = Pass, NP = Not Pass, TW: Term Work, SL: Self Learning

Total Contact Hours/week : 35

Total Credits : 25

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





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 Department of Computer Science and Engineering

Program Elective – II

Sr. No.	Course Code	Discipline	Course
1	CS368	System Engineering	Human Computer Interaction
2	CS370	Data Engineering	Natural Language Processing
3	CS372	Networking	Wireless Sensor Networks
4	CS374	Advanced Technologies	Quantum Technology

Open Elective II			
Sr. No.	Course Code	Open Elective Subject Name	Offered by the department
1	OE3721	Industrial Safety	Electrical Engineering
2	OE3421	Data Mining	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
3	OE3681	AI for Agriculture	Computer Science & Engineering (Artificial Intelligence and Machine Learning)
4	OE3481	Information Technology Foundation Program	Computer Science and Engineering
5	OE3661	AI for Cybersecurity	Computer Science and Engineering
6	OE3085	Materials Management	Civil Engineering
7	OE3501	Operations Research	Civil Engineering
8	OE3581	Plumbing (Water and Sanitation)	Civil Engineering
9	OE3402	Cyber Security	Computer Science and Information Technology
10	OE3641	AI for Manufacturing	Computer Science and Information Technology
11	OE3285	Supply Chain Management	Mechanical Engineering
12	OE3325	Entrepreneurship Development	Mechanical Engineering
13	OE3025	Reliability Engineering	Robotics & Automation
14	OE3621	Flexible Manufacturing System	Robotics & Automation





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Department of Computer Science and Engineering

Open Elective II			
Sr. No.	Course Code	Open Elective Subject Name	Offered by the department
15	OE3521	Image Processing	Electronics & Telecommunication Engineering
16	OE3541	Fuzzy Logic & Neural Network	Electronics & Telecommunication Engineering
17	OE3701	AI for Sustainability	Electronics & Telecommunication Engineering
18	OE3441	Supply Chain Analytics	Mechatronics Engineering
19	OE3461	Mobile Robotics	Mechatronics Engineering
20	OE3561	Project Management	Mechanical Engineering
21	OE3243	Marketing for Engineers	MBA



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Curriculum Structure and Evaluation Scheme
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 Department of Computer Science and Engineering

Class: Final Year B. Tech

Semester: VII

Course Code	Course	Teaching Scheme						Evaluation Scheme					
		L	T	P	TW-SL	Total Hr.	Credits	Scheme	Theory (%Marks)		Practical (%Marks)		
									Max.	Min. for passing	Max.	Min. for passing	
CS4951	Agentic AI	3	-	-	54	90	3	ISE	20	40	40	---	---
								MSE	30			---	---
								ESE	50			---	---
CS459	Cryptography and Network Security	3	-	-	54	90	3	ISE	20	40	40	---	---
								MSE	30			---	---
								ESE	50			---	---
	Program Elective-III	3	-	-	54	90	3	ISE	20	40	40	---	---
								MSE	30			---	---
								ESE	50			---	---
	Program Elective-IV	3	-	-	54	90	3	ISE	20	40	40	---	---
								MSE	30			---	---
								ESE	50			---	---
	Program Elective-IV Lab	-	-	2	6	30	1	ISE	--	---	---	50	50
								ESE	--			50	50
CS49525	High Performance Computing	2	-	2	42	90	3	ISE	--	---	---	50	50
								ESE	--			50	50
CS4472	DevOps Designs	1	-	2	24	60	2	ISE	--	---	---	50	50
								ESE	--			50	50
CS4371	Advanced JAVA Lab.	1	-	2	24	60	2	ISE	--	---	---	50	50
								ESE	--			50	50
	TOTAL	16	-	8	300	600	20						
	TOTAL CONTACT HOURS	24											

ISE: In Semester Evaluation, MSE: Mid Semester Examination, ESE = End Semester Exam, TW: Term Work, SL: Self Learning

Total Contact Hours/week : 24

Total Credits : 20

Note \$: PE-III- CS4451 Mobile Application Development-II course Evaluation scheme: ISE-50% and ESE-50% (Minimum passing :50% ISE and ESE separately)





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Program Elective-III

Sr. No.	Course Code	Discipline	Course
1	CS4953	System Engineering	Software Architecture & Design
2	CS4955	Data Engineering	Generative AI
3	CS4957	Networking	Cyber Security
4	CS4451	Advanced Technologies	Mobile Application Development-II \$

Program Elective-IV Theory

Sr. No.	Course Code	Discipline	Course
1	CS4959	System Engineering	Software Testing & QA Lab/ Site Reliability Engineering (SRE)
2	CS49511	Data Engineering	Image and Video Processing
3	CS49513	Networking	Digital Forensics
4	CS49515	Advanced Technologies	Internet of Things

Program Elective-IV Lab

Sr. No.	Course Code	Discipline	Course
1	CS49517	System Engineering	Software Testing & QA Lab/ Site Reliability Engineering (SRE) Lab
2	CS49519	Data Engineering	Image and Video Processing Lab
3	CS49521	Networking	Digital Forensics Lab
4	CS49523	Advanced Technologies	Internet of Things Lab





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Curriculum Structure and Evaluation Scheme
 To be implemented for 2025-29 & 2026-30 Batch
 Department of Computer Science and Engineering
Choice based Internship Model
Model I: Industry Internship (II)

Class: Final Year B. Tech
VIII

Semester:

Course Code	Course	Teaching Scheme						Evaluation Scheme					
		L	T	P	TW-SL	Total Hr.	Credits	Scheme	Theory (%Marks)			Practical (%Marks)	
									Max.	Min. for passing		Max.	Min. for passing
OE4383	Finance for Engineers (Online Course)	2	-	-	36	60	2	ISE	25	40	40	---	---
								ESE	75	40		---	---
OE4363	Engineering Management & Economics (Online Course)	2	-	-	36	60	2	ISE	25	40	40	---	---
								ESE	75	40		---	---
IP4025	Industry Internship & Project	-	-	-	360	360	12	ISE	---	----		50	50
								ESE	---	---		50	50
	TOTAL	-	-	-			16						

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

Note:

- 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.
- 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 Computer Science and Engineering
Model II: Research Internship (RI)

Class: Final Year B. Tech
VIII

Semester:

Course Code	Course	Teaching Scheme						Evaluation Scheme					
		L	T	P	TW-SL	Total Hr.	Credits	Scheme	Theory (%Marks)			Practical (%Marks)	
									Max.	Min. for passing		Max.	Min. for passing
OE4383	Finance for Engineers (Online Course)	2	-	-	36	60	2	ISE	25	40	40	---	---
								ESE	75	40		---	---
OE4363	Engineering Management & Economics (Online Course)	2	-	-	36	60	2	ISE	25	40	40	---	---
								ESE	75	40		---	---
RE4045	Research Internship	-	-	-	360	360	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, TW: Term Work, SL: Self Learning

Total Contact Hours/week : -
Total Credits : 16

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

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



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Model III: Entrepreneurial Internship (EI)

Class: Final Year B. Tech
VIII

Semester:

Course Code	Course	Teaching Scheme						Evaluation Scheme					
		L	T	P	TW-SL	Total Hr.	Credits	Scheme	Theory (%Marks)			Practical (%Marks)	
									Max	Min. for passing		Max	Min. for passing
ED4105	Project Management (Online Course)	2	-	-	36	36	2	ISE	25	40	40	-	-
								ESE	75	40		-	-
ED4045	Commercial Aspects of the Project (Online Course)	2	-	-	36	36	2	ISE	25	40	40	-	-
								ESE	75	40		-	-
ED4065	Entrepreneurship Development Program (EDP)	-	-	-	30	30	1	ISE	--	--	--	100	50
ED4085	Entrepreneurial Internship	-	-	-	330	330	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, TW: Term Work, SL: Self Learning

Total Contact Hours/week :-

Total Credits : 16

Note:

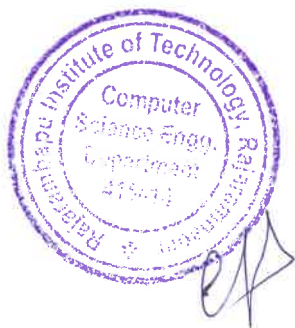
1] Weekly Contact hours are not mentioned as student is expected to be in outside research organization regularly for 20 weeks. However, student needs to report to Institute mentors as and when required.

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.

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



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 25-29					
MDM Basket Name	Sr. No.	Course Code	Course Name	Semester	Offered by Department
Construction Engineering	1	CEMD2011	Building Construction and Planning	III	Civil Engineering
	2	CEMD2021	Building Estimation and Valuation	IV	
	3	CEMD3011	Infrastructure Engineering	V	
	4	CEMD3031	Smart Cities and Sustainable Development	V	
	5	CEMD3021	Environmental Engineering	VI	
Software Programming	1	CSMD2011	Introduction to Data Structures	III	Computer Science & Engineering
	2	CSMD204	Fundamentals of Database Systems	IV	
	3	CSMD305	Software Testing	V	
	4	CSMD3031	Object-oriented Programming in Python	V	
	5	CSMD3021	Artificial Intelligence	VI	
Electrical Power System	1	EEMD2011	Electrical Power Generation	III	Electrical Engineering
	2	EEMD2021	Power System	IV	
	3	EEMD3011	Electrical Machines	V	
	4	EEMD3051	Electrical Technology	V	
	5	EEMD3021	Smart Grid	VI	
Electronics	1	ECMD2011	Electronics Devices	III	Electronics

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System Design			and Applications		& Telecommunication Engineering
	2	ECMD2021	Electronics Communication Systems	IV	
	3	ECMD3011	Advanced Communication Systems	V	
	4	ECMD3031	Electronic Product Design	V	
	5	ECMD3021	Industrial Electronics	VI	
Software Development	1	CIMD2011	Data Structures	III	Computer Science & Information Technology
	2	CIMD2021	Computer Algorithms	IV	
	3	CIMD3011	Introduction to DBMS	V	
	4	CIMD3031	OOP using Java	V	
	5	CIMD3021	Software Engineering	VI	
Product Design and Development	1	MEMD2031	Design Thinking	III	Mechanical Engineering
	2	MEMD2041	Behavioral Engineering and Design	IV	
	3	MEMD3051	Product Design Tools and Techniques	V	
	4	MEMD3071	Design and Prototyping	V	
	5	MEMD3041	Marketing and Business Fundamentals for New Products	VI	
Automobile Engineering	1	MEMD205	I. C. Engine	III	Mechanical Engineering
	2	MEMD206	Automotive Drivetrain	IV	
	3	MEMD309	Automotive Chassis Systems	V	
	4	MEMD311	Automotive Engineering Laboratory	V	
	5	MEMD306	Electric Vehicles	VI	

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Mechatronics Engineering	1	MCMD2011	Fundamentals of Mechatronics	III	Mechatronics Engineering
	2	MCMD2021	Industrial Fluid Power	IV	
	3	MCMD3011	Sensor and Instrumentation	V	
	4	MCMD3031	Industrial Automation	V	
	5	MCMD3021	Industrial Robotics	VI	
Artificial Intelligence	1	AIMD2011	Object Oriented Programming	III	Computer Science & Engineering (AI-ML)
	2	AIMD2021	Data Structures and Algorithms	IV	
	3	AIMD3011	Machine Learning	V	
	4	AIMD3031	Business Intelligence	V	
	5	AIMD3021	Principles of AI	VI	
Robotics & Automation	1	RAMD2011	Fundamentals of Robotics & Automation	III	Robotics & Automation
	2	RAMD2021	Sensors and Actuators	IV	
	3	RAMD3011	Kinematic & Dynamics for Robots	V	
	4	RAMD3051	Robot Programming	V	
	5	RAMD3021	Industrial Automation & Control	VI	



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Department of Computer Science and Engineering

B.Tech. in Computer Science & Engineering with Double Minor (Multidisciplinary and Specialization Minor)





**B.Tech. in Computer Science & 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	CSDM3XXX
2	IV	DM – II	CSDM4XXX
3	V	DM – III	CSDM5XXX
4	VI	DM – IV	CSDM6XXX
5	VII	DM – V	CSDM7XXX
6	VIII	DM – VI	CSDM8XXX

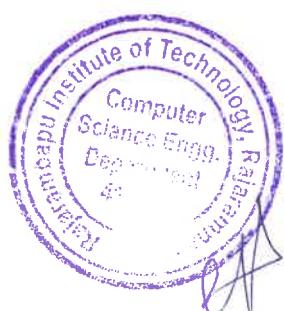
4. To select course platform, first preference must be given to NPTEL.
5. Other than NPTEL, courses from COURSERA and UDEMY platforms are allowed to register only in following cases,
 - a. If timeline of NPTEL course is not in line with timeline of academic calendar.
 - b. The suitable succeeding course 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.





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Department of Computer Science and Engineering

B.Tech. in Computer Science & Engineering with Honor and Multidisciplinary Minor



B.Tech. in Computer Science & 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	CSH3XXX
2	IV	Honor - II	CSH4XXX
3	V	Honor - III	CSH5XXX
4	VI	Honor - IV	CSH6XXX
5	VII	Honor - V	CSH7XXX
6	VIII	Honor - VI	CSH8XXX

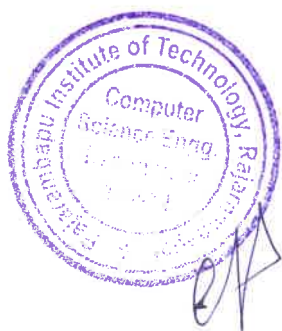
4. To select course platform, first preference must be given to NPTEL.
5. Other than NPTEL, courses from COURSERA and UDEMY platforms are allowed to register only in following cases,
 - a. If timeline of NPTEL course is not in line with timeline of academic calendar.
 - b. The suitable succeeding course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





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B.Tech. in Computer Science & 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 Computer Science & Engineering -Honors with Research and Multidisciplinary Minor degree Student need to earn total 188 Credits which consist 170 credits of regular Multidisciplinary Minor courses and 18 credits of Research courses.

Class: Final Year B. Tech

Semester: VII

Course Code	Course	Teaching Scheme							Evaluation Scheme					
		L	T	P	TW-SL	Total Hr.	Credits	Scheme	Theory (Marks %)			Practical (Marks %)		
									Max.	Min. for passing		Max.	Min. for passing	
REH4011	Intellectual Property Rights	-	-	-	60	60	2	ISE	50	40	40	---	---	
								ESE	50	40		---	---	
REH4031	Research project (Synopsis) phase - I	-	-	-	60	60	2	ISE	--	--	--	50	50	
								ESE	--	--		50	50	
REH4051	Research Specific core course - I (Online NPTEL course)	-	-	-	90	90	3	ISE	50	40	40	--	--	
								ESE	50	40		--	--	
	TOTAL	-	-	-			7							

ISE: In Semester Evaluation, UT-I: Unit Test-I, UT-II: Unit Test-II, ESE: End Semester Exam, TW: Term Work, SL: Self Learning

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

Class: Final Year B. Tech

Semester:

VIII

Course Code	Course	Teaching Scheme						Evaluation Scheme					
		L	T	P	TW-SL	Total Hr.	Credits	Scheme	Theory (Marks %)			Practical (Marks %)	
									Max.	Min. for passing		Max.	Min. for passing
REH4021	Research project phase -	-	-	-	330	330	11	ISE	--	--	--	50	50
								ESE	--	--		50	
	TOTAL	-	-	-	330	330	11						

ISE: In Semester Evaluation, UT-I: Unit Test-I, UT-II: Unit Test-II, ESE: End Semester Exam, TW: Term Work, SL: Self Learning



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B.Tech. in Computer Science & Engineering with Multidisciplinary Minor Sem-III



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Class: - S.Y. B. Tech.	Semester-III	L	T	P	Credits
Course Code: CS225	Course Name: Digital Logic and Computer Organization.	3	-	-	3

Course Description:

This course provides a comprehensive introduction to the fundamental principles of logic gates and computer organization. It begins with the basics of digital logic, including number systems, Boolean algebra, and the design of combinational and sequential circuits.

Students will explore the internal structure and functional units of modern digital computers. The course covers instruction set architecture, addressing modes, and the steps involved in instruction execution and also go through the Input/output mechanisms, bus structures, and interrupt handling techniques. It examines the organization and operation of memory systems, including RAM, ROM, cache, and Pipelining.

ss

Course Learning Outcomes:

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

1. Explain the basic structure, functional units, and evolution of computer systems and identify various logic gates used in digital circuits.
2. Perform number system conversions and apply Boolean algebra and K-Maps for logic function simplification.
3. Design and implement combinational and sequential circuits using standard components such as adders, subtractors, multiplexers, and flip-flops.
4. Illustrate machine instruction formats, addressing modes, and the steps of instruction execution in a processing unit.
5. Analyse the functioning of I/O devices, interrupts, and bus structures including their control and arbitration mechanisms.
6. Comprehend and address the structure and types of memory systems including RAM, ROM, cache, and Pipelining.

Prerequisite: Basics of Statistics, Fundamentals of C Language





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Course Content		
Unit No.	Description	Hrs.
01.	Basic Structure of Computers and Digital Logic Computer Types, Functional Units, Basic Operational Concepts, Performance -Technology, Parallelism, Historical Perspective – Generation of Computers. Digital Logic: Basic gates and Universal gates.	04
02.	Boolean Algebra Binary numbers, Number Base Conversion, octal & Hexa Decimal Numbers, Sign Magnitude, 1's complement & 2's complement representation, unsigned Binary arithmetic (addition, subtraction, multiplication, and division), subtraction using 2's complement; IEEE Standard 754 Floating point number representations Logic minimization: Representation of logic functions: logic statement, truth table, SOP form, POS form; Simplification of logical functions using K-Maps up to 4 variables.	08
03.	Combinational and Sequential Circuits Combinational circuits – Adders-Half-Adder and Full-Adder, Subtractors-Half and Full Subtractor, BCD Adder, Multiplexer, Demultiplexer, Encoder, Priority Encoder, Decoder. Sequential Circuits - Flip-Flops: Types of Flip Flops – SR Flip Flop, JK Flip Flop, D Flip Flop, T Flip Flop.	06
04.	Instruction Set Architecture Machine Instructions: Memory Location and Addresses, Instructions and Instruction Sequencing, Addressing Mode. Processing Unit: Fundamental Concepts, Hardware Component, Instruction Execution, Instruction Fetch and Execution Steps.	08





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05.	I/O Organization Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Bus Structure, Bus Operation, Arbitration.	04
06.	Memory and Pipelining The Memory System - Basic Concepts - Semiconductor RAM Memories, Internal Organization of Memory Chips, Static Memories, Dynamic RAMs, Synchronous DRAMs, Read-only Memories – ROM, PROM, EPROM, EEPROM, Flash Memory, Direct Memory Access, Memory Hierarchy, Cache Memories. Pipelining - Basic Concept - The Ideal Case, Pipeline Organization, Pipelining Issues, Data Dependencies, Memory Delay.	06

Note: Use free digital simulation tools (Unit 1, 2 & 3) to simulate the concepts learned as part of ISE

References -

Text Book:

- Digital Electronics, Floyd and Jain.

Reference Book:

- Computer Organization And Embedded Systems, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian.





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Class:- S.Y. B. Tech.	Semester-III
Course Code : CS2035	Course Name : Data Structures and Algorithms

L	T	P	Credits
3	-	-	3

Course Description:

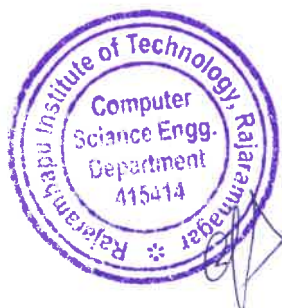
The Data Structures and Algorithms course is a comprehensive study of fundamental concepts and techniques essential for efficient problem-solving in computer science. Students will explore various data structures, including arrays, linked lists, stacks, queues, trees, graphs, and hash tables, and learn how to analyze their time and space complexity. 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 and use-cases of various data structures such as stacks, queues, trees, graphs, and hash tables.
2. Compare linear and non-linear data structures with respect to their structure, operations, and applications.
3. Apply suitable data structure to solve specific problem.
4. Determine appropriate data structure and algorithm for solving real-world problems

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





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Course Content		
Unit No.	Description	Hrs.
01.	Introduction to Data Structures: Primitive and non-primitive data structures, Operations on data structures, Algorithms, Abstract Data Types (ADT), Complexity Analysis.	06
02.	Stacks and Queues: Stack and Queue as ADT, Representation and applications of Stack and Queue. Types of Queues: Linear Queue, Circular Queue, and Priority Queue. Applications in scheduling and buffering.	06
03.	Linked Lists: Concept of linked organization and its advantages over sequential storage. Definition and structure of singly linked list, doubly linked list and circular linked list. Operations: creation, traversal, insertion, deletion. Applications of Linked Lists.	06
04.	Trees: Basic Technology, Binary Tree, Traversal methods, Binary search tree, AVL Tree, B tree, B+ tree, Min-Heap, Max-Heap, Applications: Huffman Coding, Expression Trees.	06
05.	Searching, Sorting and Hashing Techniques: Linear Search, Binary Search, Insertion Sort, Bubble Sort, Selection Sort . Radix sort, Heap sort. Hashing: Concept of hash table, Hash functions, Properties of good hash functions, Issues in hash tables, Collision resolution techniques: Open hashing and Closed hashing, Rehashing. Applications of Hashing.	06
06.	Graphs: Basic concepts of graph , Storage representation, Graph traversal techniques: Breadth-First Search (BFS), Depth-First Search (DFS). Topological Sorting , Applications of graphs.	06





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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 (Addison- Wesley Series).
- Data Structure using C -- ISRD Group (TMH) ACE series.
- Introduction to Data Structures in C – Ashok N. Kamthane (Pearson Education).

E-Resources:

- <https://www.geeksforgeeks.org/data-structures/>
- <https://visualgo.net/en>
- <https://www.coursera.org/specializations/data-structures-algorithms>





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Class:- S.Y. B. Tech.	Semester-III
Course Code : CS2074	Course Name: Discrete Mathematics

L	T	P	Credits
3	-	-	3

Course Description:

Discrete mathematics is the study of mathematical structures that introduces student to learn ideas and techniques from discrete mathematics that are widely used in science and engineering. The orientation of the course is to impart skills in students to think logically along with mathematical intuitions and apply these techniques in solving problems. Concepts and notations from discrete mathematics are useful in studying, describing objects and solving problems in branches of computer science such as computer algorithms, programming languages, cryptography, automated theorem proving and software development. Students will learn logic and proof, sets, functions as well as algorithms and mathematical reasoning.

Course Learning Outcomes:

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

1. Describe mathematical logic, truth table and their applications to programming and hardware design.
2. Apply the fundamental concepts of set theory to solve problems in logic, computing, and data analysis.
3. Understand the properties of relations, functions and algebraic systems for formal Languages.
4. Develop essential concepts to solve problems on graphs and networks.
5. Solve problems involving permutations, combinations, probability and cryptographic key generation.

Prerequisite: Basic Mathematics





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Course Content		
Unit No.	Description	Hrs.
01.	Mathematical logic: Statements and notations, connectives – negation, conjunction, disjunction, conditional, bi-conditional, Statement formulas and truth tables, well-formed formulas, Tautologies, Equivalence of formulas, Duality law, Tautological implications, functionally complete sets of connectives, other connectives, Normal and principal normal forms. Applications of propositional logic in digital circuit design.	07
02.	Set theory and Mathematical induction: Basic concepts, types of operations on sets, basic set Identities, ordered pairs, Cartesian product, The Well-Ordering Principle, The Fundamental Theorem of Arithmetic.	05
03.	Relation and Functions: Relation, Properties of binary relations, matrix and graph representation, partition and covering of set, equivalence relation, composition, POSET and Hasse diagram, Function – types, composition of functions, Inverse function Examples and general properties, Partial and total ordering.	06
04.	Algebraic systems, Groups and Lattices: Algebraic Systems, Semi groups and monoids, Groups, subgroups and homomorphism, Lattice as POSETs, Lattice as algebraic systems, Special lattices, Boolean algebra, Applications of groups in cryptography.	06
05.	Graph theory: Introduction, Isomorphism, Sub graphs – Walks, Paths, Circuits, Connectedness, Components, Euler Graphs – Hamiltonian Paths and Circuits, Matrix representation of graphs.	06
06.	Combinatorics: Permutations and Combinations: rule of sum and product, Algorithms for generation of Permutations and Combinations, Applications in probability and cryptographic key generation.	06





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References -

Text Books:

- -J. P. Tremblay & R. Manohar, Discrete mathematical structures with application to computer science (MGH International)
- -Kenneth H. Rosen, Discrete mathematics and its applications - (AT&T Bell Labs)

Reference Books:

- -Semyour Lipschutz, Marc Lipson, Discrete mathematics – (MGH), Schaum's outlines.
- -Bernard Kolman, Robert Busby, S.C. Ross and Nadeemur-Rehman, Discrete Mathematical Structures –(Pearson Education).





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Class:- S.Y. B. Tech.	Semester-III
Course Code : CS227	Course Name : Operating System

L	T	P	Credits
3	-	-	3

Course Description:

Operating systems course is intended as a general introduction to the techniques used to implement operating systems and related kinds of systems software. The topics covered will be functions and structure of operating systems, process management (creation, synchronization, and communication); processor scheduling; deadlock prevention, avoidance, and recovery; main-memory management; virtual memory management (swapping, paging, segmentation and page-replacement- algorithms); control of disks and other input/output devices; file-system structure and implementation; and protection and security.

Course Learning Outcomes:

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

1. Describe the primitive concepts of Operating System services and system software functionality.
2. Illustrate Process management core techniques in the context of effective execution of processes.
3. Implement Memory management, Storage management and I/O management core techniques in efficient execution of programs to achieve user and system goals.
4. Assess various algorithms of Process, Memory, Storage & I/O management for performance and quality criterion.

Prerequisite: Good knowledge of C, Computer Organization and Architecture, x86 Assembly level programming.





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Course Content		
Unit No.	Description	Hrs.
01.	Operating Systems Overview: Introduction, operating system operations, process management, memory management, storage management, protection and security, distributed systems. Operating Systems Structures: Operating system services and systems calls, system programs, operating system structure, operating systems generations.	06
02.	Process Management: Process concepts, process state, process control block, scheduling queues, process scheduling, multithreaded programming, threads in UNIX, comparison of UNIX and windows. Concurrency And Synchronization: Process synchronization, critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of synchronization, readers and writers problem, dining philosophers problem, monitors, synchronization examples(Solaris), atomic transactions. Comparison of UNIX and windows.	06
03.	Deadlocks: System model, deadlock characterization, deadlock prevention, detection and avoidance, recovery from deadlock banker's algorithm. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.	06
04.	File System: Implementation of File System: File system: File concept; Access methods; Directory and Disk structure; File system mounting; File sharing; Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.	06





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05.	Secondary Storage Structure: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix.	06
06.	I/O System: Hardware, application I/O interface, kernel I/O subsystem, transforming I/O requests to hardware operations, streams, performance.	06

References -

Text Books:

- Abraham Silberschatz, Peter Baer Galvin, Greg Gagne , Operating System Principles, Wiley India Private Limited, New Delhi

Reference Books:

- Stallings, Operating Systems, Internals and Design Principles, Pearson Education, India.
- Andrew S. Tanenbaum, Modern Operating Systems, Prentice Hall of India, India.
- Deitel & Deitel, Operating systems, Pearson Education, India.





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Class: S. Y. B. Tech.	Semester-III	L	T	P	Credits
Course Code: CEMD2011	Course Name: Building Construction and Planning	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.





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Course Content		
Unit No.	Details of Content	Hrs.
01.	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
02.	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
03.	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
04.	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





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05.	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
06.	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 –

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 BuiltEnvironment”, Tata McGraw-Hill Education Pvt. Ltd.

Government Rules & Regulations:-

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





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Class: - S.Y. B. Tech.	Semester - III	L	T	P	Credits
Course Code: CSMD2011	Course Name: Introduction to Data Structures	3	-	-	3

Course Description:

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

Course Learning Outcomes:

After successful completion of the course, 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





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Course Content		
Unit No.	Description	Hrs.
01.	Introduction to Data Structures: Primitive and non-primitive data structures, Operations on data structures, Algorithms, Abstract Data Types (ADT).	06
02.	Stack: Definition & Concepts, Operations on Stack, Applications of Stack, Polish expressions, Reverse Polish Expression and conversions, Recursion.	06
03.	Queue: Queue and its sequential representation, Simple Queue, Circular Queue, Double Ended Queue, Priority Queue, Applications of Queue.	06
04.	Linked List: Definition and structure of singly linked list, doubly linked list and circular linked list. Operations: creation, traversal, insertion, deletion.	06
05.	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
06.	Graph: Definition and concepts, Graph Representation, Graph Terminology, Graph Traversals – Depth First Search and Breadth First Search. Applications of Graph.	06





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References -

Text Books:

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

Reference Books:

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





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Class:- S. Y. B. Tech.	Semester- III	L	T	P	Credits
Course Code : EEMD2011	Course Name: Electrical Power Generation	03	--	--	03

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.
01.	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
02.	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
03.	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, layout of thermal power plant. heat balance and efficiency, supercritical technology.	06
04.	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
05.	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



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06.	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
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References -

Text Books:

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

Reference Books:

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





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Class : S. Y. B. Tech.	Semester : III	L	T	P	Credits
Course Code : ECMD2011	Course Name : Electronics Devices and Applications	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.





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Course Content		
Unit No.	Description	Hrs.
01.	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
02.	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
03.	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
04.	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
05.	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
06.	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





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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.





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Class:- S.Y. B. Tech	Semester-III
Course Code : CIMD2011	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





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Course Content		
Unit No.	Description	Hrs.
01.	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
02.	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
03.	Stack and Queue Stack: Definition, Representation, Operations and Applications of Stack. Queue: Definition, Representation, Operations and Applications of Linear Queue, Circular queue, Dequeue, Priority Queue.	07
04.	Linked Lists Definition, Terminologies, Representation, Operations, Singly linked list, Doubly linked list, Circular linked list, Stack using linked list, Queue using linked list.	07
05.	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
06.	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





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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", Addison, Welsely Series.
- Ashok N. Kamthane, "Introduction to Data Structures in C", Pearson Education.
- Yashwant P. Kanetkar, "Data Structures through C", BPB Publications.





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Class:- S.Y. B. Tech.	Semester- III
Course Code : MEMD2031	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

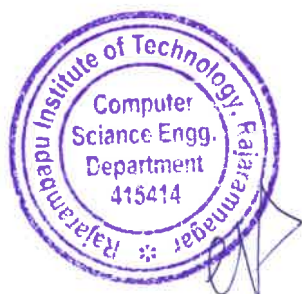
Course Learning Outcomes:

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:

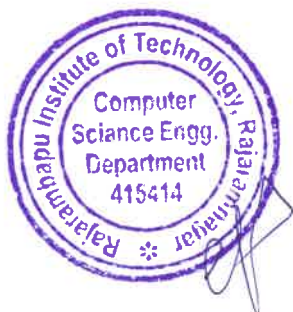
Course is open to all Students. The course demands application of creativity, sensitivity towards solving problems and liking for doing something new and creative.



Course Content		
Unit No.	Description	Hrs.
01.	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
02.	Creativity and Innovation: Definition, relevance of Creativity and Innovation in new product design, Improving creativity and innovation, hindrances to creative thinking, importance and formation of teams.	06
03.	Identifying Customer Needs: Understanding customer needs, Voice of the customer, Gathering customer needs, organizing and prioritizing needs, Product mission statement, establishing product function.	06
04.	Establishing Product Specification: Product Teardown and Experimentation, Benchmarking, Quality Function Deployment (QFD)	06
05.	Product Portfolios and Portfolio Architecture: Product Architecture-types, establishing architecture, Modular design-basic clustering method, advanced functional methods	06
06.	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,





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Class: S. Y. B. Tech.	Semester: III
Course Code: MEMD205	Course Name: I. C. Engines

L	T	P	Credits
3	--	--	3

Course Description:

This course describes the fundamentals of internal combustion engines used in automotive and allied application. The effect of operation and design of internal combustion engines on their performance, efficiency, fuel requirements, and environmental impact is studied. Topics include thermodynamics of engine processes, engine fluid flow; fuel systems in SI and CI engines, combustion, heat transfer and friction phenomena and recent engine technologies are studied under this course. Students examine the design features and operating characteristics of different types of internal combustion engines wise spark-ignition, compression ignition engines.

Course Learning Outcomes:

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

1. Explain construction and working of SI and CI engines
2. Perform a primary thermodynamic analysis of Otto and diesel cycle engines.
3. Select proper fuel system for IC engine
4. Evaluate engine emissions and pollution norms.
5. Interpret modern engine technologies

Prerequisite: Nil.

Course Content		
Unit No	Description	Hrs
1	Basics of I. C. Engines Introduction, Classification of I. C. Engines, Basic engine components and nomenclature, applications, Difference between two stroke and four stroke engine, difference between SI and CI engines.	06
2	Engine Cycles Theoretical cycles (Air standard cycles and Fuel Air cycles), Deviation of actual cycles from theoretical cycles, Various losses in actual cycles, Valve timing diagram for high and low speed engine, Port timing diagram.	06
3	Engine Systems Heat rejection and cooling, Air cooling, liquid cooling, Introduction to lubrication systems, Types of lubrication systems, Air intake system, filters & manifolds, Mufflers and resonators, Supercharging, Turbocharging.	06



4	Fuel Systems in I. C. Engines Carburetion, A/F ratio, Mixture requirements at different loads and speeds, Simple carburetor, Complete carburetor systems, Introduction to MPFI system, Requirements of injection systems, types of injection system, CRDI systems and its comparison with other systems, Injection pumps, injectors, nozzles, Governors, trouble shooting in fuel systems.	06
5	Engine emissions and control methods Emissions from SI and CI engines, need to control emissions, emission Standards, pollution norms like EURO, BHARAT etc. methods to control emissions like catalytic converter.	06
6	Recent trends in I C Engines Alternative Fuels Homogeneous Charge Compression, Ignition Engine, Lean Burn Engine, Stratified Charge Engine, Surface Ignition Engine, Four Valve and Overhead cam Engines, Electronic Engine Management, Common Rail Direct Injection Diesel Engine, Gasoline Direct Injection Engine.	06

References-

Text Books:

- M. L. Mathur, R. P. Sharma, Internal Combustion Engine, 8, Dhanpat Rai Publications
- V. Ganeshan, I C Engine, Tata McGraw Hill Publication.
- V. M. Domkundwar, A Course in Internal Combustion Engines, Dhanpat Rai & Co

Reference Books:

- E. F. Obert, I.C. Engine & Air Pollution, Harper & Row Publishers.
- SAE, Automotive Handbook, Bosch.
- John b Heywood, Internal Combustion Engine, Tata McGraw Hill Publication.

Class: S.Y. B. Tech	Semester: III	L	T	P	Credits
Course Code: MCMD2011	Course Name: Fundamentals of Mechatronics	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.
01.	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
02.	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
03.	Drives and Actuators:	06

	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.	
04.	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
05.	Signal Conditioning: Operational amplifier circuits, filtering circuits, Analog, and Digital signal conversion.	06
06.	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. Histan, McGraw Hill Education.



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Class:- S.Y. B. Tech	Semester- III	L	T	P	Credits
Course Code : AIMD2011	Course Name : Object Oriented Programming	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:

After successful completion of the course, students will be able 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.
01.	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
02.	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
03.	Introduction to Python fundamentals: Python introduction, Python syntax, Python comments, Python variables, Python data types, Python numbers, Python casting, Python strings, Python Booleans, Python operators.	06
04.	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



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05.	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
06.	Python for Machine Learning Numpy, Pandas, Matplotlib and Seaborn,	06

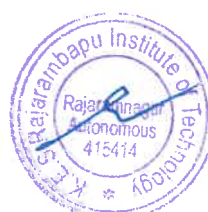
References -

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: RAMD2011	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, its 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





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Course Content		
Unit No.	Description	Hrs.
01.	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
02.	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
03.	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
04.	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-	06



	- 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.	
05.	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
06.	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", McGraw Hill Publication TMH.
- S. K. Saha, "Introduction to Robotics", TMH.
- 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.
- Fu K.S, "Robotics", McGraw Hill.
- Niku SB, "Introduction to Robotics – Analysis, Control, Applications", John Wiley & Sons Ltd..

NPTEL Course on Robotics:

- https://onlinecourses.nptel.ac.in/noc19_me74/preview
- https://onlinecourses.nptel.ac.in/noc20_del1/preview



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Class:- S.Y. B. Tech	Semester- III
Course Code : SH2175	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 in environmental science by integrating concepts and principles from various fields of science and engineering to address environmental issues.
2. Evaluate environmental impacts of human activities on ecosystems and on the environment.
3. Use scientific approach to identify and solve environment related problems.
4. Design sustainable solutions to address environmental challenges by considering renewable energy sources, waste management strategies conservation measures, and environmental policies.
5. Participate in group work to become acquainted with the importance of teamwork, collaboration
6. Develop presentation and report writing skills.





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List of Experiment		
Unit No.	Description	Hrs.
01.	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
02.	Environmental Pollution and Health Environmental Pollution, types of pollution, Air pollution, Water Pollution, Noise Pollution, Soil Pollution, Marine Pollution, Radioactive Pollution, Thermal Pollution (Causes, sources and effects, abatement methods), Pollution Case studies-Bhopal Gas Tragedy, Chernobyl Accident: A nuclear Disaster, Ganga Water Pollution.Solid Waste management (Causes, sources, effects & control measures), Hazardous waste management, Plastic waste management, E-waste management. Disaster management and risk analysis.	04
03.	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 .
- S. Deswal & A. Deswal, Basic course in environmental Studies, Dhanpat Rai & Co Ltd., Delhi.

Reference Books:

- Eldon D Enger, Bradley F. Smith, Environmental science – a study of inter-relationships Wm C Brown Publishers
- 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.



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Class:- S.Y. B. Tech.	Semester- III
Course Code : CS229	Course Name : Data Analysis using Python

L	T	P	Credits
1	-	2	2

Course Description:

This course introduces students to the core concepts, tools, and techniques of data analysis using Python. It equips engineering students with the skills to collect, clean, manipulate, analyze, and visualize data using powerful Python libraries like NumPy, Pandas, Matplotlib, Seaborn, and Scikit-learn. Students will gain hands-on experience through lab experiments and real-world datasets, enabling them to draw meaningful insights from structured data.

Course Learning Outcomes:

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

1. Describe the use of Python and its libraries for data analysis tasks.
2. Perform data loading, cleaning, and preprocessing using Pandas and NumPy.
3. Conduct exploratory data analysis and summarize datasets using statistical and visual methods.
4. Apply feature selection, data transformation, and dimensionality reduction techniques.
5. Develop and present a complete mini-project demonstrating end-to-end data analysis on real-world datasets.

Prerequisite: Fundamental mathematics and statistics, Basics of Data structures, Logical Thinking



Course Content		
Unit No.	Description	Hrs.
1.	Python Basics: Interactive Shell, Data Types Program, Dissecting Your Program, Flow control: Elements of flow control and types of operators usage in flow control. Functions: Local and Global Scope, The global Statement, Exception Handling	02
2.	Lists: The List Data Type, Working with Lists, Aussssssgmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References, Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing	02
3.	Arrays: Working with Arrays and DataFrames. NumPy arrays: creation, indexing, slicing, reshaping, Pandas Series and DataFrame operations	02
4.	Reading and Writing Files: Files and File Paths, The File Reading/Writing File Operations: The os.path Module	02
5.	Data Cleaning and Preprocessing Handling missing values: isnull(), fillna(), dropna() Removing duplicates, Data Preprocessing Data type conversion and error handling with try-except-finally	02
6.	Data Visualization with Matplotlib & Seaborn Matplotlib basics: line, bar, histogram, scatter plot. HeatMap Seaborn: Histogram (KDE), boxplot , scatterplot, pairplot	02

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

List of Experiments		
Expt. No	Description	Hrs.
1.	Understanding the Python Syntax, Variables, and Data Types.	02
2.	Understanding control structures and basic data structures of python.	02
3.	Usage of Data Collections in Python.	02



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4.	Write a program to compute summary statistics such as mean, median, mode, standard deviation and variance of the given different types of data.	02
5.	a. Develop a program to create histograms for all numerical features and analyze the distribution of each feature. Generate box plots for all numerical features and identify any outliers. Use California Housing dataset. b. Develop a program to Compute the correlation matrix to understand the relationships between pairs of features. Visualize the correlation matrix using a heatmap to know which variables have strong positive/negative correlations. Create a pair plot to visualize pairwise relationships between features. Use California Housing dataset.	02
6.	Write a Python program to perform basic data analysis operations such as loading data, computing statistics, and data type conversion. Use exception handling (try, except, finally) to manage errors such as file not found, invalid data types, and missing values.	02
7.	Load a sample dataset and using the Pandas library and perform data cleaning tasks such as handling missing values, removing duplicates, and basic filtering.	02
8.	a. Perform Exploratory Data Analysis (EDA) using Pandas to understand patterns, distributions, and relationships within a dataset. Use Placement data (StudentID, Branch, CGPA, Placed, Company, Package). b. Write a Python program to visualize the placement dataset using Matplotlib and Seaborn libraries. Perform line plot, bar chart, histogram, boxplot, and heatmap to identify data trends and relationships.	02
9.	a. Write a Python program to perform indexing, slicing, and reshaping operations on a dataset using Pandas and NumPy. Explore how to extract and manipulate specific rows and columns from load_iris() dataset b. Write a Python program to apply user-defined functions and lambda expressions on the load_diabetes() dataset from sklearn.datasets. Perform data transformation, feature categorization, and row filtering using Pandas.	02
10.	Write a Python program to perform feature selection and ranking using statistical techniques such as correlation analysis, variance threshold, and univariate tests.	02



	Use load_diabetes() dataset.	
11.	Write a Python program to load a bivariate dataset (with two numerical features) and plot the data points on a 2D graph. Then, compute and draw the direction along which the data has the highest variation. Use load_wine() dataset	02
12.	"Select a real-world dataset of your choice from your engineering domain (or any relevant area of interest), and perform end-to-end data analysis using Python. Your analysis must follow the full data science pipeline, from preprocessing to insight generation." You must include the following steps in your notebook: 1. Dataset selection & description (brief background of the dataset) 2. Data loading & inspection 3. Data cleaning & handling missing values 4. Exploratory Data Analysis (EDA) with visualizations 5. Feature Engineering (new columns using functions/lambdas) 6. Feature Selection (statistical/automated method) 7. Basic statistical analysis (correlation, mean comparisons, etc.) 8. Visual interpretation (bar charts, histograms, heatmaps, etc.) 9. Conclusions based on insights from the data	02

References –

Text Books:

- Al Sweigart, “Automate the Boring Stuff with Python”, No Starch Press.
- Python for Data Analysis Data Wrangling With Pandas, Numpy, And Ipython, Wes McKinney, Published by O’Reilly Media.

e-Resources:

- <https://www.learnbyexample.org/python/>
- <https://www.learnpython.org/>
- <https://pythontutor.com/visualize.html#mode=edit>
- Use <https://pythontutor.com/visualize.html#mode=edit> in order to visualize the python code



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Class:- S.Y. B. Tech.	Semester-III	L	T	P	Credits
Course Code : CS2135	Course Name :Data Structures and Algorithms Lab	-	-	4	2

Course Description:

The Data Structures and Algorithms Lab is an interactive and hands-on course that complements the theoretical concepts covered in the corresponding Data Structures and Algorithms lecture. This lab focuses on practical implementation, analysis, and experimentation with various data structures and algorithms. Students will gain valuable experience through programming assignments and problem-solving exercises. They will learn to design efficient algorithms, analyze their time and space complexity, and implement them using programming languages such as C or C++. The lab provides a supportive environment for students to explore fundamental data structures like linked lists, trees, graphs, and hash tables, and apply key algorithmic techniques such as sorting, searching, and graph traversal.

Course Learning Outcomes:

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

1. Apply basic operations (insert, delete, search, traverse) on fundamental data structures such as arrays, stacks, queues, linked lists, trees, hash tables, and graphs through code implementation.
2. Compare the performance and efficiency of various data structures and algorithms through experimental results.
3. Evaluate and justify the choice of appropriate data structures and algorithms for solving specific problems based on experimental data and complexity analysis.
4. Design and develop a mini-project using suitable data structures and algorithms to address a small real-world problem.

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





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

List of Experiment		
Expt. No	Description	Hrs.
01.	Implement basic operations (insert, delete, traverse, search) on arrays.	02
02.	Implement stack using array (perform push, pop, display operations).	02
03.	Implement linear queue and circular queue using array (perform enqueue, dequeue, and display operations).	02
04.	Implement singly linked list with operations: creation, insertion at beginning/end/position, deletion, traversal.	02
05.	Implement doubly linked list with insertion and deletion operations.	02
06.	Implement basic operations on Circular Singly/Doubly linked lists, such as insertion, deletion, and traversal.	02
07.	Create a binary search tree (BST) and perform insertion, deletion, search.	02
08.	Implement Searching technique (Linear Search, Binary Search)	02
09.	Implement Sorting technique (Insertion, Bubble and Selection Sort, Radix and Heap Sort)	02
10	Implement hash table with open hashing and closed hashing (linear probing or quadratic probing).	02
11.	Implement graph representation: adjacency matrix and adjacency list. Perform BFS and DFS traversals on a graph.	02
12.	Design and implement a mini-project that uses multiple data structures (e.g., stack + queue + graph or tree + hash table) for solving a real-world problem such as: Student record management system, Simple compiler (expression validation using stack), Route finder using graph traversal, Library book catalog with hash table etc.	04





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References -

Text Books:

- Data Structures using C, A Practical Approach for Beginners by Amol M. Jagtap & Ajit S. Mali.
- Data Structures and Algorithm Analysis in C++ by Mark Allen Weiss.

Reference Books:

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





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Class: - S.Y. B. Tech.	Semester- III	L	T	P	Credits
Course Code: CS231	Course Name: UI/UX Lab	--	--	2	1

Course Description:

This lab course introduces the foundational principles of User Interface (UI) and User Experience (UX) design for students without prior coding or web design background. The course focuses on user-centered design thinking, hands-on prototyping, heuristic evaluation, and accessibility. Students will use modern no-code tools to visualize, design, and test intuitive digital interfaces while developing empathy and creativity in solving real-world problems.

Course Learning Outcomes:

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

1. Identify user needs and construct user personas based on simple research methods.
2. Create wireframes and user journeys using paper sketches and no-code tools.
3. Develop basic interactive prototypes using latest tools.
4. Apply heuristic evaluation techniques to assess existing UI designs.
5. Integrate accessibility principles into user interface designs.
6. Collaborate with teams to present and critique UI/UX design solutions.

Prerequisite: Basic computer operation skills are sufficient.





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

List of Experiments		
Expt. No	Description	Hrs.
1.	Getting to Know the User: Creating User Personas from Basic Surveys or Interviews	02
2.	Understanding the User Journey: Creating Storyboards and Journey Maps	02
3.	Sketching Interfaces: Designing Paper-Based Wireframes for Everyday Apps	02
4.	Evaluating Real Apps: Heuristic Analysis Using Nielsen's 10 Usability Heuristics	02
5.	Designing Visually: Creating Digital Wireframes Using the latest tools (e.g. Canva or Figma) (No Code)	02
6.	Prototyping Basics: Linking Screens to Build Clickable Prototypes in UI Design System Software (e.g. figma, Adobe XD, etc)	02
7.	Testing with Friends: Conducting Basic Usability Tests and Observing Reactions	02
8.	Design for Everyone: Exploring Accessibility Issues and Simple Inclusive Design Fixes	02
9.	Design Decision Making: Creating Two UI Versions and Comparing via Peer Voting (A/B Style Testing)	04
10.	Design Showcase: Team-Based UI/UX Case Study and Prototype Presentation	02
11.	Design Critique Session: Peer Review and Constructive Feedback on Prototypes	02





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References -

Text Books:

- Donald Norman, "The Design of Everyday Things", Revised and Expanded, Basic Books
- Alan Cooper et al., "About Face: The Essentials of Interaction Design", Wiley

Reference Books:

- Steve Krug, "Don't Make Me Think, Revisited: A Common-Sense Approach to Web Usability", O'REILLY
- Jeff Gothelf and Josh Seiden, "Lean UX: Applying Lean Principles to Improve User Experience", O'REILLY
- Luke Wroblewski, "Mobile First", A Book Apart





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Class:- S.Y. B. Tech .	Semester-III/IV
Course Code : SH2635	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 Adequate knowledge of basic grammar of English language, Intermediate level vocabulary of English language, Ability to communicate moderately in English.





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

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





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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 -

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

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)

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





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Class: - S.Y. B. Tech.	Semester-III/IV	L	T	P	Credits
Course Code : SH2615	Course Name : Interpersonal Skills	-	-	2	1

Course Description:

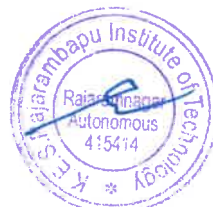
Jeevan means life and Vidya means knowledge. Jeevanvidya (JV) means science of life and art of successful and happy living. Achieving work-life balance is an art. The science behind work-life balance is based on the universal laws of nature. The aspects of it are applied on the art forms. At a high level,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

Course Outcomes:

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

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

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





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

List of Experiments		
Expt. No	Description	Hrs.
1.	Importance of Universal Laws of Nature in Human Life.- Overview of Jeevanvidya's Philosophy, scientific, universal, secular, usefulness in every walk and phase of life, overview of Universal Laws of Nature, determining factor in human life, important laws of nature and its influence on life of individual, family, society and world at large. Jeevanvidya's wisdom, living life in tune with laws of nature	02
2.	'You are the Architect of your Destiny' - This unit will make you aware that none else but you alone are responsible and accountable for what you achieve in your life , freedom of decisions, choices to make up your future, guiding powers to make the choices in your life, achieving life full of health, wealth, success, peace and happiness for yourself and all	02
3.	Setting and Achieving Goals – Defining your own goals in life , Concept of power of mind , concepts of interaction of conscious and subconscious levels of mind, tips and techniques to harness the amazing power of subconscious mind to achieve goals, Visualization and auto-suggestion techniques, real life examples	02
4.	Work-life Balance – What 'Jeevanvidya' means by work-life balance, priorities in life, time management, its importance, practical tips that enable to achieve work-life balance	02
5.	Art of Harmonious Thinking. – Importance , concept of harmonious thinking, Wishful Thinking, Positive Thinking, difference between Harmonious Thinking and Positive Thinking, powerful techniques to inculcate the habit of Harmonious Thinking, concept of Spiritual Thinking , Divine Universal Prayer – the life changer, Bless All technique, benefits of chanting the prayer	02
6.	Spirituality in Day-to-day Life – Concept of Love Work, 7 dimensions of	02





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	Love Work, benefits us as individual, family, society and entire human race, important to be a good human being, usefulness to become successful, tools to apply the different 'Jeevanvidya' principles in day-to-day life, simple but powerful and useful techniques such as attitude of gratitude , attitude of win-all	
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 -

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

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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Class: - S.Y. B. Tech.	Semester-III/IV	L	T	P	Credits
Course Code : SH2695	Course Name : Innovation Tools and Methods for Entrepreneurs	-	-	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 Creativity and Innovativeness, Problem identification, Apply design thinking approach to develop working prototype, Structured approach to problem solving



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

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

	C. Scenarios	
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 c) Financial Aspects e) Managerial Aspects b) Technical Aspects d) Production Aspects	02
12.	Investor Pitch Tool: a) Introduction c) Does and Don'ts e) Problem g) Traction i) Competition k) Financials b) Helpful Tips about preparation, pitching and content sharing d) Introduction f) Solution/Product/Service h) Market Opportunities/ Size j) Go To Market Strategies l) Team	02
13.	Revision -I	02
14.	Revision-II	02

References -

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





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Class: - S.Y. B. Tech.	Semester-III/IV	L	T	P	Credits
Course Code : SH2595	Course Name : Personal Effectiveness and Body Language	-	-	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 stress and health issues.
4. Interpret the non-verbal behavior of a person.

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





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

List of Experiments		
Expt. No	Description	Hrs.
1.	Self-awareness and Self Esteem Meaning, Factors influencing self-esteem- environmental and social factors Developing self-esteem- strategies for building self-esteem	02
2.	Goal Setting Long term and short-term goals, Steps in goal setting (SMART)- - identify strategies - consider possible blocks and ways to deal with them - outline the steps - set deadlines	02
3.	Self-Analysis SWOT Analysis, who am I, Attributes, Importance of Self Confidence	02
4.	Personality Typing Extraversion, Introversion, Sensing, Intuition, Thinking, Feeling, Judging Perceiving	02
5.	Life Skills for Personal Effectiveness Values: Punctuality, Honesty, Loyalty, Dependability, Reliability- Application of Life Skills in day - to- day life - Life Skills for Adolescents and Youth	02
6.	Time Management Strategies for effective time management (Principles, Planning, Identify & Control time stealers, Prioritize, Problems and Solutions, learn to say NO	02
7.	Stress Management Sources of stress, types, signs and symptoms of stress - positive aspects of stress - negative aspects of stress	02
8.	Stress Management Techniques Coping mechanisms, Deep Breathing Exercise, Meditation and Visual Imagery techniques, Muscle Relaxation, Peer Sharing	02
9.	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 -

- S. Hariharan, et al; Soft Skills, MJP Publishers, Chennai.
- Gopalaswamy Ramesh et al. The ACE of Soft Skills: Attitude, Communication and Etiquette for Success, New Delhi: Pearson Education.
- Jeff Butterfield, Soft Skills for Everyone, cengage Learning India Private Limited.
- UNLESH the power within... Soft Skills – Infosys Training Manual Module 1 to 5 (Infosys Campus Connect Programme)
- Masters, L. Ann et al. Personal Development for Life and Work, New Delhi: Cengage Learning.
- Covey, Stephen R., Seven Habits of Highly Effective People: Powerful Lessons in Personal Change
- 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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Class: - S.Y. B. Tech.	Semester-III	L	T	P	Credits
Course Code : SH 2735	Course Name : : German Language- III	-	-	2	1

Course Description:

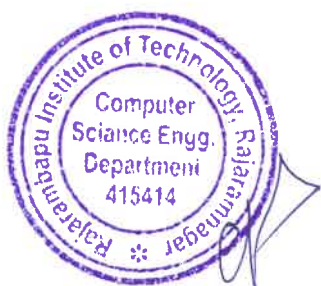
This course meets the requirements of student's overall personality development. The course helps the student in learning German as a foreign language. Vocabulary building activities, grammar, reading skills and basic conversational skills are addressed in this course.

Course Outcomes:

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

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

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





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

List of Experiments		
Expt. 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





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References -

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

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

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)

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





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Class: - S.Y. B. Tech.	Semester- III	L	T	P	Credits
Course Code : SH2715	Course Name : Japanese Language - III	-	-	2	1

Course Description:

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

Course Outcomes:

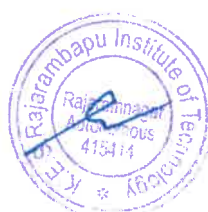
After successful completion of the course, students will be able to,

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

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

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

List of Experiments		
Expt. No	Description	Hrs.
1	Polite way of request for something, using ㇿ 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 ㇿ forms of the verbs to express sequence in action.	02





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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.





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References -

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

Other reference material, practice papers & CDs for listening practice.

The extra notes will be provided to the students as per the requirement of the syllabus.

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)

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





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Curriculum Structure and Evaluation Scheme
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B.Tech. in Computer Science & Engineering with Multidisciplinary Minor Sem-IV





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Class:- S.Y. B. Tech.	Semester-IV	L	T	P	Credits
Course Code : CS2005	Course Name : Computer Networks	3	-	-	3

Course Description:

The Computer Networks course introduces students to the fundamental concepts of data communication and networking, focusing on the transmission of digital data over communication systems. The course covers essential topics such as network models (OSI and TCP/IP), data encoding techniques, transmission media, multiplexing, switching, and error detection and correction mechanisms. It further explores data link, network, transport, and application layer protocols including Ethernet, IP addressing, routing algorithms, TCP/UDP, and key internet services such as DNS, HTTP, and web applications. Emphasis is also placed on network security basics, congestion control, and quality of service, enabling students to understand the design, operation, and performance of modern computer networks.

Course Learning Outcomes:

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

1. Recall the fundamentals of Computer Networks and Data Communication Systems.
2. Analyze different network models and protocols of different layers.
3. Design and Analyze different Routing Algorithm.
4. Apply and discuss various functions of the different protocols in network layer.
5. Create the different services of application layer.

Prerequisite:

Fundamentals of communication system engineering, Basics of Analog and Digital signal and techniques.



Course Content		
Unit No	Description	Hrs
1	Introduction: Data Communications, Networks, the Internet Protocols and Standards, OSI and TCP reference model. Analog and Digital, Periodic analog signals, digital signals, Transmission Impairments, Data rate limits and Performance.	06
2	Data Link and Medium Access Control: Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Hamming Distance, CRC; Flow Control and Error control elementary data link protocols - Stop and Wait, Go back – N ARQ	06
3	MAC and Wired LANs: Random Access, Multiple access protocols: Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA, Random Access, Controlled Access, Ethernet – IEEE Standards, Standard Ethernet, Changes in the standard, Fast Ethernet.	06
4	Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols. Routing algorithm, Congestion Control Algorithm. Case Study: IP Address Conflict in Office LAN	06
5	Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm. Case Study: Unauthorized Network Access in a Company	06
6	Application Layer: Domain name server (DNS), World wide web (WWW), Hypertext transfer protocol (HTTP), Dynamic Host Configuration Protocol (DHCP), Telnet, SNMP. Network security, Basic concepts of Cryptography, IP Security architecture (IPSEC), Firewalls.	06



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Department of Computer Science and Engineering

References:

Text Books:

- Data and Computer Communication- William Stallings (Person Education)
- TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United states of America

Reference Books:

- Larry L Peterson, Bruce S Davis, Computer Networks, Elsevier, 2012.
- Andrew S. Tanenbaum, David J Wetherall, Computer Networks, Pearson Edu, 2010.





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Class:- S.Y.B.Tech.	Semester- IV	L	T	P	Credits
Course Code : CS234	Course Name : Software Engineering And Project Management	3	--	-	3

Course Description:

This course covers key concepts of Software Engineering, including software requirements, process models, project planning, monitoring, and control. It introduces both function-oriented and object-oriented design, along with software testing techniques and strategies. Students will learn essential skills in data analysis, modeling, and design for software development. The scope of software engineering includes its historical background, economic impact, maintenance, requirements analysis, design, and team-based development.

Course Learning Outcomes:

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

1. Describe the fundamental concepts of software engineering, including software requirements, analysis, specification, and various software process models
2. Apply design principles and modern tools to create software models, and implement software testing techniques.
3. Analyze requirements and constraints, and plan software projects by estimating, scheduling, ensuring quality, and managing risks.
4. Evaluate project progress through monitoring and control techniques, utilize project management tools, and manage software projects effectively, including defect analysis and prevention

Prerequisite: Computer Programming, Domain Knowledge.





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Course Content		
Unit No.	Description	Hrs.
01.	Software Requirements, Analysis and Specification Software Engineering Problem and Approaches, Software requirement analysis and specification, problem analysis, Requirement Specification, Validation, Case study to prepare SRS.	04
02.	Software Process Models Waterfall model, V model, Evolutionary, Prototyping, Spiral model. Agile software development, Agile methodologies, Agile model: principle techniques, Extreme programming(XP): planning, design, coding, testing. XP practices, Scrum: framework, Sprint: product backlog, sprint backlog, burn down charts, Case study on Agile model.	06
03.	Function-oriented and Object-oriented Design Design principles, module level concepts, Design notation and specification, structured design methodology, Verification, Case study on DFD for Library Management System, large-scale video streaming platforms, distributed e-commerce systems, real-time ride-sharing applications, and financial trading systems. Object Oriented Analysis and Object Oriented Design, Object Oriented concepts, Unified Modelling Language, A Design Methodology, case study on Class, Object and Sequence and Collaboration diagrams for Banking system, college management system, online food ordering system.	08
04.	Software Testing Techniques and Strategies Software Testing Fundamentals, Black box testing, White box testing, Gray box testing, Unit Testing, Integration Testing, Verification & Validation, case study on modern tools and techniques for software testing, test cases writing	06
05.	Project Planning The project planning Infrastructure: Process database, process capability baseline, process asset and the body of knowledge system, Effort estimation and scheduling, Estimation and scheduling concepts Effort estimation scheduling.	06





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	Quality Planning: Quality concepts, Quantitative Quality management planning, Defect prevention planning. Risk Management: Concepts of risk and risk management assessment Risk control	
06.	Project Managing, Monitoring and Control Processes and project management and the CMM project management process, Tanning for project managers, SEPG support to projects, Review: The Reviews. Review process, Data collection, Project tracking, milestone analysis, Monitoring and control, Defect Analysis and prevention, Project management tools: Asana, Bitrix24, Zapie.	06

References -

Text Books:

- Pankaj Jalote, "Software Project Management in practice", Pearson Education.
- Pankaj Jalote, "An Integrated Approach to S/W Engineering.", Narosa Publication House.

Reference Books:

- Roger S. Pressman, "Software Engineering Practitioner's Approach", TATA McGraw-Hill





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Class: - S.Y. B. Tech.	Semester- IV	L	T	P	Credits
Course Code: CS236	Course Name: Database Management System	3	-	-	3

Course Description:

This course provides a comprehensive introduction to Database Management Systems (DBMS), covering the design, implementation, and management of relational databases. Students will explore key concepts such as data models, ER modeling, relational algebra, SQL querying, normalization, indexing, transactions, concurrency control, and database security. Emphasis is placed on practical experience using SQL and a relational database system like MySQL or PostgreSQL. The course also offers an overview of emerging trends such as NoSQL databases and Big Data. By the end, students will be equipped to design robust database systems and manage data effectively.

Course Learning Outcomes:

After Successful Completion of the course student will be able to,

1. Describe the fundamental concepts of database systems, including data models, relational schema, architecture, and components of the relational model.
2. Design ER models for real-world problems and convert them into normalized relational schemas to minimize redundancy and maintain data integrity.
3. Develop and execute SQL queries using Data Definition Language (DDL), Data Manipulation Language (DML), and advanced SQL operations.
4. Demonstrate knowledge of transaction management, concurrency control, indexing, and recovery techniques.
5. Illustrate the fundamental concepts of PL/SQL.

Prerequisite:

Understanding of programming concepts, foundational knowledge of data structures and algorithms.





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Course Content		
Unit No.	Description	Hrs.
01.	Introduction and Entity-Relationship Model: Introduction: Introduction to database, Characteristics of Database approach, Advantages of using DBMS approach, Three-schema architecture and data independence. Entity-Relationship Model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationships, Relationship types, Roles and Structural Constraints; Weak Entity Types. ER-Relational Mapping Rules.	06
02.	Relational Model: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: JOIN and DIVISION.	04
03.	Structured Query Language Data Definition and Data Types; Specifying basic constraints in SQL; Schema Change statements in SQL; Basic queries in SQL; Insert, Delete and Update statements in SQL	08
04.	Advanced Structured Query Language: More complex SQL Queries; Nested and Correlated Queries, IN, NOT IN , ALL, ANY, EXIST, NOT EXIST, UNION and INTERSECT operators, JOINS.	06
05.	Database Design: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form.	06





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06.	Transaction Processing Concepts: Introduction to Transaction processing, Transaction and System concepts, Desirable properties of Transactions and issues with concurrent transactions. 2PL and TSO algorithms.	06
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References –

Text Books:

- Silberschatz, Henry F. Korth, and S. Sudharshan, "Database System Concepts", Tata McGraw Hill.
- J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", Pearson Education.

Reference Books:

- Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", Pearson/Addison Wesley.





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Class: S.Y. B. Tech.	Semester- IV	L	T	P	Credits
Course Code: CS238	Course Name: Design and Analysis of Algorithm	3	-	2	4

Course Description:

This course serves as an introduction to the foundation in algorithm designing a solution in terms of algorithm and also analyzing performance to check the efficiency of algorithms and understanding the complexities associated with solving various computational problems. Participants will gain both theoretical knowledge and hands-on experience in working with real time applications, providing a comprehensive understanding of algorithmic strategies and performance analysis of various algorithms.

Course Learning Outcomes:

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

1. Apply appropriate algorithm techniques to solve given problems.
2. Design efficient algorithms to solve problems using a systematic approach.
3. Analyze the performance or complexity of algorithms.
4. Construct a solution that applies non-deterministic or randomized algorithms.

Prerequisite:

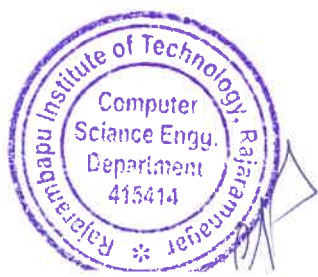
Basic programming principles and basics of Data Structure.





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Course Content		
Unit No.	Description	Hrs.
01.	Introduction to Algorithms and Performance Analysis Role of Algorithms in Computing, Algorithmic Strategies, Asymptotic Notations. Performance analysis: Time complexity, space complexity. Mathematical Analysis of Non-recursive Algorithms, Mathematical Analysis of Recursive Algorithms—Recursive Method, Recursive Tree Method, Master Method.	06
02.	Divide and Conquer General Method, Divide and Conquer Vs Brute Force Approach, Linear and Binary Search, Merge Sort, Quick Sort, and Binary Tree Traversals Decrease-And-Conquer: Topological Sort, Insertion Sort Transform-And-Conquer: Balanced Search Trees, Heaps and Heapsort.	06
03.	Greedy Approach General Method, fractional Knapsack Problem, Optimal Merge Pattern, Huffman Trees and Codes. Minimum cost spanning tree: Kruskal's Algorithm, Prim's Algorithm, Ford–Fulkerson algorithm, Dijkstra's Algorithm.	06
04.	Dynamic Programming General Method, Bellman Ford Algorithm, Floyd-Warshall Algorithm, Traveling Salesperson Problem, 0/1 Knapsack Problem, Multistage Graph.	06
05.	Backtracking and Branch & Bound Backtracking: General Method, N-Queen Problem, Graph Colouring Problem, Sum of Subset, 0/1 Knapsack Problem, Branch & Bound: General method, Comparison with backtracking, Applications: Traveling Salesman Problem, 0/1 Knapsack Problem, Assignment Problem.	06

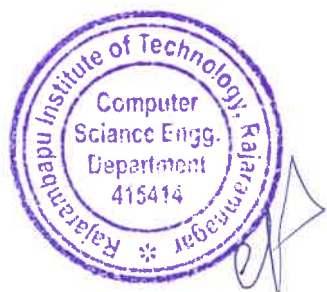




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06.	Advanced Algorithms Randomized Algorithms: Monte Carlo Vs Las Vegas algorithms, Decision Trees. Heuristic Algorithms: Genetic Algorithm and its variants, Particle Swarm Optimization Algorithms and its variants. NP Problems: NP-complete, NP Hard Problems, Cook's Theorem, Polynomial-time reductions.	06
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Experiment List		
Experiment No	Description	Hrs
1.	Linear and Binary Search with Time Complexity Analysis	02
2.	Merge Sort using Divide and Conquer with Performance Evaluation	02
3.	Quick Sort with Pivot Strategy and Complexity Analysis	02
4.	Insertion and Selection Sort using Decrease-And-Conquer approach and Performance Analysis	02
5.	Heap Sort using Transform-and-Conquer and Performance Analysis	02
6.	Prim's and Kruskal's Algorithms for Minimum Spanning Tree Construction	02
7.	Dijkstra's Algorithm for Single-Source Shortest Path in Weighted Graphs	02
8.	Floyd-Warshall Algorithm for All-Pairs Shortest Paths	02
9.	0/1 Knapsack Problem using Dynamic Programming Approach	02
10.	N-Queen Problem using Backtracking Technique	02
11.	Assignment Problem using Branch and Bound Strategy	02
12.	Traveling Salesman Problem using Heuristic Search Algorithms	04





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References -

Text Books:

- Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd Edition,, Pearson, 2017.(ISBN:9332585482)
- Ellis Horowitz, Sartaj Sahni and S. Rajasekhara, Fundamentals of Computer Algorithms, Computer Science Press. (ISBN: 0-7167-831)
- P. H. Dave, H. B. Dave, Design and Analysis of Algorithms, Pearson Education. (ISBN10:978-8177585957).
- Bhambri Vivek, "Design and Analysis of Algorithms", Regal Publications. (ISBN:9789392927003)

Reference Books:

- Cormen, Leiserson, Rivest, and Stein "Introduction to Algorithms", MIT Press, Cambridge, England. (ISBN: 9780262046305)
- Jones & Bartlett , "Foundations of Algorithms", Learning publications. (ISBN: ISBN 978-1-284-04919-0).





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Class: S. Y. B. Tech.	Semester-IV
Course Code: CEMD2021	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.





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Course Content		
Unit No.	Description	Hrs.
01.	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
02.	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
03.	Detailed estimate of building, road and culvert: Detailed estimate of load bearing structures and RCC structures.	06
04.	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
05.	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





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06.	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
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References –

References Books: -

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

I. S. Code:-

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





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Class: - S. Y. B.Tech	Semester- IV	L	T	P	Credits
Course Code: CSMD204	Course Name: Fundamentals of Database Systems	3	-	-	3

Course Description:

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

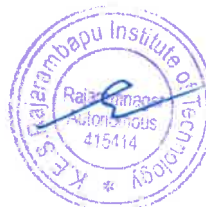
Course Learning Outcomes:

After Successful Completion of the course student will be able to,

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

Prerequisite:

A basic understanding of programming concepts (using languages such as C,C++) and foundational knowledge of data structures and algorithms.





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Course Content		
Unit No	Description	Hrs
1	Introduction to Database Concepts Purpose of Database Systems, Data abstraction, Data Models, Entities and Entity sets, Mapping Constraints, E-R Diagram, Reducing E-R Diagrams to Tables, Generalization and Aggregation	6
2	Relational Model Structure of Relational Databases, Structured Query Language (SQL): Data Definition Language, Data Manipulation Language, Aggregate functions, Set Operations.	6
3	Integrity Constraints and Database Design Domain Constraints, Referential Integrity, Functional Dependencies, Decomposition, Normalization: 1NF, 2NF, 3NF	6
4	Data Storage and Indexes File Organization, Data Dictionary Storage, Indexing: B+ tree indexing and B tree indexing, Hashing: Static and Dynamic.	6
5	Basic of Transactions Concepts of transaction processing, ACID properties, Transaction states, Serializability, Testing for serializability.	6
6	Concurrency Control and Recovery System Lock-based protocols, Timestamp - based Protocols. Crash Recovery: Failure Classification, Log-Based Recovery, Checkpoints.	6





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References –

Text Books:

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- J. Date, A. Kannan and S. Swamynathan, “An Introduction to Database Systems”, Pearson Education.

Reference Books:

- Ramez Elmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, Pearson/Addison Wesley.





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Class:- S. Y. B. Tech.	Semester- IV
Course Code : EEMD2021	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 Learning 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.
01.	Power Generation : Structure of power system, generating stations – operation and working of conventional and nonconventional energy sources. Comparison between them	06
02.	Variable load on power stations: Load curves and types of loads – base and peak loads, cost of electrical energy, depreciation and its methods.	06
03.	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
04.	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
05.	Supply systems: AC and DC transmission systems and comparison. Overhead and underground system, Construction of cables and types.	06
06.	Substation: Classification of substations, outdoor and indoor substations. Symbols for equipments in substations and their functions	06

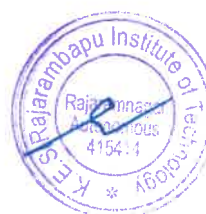
References -

Text Books:

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

Reference Books:

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





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Class:- S.Y. B. Tech.	Semester- IV	L	T	P	Credits
Course Code : ECMD2021	Course Name: Electronics Communication Systems	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
01.	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
02.	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
03.	Radio Receivers	06





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	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.	
04.	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
05.	Satellite Communication: Basic concepts of Satellite Communications, Satellite subsystems, Satellite Link design, Orbital Mechanics,	06
06.	Satellite Application: DBS, VSAT, GPS, Case Studies – Mars Mission, Chandrayan.	06

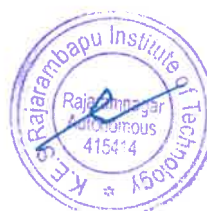
References -

Text Books:

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

Reference Books:

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





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Class:- S.Y. B. Tech	Semester-IV
Course Code : CIMD2021	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.

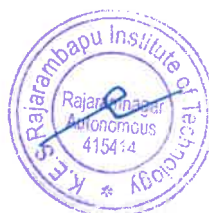
Prerequisite: Basic knowledge of Mathematics





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Course Content		
Unit No.	Description	Hrs
01.	Introduction Introduction, Characteristics of algorithm, Pseudocode conventions, Recursive algorithms, Performance analysis – time and Space complexity, asymptotic notations..	05
02.	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
03.	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
04.	Dynamic Programming General method, Multistage graphs, All pair shortest paths, 0/1 Knapsack problem, Reliability design, Traveling sales person problem.	07
05.	Backtracking General method, n-Queens problem, Subset sum problem, Graph coloring problem, Travelling sales person problem.	06
06.	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





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References -

Text Books:

- Ellis Horowitz, Satraj Sahani, Saguthevar Rajasejaram, "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", Addison Wesley.
- Alfred V. Aho , "The design and analysis of computer algorithms", Addison-Wesley Pub.





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Class:- S.Y. B. Tech.	Semester-IV
Course Code : MEMD2041	Course Name : Behavioral Engineering and Design

L	T	P	Credits
3	--	--	3

Course Description:

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

Course Learning Outcomes:

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

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

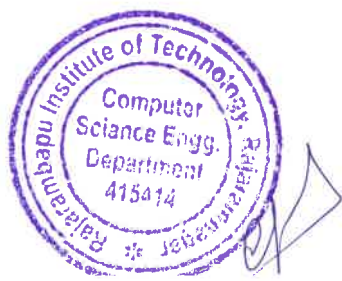
Prerequisite: Course on Design Thinking





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Course Content		
Unit No.	Description	Hrs.
01.	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
02.	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
03.	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
04.	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
05.	Behavioral Engineering in Software and Mobile App Design: Designing intuitive user interfaces (UI) and user experiences (UX) for software and mobile apps, Leveraging behavioral psychology in app onboarding and user engagement strategies, Gamification and motivational design principles, Usability testing and iteration in software and app development	06





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06.	Aesthetics and Ergonomics in Product Design: Principles of aesthetic design and its impact on user perception, Integrating aesthetics with functional design requirements, Understanding anthropometrics and ergonomics in product design, Case studies of products exemplifying successful integration of aesthetics and ergonomics	06
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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





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Class: S. Y. B. Tech	Semester: IV	L	T	P	Credits
Course Code: MEMD206	Course Name: Automotive Drivetrain	3	–	–	3

Course Description:

This course introduces the fundamentals of automotive drivetrain systems and their role in transmitting engine power to the wheels. The course covers the construction, working principles, performance characteristics, and applications of clutches, gearboxes, propeller shafts, universal joints, differentials, and final drive systems. It also introduces modern transmission technologies such as Automated Manual Transmission (AMT), Continuously Variable Transmission (CVT), Dual Clutch Transmission (DCT), hybrid drivetrains, and electric vehicle drivetrain architectures. Emphasis is given to drivetrain efficiency, torque transmission, vehicle performance, and emerging trends in mobility systems.

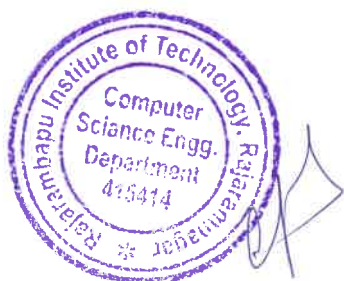
Course Learning Outcomes:

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

1. Explain the layout, components, and working principles of automotive drivetrain systems.
2. Analyze the construction, operation, and performance characteristics of different clutch systems.
3. Analyze various automotive transmission systems including manual, automatic, CVT, AMT, and DCT with respect to their construction, operation, and performance characteristics.
4. Examine the function and performance of propeller shafts, universal joints, and constant velocity joints in power transmission.
5. Evaluate the construction and working of differential and final drive systems for vehicle performance.
6. Assess hybrid and electric vehicle drivetrain technologies with respect to efficiency, energy management, and future mobility trends.

Prerequisite: NIL

Course Content		
Unit No	Description	Hrs
1	Introduction to Automotive Drivetrain: Layout of automobile power transmission system, Types of drivetrains: FWD, RWD, AWD, 4WD, Requirements of a good drivetrain, Torque, power flow, and losses in drivetrain	06
2	Clutches: Functions and requirements of a clutch, Single plate, multi-plate, cone, and centrifugal clutches, Clutch materials and wear characteristics, Hydraulic and electronic clutch actuation.	06





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3	Gearboxes and Transmission Systems: Manual transmission: sliding mesh, constant mesh, synchromesh, Automatic transmission: torque converter and planetary gear sets, Introduction to Continuously Variable Transmission (CVT), Dual Clutch Transmission (DCT) and Automated Manual Transmission (AMT)	06
4	Propeller Shafts and Universal Joints: Construction and function of propeller shafts, universal joints and constant velocity (CV) joints, slip joints, driveline vibration issues, torque transmission characteristics of shaft systems.	06
5	Differential and Final Drive Systems: Construction and working of differential systems, open differential, limited slip differential, locking differential, axle arrangements, final drive ratios, effect of differential action during vehicle cornering and traction conditions.	06
6	Modern and Electric Vehicle Drivetrains: Hybrid electric drivetrain configurations – series, parallel, and power-split systems; electric vehicle drivetrain architecture, regenerative braking systems, drivetrain efficiency and energy management, future trends in automotive drivetrain technology.	06

References –

Text Books:

- Kripal Singh, “Automobile Engineering”, Vol. I Standard publisher’s distributors.
- Dr. N. K. Giri, “Automobile Engineering”, Khanna Publishers.
- S Srinivasan, “Automotive Mechanics” Tata McGraw Hill Publication.
- K K Ramalingam, “Automobile Engineering” SCITECH publication.
- R. K. Rajput, “Automobile Engineering” Laxmi Publications.
- G. B. S. Narang, “Automobile Engineering,” Khanna Publishers.

Reference Books:

- Heinz Heisler, “Advanced Vehicle Technology”, Elsevier
- Chhikara, “Automobile Engineering”, Vol. II, Published by Satya Prakashan.
- Motor Vehicle; Newton, K., Steeds, W., Garrett, T. K., published by society of automobile engineering.
- Automobile Engineering; William H. Crouse, William Harry Crouse Tata McGraw-Hill Education.
- Motor Vehicle science volume 1; P. W. Ketts.
- Automotive Engines Theory & Servicing by J D Harderman/C D Mitchell Pierson Education





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Class: S. Y. B. Tech.	Semester: IV	L	T	P	Credits
Course Code: MCMD2021	Course Name: Industrial Fluid Power	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 Learning 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.

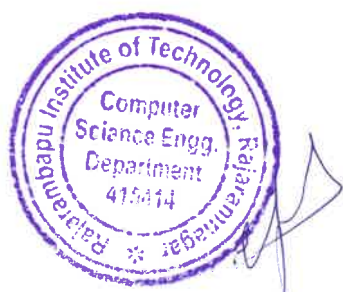
Prerequisite: Fundamental concepts of fluid mechanics, basic electrical engineering, and engineering mechanics.





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Course Content		
Unit No.	Description	Hrs.
01.	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
02.	Hydraulic System and Components (Pumps And 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.	06
03.	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
04.	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





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05.	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
06.	Hydraulic/Pneumatic Circuit Design 1. Steps in hydraulic circuit design, and simulation using Automation Studio. 2. Steps in pneumatic circuit design, and simulation using Automation Studio.	06

References -

Textbooks:

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

Reference Books:

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



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Class:- S.Y. B. Tech.	Semester- IV	L	T	P	Credits
Course Code : AIMD2021	Course Name : Data Structures & Algorithms	3	--	--	3

Course Description:

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

Course Learning Outcomes:

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

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

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



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Course Content		
Unit No.	Description	Hrs.
01.	Introduction to Data Structures: Primitive and non-primitive data structures, Operations on data structures, Algorithms, Abstract Data Types, Complexity Analysis	05
02.	Linear Data Structures: Stack: Definition, Representation and Applications of Stack. Queue: Definitions, Representation and Applications of Linear Queue, Circular Queue, and Priority Queue.	06
03.	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
04.	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
05.	Trees: Basic Technology, Binary Tree, Traversal methods, Binary search tree, AVL Tree, B tree, B+ tree, Heaps - operations and their applications.	06
06.	Graphs: Basic concepts of graph theory, Storage representation, Operations on graphs, Traversing a graph, Shortest path algorithm.	05





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



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Class: S. Y. B. Tech.	Semester: III	L	T	P	Credits
Course Code: RAMD2021	Course: Sensors & Actuators	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.

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Course Content:		
Unit No.	Description	Hrs.
01.	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
02.	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 conditioning- Applications: - capacitor microphone, capacitive pressure sensor, proximity sensor	06
03.	Intelligent Sensors: General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control.	06
04.	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

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05.	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
06.	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

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References –

Text Book:

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

Reference Books:

- Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, .
- A.D. Helfrick and W.D. cooper, Modern Electronic Instrumentation & Measurement Techniques, PHI.
- Hermann K.P. Neubert, “Instrument Transducers” , Oxford University Press.





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Class:- S.Y. B. Tech.	Semester- IV
Course Code : CS240	Course Name : Object Oriented Programming using JAVA

L	T	P	Credits
2	-	-	2

Course Description:

This course provides a comprehensive introduction to Object-Oriented Programming using Java, focusing on core concepts such as classes, objects, inheritance, polymorphism, abstraction, and encapsulation. Students will learn to write modular and reusable Java programs using features like exception handling, file I/O, multithreading, collections, and GUI development with AWT/Swing. The course also introduces database connectivity through JDBC, enabling students to build real-world, interactive applications. Emphasis is placed on practical implementation, problem-solving, and applying object-oriented principles in software development.

Course Learning Outcomes:

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

1. Describe the fundamental concepts of object-oriented programming and core features of the Java language.
2. Apply object-oriented programming principles such as inheritance, polymorphism, encapsulation, abstraction and packages to design modular Java applications.
3. Implement Java Collection Framework and String handling techniques to manage data efficiently.
4. Demonstrate exception handling mechanisms, file operations and multithreading to ensure robust and reliable Java programs.
5. Design and develop GUI-based applications with event handling and connect Java programs to databases using JDBC.

Prerequisite: Basic Knowledge of C programming, Fundamentals of Data Structure



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Course Content		
Unit No.	Description	Hrs.
01.	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	04
02.	Object Oriented Programming Concepts Introduction to OOP, Class & Object, Methods and Variables, Constructor, this keyword, Access Modifiers, static keyword, Inheritance, super keyword, Polymorphism: Method Overloading and Overriding, Abstraction, Encapsulation, Interface, Final keyword, Nested Classes	04
03.	Collection Framework Collection and Collection Framework, List: ArrayList and LinkedList, Stack, Queue: Dqueue and Priority Queue, Set: TreeSet and HashSet, Map: HashTable and HashMap,	04
04.	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	04
05.	File Handling and Multithreading File Handling: CRUD Operations on File, File Methods, Multithreading: Need of Multithreading, Thread Life Cycle, Creating threads, Thread Methods.	04



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06.	GUI Design and Database Connectivity GUI Programming with Java: The AWT class hierarchy, introduction to swing, swings Vs AWT, hierarchy for swing components. Containers: JFrame, JApplet, JDialog, JPanel, overview of some swing components: JButton, JLabel, JTextField, JTextArea, simple applications. Layout management: Layout manager types, border, grid and flow. Event Handling: Events, Event Classes, Event Listener, Delegation event models, JDBC Programming: Introduction to JDBC, CRUD Operation	04
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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>





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Class:- S.Y. B. Tech.	Semester- IV
Course Code : CS242	Course Name : Web Design Lab

L	T	P	Credits
1	--	2	2

Course Description:

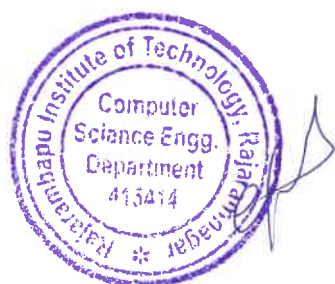
This lab-oriented course introduces students to modern web development tools and technologies. Students will learn to design responsive and interactive web interfaces using HTML5, CSS3, JavaScript, jQuery, Bootstrap, Tailwind CSS, and AJAX. The course also introduces students to popular content management systems (CMS) to build professional websites. Through hands-on experiments, students will gain proficiency in building full-featured web pages and functional websites aligned with current industry standards.

Course Learning Outcomes:

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

1. Compare structured and semantic web pages using HTML5 and CSS3.
2. Apply JavaScript and jQuery for dynamic content manipulation and interactivity.
3. Develop responsive layouts using Bootstrap and Tailwind CSS.
4. Implement AJAX for asynchronous data handling and dynamic updates.
5. Build and customize websites using CMS platforms.
6. Integrate modern design practices to enhance user experience and accessibility.

Prerequisite: Basic understanding of UI/UX principles, Fundamental knowledge of web technologies and computer programming



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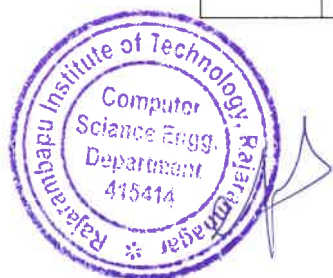
Course Content		
Unit No.	Description	Hrs.
01.	Introduction to Web Technologies and HTML5 Basics of web technologies: client-server architecture, web browsers, HTTP/HTTPS protocols. HTML5 document structure, semantic tags (<section>, <article>, <nav>, <header>), hyperlinks, lists, forms (input types, validation attributes), media embedding (audio, video, iframe), tables and attributes, accessibility best practices.	02
02.	CSS3 and Modern Styling Techniques CSS syntax and selectors, class vs ID, inline/internal/external styles, colors and units, box model, margin, padding, borders. Positioning (relative, absolute, fixed), float and clear. Advanced CSS: pseudo-classes, transitions, keyframe animations, flexbox layout, grid layout, media queries for responsive design.	02
03.	Responsive UI with Bootstrap and Tailwind CSS Need for responsive design. Introduction to Bootstrap: grid system, responsive breakpoints, navigation bar, cards, modals, carousels, buttons, and form controls. Introduction to Tailwind CSS: utility-first design, customizing styles, reusable components, responsive design, hover/focus/active states. Comparative advantages of frameworks.	02
04.	Web Interactivity with JavaScript and jQuery JavaScript basics: variables, data types, conditionals, loops, functions, arrays, objects. DOM manipulation: getElementById, querySelector, event handling, validation techniques. Introduction to jQuery: selectors, events, effects, DOM traversal, animation. Enhancing forms and UI interactions.	02

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05.	Asynchronous Communication with AJAX and JSON Introduction to AJAX: concept and use cases. XMLHttpRequest and Fetch API. Sending and receiving JSON data. Using AJAX with JavaScript and jQuery. Dynamic content loading, search suggestions, form submission without reloads, error handling, and user feedback.	02
06.	Content Management Systems and Web Deployment Overview of CMS: features, architecture, types (self-hosted vs cloud), advantages. Installation and configuration of CMS (e.g., WordPress). Themes, templates, and customization. Plugins for SEO, forms, galleries. Creating and managing posts and pages. Introduction to hosting, domain setup, and FTP basics.	02

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

List of Experiment		
Expt. No	Description	Hrs.
1.	Create a multipage static website using semantic HTML5 tags, forms, and embedded media.	02
2.	Use internal and external CSS for layout, typography, and animations.	02
3.	Use Bootstrap's grid and components to create a responsive and adaptive layout.	02
4.	Apply utility-first classes with Tailwind to build modern user interfaces.	02
5.	Use core JavaScript for event handling, validations, and DOM manipulation.	02
6.	Apply jQuery to simplify JavaScript tasks like animations and form handling.	02
7.	Load server-side data dynamically using AJAX without page reloads.	02
8.	Create registration/login forms with JavaScript-based validations.	02
9.	Combine HTML, CSS, Bootstrap/Tailwind, and JS to build a polished single-page website.	02
10.	Install and explore any CMS platform like WordPress, Joomla, or Drupal for content and layout management.	02



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11.	Customize themes and use available components/plugins (e.g., gallery, slider, contact forms).	02
12.	Mini Project (Group Based Project Activity) - Design and build a fully functional, responsive website using HTML/CSS, JS, framework & CMS-based techniques.	02

References -

Text Books:

- Jon Duckett, HTML and CSS: Design and Build Websites, Wiley
- Jon Duckett, JavaScript and jQuery: Interactive Front-End Web Development, Wiley
- David Sawyer McFarland, CSS: The Missing Manual, O'Reilly
- Chris Coyier, Practical Tailwind CSS, Frontend Masters

Reference Books:

- Ben Frain, Responsive Web Design with HTML5 and CSS3, Packt Publishing
- Smashing Magazine, WordPress: The Missing Manual, O'Reilly
- Zak Ruvalcaba, Murach's JavaScript and jQuery, Murach
- Rachel Andrew, The New CSS Layout, A Book Apart



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Class:- S.Y. B. Tech.	Semester- IV
Course Code : CS244	Course Name : Database Management System Lab

L	T	P	Credits
-	-	2	1

Course Description:

The Database Management System (DBMS) lab course provides hands-on experience in designing, implementing, and managing relational databases. Students will learn to use Structured Query Language (SQL) for creating, querying, and manipulating databases, as well as perform operations such as normalization, indexing, and transaction management. The course emphasizes practical skills through exercises involving real-world data sets and the use of database tools like MySQL, Oracle, or PostgreSQL. By the end of the lab, students will be equipped to develop efficient, secure, and scalable database solutions for various applications.

Course Learning Outcomes:

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

1. Sketch E-R diagram for given Case Study/Problem Statement.
2. Implement SQL query for various operations like retrieval, insertion and manipulation of data etc.
3. Design the application of SQL using database querying.
4. Develop an application to demonstrate database connectivity.

Prerequisite: Students should have a basic understanding of programming concepts. Familiarity with operating systems and basic computer architecture.



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

List of Experiments		
Expt. No	Description	Hrs.
1.	Design an Entity-Relationship (ER) diagram for a real-world scenario (e.g., University, Library, Hospital).	02
2.	Convert ER diagram to Relational Schema by Relational Mapping rules.	02
3.	Implement SQL Data Definition Language (DDL) commands for creating relational database tables	02
4.	Perform basic data manipulation operations in a relational database using SQL DML commands.	02
5.	Execute SQL queries using aggregate functions such as COUNT, SUM, AVG, MAX, and MIN.	02
6.	Implement SQL queries using different clauses such as Group by, having and Order by.	02
7.	Implement Sub queries (Nested, Correlated)	02
8.	Implement SQL queries using Joins (Inner, Outer and Equi).	02
9.	Implement SQL queries using advanced operators such as ANY, ALL, IN, and NOT IN.	02
10.	Implement SQL queries using advanced operators such as EXISTS and NOT EXISTS.	02
11.	Implement SQL queries using advanced operators such as set operations like UNION and INTERSECT	02
12.	Establish a connection between a relational database (e.g., MySQL, PostgreSQL, SQLite)	02



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References -

Text Books:

- Silberschatz, Abraham, Henry F. Korth, and S. Sudarshan. Database System Concepts. McGraw-Hill Education.
- Elmasri, Ramez, and Shamkant B. Navathe. Fundamentals of Database Systems. Pearson Education

Reference Books:

- Rob, Peter, and Carlos Coronel. Database Systems: Design, Implementation, and Management. Cengage Learning.
- Connolly, Thomas, and Carolyn Begg. Database Systems: A Practical Approach to Design, Implementation, and Management. Pearson Education.





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Class:- S.Y. B. Tech.	Semester- IV	L	T	P	Credits
Course Code : CS246	Course Name : Object Oriented Programming with JAVA Lab	-	-	2	1

Course Description:

This laboratory course is designed to provide hands-on experience with Object Oriented Programming (OOP) concepts using the Java programming language. Students will implement and explore fundamental and advanced OOP principles such as encapsulation, inheritance, polymorphism, abstraction, and interfaces. The course emphasizes problem-solving through Java class design, exception handling, file handling, multithreading, GUI development, and basic database connectivity using JDBC. This lab complements the theory course and enhances the student's ability to think in terms of objects and classes, applying Java's rich API for real-world problem solving.

Course Learning Outcomes:

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

1. Understand the principles of object-oriented programming and the syntax and structure of Java language.
2. Apply object-oriented concepts such as classes, objects, inheritance, polymorphism, and abstraction in Java programs.
3. Develop Java programs that utilize exception handling, multithreading, and file I/O operations.
4. Implement event-driven programming and create simple GUI-based applications using Java Swing or AWT.
5. Integrate Java programs with databases using JDBC for basic CRUD operations.

Prerequisite: Basic knowledge of C, fundamentals of Data Structure





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

List of Experiments		
Expt. No	Description	Hrs.
1.	Write a Java program to demonstrate basic syntax, user input, data types, operators, and control statements.	02
2.	Write a Java program to define a class with constructors, methods, and use of this keyword.	02
3.	Develop a program to implement inheritance and demonstrate method overriding.	02
4.	Write a Java program using interfaces and abstract classes to achieve abstraction and polymorphism.	02
5.	Implement a Java application to use different Collection frameworks for storing and retrieving data.	02
6.	Write a program to handle exceptions using try-catch-finally and create a custom exception class.	02
7.	Create a program to perform file operations: read, write, update and delete data from a file.	02
8.	Develop a multithreaded application by creating threads using Thread class and Runnable interface. Demonstrate thread methods.	02
9.	Design a GUI application using Swing and AWT components with event handling.	02
10.	Write a Java application to perform database operations (CRUD) using JDBC.	02





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References -

Text Books:

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

Reference Books:

- Daniel Liang, Introduction to Java Programming (Comprehensive Version), Pearson.
- Sachin Malhotra & Saurabh Chaudhary, Programming in Java, Oxford University Press.
- Horstmann & Cornell, Core Java Volume-I Fundamentals, Pearson Education





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Class:- S.Y. B. Tech.	Semester- IV
Course Code : CS250	Course Name : Massive Open Online Course (MOOC)

L	T	P	Credits
-	-	-	01

Course Description:

Online courses offered through platforms like NPTEL, SWAYAM, and NASSCOM provide Computer Science & Engineering (CSE) students with valuable opportunities to advance their understanding of modern computing concepts and technologies. These courses cover key domains such as algorithms and data structures, software engineering, database systems, operating systems, computer networks, cybersecurity, cloud computing, and emerging fields like Artificial Intelligence, Machine Learning, and Data Science. By combining strong theoretical foundations with hands-on practical applications, they help students enhance problem-solving abilities, work with state-of-the-art tools, and prepare for real-world, industry-oriented challenges. The objective of such courses is to cultivate skills and mindsets that encourage continuous learning, adaptability to new technologies, and readiness to thrive in an ever-evolving tech landscape.

Course Learning Outcomes:

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

1. Explain fundamental principles, core concepts, and commonly used technologies in computer science and engineering.
2. Analyze basic computing problems using mathematical reasoning and engineering principles, and develop algorithms to solve them effectively.
3. Design and implement simple computer programs and system components using standard programming languages and software tools, demonstrating an ability to test and debug them.

Note:

1. The student will get the credits of respective course in following conditions,
In case of course selected from NPTEL/SWAYAM/NASSCOM platforms, students have to complete the timely assignments, pass the exam and secure the certificate.
2. While selecting online course, following points must be taken care of,
 - a. Selected course must be approved by Departmental Programme Committee (DPC).
 - b. Duration of each online course must be of at least FOUR weeks for NPTEL/SWAYAM & minimum 12 to 20 hours for NASSCOM.



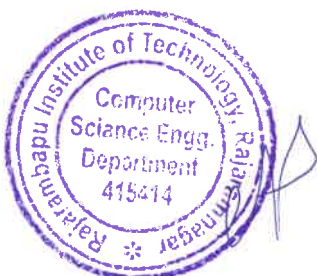


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References -

e-References :

- NPTEL (National Programme on Technology Enhanced Learning)
<https://nptel.ac.in>
- SWAYAM (Study Webs of Active Learning for Young Aspiring Minds)
<https://swayam.gov.in>
- MOOCs on NASSCOM
www.nasscom.in





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Class:- S.Y. B. Tech .	Semester-III/IV
Course Code : SH2635	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 Adequate knowledge of basic grammar of English language, Intermediate level vocabulary of English language, Ability to communicate moderately in English.





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

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



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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 -

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

Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)

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



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Class: - S.Y. B. Tech.	Semester-III/IV	L	T	P	Credits
Course Code : SH2615	Course Name : Interpersonal Skills	-	-	2	1

Course Description :

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

Course Outcomes:

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

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

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

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

List of Experiments		
Expt. No	Description	Hrs.
1.	Importance of Universal Laws of Nature in Human Life.- Overview of Jeevanvidya's Philosophy, scientific, universal, secular, usefulness in every walk and phase of life, overview of Universal Laws of Nature, determining factor in human life, important laws of nature and its influence on life of individual, family, society and world at large. Jeevanvidya's wisdom, living life in tune with laws of nature	02
2.	'You are the Architect of your Destiny' - This unit will make you aware that none else but you alone are responsible and accountable for what you achieve in your life , freedom of decisions, choices to make up your future, guiding powers to make the choices in your life, achieving life full of health, wealth, success, peace and happiness for yourself and all	02
3.	Setting and Achieving Goals – Defining your own goals in life , Concept of power of mind , concepts of interaction of conscious and subconscious levels of mind, tips and techniques to harness the amazing power of subconscious mind to achieve goals, Visualization and auto-suggestion techniques, real life examples	02
4.	Work-life Balance – What 'Jeevanvidya' means by work-life balance, priorities in life, time management, its importance, practical tips that enable to achieve work-life balance	02
5.	Art of Harmonious Thinking. – Importance , concept of harmonious thinking, Wishful Thinking, Positive Thinking, difference between Harmonious Thinking and Positive Thinking, powerful techniques to inculcate the habit of Harmonious Thinking, concept of Spiritual Thinking , Divine Universal Prayer – the life changer, Bless All technique, benefits of chanting the prayer	02

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6.	Spirituality in Day-to-day Life – Concept of Love Work, 7 dimensions of Love Work, benefits us as individual, family, society and entire human race, important to be a good human being, usefulness to become successful, tools to apply the different 'Jeevanvidya' principles in day-to-day life, simple but powerful and useful techniques such as attitude of gratitude, attitude of win-all	02
7.	Human Values – Ethics and Human values, difference in ethics and values, Qualities of human values	02
8.	Communication Skills – Ability to commendably read, write, speak and listen by conforming knowledge and presenting in a structured, cohesive fashion, Understanding and demonstrating workplace communication in the context of organization's business, understanding one's core skills for job	02
9.	Interpersonal Skills – Presenting interpersonal skills by amiable and respecting individuals, effective listening to stakeholders, bonding and developing rapport, Team success	02
10.	Decision Making – Importance of correct decision making, Analytical thinking / mind, Information processing ability, Making sound judgment and confident decision	02
11.	Cross cultured sensitizations & Adaptability – Adapting multinational & multicultural environment, embracing diversity, culturally sensitive and bonding to colleagues and stakeholders, sense of belongings and promotion of unity at work place	02
12.	Evaluation of Students for their Understanding of Various Concepts Discussed.	02

References -

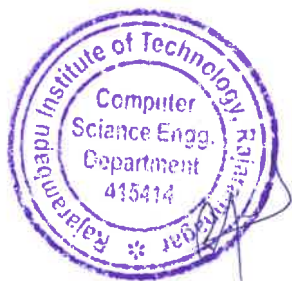
- Mr. P. W. Pai. JV's Spiritual Wisdom in Day-to-day life, Blog.
- Satguru Shri W. G. Pai. Towards the goal of beautiful life, Nam Sampradaya Mandal Publication
- Mr. P. W. Pai. JV's Spiritual Wisdom in Day-to-day life, Blog.

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- Satguru Shri W. G. Pai. Towards the goal of beautiful life, Nam Sampradaya Mandal Publication
- Satguru Shri W. G. Pai. Master Key to Happy Life, Jeevanvidya Foundation
- Satguru Shri W. G. Pai. Your Destiny In Your Thoughts: You Are The Architect Of your Destiny, Jeevanvidya Foundation
- Satguru Shri W. G. Pai. Gift of Wisdom, Jeevanvidya Foundation
- Satguru Shri W. G. Pai. Search For Happiness, Jeevanvidya Foundation
- Satguru Shri W. G. Pai. Ideal Parents Ideal Students, Jeevanvidya Foundation
- Satguru Shri W. G. Pai. Human Body - God Incarnate!, Jeevanvidya Foundation
- Satguru Shri W. G. Pai. Shape Your Destiny, Jeevanvidya Foundation
- Satguru Shri W. G. Pai. True Concept of Satguru, Jeevanvidya Foundation
- Dr. J. Murphy. Power of your subconscious mind, Amazing Reads Publication
- S. Covey. Seven people of highly effective people, Winx Club Publication
- D. Carnegie. How to win friends and influence people, Fingerprint! Publishing

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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Class: - S.Y. B. Tech.	Semester-III/IV	L	T	P	Credits
Course Code : SH2695	Course Name : Innovation Tools and Methods for Entrepreneurs	-	-	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 Creativity and Innovativeness, Problem identification, Apply design thinking approach to develop working prototype, Structured approach to problem solving

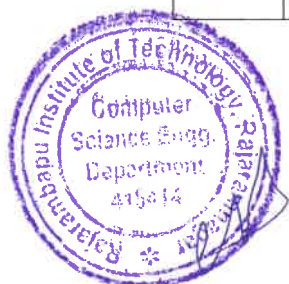


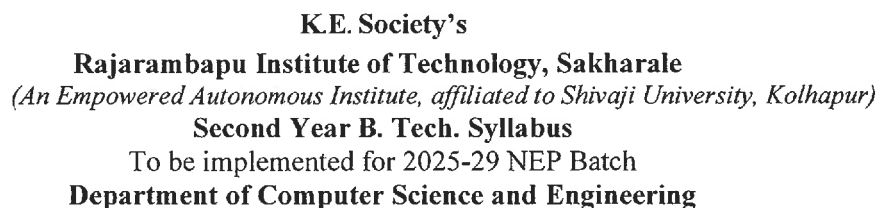


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It should consist of minimum 10 experiments based on the syllabus and experiment list mentioned below.

List of Experiments		
Expt. No	Description	Hrs.
1.	Systematic Innovation: Define the problem in depth with all details, Trend prediction, Modeling the problem to identify tradeoffs and contradictions	02
2.	TRIZ: Theory of Inventive problem solving (TRIZ), HIT Matrix, Scamper, Algorithms of brain storming and innovation, Functional analysis	02
3.	Frugal and Disruptive Innovation: Biomimicry and frugal innovation for prototyping, Disruptive innovation.	02
4.	User Journey Map: Map showing user interaction at every stage of product/service. Step-by step process of UJM creation	02
5.	Competitor analysis: Analysis of competitor and users for similar products, effectiveness of existing solutions and identifications of gaps	02
6.	Product/Software Design Specifications: Detailed specifications for better product design, detailed UI for software for clarity on user interaction, specify USPs of the product in comparison to the competitors	02
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 c) Financial Aspects e) Managerial Aspects b) Technical Aspects d) Production Aspects	02
12.	Investor Pitch Tool: a) Introduction c) Does and Don'ts e) Problem g) Traction i) Competition k) Financials b) Helpful Tips about preparation, pitching and content sharing d) Introduction f) Solution/Product/Service h) Market Opportunities/ Size j) Go To Market Strategies l) Team	02
13.	Revision -I	02
14.	Revision-II	02

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. Lavery. Entrepreneurship, OpenStax Publication.

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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Class: - S.Y. B. Tech.	Semester-III/IV	L	T	P	Credits
Course Code : SH2595	Course Name : Personal Effectiveness and Body Language	-	-	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 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 Adequate knowledge of basic grammar of English language, Intermediate level vocabulary of English language, Communicate moderately using English language.

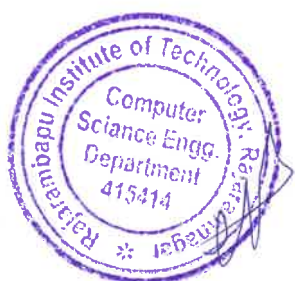




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It should consist of minimum 10 experiments based on the syllabus and experiment list mentioned below.

List of Experiments		
Expt. No	Description	Hrs.
1.	Self-awareness and Self Esteem Meaning, Factors influencing self-esteem- environmental and social factors Developing self-esteem- strategies for building self-esteem	02
2.	Goal Setting Long term and short-term goals, Steps in goal setting (SMART)- - identify strategies - consider possible blocks and ways to deal with them - outline the steps - set deadlines	02
3.	Self-Analysis SWOT Analysis, who am I, Attributes, Importance of Self Confidence	02
4.	Personality Typing Extraversion, Introversion, Sensing, Intuition, Thinking, Feeling, Judging Perceiving	02
5.	Life Skills for Personal Effectiveness Values: Punctuality, Honesty, Loyalty, Dependability, Reliability- Application of Life Skills in day - to- day life - Life Skills for Adolescents and Youth	02
6.	Time Management Strategies for effective time management (Principles, Planning, Identify & Control time stealers, Prioritize, Problems and Solutions, learn to say NO	02
7.	Stress Management Sources of stress, types, signs and symptoms of stress - positive aspects of stress - negative aspects of stress	02
8.	Stress Management Techniques Coping mechanisms, Deep Breathing Exercise, Meditation and Visual Imagery techniques, Muscle Relaxation, Peer Sharing	02



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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 -

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

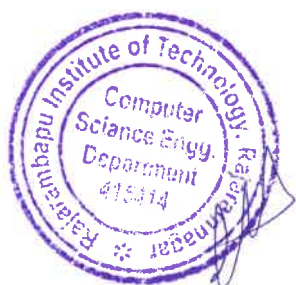




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Evaluation Scheme: ISE – 100% (Minimum Passing: 50%)

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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Class: - S.Y. B. Tech.	Semester- IV	L	T	P	Credits
Course Code : SH 2645	Course Name : German Language - IV	-	-	2	1

Course Description:

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

Course Outcomes:

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

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

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

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

List of Experiments		
Expt. 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



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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, CornelsenVerlag, 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.



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Class: - S.Y. B. Tech.	Semester- IV	L	T	P	Credits
Course Code : SH2625	Course Name : Japanese Language - IV	-	-	2	1

Course Description :

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

Course Outcomes:

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

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

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

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

List of Experiments		
Expt. 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

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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 -

- Minna No Nihongo I (3A Corporation, Japan), Publications: Goyal publishers.
- 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.