Sri Eshwar
College of Engineering
An Autonomous Institution
Affiliated to Anna University, Chennai

Programme Handbook

Regulations 2019(Revised)
Choice-based Credit System

B.E. Computer Science and Engineering

Sri Eshwar College of Engineering
(Autonomous Institution,
Affiliated to Anna University, Chennai and Approved by
All India Council for Technical Education, New Delhi.)
Kondampatti (Post)
Coimbatore – 641 202

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Department of Computer Science and Engineering
Engineering (Autonomous)
Coimbatore – 641 202.

Page | 1

1.0 Vision, Mission and Core Values of the Institution

Vision

"To be recognized as a premier institution, grooming students into globally acknowledged engineering professionals."

Mission

Our Mission at Sri Eshwar College of Engineering is:

- ✓ *Providing outcome and value-based engineering education*
- ✓ *Nurturing research and entrepreneurial culture*
- ✓ *Enabling students to be industry-ready and fulfil their career aspirations*
- ✓ *Grooming students through behavioural and leadership training programs*
- ✓ *Making students socially responsible*

2.0 Vision and Mission of the Department of Computer Science and Engineering

Vision:

"To groom students into globally competent software professionals and meet the ever-changing requirements of the industry."

Mission:

We will achieve our Vision by:

- ✓ *Creating a quality academic environment with relevant IT infrastructure and empowering faculty and students with emerging technologies*
- ✓ *Motivating staff and students to actively involve in lifelong learning and fostering research*
- ✓ *Inculcating leadership and entrepreneurship skills in students*
- ✓ *Generating opportunities for students to evolve as competent software professionals with societal consciousness*

3.0 Programme Educational Objectives (PEO)

PEO1: *To prepare graduates for a career in software engineering*

PEO2: *To prepare students for higher studies, research, entrepreneurial and leadership roles by imparting the quality of lifelong learning*

PEO3: *To enable students to apply innovative solutions for real-life problems in computer science domain*

4.0 Programme Outcomes (POs)

PO1: **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

PO2: **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using the first principles of mathematics, natural sciences, and engineering sciences

PO3: **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and the cultural, societal, and environmental considerations

PO4: **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex problems

PO5: **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

PO6: **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PO7: **Environment and sustainability**: Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO8: **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO9: **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO10: **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

PO11: **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PO12: **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

5.0 Programme Specific Outcomes (PSOs)

PSO1: Demonstrate knowledge in open-source technologies

PSO2: Develop innovative solutions by adapting emerging technologies for industry-oriented applications

PSO3: Implement SDLC principles for project/product development

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Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202

Page | 3

Sri Eshwar College of Engineering
Autonomous Institution
6.0 BE (CSE) Curriculum - Regulation 2019

SEMESTER I

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
Theory Courses								
1	R19MA101	Matrix Algebra and Calculus	BS	4	3	1	0	4
2	R19CY101	Engineering Chemistry	BS	3	3	0	0	3
3	R19CS101	Problem Solving using C	ES	3	3	0	0	3
4	R19CS104	Application Design and Development	ES	4	2	2	0	4
Theory cum Practical Courses								
5	R19HS151	Technical English	HS	4	2	0	2	3
Practical Courses								
6	R19CY111	Chemistry Laboratory	BS	2	0	0	2	1
7	R19GE111	Engineering Practices Laboratory	ES	4	0	0	4	2
8	R19CS111	Problem Solving using C Laboratory	ES	4	0	0	4	2
Professional Development Course								
9	R19EM101	Soft Skills	EM	2	0	0	2	1
TOTAL				30	13	3	14	23

SEMESTER II

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
Theory Courses								
1	R19HS11X	Language Elective	HS	3	2	0	2	3
2	R19MA102	Advanced Calculus and Complex Variables	BS	4	3	1	0	4
3	R19PH201	Physics for Information Science	BS	3	3	0	0	3
4	R19CS201	Data Structures	PC	3	3	0	0	3
5	R19EC102	Electronics and Microprocessors	ES	3	3	0	0	3
Theory cum Practical Courses								
6	R19CS151	Python Programming	ES	5	3	0	2	4
Practical Courses								
7	R19PH111	Physics Laboratory	BS	2	0	0	2	1
8	R19CS211	Data Structures Laboratory	PC	4	0	0	4	2
Mandatory Course								
9	R19MC101	தமிழர் மரபு / Heritage of Tamils	HSMC	2	1	0	0	1
TOTAL				29	20	1	8	24

SEMESTER III

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
Theory Courses								
1	R19MA203	Discrete Mathematics	BS	4	3	1	0	4
2	R19CS202	Database Management Systems	PC	3	3	0	0	3
3	R19CS203	Object Oriented Programming using Java	PC	3	3	0	0	3
4	R19CS205	Design and Analysis of Algorithms	PC	3	3	0	0	3
Theory cum Practical Courses								
5	R19IT251	Software Engineering	PC	4	2	0	2	3
6	R19EC252	Digital Principles and Computer Organization	ES	5	3	0	2	4
Practical Courses								
7	R19CS212	Database Management Systems Laboratory	PC	2	0	0	2	1
8	R19CS213	Object Oriented Programming using Java Laboratory	PC	2	0	0	2	1
9	R19CS215	Design and Analysis of Algorithms Laboratory	PC	4	0	0	4	2
Professional Development Course								
10	R19EM201	Logical Thinking	EM	2	0	0	2	1
Mandatory Course								
11	R19MC102	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HSMC	1	1	0	0	1
TOTAL				33	17	1	14	26

SEMESTER IV

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
Theory Courses								
1	R19MA206	Probability and Statistics	BS	4	3	1	0	4
2	R19CS204	Operating Systems	PC	3	3	0	0	3
3	R19CS206	Full Stack Development	PC	3	3	0	0	3
4	R19XXXX	Open Elective I*	OE	3	3	0	0	3
Theory cum Practical Courses								
5	R19AD251	Data Science	PC	5	3	0	2	4
6	R19EC352	Embedded Systems and IoT	ES	5	3	0	2	4
Practical Courses								
7	R19CS214	Operating Systems Laboratory	PC	2	0	0	2	1
8	R19CS216	Full Stack Development Laboratory	PC	2	0	0	2	1
Project Work								
9	R19CS281	Project using Design Thinking (Product/Software Development Life Cycle)	PW	2	0	0	2	1

		Professional Development						
10	R19EM202	Advanced Logical Thinking	EM	2	0	0	2	1
11	R19EM203	Summer Internship	EM	-	-	-	-	1
		Mandatory Course						
	R19MC202	Indian Constitution and Tradition	MC	1	1	0	0	NC
		TOTAL		32	19	1	12	26

SEMESTER V

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		Theory Courses						
1	R19CS301	Automata Theory and Compiler Design	PC	4	3	1	0	4
2	R19IT302	Cloud Computing	PC	3	3	0	0	3
3	R19CS302	Artificial Intelligence and Machine Learning	PC	3	3	0	0	3
4	R19XXXX	Professional Elective I*	PE	3	3	0	0	3
		Theory cum Practical Course						
5	R19EC253	Computer Networks	PC	5	3	0	2	4
		Practical Courses						
6	R19IT311	Cloud Computing Laboratory	PC	2	0	0	2	1
7	R19CS311	Artificial Intelligence and Machine Learning Laboratory	PC	2	0	0	2	1
		Professional Development Course						
	R19MC201	Environmental Science	MC	1	2	0	0	NC
		TOTAL		23	16	1	6	19

SEMESTER VI

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		Theory Courses						
1	R19CS303	Object Oriented Analysis and Design	PC	3	3	0	0	3
2	R19IT303	Cryptography and Cyber Security	PC	3	3	0	0	3
3	R19CSXX	Professional Elective II*	PE	3	3	0	0	3
		Theory cum Practical Courses						
4	R19CB534	Software Testing	PC	4	2	0	2	3
5	R19CB451	Software Project Management	PC	4	2	0	2	3
		Practical Courses						
6	R19CS312	Object Oriented Analysis and Design Laboratory	PC	2	0	0	2	1
7	R19IT312	Cryptography and Cybersecurity Laboratory	PC	2	0	0	2	1
		Project Work						
8	R19CS381	Innovative / Multi-Disciplinary Project	PW	2	0	0	2	1

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Chairman – Board of Studies Engineering
Department of Computer Science and Engineering
Sr...war College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

Page | 6

		TOTAL			23	13	0	10	18

SEMESTER VII

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		Theory Courses						
1	R19HS401	Principles of Management and Professional Ethics	HS	3	3	0	0	3
2	R19CSXXX	Professional Elective III*	PE	3	3	0	0	3
3	R19CSXXX	Professional Elective IV*	PE	3	3	0	0	3
		Theory cum Practical Course						
5	R19IT451	Blockchain Technologies	PC	5	3	0	2	4
		Project Work						
6	R19CS481	Project Work- Phase I	PW	6	0	0	6	3
		TOTAL		20	12	0	8	16

SEMESTER VIII

Sl. No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
		Theory Courses						
1	R19XXXX	Open Elective II*	OE	3	3	0	0	3
		PROJECT WORK						
2	R19CS482	Project Work-Phase II	PW	16	0	0	16	8
		TOTAL		16	3	0	16	11

Total Number of Credits:163

SUMMARY												AICTE		
Sl. No.	Course Category	Credits per Semester								Credits	Credit %	Credits	Credit %
		I	II	III	IV	V	VI	VII	VIII				
1	HS	3	3	-	-	-	-	3	-	9	5.5	16	9.8
2	BS	8	8	4	4	-	-	-	-	24	14.5	23	14.2
3	ES	11	7	4	4	-	-	-	-	26	15.8	29	17.8
4	PC	-	5	16	12	16	14	4	-	67	41.4	59	36.1
5	PE	-	-	-	-	3	3	6	-	12	7.3	12	7.4
6	OE	-	-	-	3	-	-	-	3	6	3.6	9	5.5
7	PW	-	-	-	1	-	1	3	8	13	7.9	15	9.2
8	EM	1	-	1	2	-	-	-	-	4	2.4	-	-
9	NC	-	-	-	-	-	-	-	-	-	-	-	-
10	MC	-	1	1	✓	✓	-	-	-	2	1.2	-	-
Total		23	24	26	26	19	18	16	11	163	100%	163	100%

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Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukariayu, Coimbatore - 641202

Page | 7

7.0 Professional Elective Courses: Verticals

Vertical 1	Vertical 2	Vertical 3	Vertical 4	Vertical 5	Vertical 6	Vertical 7
Programming	Full Stack Development	Artificial Intelligence	Software Engineering	Data Science	Cyber Security and Data Privacy	Cloud Computing
R19CS512 Advanced Java Programming	R19CS522 MVC Frameworks	R19CS531 Deep Learning	R19CB531 Software Quality Management	R19AD511-Health Care Analytics	R19CC521 Ethical Hacking	R19IT521 Cloud Virtualization
R19CS513 Advanced Data Structures	R19CS523 Web Application Security	R19CS532 Soft Computing	R19CB532 Free and Open-Source Software	R19AD512-Knowledge Engineering	R19CC522 Digital and Mobile Forensics	R19IT522 Cloud Economics
R19CS514 Competitive Programming	R19CS525 Flutter and Dart	R19CS533 Computer Vision	R19CB533 Agile Software Development	R19AD513-Soft Computing Techniques	R19CC523 Social Network Security	R19IT523 Cloud Networking and Connectivity
R19CS515 Advanced Algorithm Techniques	R19CS526 Cloud Service Management	R19AM516 Generative AI	R19CB534 Software Testing	R19AD514-Social Media Analytics	R19CC524 Modern Cryptography	R19IT524 Security on Cloud
R19CS516 C# and .NET	R19CS528 Docker and Kubernetes	R19CS535 Natural Language Processing	R19CB535 Software Architecture	R19AD515-Cognitive Science	R19CC525 Engineering Secure Software Systems	R19IT525 Compute Solutions and Serverless Services
R19CS517 Golang	R19CS529 UI Design with Figma	R19CS536 Game Theory	R19CB536 Software Requirement Engineering	R19AD516 – Ethics and Artificial Intelligence	R19CC526 Cryptocurrency and Blockchain Technologies	R19IT526 Cloud Storage Solutions
R19CS518 R Programming	R19CS530 Groovy on Grails	R19CS538 Ethics in AI	R19CB537 Continuous Integration and Continuous Deployment	R19AD517-Information Retrieval	R19CC527 Malware Analysis	R19IT527 Cloud Native Development and Containers
			R19CB538 Software Reliability Metrics and Models	R19AD518-Business Intelligence	R19CC528 Network Security	R19IT528 Data and Analytics on Cloud
				R19AD519 – Big Data Analytics		
				R19AD520 - Data Visualization &		

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Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641202.

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Exploration

8.0 Professional Elective Courses:

Sl. No	Course Code	Course Title	Cate-gory	Contact Periods	L	T	P	C
8.1 Vertical 1— Programming								
1	R19CS512	Advanced Java Programming	PE	3	3	0	0	3
2	R19CS513	Advanced Data Structures	PE	3	3	0	0	3
3	R19CS514	Competitive Programming	PE	3	3	0	0	3
4	R19CS515	Advanced Algorithm Techniques	PE	3	3	0	0	3
5	R19CS516	C# and .NET	PE	3	3	0	0	3
6	R19CS517	Golang	PE	3	3	0	0	3
7	R19CS518	R Programming	PE	3	3	0	0	3
8.2 Vertical 2— Full Stack Development								
1	R19CS522	MVC Frameworks	PE	3	3	0	0	3
2	R19CS523	Web Application Security	PE	3	3	0	0	3
3	R19CS525	Flutter and Dart	PE	3	3	0	0	3
4	R19CS526	Cloud Services Management	PE	3	3	0	0	3
5	R19CS528	Docker and Kubernetes	PE	3	3	0	0	3
6	R19CS529	UI Design with Figma	PE	3	3	0	0	3
7	R19CS530	Groovy on Grails	PE	3	3	0	0	3
8.3 Vertical 3—Artificial Intelligence								
1	R19CS531	Deep Learning	PE	3	3	0	0	3
2	R19CS532	Soft Computing	PE	3	3	0	0	3
3	R19CS533	Computer Vision	PE	3	3	0	0	3
4	R19AM516	Generative AI	PE	3	3	0	0	3
5	R19CS535	Natural Language Processing	PE	3	3	0	0	3
6	R19CS536	Game Theory	PE	3	3	0	0	3
7	R19CS538	Ethics in AI	PE	3	3	0	0	3
8.4 Vertical 4—Software Engineering								
1	R19CB531	Software Quality Management	PE	3	3	0	0	3
2	R19CB532	Free and Open-Source Software	PE	3	3	0	0	3
3	R19CB533	Agile Software Development	PE	3	3	0	0	3
4	R19CB534	Software Testing	PE	3	3	0	0	3
5	R19CB535	Software Architecture	PE	3	3	0	0	3
6	R19CB536	Software Requirement Engineering	PE	3	3	0	0	3

7	R19CB537	Continuous Integration and Continuous Deployment	PE	3	3	0	0	3
8	R19CB538	Software Project Management	PE	3	3	0	0	3

8.5 Vertical 5—Data Science

1	R19AD511	Health Care Analytics	PE	3	3	0	0	3
2	R19AD512	Knowledge Engineering	PE	3	3	0	0	3
3	R19AD513	Soft Computing Techniques	PE	3	3	0	0	3
4	R19AD514	Social Media Analytics	PE	3	3	0	0	3
5	R19AD515	Cognitive Science	PE	3	3	0	0	3
6	R19AD516	Ethics and Artificial Intelligence	PE	3	3	0	0	3
7	R19AM517	Information Retrieval	PE	3	3	0	0	3
8	R19AM518	Business Intelligence	PE	3	3	0	0	3
9	R19AM519	Big Data Analytics	PE	3	3	0	0	3
10	R19AM520	Data Visualization & Exploration	PE	3	3	0	0	3

8.6 Vertical 6—Cyber Security and Data Privacy

1	R19CC521	Ethical Hacking	PE	3	3	0	0	3
2	R19CC522	Digital and Mobile Forensics	PE	3	3	0	0	3
3	R19CC523	Social Network Security	PE	3	3	0	0	3
4	R19CC524	Modern Cryptography	PE	3	3	0	0	3
5	R19CC525	Engineering Secure Software Systems	PE	3	3	0	0	3
6	R19CC526	Cryptocurrency and Blockchain Technologies	PE	3	3	0	0	3
7	R19CC527	Malware Analysis	PE	3	3	0	0	3
8	R19CC528	Network Security	PPE	3	3	0	0	3

8.7 Vertical 7—Cloud Computing

1	R19IT521	Cloud Virtualization	PE	3	3	0	0	3
2	R19IT522	Cloud Economics	PE	3	3	0	0	3
3	R19IT523	Cloud Networking and Connectivity	PE	3	3	0	0	3
4	R19IT524	Security on Cloud	PE	3	3	0	0	3
5	R19IT525	Compute Solutions and Serverless Services	PE	3	3	0	0	3
6	R19IT526	Cloud Storage Solutions	PE	3	3	0	0	3
7	R19IT527	Cloud Native Development and Containers	PE	3	3	0	0	3
8	R19IT528	Data and Analytics on Cloud	PE	3	3	0	0	3

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Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202

Page | 11

10.0 PROGRAM ARTICULATION MATRIX

SEMESTER I

Year	Sem	Sl. No.	Course Code	Course Name	C	Category	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
				Induction Program																	
1	1	1	R19MA202	Matrix Algebra and Calculus	4	BS	3	3	1	2	-	-	-	-	-	-	-	2	-	-	-
1	1	2	R19CY101	Engineering Chemistry	3	BS	2	2	3	3	3	2	1	1	1	-	1	1	-	-	-
1	1	3	R19CS101	Problem Solving using C	3	BS	3	3	3	2	1	-	-	2	-	-	-	2	1	1	1
1	1	4	R19CS104	Application Design and Development	4	ES	2	2	3	-	3	2	-	3	3	2	1	3	2	3	3
1	1	5	R19HS181	Technical English	3	HS	-	-	-	-	-	-	-	-	2	3	-	2	1	-	-
1	1	6	R19CY111	Chemistry Laboratory	2	ES	2	2	2	2	2	2	1	1	1	1	-	1	-	-	-
1	1	7	R19GE111	Engineering Practices Laboratory	1	ES	2	1	1	-	-	1	-	1	1	2	-	-	2	1	-
1	1	8	R19CS111	Problem Solving using C Laboratory	2	ES	3	3	3	2	2	-	-	2	1	1	1	3	2	1	1
1	1	9	R19EM751	Soft Skills	1	EM	3	3	2	-	-	-	-	-	2	-	-	1	-	-	-

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Department of Computer Science and Engineering
Chairman – Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

SEMESTER II

Year	Sem	Sl. No.	Course Code	Course Name	C	Category	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
II	2	1	R19HS1XX	Language Elective	3	HS	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
II	2	2	R19MA102	Advanced Calculus and Complex Variables	4	BS	3	3	2	1	-	-	-	-	-	-	-	2	-	-	-
II	2	3	R19PH201	Physics for Information Science	3	BS	3	3	1	-	3	1	1	-	-	-	-	1	-	-	-
II	2	4	R19CS201	Data Structures	3	PC	3	3	2	-	1	-	-	-	-	-	-	2	1	2	-
II	2	5	R19EC102	Electronics and Microprocessors	3	ES	3	3	3	2	3	-	-	-	1	1	-	2	-	-	-
II	2	6	R19CS151	Python Programming	4	ES	3	2	2	2	3	-	-	2	2	1	2	2	3	2	2
II	2	7	R19PH111	Physics Laboratory	1	BS	3	3	2	1	-	2	2	-	1	-	-	2	-	-	-
II	2	8	R19CS451	Data Structures Laboratory	2	PC	3	3	2	1	2	-	-	1	-	-	-	2	2	2	-
II	2	9	R19MC101	தமிழர் மரபு / Heritage of Tamils	1	HSMC	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-

Chairman – Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

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SEMESTER III

Year	Sem	Sl. No.	Course Code	Course Name	C	Cate-gory	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
II	3	1	R19MA203	Discrete Mathematics	4	BS	3	3	2	2	-	-	-	-	-	-	-	2	-	-	-
II	3	2	R19CS202	Database Management Systems	3	PC	3	3	3	3	3	-	1	-	1	-	-	3	2	3	3
II	3	3	R19CS203	Object Oriented Programming using Java	3	PC	3	3	3	3	3	-	1	1	1	1	-	3	2	3	3
II	3	4	R19CS204	Design and Analysis of Algorithms	3	PC	3	3	3	3	1	-	1	1	-	-	-	3	1	2	2
II	3	5	R19IT251	Software Engineering	3	PC	2	1	-	3	3	1	1	2	3	2	2	3	2	-	2
II	3	6	R19CS205	Digital Principles and Computer Organization	4	ES	3	3	3	2	1	-	-	-	1	1	-	2	3	1	1
II	3	7	R19CS212	Database Management Systems Laboratory	1	PC	3	3	3	3	3	-	1	1	2	1	-	3	2	3	3
II	3	8	R19CS213	Object Oriented Programming using Java Laboratory	1	PC	3	3	3	3	3	-	1	1	2	1	-	3	2	3	3
II	3	9	R19CS215	Design and Analysis of Algorithms Laboratory	2	PC	3	3	3	3	1	-	1	1	2	1	-	3	1	2	2
II	3	10	R19EM201	Logical Thinking	1	EM	3	3	1	1	-	-	-	-	-	-	-	1	-	-	-
II	3	11	R19MC102	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	1	HSMC	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-

SEMESTER IV

Year	Sem	Sl. No.	Course Code	Course Name	C	Category	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
II	4	1	R19MA206	Probability and Statistics	4	BS	3	3	2	2	-	-	-	-	-	-	-	2	-	-	-
II	4	2	R19CS206	Full Stack Development	3	PC	3	3	3	3	3	-	1	1	2	1	1	3	2	3	3
II	4	3	R19CS204	Operating Systems	3	PC	3	3	3	1	2	-	1	-	-	-	-	3	3	2	-
II	4	4	R19OXXXX	Open Elective 1*	3	OE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
II	4	5	R19AD251	Data Science	4	PC	3	3	3	3	3	-	1	1	2	1	1	3	2	3	3
II	4	6	R19EC352	Embedded Systems and IoT	4	ES	3	3	3	2	2	-	-	-	1	1	-	2	-	-	-
II	4	7	R19CS216	Full Stack Development Laboratory	4	PC	3	3	3	3	3	-	1	1	2	1	1	3	2	3	3
II	4	8	R19CS214	Operating Systems Laboratory	4	PC	3	3	3	1	2	-	1	-	1	1	-	3	-	2	-
II	4	9	R19CS281	Project using Design Thinking (Product/Software Development Life Cycle)	1	PW	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2
II	4	10	R19EM202	Advanced Logical Thinking	1	EM	1	2	1	1	-	-	-	-	-	-	-	1	-	-	-
II	4	11	R19EM203	Summer Internship	1	EM	3	3	3	3	3	3	3	3	3	3	3	3	2	2	2
II	4	-	R19MC202	Indian Constitution and Tradition	NC	MC	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-

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Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.
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SEMESTER V

Year	Sem	Sl. No.	Course Code	Course Name	C	Category	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
III	5	1	R19CS301	Automata Theory and Compiler Design	4	PC	3	3	3	3	2	-	-	-	-	-	-	3	-	-	-
III	5	2	R19IT302	Cloud Computing	3	PC	1	2	2	2	3	-	-	-	-	2	-	2	2	2	2
III	5	3	R19CS302	Artificial Intelligence and Machine Learning	3	PC	2	-	3	3	2	-	-	-	2	2	-	3	3	2	-
III	5	4	R19XXXXX	Professional Elective I*	3	PE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
III	5	5	R19EC253	Computer Networks	4	PC	3	2	3	3	3	-	2	2	2	2	2	2	-	-	-
III	5	6	R19IT311	Cloud Computing Laboratory	2	PC	2	2	3	3	3	-	-	-	3	-	3	3	2	2	2
III	5	7	R19CS311	Artificial Intelligence and Machine Learning Laboratory	2	PC	3	1	3	2	3	-	-	1	3	2	2	3	3	2	-
III	5	-	R19MC201	Environmental Science	NC	MC	2	2	2	2	2	2	1	1	1	-	1	1	-	-	-

SEMESTER VI

Year	Sem	Sl. No.	Course Code	Course Name	C	Category	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
III	6	1	R19CS303	Object Oriented Analysis and Design	3	PC	3	3	3	3	2	-	1	-	-	-	3	3	2	2	3
III	6	2	R19IT303	Cryptography and Cyber Security	3	PC	3	3	3	3	2	-	1	-	-	-	-	3	1	1	2
III	6	3	R19CSXXX	Professional Elective II*	3	PE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
III	6	4	R19CB451	Software Project management	4	PC	3	3	2	2	-	-	-	-	-	-	-	2	3	1	3
III	6	5	R19CB534	Software Testing	4	PC	3	2	2	1	-	-	-	-	1	1	3	2	-	-	2
III	6	6	R19CS312	Object Oriented Analysis and Design Laboratory	3	PC	3	3	3	3	3	-	1	-	-	-	3	3	3	2	3
III	6	7	R19IT312	Cryptography and Cybersecurity Laboratory	3	PC	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2
III	6	8	R19CS381	Innovative / Multi-Disciplinary Project	1	PW	-	2	-	-	2	-	-	-	3	2	2	2	2	2	2

11.0 SYLLABI

SEMESTER I

R19MA101	Matrix Algebra and Calculus	L	T	P	C
		3	1	0	4

1. Course Description:

Matrix algebra and calculus are fundamental mathematical subjects that find widespread applications in various fields, including physics, engineering, computer science, economics and more. Differential calculus emphasizes the understanding of rates of change and how they relate to the slopes of curves. Integration spreads its wings in finding areas under curves, volumes of solids of revolution, and applications in engineering. The course enhances critical thinking and analytical skills

2. Course Objectives:

1. To study matrix algebra techniques and its applications
2. To gain knowledge in the area of infinite series and their convergence and familiarize with limitations of using infinite series approximations for solutions arising in mathematical modelling
3. To familiarize the student with functions of multivariable calculus and to and find the extreme values of the continuous functions
4. To acquire knowledge in double integration
5. To understand triple integrals and their applications

3. Syllabus

Unit-I: Matrices

Eigen values and eigen vectors: Eigen values and eigen vectors of a real matrix; Properties; Cayley Hamilton theorem (statement only); Orthogonal transformation: Orthogonal transformation of a symmetric matrix to diagonal form, reduction of quadratic form to canonical form by orthogonal transformation

Unit-II: Sequences and Series

Sequences: Definition and examples; Series: Types and convergence, series of positive terms; Tests of convergence: Comparison test, integral test and D'Alembert's ratio test; Alternating series: Leibnitz's test, Series of positive and negative terms, absolute and conditional convergence

Unit-III: Multivariable Calculus

Functions of several variables: Partial derivatives, total derivative, differentiation of implicit functions, Jacobian, properties of Jacobians, Taylor's series, maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers

Unit-IV: Double Integration

Double integrals: Evaluation of double integrals, change of order of integration, double integrals in polar coordinates, area enclosed by plane curves

Unit-V: Integration and its Application

Triple integrals: Evaluation of triple integrals, Volume as triple integral: simple problems, volume of solid, Gamma and Beta functions

Chairman – Board of Studies
Chairman – Board of Studies Engineering
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Kinathukadavu, Coimbatore – 641 202.

Page | 18

Text Books:

1.Grewal. B. S, "Higher Engineering Mathem`1atics", 44th Edition, Khanna Publications, Delhi, 2015

2.Erwin Kreyszig, "Advanced Modern Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia)

Ltd, Singapore, 2017

References:

Reference Books:

1. H. K. Dass, "Advanced Engineering Mathematics", S. Chand & Company LTD, New Delhi, Reprint 2009.
2. John Bird, "Higher Engineering Mathematics", An imprint of Elsevier, Burlington, Reprint 2010.
3. Bali. N. P and Manish Goyal, "A Text book of Engineering Mathematics", 8th Edition, Laxmi publications Ltd, 2011.
4. Veerarajan. T, "Engineering Mathematics", 3rd edition, Tata Mc Graw Hill Education pvt. Ltd, New Delhi, 2011.

Journals:

1. International Journal of Integral calculus.
2. International journal of Multivariable calculus.

Video References:

1. https://www.simplilearn.com/introduction-to-derivatives-rrt3co36vd364-video
2. https://www.khanacademy.org/math/calculus-home/integration-techniques-calc/trigonometric-substitution-calc/v/integrals-trig-substitution-1
3. http://www.dnatube.com/video/11238/What-Are-Conic-Sections
4. https://www.youtube.com/watch?v=AjmWR4kRtVk

NPTEL /Online Courses:

1. NPTEL /Online Courses:.ac.in/courses/111104092/
2. http://www.cdeep.iitb.ac.in/webpage_data/NPTEL/Online Courses:/Core%20Science/Mathematics%20I/TOC-middle-M14.html

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PS Os
R19MA101.1	Determine inverse, higher integral powers by Cayley Hamilton theorem and convert quadratic form to canonical form by orthogonal transformation.	K3	1, 2, 3, 4, 12	-
R19MA101.2	Test the convergence or divergence of series of positive terms and alternating series by various techniques.	K3	1, 2, 3, 4, 12	-
R19MA101.3	Classify the extreme values of functions of two variables and functional dependence.	K3	1, 2, 3, 4, 12	-
R19MA101.4	Apply integration concepts to compute area of the given surfaces, integrals in cartesian and polar coordinates.	K3	1, 2, 3, 4, 12	-
R19MA101.5	Apply triple integration concepts to compute volume of the given surfaces and solid structure and area, volume of the surface using Gamma and Beta functions.	K3	1, 2, 3, 4, 12	-

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Department of Computer Science and Engineering
Sreshwar College of Engineering (Autonomous)
Kinathukadavu Coimbatore – 641 28

Page | 19

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19MA101.1	3	3	2	2	-	-	-	-	-	-	-	2	-	-	-
R19MA101.2	3	3	1	2	-	-	-	-	-	-	-	2	-	-	-
R19MA101.3	3	3	1	2	-	-	-	-	-	-	-	2	-	-	-
R19MA101.4	3	3	1	1	-	-	-	-	-	-	-	2	-	-	-
R19MA101.5	3	3	1	1	-	-	-	-	-	-	-	2	-	-	-
Course to PO	3	3	1	2	-	-	-	-	-	-	-	2	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation Level

R19CY101	Engineering Chemistry	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides the Bachelor of Engineering students a solid foundation in the concepts and applications of chemistry that are pertinent to engineering disciplines. The goal of this course is to provide students with the knowledge and abilities required for a variety of engineering specialties by fusing fundamental chemical principles with engineering applications, this course gives an insight to the engineering students for optimum utilization of resources in scientific, research, technological and industrial application.

2. Course Objectives:

1. To gain the abilities necessary to become an ideal engineer and to be flexible enough to adjust to new advancements in Engineering Chemistry

2. Including the value of water for industrial use, the basic principles of battery chemistry, and the need to prevent corrosion in order to safeguard structures

3. To study innovative methods and up-to-date chemical knowledge that inspires pupils to communicate well and express themselves

4. To gain the necessary understanding of engineering materials, such as glass, refractories, cement, and nanomaterials

3. Syllabus

Unit-I: Electrochemistry and Corrosion

Basics of electrochemistry; Electrochemical cell: Reversible and irreversible cell; EMF measurements; Standard Weston Cadmium cell; Nernst equation and problems; Electrodes: single electrode potential; Types of electrodes: Calomel electrode; Electrochemical series: Significance; Conductometric titration; Potentiometric titration.

Corrosion: Definition, Classification, mechanism; Factors influencing corrosion; Corrosion control: Sacrificial anode and cathodic protection method; Corrosion inhibitors; Electroplating of Nickel and chromium; Paints: Constituents and their function.

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Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore - 641 202.

Page | 20

Unit-II: Water Technology

Introduction; Hardness of water: Determination of hardness of water by EDTA method; Alkalinity of water: Types of alkalinity, Estimation of alkalinity; Domestic water treatment: Pre-treatment, Removal of suspended impurities, Disinfection methods; Boiler feed water: Requirement of boiler feed water, Boiler troubles: scales and sludges; Treatment of boiler feed water: External treatment: Zeolite process, ion exchange method; Internal treatment method; Desalination: Reverse Osmosis.

Unit-III: Chemical Thermodynamics

Introduction to thermodynamics; Terminologies; Laws of Thermodynamics (only definitions): second law; Entropy as a thermodynamic quantity; Entropy change of an ideal gas: reversible and irreversible process, physical transformations; Clausius inequality theorem; Free energy and work function: Helmholtz and Gibbs free energy function, problems; Gibbs Helmholtz equation, problems; Clausius Clapeyron equation; Maxwell relation; Van't Hoff isotherm and its applications.

Unit-IV: Chemistry of Materials

Refractories; Classification, criteria of good refractory, properties and its application; Manufacture of Alumina, Magnesite and Silicon carbide.

Glass: Manufacture of glass by tank furnace method, Types and properties of glass.

Cement: Portland cement; Comparison and Manufacture by rotary kiln technology; Chemistry of setting and hardening of cement; Role of gypsum.

Nanomaterials; Carbon nano tubes; shape memory alloys; C60 fullerene; Liquid crystals: properties and its application.

Unit-V: Polymer Technology

Introduction; Terminologies; molecular weight of polymers (only definition); Classification of polymers: natural and synthetic, thermoplastics and thermosetting plastics; Types and mechanism of polymerization: addition (free radical), condensation and copolymerization; Properties of polymers; some commercial thermosetting resin: Phenol formaldehyde resin, Amino resins, Silicone resins; some thermoplastics: Polyethylene, PVC, polyvinyl acetate.

Text Books:

1. R.Rathinam.,"Engineering Chemistry", Pearson India Pvt.Ltd,2nd edition,2019.

2. S.Vairam and Subha Ramesh .,"Engineering Chemistry", Wiley India, Delhi, 2015.

3. S.P.C.Jain and M.Jain. "Engineering Chemistry", Dhanpat Rai Publishing Company, 16th Edition, New Delhi, 2017.

4. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.

Chairman- Board of Studies
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Reference Books:

1. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.

2. J.C. Kuriacase& J Raja ram ,Engineering Chemistry, Tata McGraw Hills Co. New Delhi, 2004.

3. S.S. Dara and S.S. Umare., "A Text book of Engineering Chemistry", S.Chand Publishing, 12th Edition, 2014.

4. A.Pahari and B.Chauhan., "Engineering Chemistry", Laxmi Publications, 2nd Edition 2010

5. Devender Singh, Balraj Deshwal, Sathish Kumar.,"Comprehensive Engineering Chemistry",IK International, 2007.

6. H.K. Chopra, A.Parmer., "Chemistry for Engineers", Narosa Publishing House, 2016.

Journals:

1. https://onlinelibrary.wiley.com/journal/15272648

2. https://link.springer.com/journal/10800

3. https://benthamopen.com/TOTHERJ/home/

4. https://www.scimagojr.com/journalsearch.php?q=13540&tip=sid

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1. https://www.youtube.com/watch?v=l2ENx_Y0dNU

2. https://www.youtube.com/watch?v=hZIMFBuP8zc

3. https://www.youtube.com/watch?v=9GMBpZZtjXM

4. https://www.youtube.com/watch?v=x5OD2KZXd54

5. https://www.youtube.com/watch?v=k_RErdKwaAg

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1. https://NPTEL /Online Courses:.ac.in/courses/113104059/lecture_pdf/Lecture%209.pdf

2. https://NPTEL /Online Courses:.ac.in/courses/Webcourse contents/IITKANPUR/wasteWater/Domestic%20Water%20TS.htm

3. https://onlinecourses.swayam2.ac.in/nou24_es03/preview

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CY101.1	Apply the principles of electrochemistry and corrosion in engineering	K3	1, 2, 3, 4, 5, 6, 7, 9, 11	-
R19CY101.2	Understand the quality of water, and its treatment methods	K2	1, 2, 3, 4, 5, 6, 8, 12	-
R19CY101.3	Apply the concepts relevant to thermodynamics	K3	1, 3, 4, 5, 6, 7, 9, 11	-
R19CY101.4	Understand the Engineering materials	K2	1, 2, 3, 4, 5, 6, 8, 9, 12	-
R19CY101.5	Understand the science of polymer and polymer reactions.	K2	1, 2, 3, 4, 5, 7, 9, 11	-

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CY101.1	3	3	2	3	3	3	2	-	2	-	2	-	-	-	-
R19CY101.2	3	3	2	3	3	3	-	1	-	-	-	3	-	-	-
R19CY101.3	1	1	3	3	2	1	1	-	1	-	1	-	-	-	-
R19CY101.4	1	2	3	3	3	2	-	1	-	-	-	2	-	-	-
R19CY101.5	2	2	3	3	3	1	1	-	2	-	3	-	-	-	-
Course to PO	2	2	3	3	3	2	1	1	1	-	1	1	-	-	-

"3"—High, "2"—Medium, "1"—Low, "- "—No Correlation

R19CS101	Problem Solving using C	L	T	P	C
		3	0	0	3

1. Course Description:

This course introduces students to the fundamental concepts of programming using the C language. The course covers essential topics such as basic C programming constructs, conditional and looping statements, modular programming and advanced concepts like pointers, arrays and structures. Through theoretical lectures, practical demonstrations and coding exercises, students will develop problem-solving skills and learn how to design and implement efficient algorithms to solve a variety of complex problems.

2.Course Objectives:

1. To understand the basic concepts of C programming.
2. To learn to apply conditional and looping statements for different programming scenarios.
3. To understand the importance of modular programming.
4. To write programs effectively with pointers, arrays, structures.

3.Syllabus

Unit-I: C Fundamentals

Basic computer organization, Problem solving techniques, Algorithm, Flowchart, Pseudocode; Introduction to C programming: Phases of a C program, Features of C, Keywords, Variable Name, Scope, Declaration, Coding Standards, Data Types and sizes: integer, float and character types, constants, Formatted I/O, Operators, Bitwise Manipulations, Expression Evaluation, Type Conversions, Preprocessor Directives

Unit-II: Control Structures

Conditional and Branching Statements: if, if-else, else-if ladder, nested-if, switch constructs, range using switch, Looping constructs: for, while, do-while -break and continue- goto and Label

Unit-III: Pointers and Functions
Pointer - Types of Pointers: NULL, Dangling, Generic pointers, Wild pointer, Arithmetic Operations in Pointer, Pointer to pointer, Functions: The anatomy of a function, Types of functions , Pointers and Function Arguments : Call by Value and Call by Reference, Function Pointers , return statement , Recursion , Storage Classes in C

Unit-IV: Arrays
Arrays: Declaring and initializing 1D array, Two dimensional arrays, Multi-dimensional arrays , Variable Length Arrays, Dynamic Memory Allocation, Passing 1D and 2D Array as arguments , Pointers and Arrays , Array of pointers

Unit-V: Strings, User-Defined Data Types and Files
Strings: Introduction, string handling functions, Two-dimensional array of strings; Structure: Basics of structure, Nested structures, Array of structures, Pointer to structures; Unions: Bit Fields; Files: Basics, Filé Functions, Random Access Files

Text Books:
1. Herbert Schildt, "C – The Complete Reference", Tata McGraw Hill Publishing Company, New Delhi, 2017.
2. Kernighan B. W. and Ritchie D. M., "C Programming Language (ANSI C)", Prentice Hall of India Private Limited, New Delhi, 2010.

References:

Reference Books:
1. Deitel and Deitel, "C How to Program", Pearson Education, New Delhi, 2011.
2. Simple Program Design: A Step-by-Step Approach, Fifth Edition by Lesley Anne Robertson.
3. https://www.udemy.com/course/c-programming-2019-master-the-basics
4. https://www.tutorialspoint.com/cprogramming

Video References:
1. https://www.youtube.com/watch?v=EjavYOFoJJ0&list=PLdo5W4Nhv31a8UcMN9-5ghv8qyFWD9_S
2. https://www.youtube.com/watch?v=irqbmMNs2Bo

NPTEL / Online Courses:
1. https://onlinecourses.NPTEL /Online Courses:. ac.in/noc22_cs40/preview
2. https://onlinecourses.NPTEL /Online Courses: ac.in/noc23_cs53/preview

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS101.1	Understand problem solving techniques and basic concepts of C	K2	1, 2, 3, 4, 5, 8, 12	1, 2, 3
R19CS101.2	Apply looping and conditional constructs for given problems	K3	1, 2, 3, 4, 5, 8, 12	1, 2, 3
R19CS101.3	Understand the use of pointers and Functions to solve complex problems	K2	1, 2, 3, 4, 5, 8, 12	1, 2, 3
R19CS101.4	Use arrays and dynamic memory allocation in modular programming	K3	1, 2, 3, 4, 5, 8, 12	1, 2, 3
R19CS101.5	Understand Structures, unions and files for problem solving	K3	1, 2, 3, 4, 5, 8, 12	1, 2, 3

5.Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS101.1	3	3	3	2	1	-	-	2	-	-	-	2	1	1	1
R19CS101.2	3	3	3	2	1	-	-	2	-	-	-	2	1	1	1
R19CS101.3	3	3	3	2	1	-	-	2	-	-	-	2	1	1	1
R19CS101.4	3	3	3	2	1	-	-	2	-	-	-	2	1	1	1
R19CS101.5	3	3	3	2	1	-	-	2	-	-	-	2	1	1	1
Course to PO	3	3	3	2	1	-	-	2	-	-	-	2	1	1	1

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS104	Application Design and Development	L	T	P	C
		2	2	0	4

1.Course Description:

Application Design and Development is a comprehensive integrated course that blends theoretical understanding with practical hands-on experience in creating diverse applications. Students will delve into essential web development concepts using HTML, CSS and JavaScript, mastering the foundations of building interactive and responsive web interfaces. Additionally, they will learn version control using Git and GitHub, enabling collaborative development and effective management of project iterations. Furthermore, students will explore mobile application development using MIT App Inventor, gaming application development with Construct 2, and image/video editing using Blender tools. Through a combination of theoretical lectures, interactive labs, and project-based learning, students will gain the skills necessary to design, develop, and deploy various types of applications.

2.Course Objectives:

1. To study HTML, CSS and JavaScript concepts to develop dynamic web pages
2. To learn GIT and GIT HUB repository and to apply the version control concepts
3. To understand MIT app inventor to develop mobile applications

Chairman Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Coimbatore - 641 202.

4. To learn Construct 2 tool to develop gaming applications and blender tools to edit images and videos

3.Syllabus

Unit-I: HTML and CSS

Introduction to web- Standards and Terminologies.HTML: Introduction and versions-HTML 5-standards and tags-Head and Body-List-Labels-Tables-Forms-Videos and Audios-Figure, Figure Captions, Images CSS: Introduction-Embedded Types-CSS Selectors-Borders, Margins, Paddings-Colors and Backgrounds- Introduction to Bootstrap-Tailwind CSS

Applications: Static website design for an organization, Report building, Color Palette design

Unit-II: Interactive Web Design using JavaScript

Introduction-Java Script adding Techniques-Variables and Operators- Conditional and Control Statements- Data Types and Functions-Events-Form Validation-Page Redirect-Java Script Exception Handling-Document Object Model (DOM)

Applications: Dynamic website design for an organization, Picture Slideshow, Weather Forecast Report

Unit-III: Git, Git Hub and Shell Scripting

Introduction to Git and GitHub-Terminologies-Local Repository Actions- Remote Repository Actions- Advanced Repository Actions-Branching-Merging-Software Developers Communities: Google Developers Group, Google Student Developers Community, Linux Developer Community, Stack Overflow, Kaggle Shell Scripting: Processing (PS) and Listing (LS)- File Creations and Handling-Users and Groups

Applications: Setting up local repository, Managing multiple branches, CRUD with Shell scripting

Unit-IV: Mobile Application Development with MITAI

Types of Mobile OS (Android and IOS)-Architecture- Phases of Mobile Application Development -MIT app inventor-Components-Viewer-Properties – Publishing an app

Applications: Talk to me, Ball Bounce, Digital Doodle, Mood Ring, Translation App, To do list, Opinion Pool, Map the movement

Unit-V: Template Driven Applications and Multimedia

Content Management System: Dynamic content-Web flow - Collection fields – Search Engine Optimization, Multimedia: Design with Canva and Blender- Image and Video Editing –Game Development with Construct 2

Applications: Creative blog development, My Portfolio, Simple games (Ball bouncing, Brick ball game, Model Building)

Text Books:

1. Internet & World Wide Web How to Program, 5th edition, by Paul Deitel Harvey Deitel, Abbey Deitel, Pearson Publication, 2018.

2. . App Inventor 2: Create Your Own Android Apps 2nd Edition by David Wolber, Hal Abelson, Ellen Spertus, Liz Looney, 2014.

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References:
Reference Books:

Reference Books:

1. CS50's Web Programming with Python and JavaScript - https://cs50.harvard.edu/web/2020

2. Get Coding! Learn HTML, CSS & JavaScript & Build a Website, App & Game – by Young Rewired State, Walker Books, 2016.

3. Version Control with Git, by Jon Loeliger, Matthew McCullough, 2nd Edition, 2012.

4. Ultimate-web-design-course-https://university.webflow.com/courses/ultimate-web-design-course.

Video References:

1. https://www.youtube.com/watch?v=XIOLqoPHCJ4
2. https://www.youtube.com/watch?v=RGOj5yH7evk
3. https://www.youtube.com/watch?v=TwxhwwX4T5U
4. https://www.youtube.com/watch?v=WKM8QCuxmQY

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1. https://www.coursera.org/learn/html-and-css-in-depth
2. https://amigoscode.com/courses/enrolled/1317178
3. https://in.coursera.org/learn/html-css-javascript-for-web-developers
4. https://amigoscode.com/p/git-github

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS104.1	Understand and apply HTML and CSS concepts	K2	1, 2, 3, 5, 6, 8, 9, 10, 11, 12	1, 2, 3
R19CS104.2	Understand and apply JavaScript concepts for dynamic web page design	K2	1, 2, 3, 5, 6, 8, 9, 10, 11, 12	1, 2, 3
R19CS104.3	Understand and apply shell commands and GIT workflow	K2	1, 2, 3, 5, 6, 8, 9, 10, 11, 12	1, 2, 3
R19CS104.4	Design and develop mobile applications	K3	1, 2, 3, 5, 6, 8, 9, 10, 11, 12	1, 2, 3
R19CS104.5	Develop simple gaming applications	K3	1, 2, 3, 5, 6, 8, 9, 10, 11, 12	1, 2, 3

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS104.1	2	2	3	-	3	2	-	3	3	2	1	3	2	3	3
R19CS104.2	2	2	3	-	3	2	-	3	3	2	1	3	2	3	3
R19CS104.3	2	2	3	-	3	2	-	3	3	2	1	3	2	3	3
R19CS104.4	2	2	3	-	3	2	-	3	3	2	1	3	2	3	3

Chairman – Board of Studies
Department of Computer Science and Engineering
Sakthi Kongunadu College of Engineering (Autonomous)

Page | 27

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS104.5	2	2	3	-	3	2	-	3	3	2	1	3	2	3	3
Course to PO	2	2	3	-	3	2	-	3	3	2	1	3	2	3	3

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19HS151	Technical English	L	T	P	C
		2	0	2	3

1. Course Description:

This course aims to educate the first year BE/B.Tech students in basic principles of English language, facilitate them to use vocabulary in different academic and professional contexts. It also cultivates their LSRW skills, namely listening, speaking, reading and writing skills thereby improving their proficiency in oral and written communication in technical English. It also covers all the areas of grammar, word formation, summarizing, report writing, which are necessary for the students of engineering sciences.

2. Course Objectives:

1. Enable learners of Engineering and Technology to develop their basic communication skills in English.
2. Emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
3. Ensure that learners use the electronic media such as internet and supplement the learning materials used in the class room.
4. Inculcate the habit of reading and writing leading to effective and efficient communication.

3. Syllabus

Unit-I: Basic Language Development

Reading: Types of Reading, Skimming and Scanning, Reading Comprehension

Writing: Word Formation, Sequence Words, Types of Sentences, Hints Development, Informal Letters—Congratulating, apologizing, etc

Grammar: Parts of Speech, Articles, Tenses.

Unit-II: Different Strategies of Reading

Reading: Articles from Newspapers & Magazines, Cloze Exercises

Writing: Instructions, Recommendations, Paragraph Writing

Grammar: Homonyms, Homophones, Homographs, Subject – Verb Agreement, Modal Verbs, Question Types, Wh-type, Yes/ No and Tag Questions.

Unit-III: Group Interaction

Reading: Reading for Specific Information & Identifying Lexical and Contextual Meaning

Writing: Formal Letters—Seeking Permission for Industrial Visit, Letter of Invitation (acceptance/declination), Jumbled Sentences

Grammar: Cause and Effect Expressions, Purpose & Function, Compound Nouns.

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 28

Unit-IV: Introduction to Effective Writing
Reading: Summarizing, Paraphrasing, Note Making
Writing: Business Letters (Enquiry, Calling for Quotations & Placing Orders), Email-Etiquette, Writing Emails, Free Writing on any given topic
Grammar: Phrasal Verbs, Single Sentence Definitions.

Unit-V: Technical Writing Practice
Reading: Reading Practice based on Competitive Examinations
Writing: Preparing Transcript for a Speech, Pictorial Representation (Charts —Flowcharts, Pie Charts, Bar Charts, Tabular Column, etc)
Grammar: Single Word Substitute, Abbreviations & Acronyms, Spotting Errors.

List of Experiments:
Listening - Listening Types - Listening to Audio files and answering
Listening - Listening for specific information – Listening to announcements and Radio Broadcasts
Listening - Listening to TED Talks & News Reading from English News Channels (CNN, NDTV, India Today etc.)
Listening - Listening Comprehension and answering accordingly.
Listening - Listening to Eminent personality interviews & other forms of interviews
Speaking - Introducing oneself & family - Role Play
Speaking – Extempore - Just A Minute (JAM) Sessions
Speaking - Group Discussion
Speaking - Narrating a story
Speaking – Compering, Welcome Address & Vote of Thanks

Text Books:
1. Jack C. Richards, "Interchange Student's Book 1", Cambridge University Press; Fourth Edition, 2015.
2. 2. S. N. Mahalakshmi, "Technical English for Engineers", V. K. Publications; Chennai, Eighth Edition, 2020.

References:

Reference Books:
1. Rizvi M.Ashraf, "Effective Technical Communication", Tata McGraw Hill Publishing Company; New Delhi, 2015.
2. Andrea J.Rutherfoord, "Pearson Education" Inc. and The Darling Kindersley Publishing Inc., 2020.
3. Raman, Meenakshi and Sharma, Sangeetha "Technical Communication Principles and Practice", 4. Oxford University Press; New Delhi, 2019.
4. Richards C. Jack, "Interchange", Fourth edition; Cambridge University Press, 2020.
5. Butterfield, Jeff, "Soft skills for Everyone", Sixth Indian Reprint, 2018.

Chairman – Board of Studies
Chairman – Board of Studies Engineering
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Coimbatore - 641 202.

Page | 29

Video References:

1. https://www.youtube.com/watch?v=tBtc6rpcMz4
2. https://www.youtube.com/watch?v=Ll23cChDSKE
3. https://www.youtube.com/watch?v=fyAtyAdCStM

Web References:

1. https://leo.stcloudstate.edu/grammar/subverag.html
2. http://www.learningdifferences.com/Main%20Page/Topics/Compound%20Word%20Lists/Compound_Word_%20Lists_complete.htm
3. http://examples.yourdictionary.com/examples-of-active-and-passive-voice.html
4. http://www.perfectyourenglish.com/grammar/numeral-adjectives.htm
5. https://en.wikipedia.org/wiki/Commonly_misspelled_English_words
6. https://www.englisch-hilfen.de/en/grammar/if.htm
7. http://www.englishforeveryone.org/Topics/Reading-Comprehension.htm

NPTEL /Online Courses:

1. https://www.udemy.com/topic/communication-skills/free/
2. https://www.bbc.co.uk/learningenglish/english/course/how-to-speak-english

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19HS151.1	Listen, Comprehend and Correspond with others in various contexts.	K3	9, 10, 12	-
R19HS151.2	Develop effective reading skills especially for academic purposes.	K3	9, 10, 12	-
R19HS151.3	Enhance Speaking skills with clarity and confidence to develop their employability skills.	K3	9, 10, 12	-
R19HS151.4	Compose letters, E-mails with proper structure.	K6	9, 10, 12	-
R19HS151.5	Illustrate clear and legible writing skills in error free style in a coherent manner.	K4	9, 10, 12	-
R19HS151.6	Choose the writing strategies and apply them in technical and workplace writing tasks.	K6	9, 10, 12	-
R19HS151.7	Apply reading skills to analyse, interpret and evaluate different genres of text.	K3	9, 10, 12	-
R19HS151.8	Analyse, infer and comprehend all kinds of academic discussions.	K4	9, 10, 12	-
R19HS151.9	Classify thoughts clearly and present orally using appropriate communicative and writing strategies.	K4	9, 10, 12	-
R19HS151.10	Discuss flawlessly by rehearsing various speaking models.	K6	9, 10, 12	-

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 30

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19HS151.1	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS151.2	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS151.3	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS151.4	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS151.5	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS151.6	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS151.7	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS151.8	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS151.9	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS151.10	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
Course to PO	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CY111	Chemistry Laboratory	L	T	P	C
		0	0	2	1

1. Course Description:

Engineering students can gain practical experience and understanding of chemical principles necessary for engineering practice which will help them to get exposed to fundamental laboratory procedures, improve their comprehension of chemical topics to build their critical thinking and problem-solving abilities.

2. Course Objectives:

1. To equip engineering students with precise measurement techniques, safe chemical handling, proper equipment usage, and adherence to experimental protocols.

2. Through hands-on experiments, reinforce theoretical concepts from lectures, providing practical insights into chemical phenomena, reactions, and properties.

3. To develop critical thinking through engaging in experimental design, data analysis, and problem-solving to apply scientific reasoning, identify errors, and address challenges, fostering a stronger grasp of the scientific method.

4. To cultivate teamwork by collaborating in group lab activities, enhancing communication, task delegation, and cooperation skills essential for success in engineering and beyond.

5. To prioritize safety protocols and hazard awareness to instill a safety-oriented mindset, ensuring responsible conduct and risk mitigation during experiments.

Chairman – Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 31

3. Syllabus:

List of Experiments:

1. Determination of total, permanent and temporary hardness of water by EDTA method.

2. Estimation of copper in brass by EDTA method.

3. Determination of alkalinity and TDS of water sample.

4. Estimation of chloride content in water by Argentometric method.

5. Determination of strength of acid by Conductometric titration (strong acid Vs strong base & strong base vs mixture of acids).

6. Determination of strength of given hydrochloric acid using pH meter.

7. Estimation of ferrous ion content of the given solution using Potentiometer.

8. Determination of do content of water sample by Winkler's method.

Text Books:

1. R.Rathinam.," Chemistry Lab Manual", Gems Publishers, 2019.

References:

1. Vogel's, "Text book of Quantitative Chemical Analysis", Pearson Publications, 2014.

2. Daniel C Harris, "Quantitative Chemical Analysis", W. H. Freeman and Company, New York, 7th Edition 2007.

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CY111.1	Analyse the role of water quality related parameters	K4	1, 2, 6, 7, 8, 9, 10, 12	-
R19CY111.2	Design the engineering materials against corrosion	K6	1, 2, 6, 7, 8, 9, 10, 12	-
R19CY111.3	Competent in applying the Argentometric method to precisely determine the chloride content in water, as well as in data analysis, laboratory procedures, and safety protocol observation.	K4	1, 2, 6, 7, 8, 9, 10, 12	-
R19CY111.4	Execute conductometric titrations and implement your understanding about the estimation of the substance from the given sample through data interpretation.	K4	1, 2, 6, 7, 8, 9, 10, 12	-
R19CY111.5	Implement the electrochemical methods to measure the concentration and amount of unknown chemical substances by validating the data using calibration techniques essential for quantitative analysis.	K4	1, 2, 6, 7, 8, 9, 10, 12	-

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CY111.1	1	1	-	-	-	1	1	1	1	1	-	1	-	-	-
R19CY111.2	1	1	-	-	-	1	1	1	1	1	-	1	-	-	-

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

Page | 32

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CY111.3	3	3	3	3	3	3	3	-	3	-	2	-	-	-	-
R19CY111.4	3	3	3	3	3	3	-	1	-	-	-	3	-	-	-
R19CY111.5	3	3	3	3	3	3	-	1	-	-	-	3	-	-	-
Course to PO	2	2	2	2	2	2	1	1	1	1	-	1	-	-	-

"3"—High, "2"—Medium, "1"—Low, "- "—No Correlation

R19GE111	Engineering Practices Laboratory	L	T	P	C
		0	0	4	2

1. Course Description:

The course encompasses a comprehensive set of practical modules aimed at providing hands-on experience in computer science, mechanical engineering, electrical engineering, and electronics. In Module I, students engage in computer assembly and disassembly, honing troubleshooting skills for both hardware and software issues. Module II delves into mechanical engineering practices, including plumbing, basic machining operations, and rapid prototyping with 3D printing. The exploration extends to the assembly of a centrifugal pump, hands-on exercises involving pump/motor submersible pump sets, and A/C refrigeration and air-conditioning systems. In Group B, Module III focuses on electrical engineering practices, involving UPS connections, domestic wiring, safety precautions, and the design of solar PV systems. Module IV, dedicated to electronics engineering practices, includes soldering techniques, a study of smartphone components, and practical projects in home automation. Through this multifaceted course, students gain a well-rounded understanding of essential skills in computer science, mechanical engineering, electrical engineering, and electronics, preparing them for diverse applications in the field.

2. Course Objectives:

1. To impart knowledge on computer assembling, disassembling and troubleshooting.

2. To provide exposure to the students with rapid prototyping with 3D printing, plumbing and basic machining operations.

3. To gain practical experience on UPS connections, domestic house wiring and solar PV system.

4. To expose the students to understand the home automation, smart phone operation and soldering and desoldering techniques.

3. Syllabus:

Group A (Computer Science & Mechanical)

Computer Science and Engineering Practices

Assembly & Disassembly

1.Identifying components of disassembling and assembling the PC

Troubleshooting

1. Basic H/W and S/W troubleshooting

Mechanical Engineering Practices

Plumbing

1.Construction of pipeline using fittings: joints, gate valves, taps, reducers; examine the functions of the plumbing tools.

2.Develop plumbing connection of a residential building involving minor troubleshooting

Basic Machining

1.Inspect the dimension of the given work piece after executing simple lathe operations

Rapid Prototyping

1.Additive Manufacturing of 3D component without support structure

2.Additive Manufacturing of 3D component with support structure

Demonstration only

Study and assemble/ maintenance the following:

1.Different types of pumps, Dynamic: Centrifugal pump, Submersible pump; Positive Displacement: Reciprocating Pump

2.Experimental learning on basic connections with minor troubleshooting of Refrigeration System.

3.Experimental learning on basic connections with minor troubleshooting of Air-Conditioning System.

Group B (Electrical & Electronics)

Electrical Engineering Practices

a) UPS Connection - Hands on exercise on basic electrical connections with UPS Connection

b) Domestic Wiring - Hands on exercise on basic domestic wiring

c) Safety Precautions - Hands on exercise on electrical earthing and safety precautions

d) Renewable Energy - Design of Solar PV System for Residence (Study)

Electronics Engineering Practices

a) Demonstrate proper soldering technique and Analyze the role of different components and equipment used in electronics.

b) Analyze smartphone component integration, design choices and their effects on performance.

c) Design a simple home automation projects and choose appropriate hardware and software components.

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19GE111.1	Perform the basic troubleshooting of the PC including assembly and disassembly.	K3	1, 2, 3, 6, 8, 9, 10	-
R19GE111.2	Identify minor plumbing troubleshooting in residential buildings and develop 3D component by additive manufacturing	K6	1, 2, 3, 6, 8, 9, 10	-
R19GE111.3	Inspect work piece after executing basic machining operations like turning, drilling & tapping and minor troubleshooting, maintenance task in an AC & pump/motor.	K4	1, 2, 3, 6, 8, 9, 10	-

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

Page | 34

CO		K3	1, 2, 3, 6, 8, 9, 10	-
R19GE111.4	Perform basic domestic wiring of a residential building with provision of inverter and safety measures and Design solar PV System for residence.	K3	1, 2, 3, 6, 8, 9, 10	-
R19GE111.5	Execute basic home automation projects.	K3	1, 2, 3, 6, 8, 9, 10	-

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19GE111.1	2	1	1	-	-	1	-	1	1	2	-	-	-	-	-
R19GE111.2	2	1	1	-	-	1	-	1	1	2	-	-	-	-	-
R19GE111.3	2	1	1	-	-	1	-	1	1	2	-	-	-	-	-
R19GE111.4	2	1	1	-	-	1	-	1	1	2	-	-	-	-	-
R19GE111.5	2	1	1	-	-	1	-	1	1	2	-	-	-	-	-
Course to PO	2	1	1	-	-	1	-	1	1	2	-	-	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS111	Problem Solving using C Laboratory	L	T	P	C
		0	0	4	2

1.Course Description:

The Problem-Solving Using C Laboratory is a practical course designed to complement theoretical knowledge with hands-on experience in programming using the C language. Through a series of laboratory sessions, students will delve into the basic concepts of C programming, including conditional and looping statements, modular programming and advanced topics such as pointers, arrays and structures. By actively engaging in coding exercises and projects, students will develop problem-solving skills, algorithmic thinking and proficiency in implementing efficient solutions to various computational problems.

2.Course Objectives:

1. To implement the basic concepts of C programming.
2. To learn to apply conditional and looping statements for different programming scenarios.
3. To understand the importance of modular programming.
4. To write programs with pointers, arrays, structures.

3.List of Laboratory Experiments / Exercises:

1. Develop flow charts and solve simple real-life or scientific or technical problems (Traffic signal control / Water level controller / Temperature control system / Automatic washing machine control system / Automatic Street light control system / Electricity Billing / Retail shop billing /Computing Electrical Current in Three Phase AC circuits) (Minimum 3 problems)

Chairman – Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 35

2. Implementation of applications of input and output statements. (Integer, char, Float, string input and output, ASCII value of character, User details)

3. Implementation operators and expressions (Centigrade to Fahrenheit, Quotient and Remainder, Kilometres per hour to miles per hour, Hour and Minutes, Profit Calculator)

4. Implementation of real-time applications using conditional statements. (Vowel or Consonant, Eligible for casting vote, Leap year or not, Display the description for the given grade, Display number of days in a month, Calculator, Triangle type, Roots of a quadratic equation)

5. Implementation of technical applications using iterative loops (Display first N natural numbers, Read N numbers and find their sum and average, find cube of the number upto a given integer, Multiplication table, Sum of N natural numbers, Sum of N natural odd numbers, Pattern printing)

6. Implementation of one-dimensional array (Display the array elements, Elements in reverse order, Sum of array elements, make a copy of array elements, Maximum and minimum, odd sum and even sum)

7. Implementation of two dimensional and multi-dimensional array (sum, subtraction, transpose, multiplication, frequency of even numbers, print diagonals, sum of diagonal elements, compare)

8. Implementation of Functions in the program (Factorial, largest number, area of shape, sum of digits, prime number or not)

9. Implementation of real time applications using recursion (factorial, Fibonacci series, count digits of number, length of string, prime or not, GCD, sum of all digits, palindrome)

10. Implementation of pointer in applications (swap two numbers, print string, read array elements, double pointer, find maximum number, palindrome, reverse array, dynamic memory allocation)

11. Implementation of strings handling functions with and without library functions (compare two strings, reverse, concatenate, copy, palindrome, count number of character, number of words, find, replace)

12. Implementation of file-handling operations (read, write, append file, compare two files, read student details and store into files)

13. Implementations of Structure in real time applications (Accept & display employee details, Calculate total payment of workers, Library operations, Menu driven program for employee structure)

14. Implementations of Union in programs (Accept & display employee details, Calculate total payment of workers, Library operations, Menu driven program for employee structure)

15. Mini Project: Develop an application for any real-world problem

References:

1. Herbert Schildt, "C – The Complete Reference", Tata McGraw Hill Publishing Company, New Delhi, 2017.

2. Kernighan B. W. and Ritchie D. M., "C Programming Language (ANSI C)", Prentice Hall of India Private Limited, New Delhi, 2010.

3. Deitel and Deitel, "C How to Program", Pearson Education, New Delhi, 2011.

4. Simple Program Design: A Step-by-Step Approach, Fifth Edition by Lesley Anne Robertson.

5. https://www.udemy.com/course/c-programming-2019-master-the-basics

6. https://www.tutorialspoint.com/cprogramming

Chairman – Board of Studies
Department of Computer Science and Engineering
Chairman – Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 36

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS111.1	Demonstrate the ability to identify, define, and analyze complex problems using appropriate algorithms, data structures, methodologies and	K3	1, 2, 3, 4, 5, 8, 9, 10, 11, 12	1, 2, 3
R19CS111.2	Design effective visual representations (UML diagrams/Flowchart) to solve the identified problems	K3	1, 2, 3, 4, 5, 8, 9, 10, 11, 12	1, 2, 3
R19CS111.3	Create solutions and implement them using suitable programming platforms	K6	1, 2, 3, 4, 5, 8, 9, 10, 11, 12	1, 2, 3
R19CS111.4	Develop effective presentation skills to present and defend the designs and solution	K4	1, 2, 3, 4, 5, 8, 9, 10, 11, 12	1, 2, 3
R19CS111.5	Understand issues related to privacy, security and accessibility and adhere to coding standards	K2	1, 2, 3, 4, 5, 8, 9, 10, 11, 12	1, 2, 3

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS111.1	3	3	3	2	2	-	-	2	1	1	1	3	2	1	1
R19CS111.2	3	3	3	2	2	-	-	2	1	1	1	3	2	1	1
R19CS111.3	3	3	3	2	2	-	-	2	1	1	1	3	2	1	1
R19CS111.4	3	3	3	2	2	-	-	2	1	1	1	3	2	1	1
R19CS111.5	3	3	3	2	2	-	-	2	1	1	1	3	2	1	1
Course to PO	3	3	3	2	2	-	-	2	1	1	1	3	2	1	1

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19EM101	Soft Skills	L	T	P	C
		0	0	2	1

1. Course Description:

This course aims to equip engineering students with essential soft skills that are integral for their holistic development. It is designed to enhance their basic language proficiency through comprehensive exercises, fostering a positive behavioral approach in daily activities, and instilling social awareness to encourage empathy and inclusivity in their interactions. Furthermore, it seeks to cultivate a teamwork mindset among students through collaborative projects and activities, emphasizing the value of synergy and cooperation. Lastly, this course endeavours to eradicate stage fear by providing practical techniques and opportunities for public speaking, thereby empowering students to communicate confidently and effectively in professional settings.

2. Course Objectives:

1. Enhance basic language skills for fresher's
2. Inculcate positive behavior in daily activities
3. Bring Social awareness among fresher's

Chairman – Board of Studies
Chairman – Board of Studies and Engineering
Department of Computer Science and Engineering
Sreeshwar College of Engineering (Autonomous)
Karathukadavu, Coimbatore – 641202.

Page | 37

4. Create a team work awareness among students
5. Eradicate stage fear among the students

3. Syllabus:

Unit-I: Behavioural Session, Goal Setting, Power Dressing

Behavioural session – Regarding interview and Life Skills a practical session is hosted for the students for how they should carry themselves in today's society and how to meet up the company's expectations

Goal Setting– Activities and goal establishment psychology classes are conducted for the students to improve their short term and long-term goals (A Goal Sheet is prepared)

Power Dressing – Perking up their dressing style

Unit-II: Language proficiency, communication building

Language proficiency – Neutral accent refinement speaking classes for students

Communication building- Multi tasking activities for communication building

Unit-III: Lexicon Building, Body Language, Story Building

Lexicon Building – (Speaking session)

Body Language – (Demo and practical session)

Story Building – (Activity)

Unit-IV: Team Building, Outdoor Speech

Team Building - Activity

Outdoor Speech – Basic Topic(Change of environment)

Unit-V: Outdoor journalism

Outdoor journalism – (Activity)

References:

Reference Books:

1. Norman Lewis, "Word power made easy"
2. Sylvia Reyes, " Team Building: The Ultimate Guide to Build & Manage Winning Teams", MC Grawhill, I
3. Dan Clay,How to write the perfect resume
4. Tyler Hayden," Communication Activities: A Team Building Activity Book"
5. Ian Tuhovsky, "Communication Skills Training: A Practical Guide to Improving Your Social Intelligence, Presentation, Persuasion and Public Speaking (Positive Psychology Coaching Series Book 9)"

Video Reference:

1. https://youtube.com/playlist?list=PLLy_2iUCG87CQhELCytvXh0E_ybOO1_q&feature=shared
2. https://youtube.com/playlist?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ&feature=shared
3. https://m.youtube.com/watch?feature=shared&v=DUlsNJtg2L8

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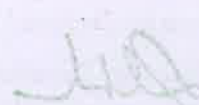
4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19EM751.1	Apply the basic personality traits in social activity for future working environment	K3	1, 2, 3, 6	-
R19EM751.2	Apply receptiveness and get customized to today's corporate world	K3	1, 2, 3, 9	-
R19EM751.3	Analyze and mingle with different types of people to overcome and eradicate fear	K4	1, 2, 3, 9	-
R19EM751.4	Create a team environment in the classroom to measure their individual team player skills	K6	1, 2, 3, 9	-
R19EM751.5	Create a vivid vision about their behavior and discipline in future and through which the can measure themselves in socializing	K6	1, 2, 3,12	-
R19EM751.6	Apply the conveyance methodologies in linguistics for future professional client handling	K3	1,2, 3,10	-

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19EM751.1	3	3	2	-	-	3	-	-	-	-	-	1	-	-	-
R19EM751.2	3	3	2	-	-	-	-	-	3	-	-	1	-	-	-
R19EM751.3	3	3	2	-	-	-	-	-	3	-	-	1	-	-	-
R19EM751.4	3	3	2	-	-	-	-	-	3	-	-	1	-	-	-
R19EM751.5	3	3	2	-	-	-	-	-	-	-	-	3	-	-	-
Course to PO	3	3	2	-	-	-	-	-	2	-	-	1	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19HS551	Business English	L	T	P	C
		3	0	0	3

1. Course Description:

This course is designed to develop a complete view of Communication, its scope and importance to the learners. The Learners will be introduced to a range of situations, which will enhance their understanding of the Communication Process and develop their Practical Skills in Listening, Speaking, Reading and Writing. Further, this course will enable the learners to plan for effective presentation by gathering relevant information, determining audience needs, and defining presentation purpose.

2. Course Objectives:

1. Develop strategies and skills to enhance their ability to read and comprehend Engineering and technology texts.
2. Strengthen their listening skills which will help them to comprehend lectures and talks in their areas of specialization.
3. Develop their speaking skills to make technical presentations.
4. Foster their ability to write convincing job applications and effective reports.
5. Build their confidence to participate in Group discussion.

3. Syllabus:

Unit-I: Types of Conversation

Reading: Reading for Information

Writing: Checklists, Process Description

Grammar: Regular and Irregular Verbs, Discourse Markers, Single Word Substitute

Unit-II: Listening Comprehension

Reading: Reading Longer Texts and Practicing Speed Reading

Writing: Job Application with Resume, Autobiographical Writing

Grammar: If Conditionals, Active and Passive Voice

Unit-III: Presentation Skills

Reading: Reading Business Plans and Reports

Writing: Memorandum, Circular, Notice, Agenda, Minutes of Meeting

Grammar: Degrees of Comparison, Numerical Adjectives.

Unit-IV: Report Writing

Reading: Descriptive and Narrative Passages

Writing: Report Writing, Types of Reports - Feasibility, Accidental and Incident Report

Grammar: Using Idioms in Sentences, Simple, Compound and Complex Sentences.

Unit-V: Interview Skills

Reading: Intensive & Extensive Reading, Note-Making

Writing: Preparing Technical Proposals

Grammar: Extended Definitions - Reported Speech - Embedded Sentences.

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Page | 40

List of Experiments:

Listening: Listening Comprehension and Answering

Speaking: Conversation Building

Listening: Listening to Various Technical Talks and Summarizing

Speaking: Describing a Process

Listening: Listening to Class Room Lectures and Seminars – Preparing Hints

Speaking: Process Description for a new product

Listening: Listening and Note taking practice

Speaking: Techniques to develop effective Presentation – Oral Presentation

Listening: Listening to Foreign Speakers and interpreting promptly

Speaking: Reviews (Books, Novels & Movies)- Technical Presentation

Text Books:

1. Jack C. Richards, "Interchange Student's Book 1", Cambridge University Press; Fourth Edition, 2015.
2. S. N. Mahalakshmi, "Technical English for Engineers", V. K. Publications; Chennai, Eighth Edition, 2020.

References:

Reference Books:

1. Rizvi M.Ashraf, "Effective Technical Communication". Tata McGraw Hill Publishing Company; New Delhi, 2015.
2. Andrea J.Rutherfoord, "Pearson Education" Inc. and The Darling Kindersley Publishing Inc., 2020.
3. Raman, Meenakshi and Sharma, Sangeetha "Technical Communication Principles and Practice", Oxford University Press; New Delhi, 2019.
4. Richards C. Jack, "Interchange", Fourth edition; Cambridge University Press, 2020.
5. Butterfield, Jeff, "Soft skills for Everyone", Sixth Indian Reprint, 2018.

Video References:

1. https://www.youtube.com/watch?v=tBtc6rpcMz4
2. https://www.youtube.com/watch?v=Ll23cChDSKE
3. https://www.youtube.com/watch?v=fyAtyAdCStM

Web References:

1. https://leo.stcloudstate.edu/grammar/subverag.html
2. http://www.learningdifferences.com/Main%20Page/Topics/Compound%20Word%20Lists/Compound_Word_%20Lists_complete.htm
3. http://examples.yourdictionary.com/examples-of-active-and-passive-voice.html
4. http://www.perfectyourenglish.com/grammar/numeral-adjectives.htm
5. https://en.wikipedia.org/wiki/Commonly_misspelled_English_words
6. https://www.englisch-hilfen.de/en/grammar/if.htm
7. http://www.englishforeveryone.org/Topics/Reading-Comprehension.htm

NPTEL /ONLINE COURSES:

1. https://onlinecourses.NPTEL /Online Courses:.ac.in/noc22_hs05/preview
2. https://onlinecourses.NPTEL /Online Courses:.ac.in/noc23_hs72/preview

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Page | 41

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19HS551.1	Apply different conversation techniques in day-to-day communication.	K3	9, 10, 12	-
R19HS551.2	Practice effective listening techniques during conversations.	K3	9, 10, 12	-
R19HS551.3	Develop effective presentation skills.	K3	9, 10, 12	-
R19HS551.4	Compose technical and non – technical reports.	K6	9, 10, 12	-
R19HS551.5	Discover an advantageous position in various employment contexts.	K4	9, 10, 12	-
R19HS551.6	Take part in speaking and writing convincingly, using appropriate communicative and effective writing strategies.	K4	9, 10, 12	-
R19HS551.7	Examine different genres of texts, infer implied meanings and critically analyses and evaluate all spoken and written discourses.	K4	9, 10, 12	-
R19HS551.8	Construct drafts with clear articulation of fluency and accuracy.	K6	9, 10, 12	-
R19HS551.9	Develop critical ideas and logical conclusions utilizing appropriate grammatical structures, digital literacy tools and textual traits in business writing.	K6	9, 10, 12	-
R19HS551.10	Discover right pronunciation and accent by listening to a variety of speeches.	K4	9, 10, 12	-

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19HS551.1	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS551.2	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS551.3	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS551.4	-	-	-	1	-	-	-	-	2	3	-	2	-	-	-
R19HS551.5	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS551.6	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS551.7	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS551.8	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS551.9	-	-	-	1	-	-	-	-	2	3	-	2	-	-	-
R19HS551.10	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
Course to PO	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

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R19HS184	Basic Japanese	L	T	P	C
		2	0	2	3

1. Course Description:

The primary objective of this course is to provide a solid foundation in speaking, listening, reading, and writing Japanese. Through interactive lessons and practical exercises, you'll learn essential vocabulary, grammar structures, and pronunciation. Additionally this course will introduce the various facets of the Japanese culture with cultural insights and real-life scenarios, thereby enhancing their awareness of the cultural subtleties inherent in the language.

2. Course Objectives:

1. Develop proficiency in basic Japanese language skills including speaking, listening and reading and writing to facilitate effective communication in everyday situations

2. Acquire a solid understanding of the fundamental Japanese grammar structures, vocabularies and pronunciations to construct simple sentences and engage in basic conversations

3. Enhance language proficiency through interactive activities, role-plays and rea-life scenarios, fostering practical language usage and confidence in communication

4. Build a foundation for further language study and cultural exploration, enabling the students to pursue advanced language proficiency and deeper cultural understanding

3. Syllabus:

Unit-I: Introduction to Japanese Scripts and Basic Greetings

Japanese Scripts (Hiragana & Katakana) – Daily greetings and expressions – Introduction to grammar particles – N_1 wa N_2 desu - N_1 wa N_2 ja arimasen – Phrase/Sentence ka – N_1 mo N_2 desu - N_1 no N_2 desu – Honorific suffixes (san, kun, chan) – Demonstrative words (Ko, So, A & Do series) – Soudesu – Soudesuka – Soudesune – Sou ja arimasen/Chigaimasu – S_1 ka S_2 ka - N_1(noun) wa N_2(place) desu – Numbers – Days of the week – Days of the month

Unit-II: introduction to concept of time

Ji, fun, pun – Ima wa nan ji desuka – Introduction to verbs (group I, group II, group III verbs) – Verb tense forms – V masu – V mashita – V masen – V masendeshita – N(time) ni V - N_1 kara N_2 made - N_1 to N_2 – N to V – S ne – N(place) e ikimasu/kimasu/kaerimasu – Doko(e) mo ikimasen/ikimasendeshita – itsu – S yo - Introduction to de particle – N(place) de V – N(vehicle) de ikimasu/kimasu/kaerimasu – N(tool) de V – N o V(transitive) – N o Shimasu – Usage of nan and nani – V masenka – V mashou, mashouka – Honorific prefixes(o/go) – "word/sentence" wa ~go de nan desuka – N(person) ni agemasu/moraimasu/kuremasu – V mou mashita.

Unit-III: Introduction to Adjectives

I ending adjectives – na ending adjectives – forms of adjectives(negative form, past form) – I ending adjective →ku/Na ending adjective→ni narimasu – degrees of adjectives – S_1 ga S_2 – N ga adjective – N ga arimasu/wakarimasu – degrees of adverbs – degrees of quantity – S_1 kara S_2 – Doushite – N_1(place) ni N_2(noun) ga arimasu – N_1(noun) wa N_2(place) ni arimasu/imasu – N_1(noun) no N_2(position) – N_1 ya N_2 nado.

Unit-IV: Introduction to Counters

Counters for objects – Counters for person – Ikutsu – nan+counter suffix – kurai and gurai – Quantifier(period) ti frequency counter(kai) – Quantifier/Noun+dake - N_1 wa N_2 yori

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Page | 43

"adjective" desu - N₁ to N₂ to Dochira ga "adjective" desuka – N no naka de nani/doko/dare/itsu ga "adjective" desuka – Interrogatives ka/mo/demo.

Unit-V: Verb Conjugations and Their Usages

5.1: V masu form and its usages

N ga hoshii desu – V masu form tai desu – V masu form ni ikimasu/kimasu/kaerimasu – V masu form mashouka.

5.2: V te form and its usages

V te form kudasai – V te form imasu – V te form mo iidesu – V te form wa ikimasen – shirimasu,

shirimasen, shitte imasu – te form of adjectives – V1 te form kara V2 – douyatte – V te form agemasu/kuremasu/moraimasu

5.3: V nai form and its usages

V nai form de kudasai – V nai form kereba narimasen – V nai form to – V nai form kutemo iidesu – N(time) madeni V.

5.4: V dictionary form and its usages

V dictionary form koto ga dekimasu – Shumi wa N suru/V dictionary form koto desu – N no/Quantifier(time)/V1 dictionary form maeni V2 – nakanaka – zehi/zettai/mochiron – V dictionary form jikan/youji/yakusoku.

5.5: V ta form and its usages

V ta form koto ga arimasu – V ta ri, V ta ri Shimasu – usage of plain form and polite form – kedo – noun modification using V plain form – V plain form/N no toki ~.

5.6: If clause

V dictionary form to~ - V ta form ra~ - V te form/I adj→kute/Na adj→de/N de mo~ - moshi/ikura~.

Total: 30 (Theory) + 30 (Practical) Hours

Text Books:

1. Minna no Nihongo, Japanese for Everyone: Elementay main textbook 1-1 & 1-2". 1st edition, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.
2. "Basic Kanji 320", published by Meguro Language Centre, Tokyo.

Reference Books:

1. "Genki: An Integrated course in elementary Japanese" authored by Eri Banno, Yoko Ikeda, and Yutaka Ohno, latest edition published in 2011 by The Japan Times.
2. "Nihongo So-matome: JLPT N5 grammar" authored and published by Ask Publications, latest edition 2021.

Web Resources:

1. www.japaneselifestyle.com
2. www.learn-japanese.info/
3. www.kanjisite.com/
4. www.learn-hiragana-katakana.com/typing-hiragana-characters/

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Page | 44

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19HS184.1	Recognize and write the Japanese alphabets without errors	K2	9,10,12	-
R19HS184.2	Extend the conversation using basic sounds in the Japanese language	K2	9,10,12	-
R19HS184.3	Explain the concept of time by learning verbs, tenses and vocabularies.	K3	9,10,12	-
R19HS184.4	Make use of the appropriate vocabularies required for simple conversations in Japanese language.	K3	9,10,12	-
R19HS184.5	Comprehend the conversation and give the correct meaning	K3	9,10,12	-
R19HS184.6	Develop the ability to accurately pronounce the Japanese sounds, syllables and vocabularie through guided pronunciation exercises and feedback.	K3	9,10,12	-
R19HS184.7	Enhance the students ability to understand spoken Japanese through exposure to various audio materials including dialouges, interviews and recordings of native speakers.	K3	9,10,12	-
R19HS184.8	Develop their reading skills in Japanese by engaging with written texts such as articles, short stories, and excerpts from newspapers or books.	K3	9,10,12	-
R19HS184.9	Improve their Japanese writing skills by completing writing assignments, such as essays, journal entries, and compositions.	K3	9,10,12	-
R19HS184.10	Learn to utilize digital tools and resources effectively for language learning, including online dictionaries, language learning apps, and interactive multimedia materials	K3	9,10,12	-

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19HS184.1	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS184.2	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS184.3	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS184.4	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS184.5	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS184.6	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS184.7	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS184.8	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS184.9	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19HS184.10	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
Course to PO	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19HS185	BASIC GERMAN	L	T	P	C
		2	0	2	3

1. Course Description:

To acquire fundamental proficiency in basic German language skills, enabling effective communication in common everyday situations and laying the groundwork for further language learning and cultural exploration.

2. Course Objectives:

1. Basic German introduces learners to essential language components such as vocabulary, grammar, pronunciation, and basic conversational phrases.

2. Through interactive lessons and practical exercises, students develop the ability to communicate in basic German for everyday scenarios including greetings, introductions, shopping, dining, and navigating daily life situations.

3. Additionally, learners become familiar with the German alphabet, basic sentence structure, and common expressions, facilitating basic reading and writing skills.

3. Syllabus

Unit-I: Basic Introduction to German Scripts

Theme and Text (Introduction to German - German script, Deutsche Namen, Daily Greetings and Expressions) – Grammar ('wh' questions, das Alphabet)– Speak Action (Buchstabieren, sich und andere vorstellen nach Namen und Herkunft fragen, internationale Wörter auf Deutsch verstehen, jemanden begrüßen)– pronunciation (Buchstabieren J,V,W,Y, - Long vowels A,E,I,O,U - Pronunciation of Ä,Ü,Ö) – To learn (internationale Wörter in Texten finden, Wörter sortieren)

Theme and Text (Gespräche im caf'e, Getränkekarte, Telefon-buch, Namen, Rechnungen) – Grammar (Frägesatze mit wie, woher, wo, was Verben in präsens Singular und Plural, das Verb Sein, Personalpronomen und Verben)– Speak Action (eine Gespräch beginnen sich und andere vorstellen zählen, etwas bestellen und bezhalen Telefonnummern und verstehen)– pronunciation (Wortakzent in Verben und in Zahlen) – To learn (Grammatiktabelle ergänzen, mit einem Redemittelkasten arbeiten)

Unit-II: Numbers and Nominative Case

Theme and Text (Numbers – 1 to 12 (Eins bis Zwolf) – 20, 30, 40, 90 (zwanzig-Neunzig) – All Numbers (1-10000) – German Currency (Euro) – Basic Mathematics (plus, Minus, Malen, Geteilt durch)) – Grammar (Introduction of verbs –Have Verb – To Come, To Speak, To Read, To Drive, To Fly, To write, To Eat, To sleep, To take etc.,)

Theme and Text (Communication in course) – Grammar (Singular and Plural, Artikel: der,das,die/ ein,eine, verneinung: kein, keine, Komposita: das Kursbuch) – Speak Action (Gegenstände fragen/ Gegenstände benennen im kurs:) – pronunciation (word accent Marking,

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Department of Computer Science and Engineering
Chairman – Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 46

Umlaute ö ä ü hören und sprechen) – To learn (Lernkarten schreiben, Memotipps, eine Regel selbst finden)

Theme and Text (City, Town, Language: Nachbar, Sprachen, Sehenswürdigkeiten in Europa) – Grammar (Past tense for Sein, W-Frage, Aussagesatz und Satzfrage) – Speak Action (about city and siteseeing) – pronunciation (Satzakzent in Frage- und Aussagesätzen) – To learn (eine Regel ergänzen, eine Grammatiktabelle erarbeiten, Notizen machen)

Unit-III: Akkusative Case and Prepositions

Theme and Text (Menschen und Hauser, Furniture catalogue, E-Mail, House information) – Grammar (possesivartikel im Nominativ, Artikel im Akkusativ, Adjektive im satz, Graduierung mit zu)– Speak Action (Whonung bescreiben about perons and things)– pronunciation (consonant - ch) – To learn (wortschatz systematisch)

Theme and Text (Termine - Appointment and punctuality in Germany) – Grammar (questions with wann?, Preposition (am, um, von... bis), verneinung mit nicht, trennbare verben, präteritum von haben) – Speak Action (Daily plan making, time commitment, excuse for late coming) – pronunciation (consonants- p,b,t,d / k,g) – To learn (Rollenkarten arbeiten)

Theme and Text (orientation in working area, go for work, floor plan city plan, office and computer) – Grammar (preposition: in,neben, unter, auf, vor, hinter, an, zwischen, bei und mit + Datic)– Speak Action (work place, work, giving appointments)– pronunciation (consonants: f,w und v) – To learn (Making notice in calender)

Unit-IV: Dativ Case and Prepositions

Theme and Text (Holiday and Party, holiday plan, party plan in Germany) – Grammar (regular and iregular verbs) – Speak Action (holiday speak, accident, Ich-Text schreiben) – pronunciation (lange und kurze vokale markieren) – To learn (Text Order)

Theme and Text (organising an Excursion to Berlin through city orientation, Bus plan, City plan, post card, Excursion programme) – Grammar (preposition: in, durch, über + Akkusativ: zu, an... vorbei + Dativ, Modalverb wollen) – Speak Action (Tourism, culture, postcard preparation, travel description) – pronunciation (r and l)– To learn (plaket making)

Theme and Text (Beruf und all Tag, Visiten karten, wörterbuch) – Grammar – Speak Action (profession, statistic speaking) – pronunciation (n,ng and nk)– To learn (wörterbuch , text information in tabel)

Unit-V: Adjectives and Pronunciation

Theme and Text (Haushaltstipp, kochrezept, maße und gewichte, Mahlzeiten und Gerichte) – Grammar (jeden Tag, manchmal, nie, Question - welche, Comparison – viel, gut, gern) – Speak Action (about eat, drink question and answers) – pronunciation (e,en,el,er) – To learn (Text auswerten und zusammenfassen)

Theme and Text (Clothing , colour, weather) – Grammar (Adjecktive im Akkusativ, unbestimmer Artikel) – Speak Action (weather, dress and colour understanding) – pronunciation (e-o- ö and ie-u- ü) – To learn (wetter and Farben interkulturelle)

Theme and Text (in super market,purchase, House Maintainence, Emotion, Sports, Body parts) – Grammar (Modal Verb) – Speak Action (Body parts) – To learn (Rollenkarten arbeiten)

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Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore - 641 202.

Page | 47

Text Books:

1. Funk, Kuhn, Demme, "Studio D A1 Deutsch als Fremdsprache" Goyal Publishers and Distributors; 2016
2. Hueber, "Fit for Goethe- Zertifikat A1 (Start Deutsch 1)" Goyal Publishers and Distributors; 2016

References

Reference Books:

1. Stefanie Dengler, "Netzwerk Deutsch Als Fremdsprache A1" by Goyal Publishers & Distributors Pvt Ltd;
2. Fran Martin, "Grammar Tables for Student of German" by Independently Published, 2017

Web Resources:

1. www.memrise.com/courses/english/german/
2. www.deutsch-lernen.com/
3. www.duolingo.com

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19HS185.1	Recognize and write the German alphabet	K2	9, 10, 12	-
R19HS185.2	Speak using basic sounds of the German language	K2	9, 10, 12	-
R19HS185.3	Apply appropriate vocabulary needed for simple conversation in the German language	K3	9, 10, 12	-
R19HS185.4	Apply appropriate grammar to write and speak in the German language	K3	9, 10, 12	-
R19HS185.5	Comprehend the conversation and give the correct meaning	K3	9, 10, 12	-
R19HS185.6	Improve speaking skills in German by practicing pronunciation, intonation, and conversational fluency through interactive exercises, role-plays, and speaking tasks.	K3	9, 10, 12	-
R19HS185.7	Develop listening comprehension skills in German by accurately understanding spoken language at a beginner level, including dialogues, short passages, and audio recordings.	K3	9, 10, 12	-
R19HS185.8	Enhance students reading comprehension skills in German by reading and understanding simple texts, such as short stories, advertisements and extracting key information.	K3	9, 10, 12	-
R19HS185.9	Improve students writing skills in German by composing short texts, such as emails, letters, and simple narratives, using appropriate vocabulary, grammar, and sentence structures.	K3	9, 10, 12	-
R19HS185.10	Cultivate effective strategies for independent language learning, including vocabulary acquisition, grammar study, self-assessment, and utilizing resources such as dictionaries, language learning software, and online materials.	K3	9, 10, 12	-

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 48

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 02
R19HS185.1	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS185.2	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS185.3	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS185.4	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS185.5	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS185.5	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS185.5	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS185.5	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS185.5	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
R19HS185.5	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-
Course to PO	-	-	-	-	-	-	-	-	2	3	-	2	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19MA102	Advanced Calculus and Complex Variables	L	T	P	C
		3	1	0	4

1. Course Description:

Calculus and Complex Variables is a foundational course that combines two important branches of mathematics which deals with the study of rates of change and accumulation, and complex variables, which extends the concepts of real numbers to the complex plane. This course provides students with a rigorous understanding of calculus principles and techniques including derivatives, integrals and applications as well as an introduction to complex numbers, functions, differentiation, and integration in the complex plane.

2. Course Objectives:

1. To study vector calculus which can be widely used for modeling the various laws of physics.
2. To acquire knowledge in analytical functions and to construct the analytic functions.
3. The various methods of complex analysis can be used for efficiently solving the problems.
4. To impart the knowledge of Laplace transform in solving differential equations.
5. To study the ordinary differential equations and their applications.

3. Syllabus

Unit-I: Vector Calculus

Gradient and directional derivative; Divergence and curl; Irrotational and solenoidal vector fields; Integral Theorems: Green's theorem in a plane, Gauss divergence theorem, Stoke's theorem(excluding proofs), Verification of theorem and applications (for cubes and rectangular parallelepipeds).

Chairman - Board of Studies
Chairman – Board of Studies and Engineering
Department of Computer Science and Engineering
Sreeshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Unit-II: Complex Differentiation

Analytic functions: Cauchy-Riemann equations (excluding proof), Properties of analytic function, Harmonic conjugate; Construction of analytic function by Milne Thomson method, Bilinear transformation.

Unit-III: Complex Integration

Cauchy's integral theorem, Cauchy's integral formula, Cauchy's integral formula for derivatives, Cauchy residue theorem; Taylor's and Laurent's series; Contour integral in unit circle and semi-circle (Excluding poles on real axis).

Unit-IV: Laplace Transforms

Existence conditions, Properties (excluding proofs), Transform of elementary and special functions, Transforms of derivatives and integrals; Periodic function; Inverse Laplace transform; Applications to solution of linear second order ordinary differential equations with constant coefficients.

Unit-V: Ordinary Differential Equations

Higher order linear differential equations with constant coefficients; Cauchy's and Legendre's linear differential equations; Method of variation of parameters; Application of ordinary differential equations in simple harmonic motion and basic elements of electrical circuits.

Text Books:

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publications, Forty Fourth Edition, 2015.
2. Monty J. Strauss, Gerald J. Bradley and Karl J. Smith," Calculus", 3rd Edition, 2002.

References:

References Books:

1. Erwin Kreyszig, "Advanced Modern Engineering Mathematics", John Wiley and Sons (Asia) Ltd, Tenth Edition, 2017.
2. Bali N. P and Manish Goyal," A Textbook of Engineering Mathematics", Laxmi Publication, Eighth Edition, 2011.
3. Jain R.K. and Iyengar S.R.K, "Advanced Engineering Mathematics", Naros Publications, Third Edition, 2007.

Journals:

1. Handbook of Differential Equations: Ordinary Differential Equations.
2. Abstract and Applied Analysis.

Video References:

1. https://www.youtube.com/watch?v=NG9hkGQwT3k
2. https://www.youtube.com/watch?v=CogfMjKUGc0
3. http://videolectures.net/mit1803s06_mattuck_lec19/
4. http://freevideolectures.com/Course/3244/Advanced-Engineering-Mathematics/12
5. https://www.youtube.com/watch?v=OUbMX4eQ5oM

NPTEL /Online Courses:

1. http://NPTEL /Online Courses:.ac.in/courses/111105035/22

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

Page | 50

2. http://NPTEL /Online Courses:.ac.in/courses/111108081/

3. http://NPTEL /Online Courses:.ac.in/courses/122102004/2

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19MA102.1	Compare the ideas of vector integral theorems for solving given problems and exhibit the relation between them	K3	1, 2, 3, 4, 12	-
R19MA102.2	Make use of Milne Thomson method to construct analytic functions related to complex variable.	K3	1, 2, 3, 4, 12	-
R19MA102.3	Apply the concepts of integration for complex functions in certain regions to determine real integrals.	K3	1, 2, 3, 4, 12	-
R19MA102.4	Apply Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.	K3	1, 2, 3, 4, 12	-
R19MA102.5	Apply various techniques in solving differential equations.	K3	1, 2, 3, 4, 12	-

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19MA102.1	3	3	2	2	-	-	-	-	-	-	-	2	-	-	-
R19MA102.2	3	3	1	1	-	-	-	-	-	-	-	2	-	-	-
R19MA102.3	3	3	2	2	-	-	-	-	-	-	-	2	-	-	-
R19MA102.4	3	3	2	1	-	-	-	-	-	-	-	2	-	-	-
R19MA102.5	3	3	1	1	-	-	-	-	-	-	-	2	-	-	-
Course to PO	3	3	2	1	-	-	-	-	-	-	-	2	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19PH201	Physics for Information Science	L	T	P	C
		3	0	0	3

1. Course Description:

Physics for information science is a fundamental course designed to provide engineering students with a strong foundation in the field of crystal structures, semiconductors, magnetic as well as superconducting materials and their applications in the realm of information science to cater the need of non-circuit branch students to realize the feasible solutions involving latest technologies and related services.

2. Course Objectives:

1. To study about crystal growth techniques and crystal structures.
2. To study the electrical and superconductivity of materials.
3. To study the basics of semiconducting and magnetic properties of materials and their engineering applications.

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641202.

Page | 51

4. To study about the performance of modern optoelectronic materials and their engineering applications.

3. Syllabus

Unit-I: Crystal Structure and Crystal Growth

Single crystalline, polycrystalline and amorphous materials, unit cell, crystal systems, Bravais lattices; Miller indices: directions and planes in a crystal, Interplanar distance for a cubic crystal; Coordination number and packing factor for SC, BCC, FCC, HCP structures; Growth of single crystals: Bridgman, Czochralski methods.

Unit-II: Introduction to Solid State

Classical free electron theory: Fermi-Dirac distribution function; Density of energy states; Expression for electrical conductivity, Thermal conductivity, Wiedemann-Franz law, Success and failures; Electrical resistivity of materials: Classification; Superconductors: properties and applications of superconductors.

Unit-III: Review of Semiconductor Physics

Elemental and Compound semiconductors; Intrinsic semiconductor: Carrier concentration derivation, Fermi level, variation of Fermi level with temperature, electrical conductivity, band gap determination; Extrinsic semiconductors: Carrier concentration derivation in n-type and p-type semiconductor, variation of Fermi level with temperature, impurity concentration; Hall effect: Determination of Hall Coefficient, applications.

Unit-IV: Magnetic Properties and Data Storage

Origin of magnetic moment, Bohr magneton; Properties of dia, para, ferro, antiferro magnetic materials; Ferromagnetism: Domain theory of Ferromagnetism, different types of energies involved in the domain growth, Hysteresis , Hard and soft magnetic materials, applications; Magnetic semiconductors, Magnetic principle in computer data storage, Magnetic hard disc (GMR sensor).

Unit-V: Modern Optoelectronic Devices

Quantum dot lasers; Photo-transistors; Photodiodes: PIN diodes; APDs; Opto-electronic switches; Solar cells; CCDs; Optoelectronic integrated circuits.

Lab Components for Assignments/Tutorials

Text Books

1. Kasap, S.O., "Principles of Electronic Materials and Devices", McGraw-Hill Education, 2007.

2. Umesh K Mishra and Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2008.

3. Wahab, M.A., "Solid State Physics: Structure and Properties of Materials", Narosa Publishing House, 2009.

References:

Reference Books:

1. Halliday, D. Resnick, R. and Walker. J, "Principles of Physics", Wiley, 2015.
2. Avathanulu, M.N. and Kshirsagar, P.G., "Engineering Physics", S. Chand and company, 2014.
3. Arthur Beiser, "Concepts of Modern Physics", Tata McGraw Hill, 2009.

Chairman – Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 52

4.   Pillai, S.O., "Solid State Physics", New age International Publishers, 7th Edition, 2015.

Journals:
1. Journal of Information Science (https://journals.sagepub.com/home/jis)
2. Archives of Information Science and Technology (https://scholars.direct/journal.php?jid=information-science)

Video References:
1. https://www.youtube.com/watch?v=KMcsjCXfLQw&list=PLfIFNJ1DPG4nRLP5qsXn1UWTgAyysZE6
2. https://www.youtube.com/watch?v=YYgE1fXOT_U

NPTEL /Online Courses:
1. https://onlinecourses.NPTEL /Online Courses:.ac.in/noc21_ph14/preview
2. https://study.com/academy/lesson/crystalline-structure-definition-structure-bonding.html
3. https://study.com/academy/lesson/semiconductors-superconductors-definition-properties.html#:~:text=Lesson%20Summary-,A%20superconductor%20is%20a%20material%20that%20acts%20strangely%20when%20cooled,a%20conductor%20and%20an%20insulator
4. https://onlinecourses.NPTEL /Online Courses:ac.in/noc22_ph37/preview

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19PH201.1	Understand the basics of crystals, their structures and different crystal growth techniques	K2	1, 2, 3, 5, 6, 7, 12	-
R19PH201.2	Identify and solve problems concerning physical parameters related to electrical and superconductivity in different situations.	K3	1, 2, 3, 5, 6, 7, 12	-
R19PH201.3	Acquire knowledge on basics of semiconductor physics and its applications in various devices.	K2	1, 2, 3, 5, 6, 7, 12	-
R19PH201.4	Gain knowledge on magnetic properties of materials and their suitability in engineering applications.	K2	1, 2, 3, 5, 6, 7, 12	-
R19PH201.5	Interpret the knowledge on behaviour of modern optoelectronic materials and their applications.	K3	1, 2, 3, 5, 6, 7, 12	-

5.Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02
R19PH201.1	3	2	1	-	1	1	1	-	-	-	-	1	-	-
R19PH201.2	3	2	1	-	2	1	1	-	-	-	-	1	-	-
R19PH201.3	3	3	1	-	3	1	1	-	-	-	-	1	-	-

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02
R19PH201.4	3	3	1	-	3	1	1	-	-	-	-	1	-	-
R19PH201.5	3	3	1	-	3	1	1	-	-	-	-	1	-	-
Course to PO	3	3	1	-	3	1	1	-	-	-	-	1	-	-

"3"—High, "2"—Medium, "1"—Low, "- "—No Correlation

R19CS201	Data Structures	L	T	P	C
		3	0	0	3

1.Course Description:

This course provides a comprehensive introduction to data structures. Students will delve into the principles behind organizing and manipulating data efficiently, covering a wide array of topics including lists, stacks, queues, sorting algorithms, searching techniques, hashing, trees, and graphs. Through a combination of theoretical lectures, practical coding exercises, and real-world applications, students will gain a solid understanding of how to select and implement the appropriate data structures and algorithms to solve complex computational problems.

2.Course Objectives:

1. To understand the concepts of abstract data types
2. To learn linear data structures – lists, stacks, and queues
3. To understand sorting, searching and hashing algorithms
4. To learn to apply the tree and graph structures to real world problems

3.Syllabus:

Unit-I: Linked Lists

Arrays vs Linked List - Types of Linked List: Singly Linked list - Doubly Linked List - Singly Circular Linked list - Doubly Circular Linked List – Operations on Linked List: Insertion-Deletion- Find-Reverse – Modifying Linked List - Floyd's cycle finding algorithm (Slow pointer and Fast pointer)

Unit-II: Stacks and Queue

Stack: Implementation using array and linked list–Push- Pop–Applications (Infix to Postfix conversion, Processing Function Calls)-Queue: Implementation using array and linked list - Enqueue –Dequeue- Priority Queue- Circular Queue-Applications (Call log management)

Unit-III: Trees

Terminologies -Binary Trees: Implementation – Traversals- Expression Trees - Cousins of Binary Tree - Binary Search Trees: Construction-Insertion-Deletion – Searching-Find Min-Find Max-AVL Trees: Insertion – Deletion- Priority Queues (Heaps) Applications (Dictionary, Text Processing)

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

Page | 54

Unit-IV: Graphs

Representation – Types - Traversals: Depth First Search (DFS)-Breadth First Search (BFS) – Finding Shortest Path (Dijkstra's algorithm) - Topological sort- Minimum Spanning Tree (Prim's and Kruskal's algorithm) - Applications (Traffic Redirection Problem, Travelling Salesman Problem)

Unit-V: Sorting, Searching and Hashing

Sorting: Internal Sorting-Bubble Sort-Insertion Sort- Quick Sort- External Sorting- Merge Sort- Searching: Linear Search-Binary Search -Hashing: Hash table – Hash functions – Collision Resolution Techniques–Applications (Telephone Directories, Spell Checker, Design of Game Boards)

Text Books:

1. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2019
2. Seymour Lipschutz," Data Structures using C", First Edition, McGraw Hill Education, 2017

References:

References Books:

1. Narasimha Karumanchi "Data Structures and Algorithms Made Easy" Fifth Edition, Career Monk publications,2017
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997

Web References:

1. https://www.geeksforgeeks.org/data-structures
2. https://www.javatpoint.com/data-structure-tutorial
3. https://www.udemy.com/course/datastructurescncpp/

NPTEL /Online Courses:

1. https://in.coursera.org/learn/data-structures?action=enroll

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS201.1	Apply the concepts of linked lists by demonstrating and understanding of their implementation and usage to solve given problems	K3	1, 2, 3, 5, 12	1, 2
R19CS201.2	Construct stacks and queues using arrays and linked lists and apply these structures to appropriate scenarios	K3	1, 2, 3, 5, 12	1, 2
R19CS201.3	Implement tree data structures and their operations to enhance data management and retrieval systems	K3	1, 2, 3, 5, 12	1, 2
R19CS201.4	Assess graph-based algorithms to solve complex problems requiring efficient data traversal and manipulation	K4	1, 2, 3, 5, 12	1, 2
R19CS201.5	Examine sorting, searching and hashing algorithms to organize and retrieve data effectively	K5	1, 2, 3, 5, 12	1, 2

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS201.1	3	3	2	-	1	-	-	-	-	-	-	2	1	2	-
R19CS201.2	3	3	2	-	1	-	-	-	-	-	-	2	1	2	-
R19CS201.3	3	3	2	-	1	-	-	-	-	-	-	2	1	2	-
R19CS201.4	3	3	2	-	1	-	-	-	-	-	-	2	1	2	-
R19CS201.5	3	3	2	-	1	-	-	-	-	-	-	2	1	2	-
Course to PO	3	3	2	-	1	-	-	-	-	-	-	2	1	2	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19EC102	Electronics and Microprocessors	L	T	P	C
		3	0	0	3

1. Course Description:

This course offers a comprehensive exploration of fundamental concepts of semiconductor theory, diodes and transistors. Delve into the architecture and instruction set of the iconic 8085 microprocessor, learning to write assembly programs that bring it to life. Uncover the inner workings of the versatile 8051 microcontroller, mastering its architecture, instruction set, and interfacing principles for peripheral devices.

2. Course Objectives:

1. To instil knowledge on semiconductors and semiconducting materials to bestow comprehensive exposure on construction of electron devices like diodes, transistors and its operation.
2. To understand the Architecture, addressing modes, instruction set of 8086
3. To introduce commonly used peripheral/interfacing ICs
4. To understand the Architecture, addressing modes, instruction set of 8051

3.Syllabus

Unit-I: Diodes and its Applications

Semiconductor – Commonly used semiconductors - intrinsic and extrinsic semiconductor - p type and n type semiconductor - PN junction diode: properties, biasing and VI characteristics –half wave rectifier with output frequency and center tap full wave rectifier with output frequency - Zener diode - Zener diode as voltage stabilizer.

Unit-II: Transistors and Amplifiers

Transistor – Transistor action - Transistor as an amplifier - CB, CE, CC connections and its comparison – transistor biasing - Field effect transistor: types, JFET, working principle, difference JFET and BJT – JFET as an amplifier and its output characteristics – MOSFET: types, circuit operation of D-MOSFET and E-MOSFET.

Unit-III: Introduction to Microprocessor

Introduction to Microprocessor and Buses - 8086 Architecture –Pin description – interrupt processing – operand addressing – assembler directives - instruction set (commonly used instructions only)

Chairman – Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 56

Unit-IV: Peripherals and Interface
8255 Programmable Peripheral Interface – 8251 Universal Synchronous and Asynchronous Receiver Transmitter - 8253 Timer – DAC – ADC.

Unit-V: Introduction to Microcontroller
Introduction to 8-bit microcontroller: 8051 architecture, memory organization, special function registers - port operation - timer/counters - serial interface - interrupts – operand addressing.

Text Books:

1. V.K.Mehta and Rohit Mehta, "Principles of Electronics" S.Chand, 12/e, 2014 (Unit I & II)
2. Krishna Kant, "Microprocessors and Microcontrollers: Architecture, Programming and System Design 8085, 8086, 8051, 8096", PHI, 2013 (Unit III, IV & V)

References:

1. Robert Boylestad, Louis Nashelsky, "Electronic devices and Circuit theory", Pearson, 11/e, 2015
2. A.K.Ray and K.M.Bhurchandi, "Advanced Microprocessor and Peripherals", MGH, 3/e, 2017
3. Mohammed Ali Mazidi, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson, 2/e, 2012

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19EC102.1	Understand the basics of semiconductor theory and working of diodes	K2	1, 2, 3, 4, 5, 9, 10, 12	-
R19EC102.2	Understand the working of BJT and FET and Biasing techniques	K2	1, 2, 3, 4, 5, 9, 10, 12	-
R19EC102.3	Apply the architecture of 8086 microprocessor and Use instruction set	K3	1, 2, 3, 4, 5, 9, 10, 12	-
R19EC102.4	Understand the working of peripheral ICs and its interface with microprocessor	K2	1, 2, 3, 4, 5, 9, 10, 12	-
R19EC102.5	Apply the architecture of 8051 microcontroller and instruction set	K3	1, 2, 3, 4, 5, 9, 10, 12	-

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19EC102.1	3	3	3	2	3	-	-	-	1	1	-	2	-	-	-
R19EC102.2	3	3	3	2	3	-	-	-	1	1	-	2	-	-	-
R19EC102.3	3	3	3	2	3	-	-	-	1	1	-	2	-	-	-
R19EC102.4	3	3	3	2	2	-	-	-	1	1	-	2	-	-	-
R19EC102.5	3	3	3	2	3	-	-	-	1	1	-	2	-	-	-
Course to PO	3	3	3	2	3	-	-	-	1	1	-	2	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

Chairman – Board of Studies

R19CS151	Python Programming	L	T	P	C
		3	0	2	4

1.Course Description:

This course covers the fundamental concepts and practical applications of Python programming. Students will explore topics ranging from basic data types and expressions to advanced data manipulation and visualization techniques. The course will explores into programming paradigms, emphasizing Python's versatility in supporting imperative, functional, and object-oriented programming styles. Through hands-on exercises, projects and real-world examples, students will develop a strong foundation in Python programming, enabling them to write efficient, readable and maintainable code for a variety of applications.

2.Course Objectives:

1. To learn to write simple programs
2. To develop programs with conditions and loops
3. To use data structures – lists, tuples, dictionaries and sets
4. To understand file operations
5. To learn to use libraries for data manipulation and visualization

3.Syllabus

Unit-I: Data, Expressions, Statements

Introduction: Python Interpreter and interactive mode, comments, Identifiers and Keywords; Data types: int, float, Boolean, String; Variables and Expressions; Operators: types, precedence

Illustrative Programs: Financial application, Health care application

Unit-II: Programming Paradigms

Conditional Statements: conditional (if), alternative (if-else), chained conditional (if-elif-else); Looping Statements: while, for; Jump Statements: break, continue, pass; Fruitful Functions: return values, parameters, local and global scope, function composition, recursion; Strings: slices, immutability, functions and methods; Python-DB connectivity

Illustrative Programs: Towers of Hanoi, Kadane's Algorithm, and Chocolate Distribution Algorithm

Unit-III: Lists, Tuples and Dictionaries

Lists: operations, slices, methods, loop, mutability, aliasing, cloning, parameters, lists as arrays; Tuples: assignment, tuple as return value; Dictionaries: operations and methods; Sets: operations

Illustrative Programs: Dutch National Flag Algorithm, Count and Say Problem

Unit-IV: Files, Modules and Packages

Files: text files, reading and writing files; Format Operator; Command Line Arguments; Error and Exception Handling; Modules; Packages; Introduction to Tkinter; Introduction to Open CV

Illustrative Programs: Word count, File copying

Unit-V: Data Manipulation and Data Visualization
NumPy: Basics of NumPy Arrays; Computations: Universal Functions; Aggregations: Min-Max and Everything In Between; Pandas: Objects, Data Indexing and Selection, Data Operations, Handling Missing Data; Matplotlib: Types of plots, Simple Line Plots, Boxplots, Simple Scatter Plots **Case study:** Analyze the performance of cricket players and plot a graph

3. List of Laboratory Experiments / Exercises:

1. Design a flowchart to address a real-world problem of your choice.
   Suggested Problems: Traffic signal control / Water level controller / Temperature control system / Automatic washing machine control system / Automatic Street light control system / Electricity Billing / Retail shop billing/Computing Electrical Current in Three Phase AC circuits (Minimum three problems)

2. Create a Python application that uses expressions and control flow statements to automate a common task. Ensure that your application is user-friendly and robust to different inputs.
   Suggested Problems: Swap two numbers without a temporary variable, Quadratic Equation, Valid Palindrome

3. Implement a Python program that simulates a real-world system or process using conditions and iterative loops.
   Suggested Problems: check whether an alphabet is a vowel or consonant, sum of all even numbers from 0 to n, factorial of a number

4. Implementation of real-time/technical applications using Lists and Tuples(Minimum Index Sum of Two Lists, Concatenate two lists index-wise, Tuple with the same product, Copy specific elements from one Tuple to a new tuple)

5. Implementation of real-time/technical applications using Set and Dictionaries (Magic Dictionary, Longest Word in Dictionary, Set Mismatch and Smallest Number in Finite Set)

6. Implementation of Functions in the program (Factorial, largest number in a list, area of shape)

7. Implementation of Strings in the program (Determine if string halves are alike, palindrome, character count, replacing characters)

8. Implementation of file-handling operations (copy from one file to another, word count, longest word)

9. Implementation of libraries (Pandas, NumPy, Matplotlib)

10. Implementation of applications of standard libraries (Handle scalars to work on the NumPy array, Insert values at random positions in an array, Convert the index of a series into a column of a data frame, Combine many series to form a data frame, Get frequency counts of unique items of a series, Union of two arrays, Convert a NumPy array to a data frame of a given shape, Plotting datasets)

11. Mini Project: Develop an application for any real-world problem

Text Books:

1.	Al Sweigart, "Automate the Boring Stuff with Python: Practical Programming for Total Beginners," 2nd Edition, No Starch Press, 2019
2.	Liang Y. Daniel, "Introduction to Programming Using Python", Pearson Education, 2017
3.	Alan D. Moore, "Python GUI Programming with Tkinter: Develop responsive and powerful GUI applications with Tkinter," Packt Publishing Limited, 2018

References:

References Books

1. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-Disciplinary Approach," Pearson India Education Services Pvt. Ltd., 2016

2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist," Second edition, Updated for Python 3, Shroff O'Reilly Publishers, 2016

3. Timothy A. Budd," Exploring Python," Mc-Graw Hill Education (India) Private Ltd., 2015

Web Resources:

1. https://www.coursera.org/specializations/python

2. https://jakevdp.github.io/PythonDataScienceHandbook/02.00-introduction-to-numpy.html

NPTEL /Online Courses:

1. https://www.coursera.org/specializations/python

2. https://www.coursera.org/learn/python-crash-course

3. https://NPTEL.ac.in/courses/106106145

4.Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS151.1	Apply syntax and semantics of Python programming language for developing real-world applications	K3	1, 2, 3, 4, 5, 8, 9, 10, 11, 12	1, 2, 3
R19CS151.2	Write python functions to facilitate code reuse and manipulate strings	K3	1, 2, 3, 4, 5, 8, 9, 10, 11, 12	1, 2, 3
R19CS151.3	Develop Python solutions by implementing lists, tuples, and dictionaries	K4	1, 2, 3, 4, 5, 8, 9, 10, 11, 12	1, 2, 3
R19CS151.4	Apply advanced skills in utilizing built-in functions for file system applications	K3	1, 2, 3, 4, 5, 8, 9, 10, 11, 12	1, 2, 3
R19CS151.5	Analyse data manipulation and visualization and demonstrate them in real time applications	K4	1, 2, 3, 4, 5, 8, 9, 10, 11, 12	1, 2, 3

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS151.1	3	2	2	2	3	-	-	2	2	1	2	2	3	2	2
R19CS151.2	3	2	2	2	3	-	-	2	2	1	2	2	3	2	2
R19CS151.3	3	2	2	2	3	-	-	2	2	1	2	2	3	2	2

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Chairman – Board of Studies

Chairman - Board of Studies

Sri Eshwar College of Engineering and Engineering

Kinathukadavu, Coimbatore - 641202.

College of Engineering (Autonomous)

Page | 60

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS151.4	3	2	2	2	3	-	-	2	2	1	2	2	3	2	2
R19CS151.5	3	2	2	2	3	-	-	2	2	1	2	2	3	2	2
Course to PO	3	2	2	2	3	-	-	2	2	1	2	2	3	2	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19PH111	Physics Laboratory	L	T	P	C
		0	0	2	1

1. Course Description:

This course is designed to lay a strong foundation in Engineering Physics that forms a basis to various branches of Engineering. It helps the students to perform experiments, to correlate theory with experimental data, analyse using graphical representations and present them as part of a clear, well-organized lab report. At the end of the course, students will be able to demonstrate a working knowledge of fundamentals of Physics and communicate their ideas effectively, both orally and in writing.

2. Course Objectives:

To enable the students to

1. Demonstrate competency and understanding of the basic concepts found in experimental Physics.
2. Estimate the error in measurements and the ability to prepare a valid laboratory record.
3. Understand the measurement techniques and usage of instruments in physics.

3. Syllabus:

List of Laboratory Experiments:

1. Compute the Young's modulus of the given material using uniform bending.
2. Calculate the Rigidity modulus of the given wire using torsional oscillation method.
3. Determine the coefficient of viscosity of given liquid by Poiseuille's flow method
4. Estimate the wavelength of LASER using diffraction grating.
5. Calculate the energy band gap of a given semiconductor diode.
6. Estimate the thermal conductivity of a bad conductor using Lee's Disc Method
7. Enumerate the wavelength of Mercury spectrum using spectrometer
8. Compute and analyse the energy loss using B-H curve of a ferromagnetic material.

Text Book:

1. In house laboratory manual "Physics Manual" prepared by the faculty members (Physics) – Sri Eshwar College of Engineering – Coimbatore.

References:

1. C. L. Arora, "Practical Physics", S. Chand & Co., New Delhi, 3rd Edition, 2012.
2. Dr.T. Radhakrishna, "Practical Physics for Engineering Students", SM Enterprises, 2nd Edition, 2014.

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

Page | 61

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19PH111.1	Develop skills to impart practical knowledge in real time solutions.	K4	1, 2, 3, 4, 6, 7, 9, 12	-
R19PH111.2	Interpret and formulate experiments in engineering physics.	K3	1, 2, 3, 4, 6, 7, 9, 12	-
R19PH111.3	Develop skills to impart practical knowledge in real time solutions.	K4	1, 2, 3, 4, 6, 7, 9, 12	-
R19PH111.4	Design new experiments with practical knowledge.	K4	1, 2, 3, 4, 6, 7, 9, 12	-
R19PH111.5	Apply deep knowledge about the solution to theoretical problems.	K3	1, 2, 3, 4, 6, 7, 9, 12	-

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19PH111.1	3	3	2	1	-	2	2	-	1	-	-	2	-	-	-
R19PH111.2	3	3	2	1	-	2	2	-	1	-	-	2	-	-	-
R19PH111.3	3	3	2	1	-	2	2	-	1	-	-	2	-	-	-
R19PH111.4	3	3	2	1	-	2	2	-	1	-	-	2	-	-	-
R19PH111.5	3	3	2	1	-	2	2	-	1	-	-	2	-	-	-
Course to PO	3	3	2	1	-	2	2	-	1	-	-	2	-	-	-

"3"—High, "2"—Medium,"1"—Low,"-"—No Correlation

R19CS211	Data Structures Laboratory	L	T	P	C
		0	0	4	2

1.Course Description:

The Data Structure Laboratory is a hands-on course designed to complement theoretical knowledge with practical implementation skills in data structures. Through a series of lab sessions, students will work on implementing code and projects focusing on lists, stacks, queues, sorting algorithms, searching techniques, hashing, trees and graph data structures. By actively engaging in coding exercises and projects, students will deepen their understanding of the course, enhance their programming skills, and gain valuable experience applicable across various domains of computer science and engineering.

2.Course Objectives:

1. To implement linear and nonlinear data structures
2. To learn to apply the data structures to various real world
3. To implement graph algorithms
4. To implement sorting, searching and hashing techniques

3. List of Laboratory Experiments / Exercises:

1. Develop a Multimedia Library Management System that organizes and manages various types of multimedia content such as audio, video, and images. Each type of content requires a different approach in terms of databases structure for efficient management. Choose a suitable linked list operation for each multimedia category's specific needs.

2. Demonstration of applications of Linked List (Reversal Problems, Segregation of Even and Odd nodes in Linked List, Palindrome checking using Linked List, Loop Detection, Sorting the biotonic using doubly linked list)

3. Build a critical software project for a large healthcare organization that processes and manages a high volume of patient data, requiring efficient and reliable data structures for task management, resource allocation, and communication. Select appropriate data structures (stacks and queues) for specific use cases, considering their performance characteristics, flexibility, and memory usage.

4. Demonstration of applications of Stack and Queue (Evaluating Postfix Expressions, Infix to Postfix conversion, Balancing symbols and Postfix evaluation, Wild card pattern matching)

5. Develop a movie recommendation system for a popular streaming platform that recommends movies to users based on their past watching history and preferences. Use a binary tree data structure to store and search for movies based on different criteria efficiently.

6. Build an online book store with a vast collection of books to manage the inventory efficiently and provide a seamless user experience with the help of a Binary Search Tree (BST) data structure.

7. Demonstration of applications of Trees (Segment Tree and Range Minimum Query on the Constructed Segment Tree, Maximum depth of Binary tree)

8. Design a network for any food delivery partner to understand how people are connected, how information flows through the network and identify influential users using graph traversal algorithms

9. Construct a travel management system that aims to streamline the planning and organization of travel itineraries for a travel agency. The system utilizes various graph algorithms (Topological Sort, Connected Graph and Ticket Itinerary) to efficiently manage the complexities of travel planning

10. Design a food delivery app for a bustling city. Thousands of orders flow daily, and ensuring fast and efficient delivery is crucial for customer satisfaction. Use Dijkstra's algorithm to find the shortest paths for delivery drivers, optimizing their routes and minimizing delivery times

11. Design an optimized network infrastructure of an organization that connects the various departments within the organization using the minimum amount of cabling to reduce costs and enhance network efficiency. Implement Prim's and Kruskal's algorithms for finding the Minimum Spanning Tree (MST) for the network

12. Create a Student Grade Management System for a university that efficiently organizes and displays student grades for various courses. The system should employ different sorting algorithms to cater to diverse requirements and optimize the display of grades. Choose the suitable sorting algorithms (Bubble Sort, Insertion Sort, Quick Sort, Merge Sort) for quick grade overview, mark entry, course ranking and overall grade report

13. Develop a Product Inventory Management System for a retail company that handles a large number of products to implement efficient searching techniques to retrieve information about products in the inventory quickly. Select the appropriate searching technique (Linear Search, Binary Search) for quick product lookup, inventory sorting, and retrieval

14. Demonstration of applications of hashing (Single swap sorted array, Anagram Checking and Range Minimum Query Using Sparse Table, Merge two sorted arrays)

References:
1. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2019
2. Narasimha Karumanchi "Data Structures and Algorithms Made Easy" Fifth Edition, Career Monk publications,2017
3. Seymour Lipschutz, "Data Structures using C", First Edition, McGraw Hill Education, 2017
4. https://www.geeksforgeeks.org/data-structures
5. https://www.javatpoint.com/data-structure-tutorial
6. https://www.udemy.com/course/datastructurescncpp/
7. https://in.coursera.org/learn/data-structures?action=enroll

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS211.1	Demonstrate the ability to identify, define and analyze complex problems using appropriate algorithms, data structures, methodologies and	K3	1, 2, 3, 4, 5, 8, 12	1, 2
R19CS211.2	Design effective visual representations (UML diagrams/Flowchart) to solve the identified problems	K3	1, 2, 3, 4, 5, 8, 12	1, 2
R19CS211.3	Create solutions and implement them using suitable programming platforms	K6	1, 2, 3, 4, 5, 8, 12	1, 2
R19CS211.4	Develop effective presentation skills to present and defend the designs and solution	K4	1, 2, 3, 4, 5, 8, 12	1, 2
R19CS211.5	Understand issues related to privacy, security and accessibility and adhere to coding standards	K2	1, 2, 3, 4, 5, 8, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS211.1	3	3	2	1	2	-	-	1	-	-	-	2	2	2	-
R19CS211.2	3	3	2	1	2	-	-	1	-	-	-	2	2	2	-
R19CS211.3	3	3	2	1	2	-	-	1	-	-	-	2	2	2	-
R19CS211.4	3	3	2	1	2	-	-	1	-	-	-	2	2	2	-
R19CS211.5	3	3	2	1	2	-	-	1	-	-	-	2	2	2	-
Course to PO	3	3	2	1	2	-	-	1	-	-	-	2	2	2	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19MC101	தமிழர் மரபு / Heritage of Tamils	L	T	P	C
		2	0	0	1

1. Course Description / பாடநெறி விளக்கம்:

This course is taught to provide an insight to the students into the rich culture and heritage of the state. The students should know the valued things such as historic buildings that have been passed down from

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 64

previous generations and relating to things of tamil historic and cultural value that are worthy of preservation. This course explains about the growth of nationalism, growth of tamil language, various religious reformers, spread of Dravidian movement and its possible impact in the society, role of selfrespect movement, educational development in Tamilnadu since independence and the growth of fine arts in Tamilnadu.

மாநிலத்தின் வளமான கலாச்சாரம் மற்றும்பாரம் பரியம்பற்றிய நுண்ணறிவை மாணவர்களுக்கு வழங்க இந்த பாடநெறி கற்பிக்கப்படுகிறது. முந்தைய தலைமுறையினரிடமிருந்து பெறப்பட்ட வரலாற்று கட்டிடங்கள் மற்றும் தமிழ் வரலாற்று மற்றும் கலாச்சார மதிப்புள்ள விஷயங்கள் பாதுகாக்கப்பட வேண்டிய மதிப்புமிக்க விஷயங்களை மாணவர்கள் அறிந்துகொள்ள வேண்டும். தமிழ்நாட்டின் தேசியத்தின் வளர்ச்சி, தமிழ்மொழியின் வளர்ச்சி, பல்வேறு சமயசீர்திருத்தவாதிகள், திராவிடஇயக்கத்தின் பரவல் மற்றும் சமுதாயத்தில் அதன் தாக்கம், சுயமரியாதை இயக்கத்தின் பங்கு, சுதந்திரத்திற்குப் பிறகு தமிழகத்தில் கல்வி வளர்ச்சி மற்றும் தமிழகத்தில் நுண்கலைகளின் வளர்ச்சி பற்றி இந்த பாடநெறி விளக்குகிறது.

2. Course Objectives /பாடத்தின் நோக்கங்கள்:

1. To make an inference about language and traditional of the state.
   மாநிலத்தின் மொழி மற்றும் பாரம்பரியம் பற்றி அனுமானிக்க உதவுகிறது.
2. To acquire knowledge in construction of status and various musical instruments
   கட்டிடக்கலை மற்றும் பல்வேறு இசைக் கருவிகளை உருவாக்குவதற்கான அறிவைப் பெறுதல்.
3. To study the detailed information about folklore and paramilitary arts.
   நாட்டுப்புறவியல் மற்றும் ராணுவக் கலைகள் பற்றிய விரிவான தகவல்களைப் படிக்க உதவுகிறது.
4. To gain knowledge of rich culture and success history of ancient kingdoms.
   பண்டைய ராஜ்யங்களின் வளமான கலாச்சாரம் மற்றும் வெற்றி வரலாற்றைப் பற்றிய அறிவைப் பெற உதவுகிறது.
5. To acquaint the student with the knowledge of siddha medicine and about the Indian freedom struggle.
   சித்தமருத்துவம் மற்றும் இந்திய சுதந்திரப் போராட்டம் பற்றிய அறிவை மாணவருக்கு அறிமுகப்படுத்துதல்.

3. Syllabus / பாடத்திட்டங்கள்:

Unit-I / அலகு-I: LANGUAGE AND LITERATURE / மொழி மற்றும் இலக்கியம்

Language Families in India – Dravidian Languages – Tamil as aClassical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature – Management Principles in Thirukkural – Tamil Epics and Impact of Buddhism & Jainism in Tamil Land – Bakthi Literature Azhwars and Nayanmars – Forms of minor Poetry – Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidhasan.

இந்திய மொழி குடும்பங்கள் – திராவிட மொழிகள் –தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச்சார் பற்றதன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் –திருக்குறளில் மேலாண்மைக் கருத்துகள் –தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமணபௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் –சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி –தமிழிலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

Unit-II / அலகு - II: Heritage–Rock Art Paintings To Modern Art – Sculpture / மரபு –பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை

Hero stone to modern sculpture – Bronze icons – Tribes and their handicrafts – Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments – Mridhangam, Parai, Veenai, Yazh and Nadhaswaram – Role of Temples in Social and Economic Life of Tamils.

நடுக்கல் முதல் நவீன சிற்பங்கள் வரை –ஐம்பொன் சிலைகள் –பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினை பொருள்கள், பொம்மைகள் – தேர் செய்யும் கலை –சுடுமண் சிற்பங்கள் –நாட்டுப்புறத் தெய்வங்கள் –குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக்கருவிகள் –மிருதங்கம், பறை, யாழ், வீணை, நாதஸ்வரம் –தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு

Chairman - Board of Studies
Chairman— Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu Coimbatore – 641202.

Page | 65

Unit-III/ அலகு-III: Folk And Martial Arts / நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்

Therukoothu, Karagattam, VilluPattu, KaniyanKoothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance – Sports and Games of Tamils.

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஒயிலாட்டம், தோல் பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம் – தமிழர்களின் வீர விளையாட்டுகள்.

Unit-IV/ அலகு-IV: Thinai Concept of Tamils / தமிழர்களின் திணைக் கோட்பாடுகள்

Flora and Fauna of Tamils &Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram Concept of Tamils – Education and Literacy during Sangam Age – Ancient Cities and Ports of Sangam Age – Export and Import during Sangam Age – Overseas Conquest of Cholas.

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் –தமிழர்கள் போற்றிய அறக்கோட்பாடு –சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் –சங்ககாலத்தில் ஏற்று மதிமற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

Unit-V / அலகு -V:Contribution of Tamils to Indian National Movement and Indian Culture / இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு

Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு -இந்தியாவின் பிற்பகுதியில் தமிழ்ப் பண்பாட்டின் தாக்கம் –சுயமரியாதை இயக்கம் –இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு –கல்வெட்டுகள், கையெழுத்துப் படிகள் –தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு

Text Books:

1. தமிழக வரலாறு –மக்களும் பயன்பாடுகளும் –கே.கே.பிள்ளை (தமிழக பாடநூல் கழகம் மற்றும் கல்வியல் பணிகள் கழகம்).
2. கணினித் தமிழ் –முனைவர் இல .சுந்தரம் (விகடன்பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை   வெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம் (தொல்லியல் துறை வெளியீடு).

5. Social Life of Tamils - Dr.K.K.Pillay, A joint publication of TNTB & ESC and RMRL – (in print).

6. Social Life of the Tamils - The Classical Period - Dr.S.Singaravelu (Published by: International Institute of Tamil Studies.

7. Historical Heritage of the Tamils - Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture - Dr.M.Valarmathi (Published by: International Institute of Tamil Studies).

9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Tamil Nadu).

10. Studies in the History of India with Special Reference to Tamil Nadu - Dr.K.K.Pillay.

References:

1. Journey of Civilization Indus to Vaigai - R.Balakrishnan, Published by: RMRL.
2. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

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4. Course Outcomes/ பாடநெறி முடிவுகள்:

CO. No.	Course Outcome /பாடநெறி முடிவுகள்	BTL	POs	PSOs
R19MC101.1	To know about the language families in India, impact of the religions, contribution of Bharathiar and Bharathidhasan. இந்தியாவில் உள்ள மொழி குடும்பங்கள், மதங்களின் தாக்கம், பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்புபற்றி தெரிந்து கொள்வது.	K2	9, 12	-
R19MC101.2	Observe the growth of sculpture making of musical instruments and the role of temples in socio and economic lives. தமிழர்களின் வாழ்வில் இசைக்கருவிகள், சிற்பங்களை உருவாக்கும் முறைகள், சமூக, பொருளாதார வளர்ச்சி மற்றும் கோவில்களின் பங்களிப்பு பற்றி அறிந்து கொள்வது	K2	8, 9, 12	-
R19MC101.3	Understand the significance of folklore and martial arts. நாட்டுப்புறவியல் மற்றும் தற்காப்புக் கலைகளின் முக்கியத்துவத்தைப் புரிந்து கொள்வது.	K2	8, 9, 12	-
R19MC101.4	Learn the Sangam literature, Sangam age and overseas conquest of Cholas. சங்க இலக்கியம், சங்ககாலம் மற்றும் சோழர்களின் வெற்றிகள் ஆகியவற்றைக் கற்றுக் கொள்வது.	K2	9	-
R19MC101.5	Understand the contribution of Tamils to Indian freedom struggle, Role of siddha medicines. இந்திய சுதந்திரப் போராட்டத்தில் தமிழர்களின் பங்களிப்பு, சித்த மருந்துகளின் பங்கு ஆகியவற்றைப் புரிந்து கொள்வது.	K2	8, 9	-

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19MC101.1	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-
R19MC101.2	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-
R19MC101.3	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-
R19MC101.4	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
R19MC101.5	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-
Course to PO	-	-	-	-	-	-	-	1	1	-	-	1	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

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Department of Computer Science and Engineering
Chairman – Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19MA203	Discrete Mathematics	L	T	P	C
		3	1	0	4

1. Course Description:

Discrete Mathematics is a foundational course that focuses on mathematical structures and techniques used in computer science, information technology, and other fields. Unlike continuous mathematics, which deals with objects that vary continuously, discrete mathematics deals with discrete, countable structures such as integers, graphs, sets, and logic. This course covers a wide range of topics including logic and proof techniques, set theory, functions and relations, combinatorics, graph theory. Emphasis is placed on developing problem-solving skills and mathematical reasoning.

2. Course Objectives:

1. To gain knowledge of the concepts needed for test the logic of a program.
2. To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
3. To understand the basic concepts of combinatorics and graph theory.
4. To familiarize the applications of algebraic structures.
5. To apply effectively the concepts and results of number theory.

3. Syllabus:

Unit-I: Propositional Calculus

Propositions: Logical connectives, compound propositions, tautology, contradiction; Logical equivalences and implications; Principal disjunctive and conjunctive normal forms; Predicates; Quantifiers; Rules of inference: validity of arguments.

Unit-II: Combinatorics

Permutations and combinations; Inclusion and exclusion principle; Pigeonhole principle; Mathematical induction; Recurrence relations: Solving linear recurrence relations using generating function.

Unit-III: Graph Theory

Graphs: Types of graphs, matrix representation of graphs, walk, path, circuit; Graph isomorphism using adjacency matrix and circuits; Euler graph; Hamiltonian graph.

Unit-IV: Algebraic Structures

Algebraic structures with one binary operation: Groups, properties of groups, subgroup, cosets, Lagrange's theorem, Normal subgroup; Group homomorphism and isomorphism: Cayley's theorem, fundamental theorem on homomorphism.

Unit-V: Number Theory

Division algorithm; Base-b representations; Number patterns; Linear Diophantine equations; Congruence: Simultaneous linear congruences, Chinese Remainder Theorem (statement only), Wilson's theorem, Fermat's theorem, Euler's Theorem.

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 68

Text Books:

1. Kenneth H. Rosen," Discrete Mathematics and its Applications", 7th Edition, Tata McGraw – Hill Pub. Co. Ltd, New Delhi, 2011.
2. Thomas Koshy, "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, 2002.

References:

Reference Books:

1. Tremblay J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

2. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice – Hall, Engle Cliffs, N. J, 1974.

3. San Ling and Chaoping Xing, "Coding Theory – A first Course", Cambridge Publications, Cambridge, 2004.

Journals:

1. SIAM Journal on Discrete mathematics.

2. International journal of Discrete mathematics.

Video References:

1. https://www.youtube.com/watch?v=xIUFkMKSB3Y

2. https://NPTEL /Online Courses:.ac.in/courses/106106094/32

3. www.NPTEL /Online Courses:.ac.in/courses/106108054/

4. https://NPTEL /Online Courses:.ac.in/courses/106104149/2

5. https://www.youtube.com/watch?v=qPtGlrb_sXg

NPTEL /Online Courses:

1. http://www.NPTEL /Online Courses:videos.in/2012/11/graph-theory.html

2. http://NPTEL /Online Courses:ac.in/courses/111107058/20

3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-fall-2010

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19MA203.1	Apply principles and fundamental concepts of inference theory in proving and testing the logic.	K3	1, 2, 3, 4, 12	-
R19MA203.2	Use induction techniques, generating functions and basics of counting principle to solve mathematical statements.	K3	1, 2, 3, 4, 12	-
R19MA203.3	Examine the types of circuits in a graph, the existence of isomorphism and sketch the Euler and Hamiltonian paths and circuits in a graph.	K3	1, 2, 3, 4, 12	-
R19MA203.4	Apply the concept of algebraic structures with one or more binary operations.	K3	1, 2, 3, 4, 12	-
R19MA203.5	Apply integrated approach to number theory provide a firm basis.	K3	1, 2, 3, 4, 12	-

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Chairman – Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641202.

Page | 69

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19MA203.1	3	3	1	1	-	-	-	-	-	-	-	2	-	-	-
R19MA203.2	3	3	2	2	-	-	-	-	-	-	-	2	-	-	-
R19MA203.3	3	3	2	2	-	-	-	-	-	-	-	2	-	-	-
R19MA203.4	3	3	1	1	-	-	-	-	-	-	-	2	-	-	-
R19MA203.5	3	3	3	2	-	-	-	-	-	-	-	2	-	-	-
Course to PO	3	3	2	2	-	-	-	-	-	-	-	2	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS202	Database Management Systems	L	T	P	C
		3	0	0	3

1.Course Description:

This course offers a comprehensive exploration of Database Management Systems (DBMS) theory, focusing on essential concepts and principles underlying the design, implementation and optimization of databases. Students will explore into various topics, including an Introduction to Databases, Structured Query Language (SQL) & Procedural Language/SQL (PL/SQL), Transaction and Concurrency Control, Storage & Indexing, and NoSQL databases. The students will gain a deep understanding of database architectures, data modelling techniques, query languages, transaction management strategies, storage mechanisms, indexing methods and the role of NoSQL databases in modern data management.

2.Course Objectives:

1. To learn about data models and fundamentals of database system
2. To develop queries with SQL
3. To understand the internal storage structures using different file and indexing techniques
4. To understand the basics of transaction processing- concurrency control techniques and recovery procedures
5. To learn the principles of non-structured database systems

3.Syllabus:

Unit-I: Introduction to Databases

Purpose of Database – Types and examples of Databases (RDBMS, NOSQL, In-memory Databases & Distributed SQL databases)– Relational Database System Architecture - Views of Data– Schema architecture – Data Independence – Schema and instance- Data Models–Benefits and Phases of Data Model - ER Diagram - Symbols, Components, Relationships, Weak entities, Attributes, Cardinality - Extended ER Diagram – Examples- Relational Data Model – Keys - Relational Algebra-Normalization - 1NF, 2NF, 3NF, BCNF,4NF,5NF

Case Study: ER Diagram on Online Streaming, Movie Ticket Recommendation, Bike Tracking

Unit-II: SQL & PL/SQL

SQL Fundamentals – DDL Commands - Create, Drop, Alter, Truncate, Rename, Keys - Primary Key, Candidate Key, Super Key, Foreign Key – DML Commands – DQL Commands - Select, Insert, Update, Delete, Any, All, In, Exists, Non-Exists, Union, Intersection, Advanced SQL Features –Aggregate Functions - SUM, COUNT, AVG, MIN, MAX, EXPLAIN, COALESCE - Clauses – Order By - Group By, Having, CASE, LIMIT,WITH Clause, Date Functions, String Functions -Subqueries - Nested, Correlated, Joins- Inner, Outer, and Equi-Joins - Order of Execution, Embedded SQL- Dynamic SQL. Creation and Dropping of Views, Types of Views - Creation and Execution of Stored Procedures - Cursors - Opening, Fetching, and Closing - Triggers - Creation, Insertion, Deletion, and Updating Database - Exception Handling - MySQL JDBC Connectivity

Case Study: Online Streaming, Movie Ticket Recommendation, Bike Tracking, Import/Export Random records from CSV file to MYSQL

Unit-III: Transaction and Concurrency Control

Transaction processing - ACID Properties - Failure and Recovery – Schedules – Serializability - Concurrency Control –Lock-based protocol - Isolation levels - SQL Facilities for concurrency and recovery- Database Integrity, Security and Authorization

Case Study: ACID Properties in Online Streaming Database

Unit-IV: Storage & Indexing

Overview of Storage Techniques – File organization - RAID –Indexing - Types of ordered indices - B & B+ tree – Hashing - Static & Dynamic Hashing - Query Processing & Optimization – SQL Performance Tuning

Case Study: Indexing in Online Streaming Database to optimize the retrieval of data

Unit-V: NOSQL

Need for NO SQL – Characteristics of NOSQL - Key-value database - Columnar Databases - Apache Cassandra – Click House– Document Databases - MongoDB – CRUD operations with MongoDB - MongoDB JDBC Connectivity –MongoDB Testing - Graph Databases – Metabase

Case study: Conversion of Online Streaming Database (RDBMS) to MongoDB

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, — "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2013

2. RamezElmasri, Shamkant B. Navathe, —"Fundamentals of Database Systems", Sixth Edition, Pearson Education, 2014

References:

References Books:

1. C.J.Date, A.Kannan, S.Swamynathan, —"An Introduction to Database Systems", Eighth Edition, Pearson Education, 2013

2. KrisitnaChodorow, MongoDB – The Definitive Guide", O' Reilly, 2013

Video References:

1. https://www.youtube.com/playlist?list=PLsjUcU8CQXGFFAhJI6qTA8owv3z9jBbpd
2. https://www.youtube.com/watch?v=c5HAwKX-suM
3. https://youtu.be/FNYdBLwZ6cE
4. https://youtu.be/qEhNHOEa5sE

NPTEL /Online Courses:

1. https://onlinecourses.NPTEL.ac.in/noc23_cs41/preview
2. https://codewithmosh.com/p/complete-sql-mastery
3. https://www.udemy.com/course/nosql-databases-for-beginners/

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS202.1	Use data models and depict a database system	K3	1, 2, 3, 4, 5, 9, 12	1, 2, 3
R19CS202.2	Design relations for various business requirements	K3	1, 2, 3, 4, 5, 9, 12	1, 2, 3
R19CS202.3	Understand the properties of the database and recovery process	K2	1, 2, 3, 4, 5, 9, 12	1, 2, 3
R19CS202.4	Understand the optimization techniques in database storage	K2	1, 2, 3, 4, 5, 9, 12	1, 2, 3
R19CS202.5	Design non-structured database systems in application development	K3	1, 2, 3, 4, 5, 9, 12	1, 2, 3

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS202.1	3	3	3	2	3	-	-	-	2	-	-	2	3	2	1
R19CS202.2	3	3	3	2	3	-	-	-	2	-	-	2	3	2	1
R19CS202.3	3	3	3	2	3	-	-	-	2	-	-	2	3	2	1
R19CS202.4	3	3	3	2	3	-	-	-	2	-	-	2	3	2	1
R19CS202.5	3	3	3	2	3	-	-	-	2	-	-	2	3	2	1
Course to PO	3	3	3	2	3	-	-	-	2	-	-	2	3	2	1

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS203	Object-Oriented Programming Using Java	L	T	P	C
		3	0	0	3

1.Course Description:

This course provides students with a comprehensive understanding of the principles, mechanisms and advanced features of the Java programming language. Starting with the Foundations of Java, students will build a solid understanding of basic syntax, data types, control structures, and object-oriented concepts. They will explore into Object-Oriented Mechanisms, mastering topics such as classes, objects, inheritance, polymorphism and encapsulation. The course also covers essential Java libraries and

features, including Strings, Collections, Java 8 Features, Exception Handling, and Multithreading. Additionally, students will explore JavaFX for graphical user interface (GUI) development and JDBC for database connectivity, enhancing their proficiency in Java application development.

2.Course Objectives:

1. To understand object-oriented programming concepts and the basics of java programming language
2. To know the principles of packages, inheritance and interfaces
3. To understand strings & collections with java 8 features
4. To develop a Java application with exception handling and threads
5. To develop windows-based applications with jdbc

3.Syllabus:

Unit-I: Foundations of Java

Overview of OOP – Object oriented programming paradigms – Features of Object-Oriented Programming – Java Buzzwords – Overview of Java – JVM - JDK – Programming Structures in Java – Classes & its types in Java - Data Types, Variables – Operators – Keywords - Control Statements – Wrapper Classes – Constructors - Methods - Access specifiers - Arrays & its types – java.util. Arrays - Java Doc comments - I/O classes

Unit-II: Object Oriented Mechanisms

Association – Aggregation – Composition - Polymorphism – Overloading Vs Overriding – Static and Dynamic Binding - Inheritance - Basics – Types of Inheritance – Super, static & final keywords with inheritance and polymorphism – Abstraction - Abstract Classes and Interfaces - Encapsulation - Packages – Access modifiers

Unit-III: Strings, Collections & Java 8 Features

Strings, creation, declaration of a string, storage structure of a string and its methods, StringBuilder, String Buffer, regex - Collection Interface – Generics - List, Set, Map interfaces and classes, Comparable - Comparator – Java lambda expressions – Date & time Object in java 1.8 and its functions – Streams

Unit-IV: Exception Handling and Multithreading

Exception handling - Hierarchy, Types of exception, Mechanisms - try, catch, throw, throws and finally, Exception Propagation - Exception in Inheritance - Introduction to Multiprocessing - threads vs process – threads - Creation of thread - Thread states - Thread Lifecycle and its methods, Executor Framework, Concurrency API, Synchronization Blocks

Unit-V: JAVAFX & JDBC

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – Flow Pane – HBox and VBox – Border Pane – Stack Pane – Grid Pane. Menus – Basics – Menu bars – Menu Item - JDBC – drivers, Steps to create a JDBC application - DB Connection Pool

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Department of Computer Science and Engineering
Chairman – Board of Studies,
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page 73

Text Books:

1.	Herbert Schildt, "Java: The Complete Reference", 12th Edition, McGraw Hill Education, New Delhi, 2019
2.	Cay S.Horstmann., "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018

References:

References Books:

1. Deitel P and Deitel H, "Java: How to Program", 11th Edition, Prentice Hall, 2018
2. James Gosling, Bill Joy, Guy Steele, Gilad Bracha, Alex Buckley and Daniel Smith, "The Java Language Specification – Java SE", 13th Edition, Oracle America Inc., USA, 2019
3. Matt Weisfeld, "The Object-Oriented Thought Process", 5th Edition, Addison-Wesley Professional, US, 2019

Video References:

1. https://www.youtube.com/@abdul_bari/videos
2. https://www.youtube.com/@JennyslecturesCSIT
3. https://caveofprogramming.teachable.com/p/java-multithreading

NPTEL /Online Courses:

1. https://www.udemy.com/course/java-se-programming/
2. https://cse.iitkgp.ac.in/~dsamanta/java/index.htm
3. https://caveofprogramming.teachable.com/p/java-for-complete-beginners

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS203.1	Understand the core concepts of Java programming	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS203.2	Understand the principles of object-oriented programming	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS203.3	Understand the concepts of strings and collections	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS203.4	Apply exception-handling & multithreading concepts in applications	K3	1, 2, 3, 5, 7, 12	1, 2
R19CS203.5	Apply JavaFX & JDBC in application development	K3	1, 2, 3, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS203.1	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS203.2	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS203.3	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS203.4	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS203.5	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

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R19CS205	Design And Analysis of Algorithms	L	T	P	C
		3	0	0	3

1.Course Description:

This course explores the fundamental principles of algorithmic design and analysis, equipping students with the essential tools to tackle complex computational problems efficiently. Through a comprehensive exploration of various algorithmic techniques, including Brute Force, Divide-and-Conquer, Dynamic Programming, Greedy Approach, Backtracking, and Branch and Bound, students will gain a profound understanding of how to formulate, analyze and optimize algorithms for diverse applications. Through hands-on exercises, projects and theoretical discussions, students will develop the skills necessary to design algorithms, assess their efficiency, and make informed decisions regarding algorithm selection for real-world problems.

2.Course Objectives:

1. To understand the algorithm analysis techniques
2. To learn to the efficiency of alternative algorithmic solutions for the same problem
3. To understand different algorithm design techniques
4. To understand the limitations of Algorithmic Power

3.Syllabus

Unit-I: Algorithm Analysis Techniques

Notion of an algorithm - Importance & role of algorithms in computing – Important problem types – Analysis of algorithmic efficiency –Time and Space Complexity - Asymptotic notations and their properties - Analysis framework - Mathematical analysis for recursive and non-recursive algorithms – String Algorithms: Naïve algorithm- Rabin Karp Algorithm-KMP Algorithm- Manachers algorithm

Unit-II: Brute Force and Divide-And-Conquer

Brute force: Selection sort– String matching – Exhaustive search – Boyer Moore algorithm-Travelling salesman problem – Knapsack problem – Assignment problem- Huffman codes and data compression-Divide and Conquer: Binary search – Quick sort – Heap sort – Multiplication of large integer

Unit-III: Dynamic Programming

Ugly numbers– Coin changing problem – Friends pairing problem- Golomb sequence –Warshall's algorithm– Floyd's algorithm – Multi stage graph – Optimal binary search trees – Fractional Knapsack Problem- K Knight's tour on chess board

Unit-IV: Greedy Approach

Definition- Activity selection problem - Longest common subsequence- Sieve of sundaram–Assign mice to holes– Huffman trees- – Sparse matrix - Bloom filter

Unit-V: Backtracking and Branch and Bound
Backtracking – Rat in maze-Permutation and Combination-N Queen problem – Hamiltonian circuit problem – Knight's tour problem-Subset sum problem- Graph Coloring -Branch and Bound – Assignment problem – Knapsack problem – Travelling salesman problem

Text Books:
1. Anany Levitin, —Introduction to the Design and Analysis of Algorithsl, Third Edition, Pearson Education, 2012

References:

Reference Books:
1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2008
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, —Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS205.1	Understand the importance of designing strategies, time and space complexity	K2	1, 2, 3, 4, 5, 7, 12	1, 2
R19CS205.2	Apply brute force and divide and conquer strategies in solving problems	K3	1, 2, 3, 4, 5, 7, 12	1, 2
R19CS205.3	Apply dynamic programming in solving complex problems	K3	1, 2, 3, 4, 5, 7, 12	1, 2
R19CS205.4	Apply greedy algorithms in solving problems	K3	1, 2, 3, 4, 5, 7, 12	1, 2
R19CS205.5	Compare the time and space complexities of different types of algorithms	K3	1, 2, 3, 4, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS205.1	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
R19CS205.2	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
R19CS205.3	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
R19CS205.4	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
R19CS205.5	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
Course to PO	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

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R19IT251	Software Engineering	L	T	P	C
		2	0	2	3

1. Course Description:

This course delves into contemporary software development methodologies like Agile and DevOps, emphasizing practical applications for diverse project scenarios. Through hands-on projects, students learn project planning, risk management, Unified Modeling Language (UML) diagram construction, and software testing strategies using advanced tools and techniques.

2. Course Objectives:

1. To study about various Software Process Models.
2. To exercise with the project planning and Requirements Analysis.
3. To gain experience in the various software design methodologies.
4. To study fundamental concepts in software testing models.
5. To have an exposure with the modern tools used in the Software Engineering.

3. Syllabus:

Unit-I: Software Process Model

SDLC- SDLC Models-Overview of Agile Development Models: Scrum - Scrum Roles - Scrum Meetings - Scrum Artifacts - Extreme Programming, Feature Driven Development, Kanban and Lean Software Development - DevOps and benefits.

Case Study: SDLC followed in MNCs (Infosys, CTS, Google, etc.)

Unit-II: Project Planning and Requirement Analysis

Project Planning: Top-Down and Bottom-Up Planning - Project Duration: Schedule Monitoring Tools - Gantt Chart, PERT Chart, Critical Path. Software Requirements: Functional and Non-functional Requirements - User requirements - System requirements - Software requirements Document (ISO/IEC/IEEE 29148:2011). Requirements Elicitation and Analysis - Requirements Validation.

Case Study: Project Planning with MS Project & Modern Requirements Elicitation for Azure DevOps Application.

Unit-III: Software Design

Design process – Design Concepts-Design Model– Design Heuristic –Unified Modeling Language - Principles of Modeling - Basic Behavioural Modeling: Use Case - Class Diagram - Activity Diagram - Interaction Diagram - Sequence Diagram – Collaboration Diagram - Architectural Modelling: Component Diagram - Deployment diagram - Package Diagram. Design Patterns - Problem Solving by Design Pattern.

Case Study: Model Designing with Argo UML and Star UML.

Unit-IV: Software Testing

Software testing Fundamentals - BlackBox Testing Techniques: Equivalent Partitioning-Boundary Value Analysis (BVA)-Decision Table Based Testing - Cause Effect Graphing Based Testing - White Box Testing Techniques: Logic Coverage criteria - Basic path Testing - Loop Testing - Data flow Testing. Unit testing –Integration Testing – Alpha & Beta Testing and Debugging - Software Configuration Management with GitHub.

Case Study: Reengineering and Reverse Engineering for Agile Projects.

Unit-V: Modern Tools for Software Engineering

Project Planning with ZenTao - Automation Testing with Selenium - Performance Testing with Jmeter - Code Review with Gerrit - Continuous Integration and Deployment with Jenkins – Software Configuration Management with Puppet - Static Code Analysis Using Sonar Cloud.

List of Laboratory Experiments / Exercises:

1. Define the problem statement for the given project
2. Identifying the requirements from problem statements
3. Document the Software Requirements Specification (SRS) for the identified system.
4. Modelling UML Use Case Diagrams and capturing Use Case Scenarios
5. E-R Modelling from the problem statements
6. Identifying Domain Classes from the problem statements
7. State chart and Activity Modelling
8. Modelling UML Class Diagrams and Sequence Diagrams
9. Modelling Data Flow Diagrams
10. Designing Test Suites
11. Implement the modified system using Sonar Cloud and test it for various scenarios.

List of Sample Projects

1. Digitalized Secure Banking.
2. Ecotourism management system.
3. Natural Resources utilization management system for Agricultural Development.
4. Fisheries Resource Management System.
5. Autonomous Robot Aided Agriculture.
6. E-Waste Recycling System.
7. Railway Train Ticket Generation.
8. Coffee Vending system.
9. Robotic Vacuum Cleaning system.
10. Insurance Management system.
11. Primary Health Centre (PHC) Monitoring and Management System.
12. Automated Healthcare monitoring system.
13. Asian Tourism Management system.
14. RFID based security system.
15. Inventory Management System for Car accessories.
16. Automated Food Ordering System.
17. Loan Automation System.
18. Investment scheme Guidelines System.
19. Sports Event Management System.
20. Automated Farming Assistance system.

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Kinathukadavu, Coimbatore - 641 202.

Page | 78

Text Books:

1. Roger S. Pressman, "Software Engineering – A Practitioner's Approach", Ninth Edition, McGraw- Hill International Edition, 2019.
2. Ian Sommerville,"SoftwareEngineering",NinethEdition,Pearson,2011.

References:

References Books

1. BerndBruegge, AlanHDutoit, Object-Oriented Software Engineering,3rded,Pearson,2009.
2. Stephen R.Schach - Software Engineering, Tata McGraw-Hill Publishing Company Limited, 2007.
3. Rajib Mall - Fundamentals of Software Engineering, Third Edition, PHI Learning Private Limited, 2009.
4. Pankaj Jalote - Software Engineering, A Precise Approach, Wiley India, 2010.

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19IT251.1	Compare the various software process models and select the suitable model	K3	1, 2, 4, 5, 7, 9, 10, 11, 12	1,3
R19IT251.2	Analyze the complexity of the project and develop the project plan.	K4	1, 2, 4, 5, 7, 9, 10, 11, 12	1,3
R19IT251.3	Construct the UML diagrams for a project using software design methodology.	K3	1, 2, 4, 5, 7, 9, 10, 11, 12	1,3
R19IT251.4	Analyze and apply the appropriate software testing strategy in the chosen project.	K4	1, 2, 4, 5, 7, 9, 10, 11, 12	1,3
R19IT251.5	Demonstrate the knowledge on contemporary tools in software engineering.	K3	1, 2, 4, 5, 7, 9, 10, 11, 12	1,3

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19IT251.1	2	1	-	3	3	-	1	-	3	1	3	3	2	-	2
R19IT251.2	2	2	-	3	3	2	1	2	3	3	3	3	2	-	2
R19IT251.3	2	1	-	3	3	-	1	3	3	3	3	3	2	-	2
R19IT251.4	2	2	-	3	3	3	2	3	3	3	2	1	2	-	2
R19IT251.5	2	-	-	3	3	-	1	3	3	-	2	3	2	-	2
Course to PO	2	1	-	3	3	1	1	2	3	2	2	3	2	-	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

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Page | 79

R19EC252	Digital Principles and Computer Organization	L	T	P	C
		2	0	2	4

1.Course Description:

This course explores foundational concepts in digital systems, covering binary arithmetic, logic gates, and sequential circuits. Emphasis is placed on computer organization, including CPU architecture, memory systems, and input/output mechanisms. Students gain insights into how these components interact to form modern computing systems.

2.Course Objectives:

1. To understand the Boolean algebra and techniques behind minimization techniques and implement using universal gates

2. To understand and design combinational and sequential logic circuits

3. To understand the design of basic computer organization and the performance enhancement techniques

3.Syllabus

Unit-I: Logic Gates and Minimization Techniques

Basic Theorems and properties of Boolean algebra – canonical form and standard forms – digital logic gates – Minimization Techniques: K-Map (upto 4 variables) – Don't care condition - NAND & NOR Implementation.

Unit-II: Combinational Logic Circuits

Combinatorial Logic Circuits: Design Procedure – Half adder and Full adder – Half Subtractor and Full Subtractor – Magnitude comparator – Encoder and Decoder - Multiplexer and Demultiplexer – code converter (binary to gray, BCD to excess-3 and vice versa).

Unit-III: Sequential Logic Circuits

Sequential Circuits: Flip-flops-Triggering of Flip-flops- Registers – Shift Registers – Ripple Counters - Synchronous counters (up and down counter) – Random Access Memory (RAM).

Unit-IV: Basic Computer Organization

Data Representation: Fixed and Floating Point – Micro operations: Arithmetic, Logic, shift – Arithmetic Logic Shift Unit – Instruction Codes – Computer registers – Computer Instructions – Timing and control – Instruction Cycle – Design of Basic computer.

Unit-V: Performance Enhancement Techniques

Parallel processing - Pipelining – Arithmetic and Instruction pipeline – RISC pipeline - Memory hierarchy Main memory - Cache memory – Characteristics and Multiprocessors – Interconnection Structures.

List of Experiments

1. Verification of Boolean theorems using logic gates.

2. Implementation of half adder and full adder using logic gates

3. Implementation of Multiplexer and De-multiplexer using logic gates.

4. Verification of JK and D Flip-flops.

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Department of Computer Science and Engineering
Sri Eshwar Chairman – Board of Studies
College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641202.

Page | 80

5. Implementation of SISO and PIPO 4-bit shift register using Flip- flops.

6. Construction and verification of 4-bit ripple counter.

Text Books:

1. M. Morris Mano, Michael D Ciletti, "Digital Design", Pearson Education, 6/e, 2018 (Unit I, II, III)

2. M. Morris Mano, "Computer System Architecture", Pearson Education, 3/e, 2017 (Unit IV & V)

References:

1. Donald P. Leach and Albert Paul Malvino, "Digital Principles and Applications", MGH, 8/e, 2014

2. Thomas L. Floyd, "Digital Fundamentals", Pearson, 11/e, 2017

3. John L. Hennessy, David A. Patterson, "Computer Architecture A Quantitative Approach", Morgan Kaufmann Press, 5/e, 2012

4. William Stallings, "Computer Organization and Architecture: Designing for Performance", Pearson, 10/e, 2016

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19EC252.1	Understand the working of logic gates and Apply minimization techniques	K3	1, 2, 3, 4, 5, 9, 10, 12	-
R19EC252.2	Design and analyze combinational logic circuits	K4	1, 2, 3, 4, 5, 9, 10, 12	-
R19EC252.3	Design and analyze sequential logic circuits	K4	1, 2, 3, 4, 5, 9, 10, 12	-
R19EC252.4	Understand the basic computer organization and apply in complex digital system design	K3	1, 2, 3, 4, 5, 9, 10, 12	-
R19EC252.5	Understand the various performance enhancement techniques in processors and memories.	K2	1, 2, 3, 4, 5, 9, 10, 12	-

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19EC252.1	3	3	3	3	3	-	-	-	1	1	-	2	-	-	-
R19EC252.2	3	3	3	3	3	-	-	-	1	1	-	2	-	-	-
R19EC252.3	3	3	3	3	3	-	-	-	1	1	-	2	-	-	-
R19EC252.4	3	3	3	2	1	-	-	-	1	1	-	2	-	-	-
R19EC252.5	3	3	3	2	1	-	-	-	1	1	-	2	-	-	-

"3" —High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS212	Database Management Systems Laboratory	L	T	P	C
		0	0	2	1

1.Course Description:

This practical course offers hands-on experience in essential database concepts and technologies. Students will explore into Introduction to Databases, mastering the fundamentals of data modelling and relational database design. They will then explore Structured Query Language (SQL) and Procedural Language/SQL (PL/SQL), acquiring skills in querying and manipulating data. Through practical exercises, students will learn Transaction and Concurrency Control techniques, ensuring data integrity and consistency in multi-user environments. Additionally, they will gain proficiency in Storage & Indexing, optimizing database performance through efficient data storage and retrieval strategies. Finally, students will explore NoSQL databases, understanding their unique characteristics and applications in modern data management scenarios

2.Course Objectives:

1. To provide knowledge on designing databases using proper data modelling techniques
2. To inculcate knowledge of SQL queries using various database tools and techniques
3. To learn the Advanced SQL queries for the relational databases
4. To impart SQL and procedural interfaces to SQL comprehensively
5. To enable the students to develop an application using database concepts

3.List of Laboratory Experiments / Exercises:

Design a project for the following application using JDBC Connectivity

- Online Food Ordering System
- Online Movie Ticket Booking System
- Online Parking System
- Online Hotel Room Booking System

1 ER Diagrams

Create an Entity Relationship model for the above applications

2 SQL Queries

Develop the SQL Queries using the following commands for the database
   a. DDL commands - Create, alter (Add, Modify, Rename), Truncate, Drop commands
   b. DML commands - Insert, Update, and Delete commands
   c. DQL commands - Select and its basic operations
   d. DCL commands - Commit, Rollback, and Savepoint operations
   e. TCL commands - Grant and Revoke operations for the different users

3 Implementation of Key constraints
   a. Build the Integrity Constraints - Unique, NOT NULL, Auto Increment, Primary Key, Foreign Key, Check, Default constraints for the given databases

4 Advanced SQL Queries

Implementation of Aggregate Functions

a. Find the total count of all the records in the table

b. Find the average value of a specific column in the table

c. Find the maximum/min/sum value of a specific column in the table

d. Find the count of all distinct values in a specific column in the table

5 Implementation of Group By Clause

a. Find the average/max/min/sum of all values of a specific column for each group records in the table

b. Find the count/average/max/min of all records in the table grouped by multiple columns

6 Implementation of OrderBy Clause

a. Sort the list of all records in the table by multiple columns/specific columns in ascending or descending order

b. Find the top/ bottom 10 records in the table sorted by a specific column/multiple columns

c. Find the list of all records in the table sorted by a specific column/multiple columns and limited to a certain range

7 Implementation of String Functions

a. Find the length of characters in a specific string

b. Find the leftmost/rightmost portion of a specific string up to a certain character or length

c. Find the specific portion of a string extracted using a regular expression pattern

d. Find the specific string with all occurrences of a certain character or pattern replaced with another character or string

e. Find the specific string converted to uppercase or lowercase

f. Find the specific string with leading or trailing whitespace characters removed

g. Find the specific string with a certain character or substring removed or replaced

h. Find the specific string with a certain character or substring added at a certain position

i. Find the specific string with all occurrences of a certain substring concatenated with another substring

8 Implementation of Date function

a. Find the current date and time in MySQL

b. Find the day of the week for a specific date in MySQL

c. Find the month/year for a specific date in MySQL

d. Find the difference between two specific dates in MySQL

e. Find the date in MySQL after adding/subtracting a specific number of days to a specific date.

f. Find the number of days/average time between two specific dates in MySQL

g. Find the earliest or latest date in a specific column of the table in MySQL

9 Implementation of Nested queries

    a. Find the maximum/min/count/sum/average/distinct count value of a specific column in the table for a specific subset of records selected using a nested query

    b. Find the average/max/sum/count/min value of a specific column in the table where the value of another column is equal to a specific value selected using a nested query

    c. Find the maximum value of a specific column in the table for a specific subset of records selected using a nested query within another nested query

10 Implementation of Joins

    a. Find the result of an inner/left/right/full outer/cross joins between two/multiple tables on a specific column in MySQL

11 Construction of Index

    b. Create an index for the database and show the comparative analysis of Query execution time with and without using an index for the given scenario

12 Implementation of views

    a. Perform the DDL, DML, and DQL operations on the views and check the consistency of the relations

    b. Create different types of views and their categories of the REFRESH command.

    c. Implement the materialized views with Aggregate and Join queries

13 PLSQL

Develop a program in PLSQL using Before/After trigger, row, and statement trigger and instead of trigger

    a. Develop a program in PLSQL using Before/After trigger, row, and statement trigger and instead of trigger.

    b. Create a trigger and check for the before/after insertion, update, and deletion operations in the table.

14 NOSQL

Implementation of MongoDB application and run through CRUD operations

    a. Command to create a collection and a document in MongoDB

    b. Command to insert/update/delete a document in a MongoDB collection

    c. Command to query a MongoDB collection to retrieve documents that meet certain criteria

    d. Command to use aggregation pipelines to perform more complex queries in MongoDB

    e. Command to create an index in MongoDB to improve query performance

15 Create tables and execute the queries using Click House

    a. Command to create a table, view, and functions

    b. Command to insert the data in a table from compressed files, Infiles, and multiple files

c.	Command to query the data using the SELECT, WHERE, JOIN, GROUPBY, HAVING clauses
d.	Command to query the data using the Regular, Aggregate, and Table functions

References:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, —"Database System Concepts", Sixth Edition, Tata McGraw Hill, 2013

2. Ramez Elmasri, Shamkant B. Navathe, —"Fundamentals of Database Systems", Sixth Edition,Pearson Education, 2014

3. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence – "Sadalage, P. & Fowler, Pearson Education, 2013

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS212.1	Demonstrate the ability to identify, define, and analyze complex problems using appropriate methodologies, queries and tools	K3	1, 2, 3, 4, 5, 7, 12	1, 2, 3
R19CS212.2	Design effective visual representations to solve the identified problems	K3	1, 2, 3, 4, 5, 7, 12	1, 2, 3
R19CS212.3	Develop database-oriented solutions and write queries to perform various operations	K3	1, 2, 3, 4, 5, 7, 12	1, 2, 3
R19CS212.4	Develop effective presentation skills to present and defend the designs and solutions	K3	1, 2, 3, 4, 5, 7, 12	1, 2, 3
R19CS212.5	Understand issues related to privacy, security and accessibility and adhere to coding standards	K3	1, 2, 3, 4, 5, 7, 12	1, 2, 3

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS212.1	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
R19CS212.2	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
R19CS212.3	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
R19CS212.4	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
R19CS212.5	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-
Course to PO	3	3	3	3	1	-	1	-	-	-	-	2	1	1	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

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Page | 85

R19CS213	Object-Oriented Programming Using Java Laboratory	L	T	P	C
		0	0	2	1

1.Course Description:

This laboratory course offers hands-on experience in applying Java concepts and techniques to real-world programming scenarios. Students will engage in practical exercises and projects covering key topics such as Foundations of Java, Object-Oriented Mechanisms, Strings, Collections & Java 8 Features, Exception Handling, Multithreading, JavaFX, and JDBC. Through guided lab sessions, students will develop proficiency in writing Java code, designing object-oriented solutions, implementing error handling strategies, and building graphical user interfaces and database-driven applications using JavaFX and JDBC.

2.Course Objectives:

1. To understand object-oriented programming concepts and the basics of java programming language
2. To know the principles of packages, inheritance and interfaces
3. To understand strings & collections with java 8 features
4. To develop a Java application with exception handling and threads
5. To build windows-based applications with JDBC

3.List of Laboratory Experiments / Exercises:

1. **Foundations of Java**
   - Implement class, objects, data types, operators, control statements, wrapper classes and scanner classes using java
   - Implement command line arguments with i/o packages using java
   - Implement sequential search, binary search and quadratic sorting algorithms using java

2. **Object-Oriented Mechanisms**
   - Implement encapsulation, abstraction, polymorphism and inheritance using java
   - Implement interface by accessing super class constructors and methods using java

3. **Strings, Collections & Java 8 Features**
   - Implement string, string functions, string builder, string buffer and regex using java
   - Implement lambda expression & for each() method using java
   - Implement generics-wildcard expression using java
   - Implement stack and queue data structures using java
   - Implement list, map, set, date and time using java

4. **Exception Handling And Multithreading**
   - Implement exception handling by creating user-defined exceptions using java
   - Implement multithreading and inter-thread communication using java

5. **JAVAFX & JDBC**
   - Develop applications using javafx controls, layouts and menus

6. **Project**
   - Develop an application using jdbc-oops-collections-javafx in eclipse IDE

References:

1. Deitel P and Deitel H, "Java: How to Program", 11th Edition, Prentice Hall, 2018
2. James Gosling, Bill Joy, Guy Steele, Gilad Bracha, Alex Buckley and Daniel Smith, "The Java Language Specification – Java SE", 13th Edition, Oracle America Inc., USA, 2019

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS213.1	Demonstrate the ability to identify, define, and analyze complex problems using appropriate algorithms, data structures, methodologies and	K3	1,2,3,4,5,8,12	1,2
R19CS213.2	Design effective visual representations (UML diagrams/Flowchart) to solve the identified problems	K3	1,2,3,4,5,8,12	1,2
R19CS213.3	Create solutions and implement them using suitable programming platforms	K6	1,2,3,4,5,8,12	1,2
R19CS213.4	Develop effective presentation skills to present and defend the designs and solution	K4	1,2,3,4,5,8,12	1,2
R19CS213.5	Understand issues related to privacy, security and accessibility and adhere to coding standards	K2	1,2,3,4,5,8,12	1,2

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS213.1	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2
R19CS213.2	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2
R19CS213.3	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2
R19CS213.4	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2
R19CS213.5	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2
Course to PO	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS215	Design and Analysis of Algorithms Laboratory	L	T	P	C
		0	0	4	2

1.Course Description:

In this practical course students will immerse themselves in the application of foundational algorithmic techniques to real-world problems. Through hands-on exercises, coding assignments and project work, students will gain practical experience in Algorithm Analysis Techniques, including Brute Force, Divide-and-Conquer, Dynamic Programming, Greedy Approach, Backtracking and Branch and Bound. By implementing these algorithms in various programming languages, students will develop a deep understanding of their operation, efficiency and applicability across different problem domains. Through iterative refinement and experimentation, students will hone their algorithmic design skills, learning to optimize solutions for performance and scalability.

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641202.

Page | 87

2.Course Objectives:

1. To understand the techniques for analyzing algorithms
2. To learn the paradigms for designing the algorithms
3. To analyze the efficiency of various algorithm design techniques
4. To understand the limitations of algorithmic power

3.List of Laboratory Experiments / Exercises:

1. Implementation of string algorithms

2. Demonstration of applications of string algorithms (Naïve algorithm, Rabin Karp Algorithm, KMP Algorithm and Manachers algorithm)

3. Implementation of brute force and divide-and-conquer techniques

4. Demonstration of applications of brute force and divide and conquer techniques (Boyer Moore algorithm, Travelling salesman problem, Knapsack problem, Assignment problem, Jump game, Maximum subarray, Merge Intervals, Tiling problem, Karatsuba algorithm)

5. Implementation of dynamic programming

6. Demonstration of applications of dynamic programming (Warshall's algorithm, Floyd's algorithm, Knapsack Problem, Longest Common Subsequence, Levenshtein distance (Edit distance) problem, Longest palindrome, Longest common substring, Longest happy string, Palindrome partitioning, Minimum coin change, Equal subset sum partition, Wildcard matching, longest repeated subsequence)

7. Implementation of Greedy approach

8. Demonstration of applications of Greedy approach (Activity Selection Problem, Graph Colouring Problem, Huffman coding compression algorithm, shortest superstring problem, Flip the world, Dials algorithm, Minimum spanning tree, Sieve of sundaram, Remove invalid parenthesis, Maximum ribbon cut)

9. Implementation of backtracking and branch & bound

10. Demonstration of applications of backtracking and branch & bound (Queen problem, Hamiltonian circuit problem, Knight's tour problem, Subset sum problem, Sudoku Solver, Letter combinations of a phone number, Combinatorial optimization problems, Zigzag conversion, Valid Sudoku, People holding hands, Reverse pairs)
11. Mini project: Create a simple gaming application

References:

1. Anany Levitin, —Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012James

2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, —Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman – Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 88

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS215.1	Demonstrate the ability to identify, define, and analyze complex problems using appropriate algorithms, data structures, methodologies and tools	K6	1, 2, 3, 4, 5, 7, 9, 11, 12	2, 3
R19CS215.2	Design effective visual representations (UML diagrams/Flowchart) to solve the identified problems	K3	1, 2, 3, 4, 5, 7, 9, 11, 12	2, 3
R19CS215.3	Develop and analyze algorithms and implement them using suitable programming platforms	K3	1, 2, 3, 4, 5, 7, 9, 11, 12	2, 3
R19CS215.4	Develop effective presentation skills to present and defend the designs and solutions	K3	1, 2, 3, 4, 5, 7, 9, 11, 12	2, 3
R19CS215.5	Understand issues related to privacy, security and accessibility and adhere to coding standards	K2	1, 2, 3, 4, 5, 7, 9, 11, 12	2, 3

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS215.1	3	3	3	3	2	-	1	-	1	-	2	2	-	1	2
R19CS215.2	3	3	3	3	2	-	1	-	1	-	2	2	-	1	2
R19CS215.3	3	3	3	3	2	-	1	-	1	-	2	2	-	1	2
R19CS215.4	3	3	3	3	2	-	1	-	1	-	2	2	-	1	2
R19CS215.5	3	3	3	3	2	-	1	-	1	-	2	2	-	1	2
Course to PO	3	3	3	3	2	-	1	-	1	-	2	2	-	1	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19EM201	Logical Thinking	L	T	P	C
		0	0	2	1

1. Course Description:

This course is to cultivate in engineering students a solid foundation in basic logical thinking, reasoning, and problem-solving skills. This includes the ability to analyse and evaluate arguments, identify logical fallacies, and construct clear and cogent arguments. Through a combination of theoretical lectures and practical exercises, students will develop the critical thinking skills necessary to approach engineering problems systematically, with clarity and precision. Additionally, they will gain an understanding of the importance of logical thinking in the design and implementation of engineering solutions, thereby enhancing their overall effectiveness as engineers.

2. Course Objectives:

1. To create a transformation in thought process.
2. To enhance problem solving ability.
3. Realizing the importance of aptitude in real life, why it is frequently tested and how it should be learnt and discovered from within.
4. Understand the difference between some of the important concepts like - Method memorization, Understanding, forced belief, and realized truth.

Chairman – Board of Studies
Department of Computer Science and Engineering
S _shwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 89

| | 5. | To provide exposure on frequently asked problems and puzzles in various placement and competitive exams through understanding the algorithms and concepts associated in the backend. |

3. Syllabus:

Unit-I: Foundation

Understanding Vs Method Memorizations: Zero Knowledge Approach and Pattern Finding Approach; Foundational approach: AI Models, Numbers, Prime Numbers, OTP logic; Factors: Equal distribution, HCF, Tiles factory, Cost optimization problems and Case Studies.

Unit-II: Finance and Technology

Fundamentals of Finance: Percentages, Profit & Loss, Pricing Logics; Interest: Cash Flow and Taxes; Programming Logic: Introduction to digital ledger, Decentralized banking, Block chain, crypto currencies and Case Studies.

Unit-III: Human Resources, Work Planning & Dynamic Programming

Fundamentals of Human Resources & Operations: Resources allocation, Time & Work, Einstein's Puzzle, Backtracking, All possible routes, Stanford programming and Case Studies.

Unit-IV: Statistics and Geometry

Fundamentals of statistics: Mean, Median and Mode, Real life application of statistics, Application of Ratios and Proportions in business problems, Partnerships; Geometry: 2D, 3D Visualizations, Tools, Applications; Introduction to AR, VR and Tools like Unity and Unreal Engine and Case Studies.

Unit-V: AI & DS - Insights & Visualization

Real life application of Linear algebra, Calculus, Probability and Statistics, Graph theory and information theory; Important mathematical subtopics applied in AI and DS; Data representation and understanding; Analyzing the data: Introduction to basic visualization and dash boarding tools; Creating insights using data: AI tools and Case Studies.

References:

Reference Books:

1. Dr. R S Aggarwal, Quantitative Aptitude, Revised Edition, S. Chand Publishing Company Ltd(s), 2022
2. Arun Sharma, How to prepare for Quantitative Aptitude for the CAT, 10th Edition, Tata McGraw-Hill Publishing Company Ltd, 2022

Online References:

1.https://www.hackerearth.com/
2.https://www.geeksforgeeks.org/
3.https://www.indiabix.com

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19EM201.1	Understand the importance and impact created by aptitude concepts in real life.	K2	1, 2, 3, 6	-
R19EM201.2	Understand a lot of learning methods and will be able to apply them in real life problems.	K2, K3	1, 2, 4, 12	-
R19EM201.3	Able to apply and solve problems based on application of aptitude concepts in real life	K3	1, 2, 3, 4	-

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman – Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641202.

Page | 90

R19EM201.4	Analyze, evaluate, and compare different scenarios given in a problem and find the strategically best solutions.	K4, K5	2, 4	-
R19EM201.5	Creating own questions based on parameters and constraints given.	K6	2, 3	-
R19EM201.6	Create shortcut formulas by self	K6	2, 5	-

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19EM201.1	3	3	2	-	-	1	-	-	-	-	-	1	-	-	-
R19EM201.2	3	3	-	2	-	-	-	-	-	-	-	1	-	-	-
R19EM201.3	3	3	2	1	-	-	-	-	-	-	-	1	-	-	-
R19EM201.4	3	3	-	2	-	-	-	-	-	-	-	1	-	-	-
R19EM201.5	3	3	2	-	-	-	-	-	-	-	-	1	-	-	-
R19EM201.6	3	3	-	-	2	-	-	-	-	-	-	1	-	-	-
Course to PO	3	3	1	1	-	-	-	-	-	-	-	1	-	-	-

"3"—High, "2"—Medium, "1"—Low, "—" — No Correlation

R19MC102	தமிழரும் தொழில் நுட்பமும் / **Tamils and Technology**	L	T	P	C
		1	0	0	1

1. Course Description / பாடநெறி விளக்கம்:

This course teaches students about the technologies used in weaving, ceramics, design, and construction during the Sangam era. The importance of technologies like manufacturing, irrigation, and agriculture must be understood by the students. . Students can progress the new equipment by studying the ancient irrigation and agricultural methods. Students need to understand the evolution of Tamil computing and Scientific Tamils in order to recognize modern technology. Students can benefit greatly from the expansion of scientific Tamil knowledge, Tamil computer applications, and Tamil book digitization.

சங்ககாலத்தில் நெசவு, மட்பாண்டங்கள், வடிவமைப்பு மற்றும் கட்டுமானத்தில் பயன்படுத்தப்பட்ட தொழில் நுட்பங்களைப் பற்றி இந்த பாட நெறி மாணவர்களுக்கு கற்பிக்கிறது. உற்பத்தி, நீர்ப்பாசனம், விவசாயம் போன்ற தொழில் நுட்பங்களின் முக்கியத்துவத்தை மாணவர்கள் புரிந்து கொள்ள வேண்டும். பழங்கால நீர்ப்பாசனம் மற்றும் விவசாய முறைகளைப் படிப்பதன் மூலம் மாணவர்கள் புதிய உபகரணங்களை மேம்படுத்தலாம் நவீன தொழில் நுட்பத்தை அங்கீகரிக்கும் வகையில் தமிழ் கணினி மற்றும் அறிவியல் தமிழர்களின் பரிணாம வளர்ச்சியை மாணவர்கள் புரிந்து கொள்ள வேண்டும். அறிவியல் தமிழ் அறிவின் விரிவாக்கம், தமிழ் கணினி பயன்பாடுகள், தமிழ் புத்தகங்களை டிஜிட்டல் மயமாக்குதல் போன்றவற்றின் மூலம் மாணவர்கள் பெரிதும் பயனடையலாம்.

2. Course Objectives /பாடத்தின்நோக்கங்கள்:

1. To facilitate the students to understand weaving and ceramic technology of sangam age.

   நெசவு மற்றும் மட்பாண்டம் செய்யும் முறைகள் பற்றிய தெளிவானபுரிதல்.

2. Observe the design of houses, sculptures and construction of temples.

சங்ககால கோயில்கள் வடிவமைப்பு மற்றும் கட்டமைப்பின் பல்வேறு பரிமாணங்களைப் பற்றி அறிந்துகொள்வது.

3. Understanding the various manufacturing technology in ship, iron andstone types in Silappathikaram.

சிலப்பதிகாரத்தில் கப்பல், இரும்பு மற்றும் கல்வகைகளில் பல்வேறு உற்பத்தித் தொழில்நுட்பத்தைப் புரிந்து கொள்வது.

4. Understand the significance of agriculture and irrigation technology in ancient period.

அணை கட்டுமான வழிமுறைகள், விவசாயம் மற்றும் கடலில் இயந்திரங்களின் பயன்பாடு பற்றி அறிந்து கொள்வது.

5. Explain the growth of scientific Tamil, Tamil computing and digitization of Tamil books.

அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணினி, தமிழ் நூல்களின் டிஜிட்டல் மயமாக்கல் ஆகியவற்றை அறிந்து கொள்வது.

3. Syllabus / பாடத்திட்டங்கள்:

Unit-I / அலகு-I: Weaving and Ceramic Technology/ நெசவு மற்றும் பானைத் தொழில்நுட்பம்

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries

சங்ககாலத்தில் நெசவுத் தொழில் –பானைத் தொழில்நுட்பம்- கருப்பு சிவப்பு பாண்டங்கள் –பாண்டங்களில் கீறல் குறியீடுகள்.

Unit-II / அலகு - II: Design And Construction Technology / வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்

Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple) - ThirumalaiNayakarMahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period.

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள், சங்ககாலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்ககாலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் –சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் –மாமல்லபுரச் சிற்பங்களும் கோவில்களும் –சோழர்காலத்துப் பெருங்கோயில்கள் மற்றும் பிறவழி பாட்டுத்தலங்கள் –நாயக்கர்காலக் கோயில்கள் –மாதிரிகட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் –செட்டிநாட்டு வீடுகள் –பிரிட்டிஷ்காலத்தில் சென்னையில் இந்தோ –சாரோசெனிக் கட்டிடக்கலை.

Unit-III/ அலகு - III: Manufacturing Technology/ உற்பத்தி தொழில்நுட்பம்

Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold Coins as source of history – Minting of Coins – Beads making-industries Stone beads –Glass beads – Terracotta beads –Shell beads – Archeological evidences – Gem stone types described in Silappathikaram.

கப்பல் கட்டும் கலை –உலோகவியல் –இரும்புத் தொழிற்சாலை –இரும்பு உருக்குதல், எஃகு –வரலாற்று சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் –நாணயங்கள் அச்சடித்தல் –மணிகள் உருவாக்கும் தொழிற்சாலைகள் –கல்மணிகள், கண்ணாடி மணிகள், சுடுமண் மணிகள், சங்குமணிகள் –தொல்லியல் சான்றுகள் –சிலப்பதிகார மணிகளின் வகைகள்.

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 92

Unit-IV/ அலகு-IV: Agriculture And Irrigation Technology/ வேளாண்மை மற்றும் நீர்பாசனதொழில்நுட்பம்
Dam, Tank, ponds, Sluice - Significance of KumizhiThoombu of Chola Period - Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society.   அணை, ஏரி, குளங்கள், மதகு -சோழர் கால குமிழித்தும் பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் –வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு –மீன்வளம், முத்து மற்றும் முத்து குளித்தல் பெருங்கடல் குறித்த பண்டைய அறிவு –அறிவுசார் சமூகம்

Unit-V / அலகு-V:Scientific Tamil & Tamil Computing / அறிவியல் தமிழ் மற்றும் கணித் தமிழ்
Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.   அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி –தமிழ் நூல்களை மின் பாதிப்பு செய்தல் –தமிழ் மென்பொருட்கள் உருவாக்கம் –தமிழ் இணைய கல்விக்கழகம் –தமிழ்மின் நூலகம் –இணையத்தில் தமிழ் அகராதிகள் –சொற்குவைத்திட்டம்.

Text Books:

1. தமிழக வரலாறு –மக்களும் பயன்பாடுகளும் –கே.கே.பிள்ளை (தமிழக பாடநூல் கழகம் மற்றும் கல்வியல் பணிகள் கழகம்)
2. கணினித் தமிழ் –முனைவர்.இல சுந்தரம் (விகடன்பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils - Dr.K.K.Pillay, A joint publication of TNTB & ESC and RMRL – (in print).
6. Social Life of the Tamils - The Classical Period - Dr.S.Singaravelu (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils - Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture - Dr.M.Valarmathi (Published by: International Institute of Tamil Studies).
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Tamil Nadu).
10. Studies in the History of India with Special Reference to Tamil Nadu - Dr.K.K.Pillay.

References:

1. Journey of Civilization Indus to Vaigai - R.Balakrishnan, Published by: RMRL.
2. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 93

4. Course Outcomes/ பாடநெறி முடிவுகள்:

CO. No.	Course Outcome /பாடநெறி முடிவுகள்	BTL	POs	PSOs
R19MC102.1	Describe about the weaving industry in sangam age and ceramic technology. சங்ககாலத்தில் நெசவுத்தொழில் மற்றும் பீங்கான் தொழில்நுட்பம் பற்றி விரிவாக அறிந்துகொள்ளுதல்.	K2	10, 12	-
R19MC102.2	Observe the design of houses, sculptures and construction of temples. வீடுகளின் வடிவமைப்பு, சிற்பங்கள் மற்றும் கோவில்களின் கட்டுமானத்தைப் பற்றி தெரிந்து கொள்ளுதல்.	K2	10, 12	-
R19MC102.3	Relate the various manufacturing materials and stone types in Silappathikaram. சிலப்பதிகாரத்தில்உள்ளபல்வேறுஉற்பத்திப்பொருட்கள்மற்றும் கல்வகைககளைப்பற்றிபுரிந்துகொள்ளுதல்.	K2	10, 12	-
R19MC102.4	Understand the significance of agriculture and irrigation technology in ancient period. பண்டையகாலத்தில் விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தின் முக்கியத்துவத்தை புரிந்து கொள்ளுதல்.	K2	10, 12	-
R19MC102.5	Explain the growth of scientific Tamil, Tamil computing and digitization of Tamil books. அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணினி, தமிழ் நூல்களின் டிஜிட்டல் மயமாக்கல் ஆகியவற்றை விரிவாக தெரிந்து கொள்ளுதல்.	K2	10, 12	-

5. Course Articulation matrix:

CO	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO01	PSO02	PSO03
R19MC102.1	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
R19MC102.2	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
R19MC102.3	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
R19MC102.4	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
R19MC102.5	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-
Course to PO	-	-	-	-	-	-	-	-	-	1	-	1	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19MA206	Probability and Statistics	L	T	P	C
		3	1	0	4

1. Course Description:

This course provides a foundational understanding of probability theory and statistical methods, essential for making informed decisions in diverse fields such as science, engineering, business, and social sciences. The curriculum encompasses both theoretical principles and practical applications, enabling students to analyze data, draw meaningful inferences, and make informed decisions in uncertain situations.

2. Course Objectives:

1. To quantify the outcomes of random occurrences.

2. To acquire the knowledge of various distributions and its applications.

3. To describe the difference between correlation and regression also to calculate and interpret the linear regression equation.

4. To make an inference about the population on the basis of a random sample taken from that population.

5. To learn how to approximate the value of a population parameter on the basis of sample statistics.

3. Syllabus:

Unit-I: Probability

Probability axioms; Conditional probability; Baye's theorem statement only; Discrete and continuous random variables; Moments, moment generating functions.

Unit-II: Standard Distributions

Discrete distributions: Binomial, poisson, geometric; Continuous distributions: Uniform, exponential and Gaussian

Unit-III: Pair of Random Variables

Joint distributions; marginal and conditional distributions; covariance; linear correlation; regression lines

Unit-IV: Testing of Hypothesis

Sampling distributions: Statistical hypothesis; Large sample test: Single mean, difference of means, proportion; Small sample test: t-test, F-test; Chi-square test: Goodness of fit, independence of attributes.

Unit-V: Estimation Theory

Unbiased estimators; method of moments; maximum likelihood estimation; curve fitting by principle of least squares.

Text Books:

1. Johnson R. A., Miller and Freund's, "Probability and Statistics for Engineers", 8thEdition, Pearson Education, Delhi, 2015.

2. Walpole R. E., Myers S.L. and Keying Ye, "Probability and Statistics for Engineers and Scientists",9th Edition, Pearson Education Inc, 2012.

Chairman – Board of Studies
Department of Computer Science and Engineering
Sri ishwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641202

Page | 95

References:

1. Devore. J. L., "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, New Delhi, 2014.
2. Gupta S. P, "Statistical Methods", Sultan Chand & Sons Publishers, 2014.
3. Veerarajan. T, "Probability, Statistics and Random Processes", 3rd Edition, Tata McGraw Hill, 2009.

Journals:

1. Journal of the Indian society for probability and statistics
2. International journal of probability and statistics

Video References:

1. www.NPTEL /Online Courses:videos.in/2012/12/probability-random-variables.html
2. www.freevideolectures.com › Mathematics › IIT Kharagpur
3. www.freevideolectures.com › Computer Science › IIT Madras
4. https://www.youtube.com/watch?v=32CuxWdOlow
5. https://www.youtube.com/watch?v=I_dhPETvll8

NPTEL /Online Courses:

1. NPTEL /Online Courses:.ac.in/courses/111104079/
2. https://NPTEL /Online Courses:.ac.in/noc/courses/noc22/SEM1/noc22-ma30/
3. https://onlinecourses.NPTEL /Online Courses:.ac.in/noc22_mg31/

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19MA206.1	Apply fundamental probability concepts to explore random experiments.	K3	1, 2, 3, 4, 12	-
R19MA206.2	Apply the concepts of standard distributions to solve real-world problems and make informed decisions.	K3	1, 2, 3, 4, 12	-
R19MA206.3	Apply the functions of two-dimensional random variables through its probability values.	K3	1, 2, 3, 4, 12	-
R19MA206.4	Analyze the concept of various test statistics used in hypothesis testing for mean and variances of large and small samples.	K4	1, 2, 3, 4, 12	-
R19MA206.5	Evaluate the values of parameters based on measured empirical data that has a random component.	K5	1, 2, 3, 4, 12	-

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19MA206.1	3	3	2	1	-	-	-	-	-	-	-	2	-	-	-
R19MA206.2	3	3	2	1	-	-	-	-	-	-	-	2	-	-	-
R19MA206.3	3	3	2	2	-	-	-	-	-	-	-	2	-	-	-
R19MA206.4	3	3	2	2	-	-	-	-	-	-	-	2	-	-	-
R19MA206.5	3	3	2	2	-	-	-	-	-	-	-	2	-	-	-
Course to PO			2	2	-	-	-	-	-	-	-	2	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

Chairman - Board of Studies

Department of Computer Science and Engineering
Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

Page | 96

R19CS204	OPERATING SYSTEMS	L	T	P	C
		3	0	0	3

1. Course Description:

This course introduces students to the fundamental principles and concepts underlying modern operating systems. Through lectures, practical exercises, and assignments, students will gain a deep understanding of the design, implementation, and management of operating systems. Topics covered include process management, memory management, file systems, device management, security, and virtualization. Emphasis will be placed on both theoretical concepts and practical applications, with hands-on experience in working with various operating systems.

2. Course Objectives:

1. To understand the services provided by and the design of an operating system.
2. To understand what a process is and how processes are synchronized and scheduled.
3. To understand different approaches to memory management.
4. Students should be able to use system calls for managing processes, memory, and the file system

3.Syllabus:

UNIT – I   Kernel and Process Management

Operating System Overview: Objective and Functions-Types of Operating System-Services- Boot Block-Kernel- Microkernel-Monolithic Kernel-Macro Kernel-System Calls Processes: States of Process-Process Control Block (PCB)-Context Switch-Creation and Termination-Inter-process Communication Threads: Introduction-Multithreading Models-Thread Libraries-Threading issues Case Study: Zombie Process and their Prevention-Lottery Process Scheduling

UNIT – II   CPU Scheduling and Process Synchronization

CPU Scheduling: Scheduling – Scheduling Criteria-Scheduling Algorithms: Preemptive and Non-Preemptive Scheduling (FCFS, SJF, LRTF, Round-Robin, Priority)-Process Synchronization: The Critical Section Problem-Peterson's Solution-Synchronization Hardware-Mutex Locks-Semaphores-Classical Problems of Synchronization-Producer Consumer Problem-Dining Philosophers Problem Case Study: Sleeping Barber Problem-Dekker's Algorithm-Bakery Algorithm

UNIT– III   Deadlock and Memory Management

Deadlocks: Necessary Conditions -Resource Allocation Graph- Deadlock Prevention, Deadlock Avoidance-Banker's Algorithm-Deadlock Detection-Recovery from Deadlock Main Memory Management: Swapping-Contiguous Memory Allocation-Paging- Segmentation-Segmentation with paging Case Study: Snow Cone: Android Memory Management.

UNIT- IV   Virtual Memory Management and Secondary Storage

Virtual Memory Management: Demand Paging-Page Replacement (FIFO, LRU, Optimal)- Allocation of Frames-Thrashing File Management: Overview-Organization-Access-File Directories-File Structures-File Sharing and Protection-Allocation Methods-Free Space Management Mass Storage Structure: Mass Storage System-Disk Structure-Disk Scheduling and Management-Swap Space management-I/O Management and Disk Scheduling Case Study: Buddy Memory Allocation Scheme in Operating Systems

UNIT – V   RTOS and Virtualization

RTOS: Introduction to real-time systems and OS- RTOS services, real-time tasks- RTOS memory management- FreeRTOS Virtualization: Process and System VMs-Taxonomy of VMs -Hardware Emulation-Full Virtualization with binary translation-Hardware assisted -Operating System-Virtualization- Case Study: RTOS for fault Tolerant Applications-Container /Docker

Text Books:

1. Abraham silberschatz,Peter Bear Galvin and Greg Gagne, "Operating System Concepts",John Willey&Sons(asia)Pvt ltd, Tenth Edition,2018.

Chairman – Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu Coimbatore – 641 202.

Page | 97

2. Remzi H.Arpaci-Dusseau, Andrea C.Arpaci-dussea,"Operating Systems :Three Easy Pieces", Amazon Digital Services, First Edition,2018.
3. Dhanajay M.Dhamdgere, "Operating systems-A Concept Based Approach", Third Edition, Tata McGraw Hill Edition 2019
4. Smith,Nair,Virtual Machines:Versatile Platforms for Systems and Processes, Morgan Kaufman Publishers(2005)

References:

References Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", Pearson Education, Third Edition, 2015.
2. William Stallings, "Operating Systems: Internals and Design Principles", Pearson Education, Ninth Edition, 2018
3. Charles Crowley,"Operating systems:A Design-Oriented approach",Tata McGraw Hill Education,2017.
4. Operating System Fundamentals-NPTEL /ONLINE COURSES: COURSE.

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS204.1	Analyze the states of a process and explain the role of the Process Control Block.	K4	1, 2, 3, 4, 12	1, 2
R19CS204.2	Evaluate CPU Scheduling Algorithms and Implement Synchronization Mechanisms.	K5	1, 2, 3, 4, 12	1, 2
R19CS204.3	Design Solutions for Deadlocks and Implement Memory Management Strategies.	K5	1, 2, 3, 4, 12	1, 2
R19CS204.4	Apply their understanding of file management concepts, including file directories, structures, and sharing, to real-world scenarios.	K3	1, 2, 3, 4, 12	1, 2
R19CS204.5	Apply their understanding of Real-Time Operating Systems and virtualization to real-world scenarios.	K3	1, 2, 3, 4, 12	1, 2

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS204.1	3	2	1	1	-	-	-	-	-	-	-	2	2	2	-
R19CS204.2	3	2	1	1	-	-	-	-	-	-	-	2	2	2	-
R19CS204.3	3	2	1	1	-	-	-	-	-	-	-	2	2	2	-
R19CS204.4	3	2	1	1	-	-	-	-	-	-	-	2	2	2	-
R19CS204.5	3	2	1	1	-	-	-	-	-	-	-	2	2	2	-
Course to PO	3	2	1	1	-	-	-	-	-	-	-	2	2	2	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

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R19CS206	Full Stack Development	L	T	P	C
		3	0	0	3

1.Course Description:

Full Stack Development is a comprehensive course designed to equip students with the knowledge and skills required to become proficient full stack developers. The course covers essential front-end and back-end technologies, including HTML5, CSS3, JavaScript, React.js, Node.js with Express.js, Spring Boot backend framework, and fundamentals of MongoDB. Through a combination of theoretical lectures, hands-on coding exercises, and real-world examples, students will gain a deep understanding of each technology's role in the development process and how they work together to build modern web applications

2. Course Objectives:

1. To study about HTML5, CSS3, and JavaScript constructs
2. To learn ReactJS and NodeJS with ExpressJS
3. To understand Spring Boot backend framework
4. To understand the fundamentals of MongoDB

3.Syllabus:

Unit-I: HTML5, CSS3 and JavaScript

Components of a full stack application-HTML5 – Tags – Attributes– Properties –Importance of Semantic HTML – Classes - CSS3 – CSS3 syntax and Properties – Borders – Text – Image – Grid layout – Media Queries – Animations – Types of CSS frameworks – Overview of JavaScript – Advanced Working with Functions – JavaScript Namespaces – Prototypes – Error Handling – Modules in JavaScript – Chaining JavaScript Methods – Promises

Case Study: Website design for an automobile industry

Unit-II: Reactjs

ReactJS – Library & directory – React Components – Types of Components –Component composition – Component styling – Adding styles – Component intercommunication – Data sharing – Routing – Hooks – States – Hooks vs States – Types of Hooks – Redux – Using Redux as state container for react apps – React Bootstrap – Props and Router

Case Study: Portfolio development with authentication

Unit-III: MongoDB

MongoDB – Features – Environment – Data Modelling – Schema creation using Mongoose(ODM) - Create Database –Data Types – Drop Database –Collection –Insert Document – Query Document – Update Document – Delete Document – Projection – Limiting Records – Sorting Records – Indexing – Aggregation

Case Study: Design of a simple search engine

Unit-IV: Nodejs and Expressjs
NodeJS – Node Module System - Node Package Manager (NPM) - Building RESTful API's Using Express - Express Advanced Topics - Asynchronous JavaScript - CRUD Operations Using Mongoose - Mongo Data Validation - Mongoose Modelling Relationships between Connected Data - Authentication and Authorization - Deployment
Case Study: QR Code Generator application

Unit-V: Spring Boot
Spring Boot – Configuration - Spring data JPA - Create Spring Data Repositories for JPA – web application with Spring Boot – RESTful controllers - Message Converters - WAR or JAR deployment – Creating a RESTful application with Spring Boot – HTTP GET, PUT, POST, DELETE
Case Study: Real time message transfer application

Text Books:
1. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development',Addison-Wesley, Second Edition, 2018
2. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019

References:

References Books:

1. Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018
2. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018

Video References:
1. https://www.youtube.com/watch?v=JkeyKeK3V24
2. https://www.youtube.com/watch?v=w7ejDZ8SWv8
3. https://www.youtube.com/watch?v=WlgGfipGS1A
4. https://www.youtube.com/watch?v=lBBtq3Oawqw

NPTEL /Online Courses:
1. https://www.tutorialspoint.com/the_full_stack_web_development/index.asp
2. https://www.coursera.org/specializations/full-stack-react
3. https://www.udemy.com/course/the-full-stack-web-development/

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS206.1	Build dynamically enriched web pages with HTML5, CSS3, and JavaScript	K6	1, 2, 3, 4, 5, 12	1, 2, 3
R19CS206.2	Implement data handling and fetching in React applications using state management libraries	K3	1, 2, 3, 4, 5, 12	1, 2, 3
R19CS206.3	Develop a web application with MongoDB as the backend	K3	1, 2, 3, 4, 5, 12	1, 2, 3
R19CS206.4	Develop ExpressJS applications that define routes and handle HTTP requests and responses	K3	1, 2, 3, 4, 5, 12	1, 2, 3

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore 641 202.

Page | 100

CO				
R19CS206.5	Develop RESTful APIs with Spring Boot for resource representation, HTTP methods and error handling	K6	1, 2, 3, 4, 5, 12	1, 2, 3

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS206.1	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
R19CS206.2	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
R19CS206.3	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
R19CS206.4	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
R19CS206.5	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
Course to PO	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19AD251	Data Science	L	T	P	C
		3	0	2	4

1. Course Description:

The course aims to provide students with a comprehensive understanding of data science, covering key concepts, methodologies, and tools essential for data analysis, interpretation, and decision-making. Students will learn to collect, preprocess and analyze data from various sources using statistical techniques and machine learning algorithms. Students will gain practical experience in applying data science methods to real-world problems. By the end of the course, students will be equipped with the knowledge and proficiency needed to extract valuable insights from data, make informed decisions, and contribute effectively to the rapidly evolving field of data science

2. Course Objectives:

1. Gain a foundational understanding of data science concepts and methods.
2. Develop the ability to collect, clean, and manage data.
3. Learn how to analyse data using statistical and machine learning techniques.
4. Develop the ability to solve real-world problems using data science
5. Develop an understanding of the ethical implications of data science

3. Syllabus:

Unit-I: Basics of Data Science

Data science: Need for data science, various data science disciplines, connecting to data science disciplines, reason behind these disciplines, popular data science techniques, data science related to other fields; computational thinking; Data science life cycle. Different / popular tools available for data science, data exploration, feature engineering, applications.

Unit-II: Data Acquisition and Exploration

Data collection and management: Introduction, sources of data, data collection and APIs, data pre-processing techniques: data analysis and data analytics: descriptive analysis, diagnostic analytics,

predictive analytics, prescriptive analytics. Exploratory analysis, data pre-processing, handling missing values, dealing with outliers, categorical to numerical conversion.

Unit-III: Statistics

Statistics: Role to statistics, probability concepts, axioms of probability; probability distributions: Poisson, Normal, Binomial, Uniform; distribution properties, measures of central tendency, mean and variance of a Discrete and continuous random variable, covariance and correlation, Central limit theorem.

Unit-IV: Roles – Data Science

Introduction to Python, Installing Python and Jupyter, variables and data types, Operators, Conditional Statement, Python Functions, Sequence, Iteration, Modules and Packages;Data Engineering: Cloud (GCP) and ETL tools. Introduction to Data Engineering ,Extract (GCP Console, Cloud SDK, client libraries) Loading (Cloud Storage, PUB/Sub) Transformation (Cloud Functions, Cloud Dataflow, Cloud Dataproc); Data Analyst: Tableau, SQL Connect to data and edit a data source, Sort, filter, and group data, Use the Tableau workspace to create visualizations, Build a range of essential chart types for analysis, Create basic calculations, including quick table calculations; Build interactive dashboards to reveal data insights, Describe how to share and publish visualizations.

Unit-V: Data Modelling with Machine Learning Applications

Introduction to ML: Types of machine Learning Models, Supervised learning: Linear regression,Logistic regression, Naive Bayes, Support vector machines, Model selection and feature selection, Ensemble methods: Bagging, boosting. Unsupervised learning: Hierarchical clustering, K-means clustering, Evaluating and debugging learning algorithms.

List of Laboratory Experiments / Exercises

1. Data Acquisition using REST API, requests module and beautiful soup package.
2. Plot and generate different types of probability distributions.
3. Plotting normal distribution and perform normality test using Q-Q plot.
4. Exploratory Data Analysis (EDA)
5. House Price prediction using linear regression.
6. Medical diagnosis for disease spread pattern using logistic regression.
7. Customer segmentation in business model based on their demographic, psychographic and behavioural data.
8. Customer churn classification using decision tree and random forest on telecom data.
9. Behavioural analysis of online shoppers' intention for online purchase model using KNN Model.
10. Creating an interactive dashboard using Tableau.

Text Books:

1. Avrim Blum, John Hop croft, and RavindranKannan," Foundations of Data Science", Springer-2018.
2. Kevin P.Murphy, "Machine Learning: A Probabilistic Perspective", MITPress, 2012.

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman – Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202

Page | 102

3.	CathyO'Neil, Rachel Schutt, "Doing Data Science, Straight Talk from The Frontline", O'Reilly, 2013.	

References:

1. Dean J, "Big Data, Data Mining and Machine learning", Wiley Publications, 2014.
2. Provost F and Fawcett T, "Data Science for Business", O'Reilly Media Inc, 2013.

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19AD251.1	Apply the fundamentals of data science for effective contribution to real-world applications.	K3	1, 5	1,2
R19AD251.2	Apply the various data collection and exploration techniques to analyze the data.	K3	1,5	1,2
R19AD251.3	Analyze the distribution of data using various statistical measures.	K4	1, 2, 5, 9	1,2
R19AD251.4	Design interactive dashboards using suitable data science tools to reveal the insights of data.	K4	1, 2, 3, 5, 9, 11	1,2
R19AD251.5	Implement different machine learning algorithms for real time applications.	K3	1, 3, 5, 9, 11	1,2

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19AD251.1	3	-	-	-	1	-	-	-	-	-	-	-	3	2	-
R19AD251.2	3	-	-	-	2	-	-	-	-	-	-	-	3	2	-
R19AD251.3	3	3	-	-	2	-	-	-	3	-	-	-	3	2	-
R19AD251.4	3	3	3	-	3	-	-	-	3	-	3	-	3	2	-
R19AD251.5	3	-	3	-	3	-	-	-	3	-	3	-	3	2	-
Course to PO	3	1	1	-	2	-	-	-	2	-	1	-	3	2	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19EC352	Embedded Systems and IoT	L	T	P	C
		3	0	2	4

1. Course Description:

This course empowers you to unlock the potential of the Internet of Things (IoT) by diving into the core technologies driving smart devices. Gain a solid understanding of embedded system architecture and development processes, learn how to design and connect embedded hardware within the IoT landscape, and explore the powerful integration with cloud computing and GSM interfaces. By the end, you'll be equipped to develop and build your own simple IoT applications.

2. Course Objectives:

1. To understand the Embedded system architecture and development process

	2. To understand IoT architecture and apply the embedded hardware design
	3. To understand the concepts of Cloud computing and GSM interface
	4. To develop products for simple IOT applications

3. Syllabus

Unit-I: Embedded System Architecture

Introduction to Embedded systems; application areas; categories; overview; specialities; recent trends; hardware architecture; software architecture; application software; communication software; Embedded System Lifecycle; process of generating executable image; developing and testing tools; Market available freeware for Embedded Systems development.

Unit-II: Embedded System Development

Development process: requirements engineering, design, implementation, integration and testing; Architecture of Kernel; Tasks and task scheduler; Interrupt service routines; semaphores; mailboxes; timers; memory management; valgrind for memory analysis priority inversion problem; Debugging Tools for Embedded Systems; Introduction to Embedded AI, Edge AI and role of Tiny ML in embedded systems.

Unit-III: IOT Architecture and Embedded Hardware

IoT Evolution and Applications; IoT Application development stages; Microcontrollers used in IoT; Arduino IDE and exploration; Basics of Arduino Programming; PWM signalling in Arduino; Interfacing Sensors: IR sensor; Potentiometer with Arduino; Interfacing Servo motor with Arduino; Introduction to Bluetooth Technology; Interfacing HC-05 and Arduino; Introduction to Arduino Mega, Due; Interfacing of Accelerometer and Colour Sensor; Interfacing Gyroscope with Arduino Uno.

Unit-IV: GSM, Cloud Computing and IoT

Introduction to GSM; Interfacing GSM with Arduino Uno; Calling; Messaging using GSM; Controlling an LED using GSM; Introduction to Cloud Computing; Challenges in Cloud Computing; Data protocols in IoT; Cloud types; Cloud architecture: Infrastructure, platforms, communication protocols and applications; Cloud Services: IaaS, PaaS, SaaS; Understanding Adafruit; Communicating with Cloud.

Unit-V: Product Building and Miniaturization

NodeMCU in a nutshell; ESP32 in a nutshell; Attiny85 in a Nutshell; Programming Attiny85 with Arduino Uno; Interfacing Gyro; Bluetooth with Attiny85; General Voltage Regulation Techniques for IoT; Raspberry Pi in a NutShell; Headless Setup of Raspberry Pi; Video Surveillance using Raspberry Pi; Realtime projects with IoT; Accident Impact Detection; Driver Drowsiness Detection System; Advanced Driver Assist System.

List of Experiments

Prelims:

a. Interfacing Arduino with - Pot, Servo motor, IR Sensor, Stepper Motor, and other Analog/Digital sensors.

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 104

Core projects:

1. Displaying Text/Images using OLED

2. Controlling an LED using WebPage - With NodeMCU

3. Fire Accident Detection Project using MQ135 & LM35. Generating Alert using GSM

4. Logistics tracker using NodeMCU and GPS

5. Interfacing Gyro, Bluetooth with Attiny85

6. Interfacing Ultrasonic sensor and other sensors with Raspberry Pi

Text Books:

1. Embedded Systems- Architecture, Programming And Design | Third Edition - Rajkamal McGraw-Hill 2015 (Unit–I, II)

2. https://www.routledge.com/Lets-Get-IoT-fied-30-IoT-Projects-for-All-Levels/Juluru-Vasudevan-Murugesh/p/book/9780367706074 (Unit III, IV (Half))

3. Internet of Things, 2ed, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram, ISBN: 9789388991018, Wiley India. (Unit IV, V)

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19EC352.1	Analyze and synthesize the architecture of Embedded Systems, delineating its constituent components.	K4	1, 2, 3, 4, 5, 9, 10, 12	1, 2
R19EC352.2	Utilize conceptual understanding to apply the design process of Embedded Systems	K3	1, 2, 3, 4, 5, 9, 10, 12	1, 2
R19EC352.3	Apply advanced cognitive skills to conceptualize the architecture of IoT systems and develop basic applications employing embedded hardware.	K3	1, 2, 3, 4, 5, 9, 10, 12	1, 2
R19EC352.4	Apply higher-order cognitive abilities to implement Cloud services in IoT applications	K3	1, 2, 3, 4, 5, 9, 10, 12	1, 2
R19EC352.5	Generate innovative solutions by integrating NodeMCU and Raspberry Pi boards to design IoT applications	K3	1, 2, 3, 4, 5, 9, 10, 12	1, 2

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19EC352.1	3	3	3	1	1	-	-	-	1	1	-	2	3	1	-
R19EC352.2	3	3	3	1	2	-	-	-	1	1	-	2	3	1	-
R19EC352.3	3	3	3	3	3	-	-	-	1	1	-	2	3	1	-
R19EC352.4	3	3	3	2	2	-	-	-	1	1	-	2	3	1	-
R19EC352.5	3	3	3	3	3	-	-	-	1	1	-	2	3	1	-

Chairman - Board of Studies
Chairman – Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 105

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
Course to PO	3	3	3	2	2	-	-	-	1	1	-	2	3	1	-

"3" —High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS214	Operating Systems Laboratory	L	T	P	C
		0	0	2	1

1. Course Description:

The Operating Systems Laboratory complements the theoretical concepts learned in the Operating Systems course by providing hands-on experience with operating system principles and practices. Through a series of guided exercises and projects, students will gain practical skills in operating system design, implementation, and management. This laboratory course focuses on reinforcing key concepts through experimentation, troubleshooting, and real-world application.

2. Course Objectives:

1. To provide an understanding of the design aspects of operating system concepts through simulation.
2. Introduce basic Unix commands, system call interface for process management, interprocess communication and I/O in Unix.
3. Simulate and implement operating system concepts such as scheduling, deadlock management, file management and memory management.
4. Able to implement C programs using Unix system calls.

3.List of Laboratory Experiments / Exercises:

1. LINUX Commands:
   man, touch, cat, mkdir, rm, rmdir, ls, cd, cp, mv, pwd, bc, head, tail, wc, rev, who, echo, finger, find, awk, more, paste, bg, fg
2. Shell Programming:
   Operators and decision-making statements for pattern generation, simulating arithmetic calculator, and printing number series
3. System Calls:
   •Process Management: fork, exec, getpid, exit, wait, close, stat, system
   •Interprocess Communication: pipe, mkfifo, creat, write, read, open, seek, close
4. Demonstrate the Creation of Zombie and Orphan Processes
5. Implementation of Threading & Synchronization Applications
6. CPU Scheduling:
   First Come First Serve, Shortest Job First, Priority and Round-Robin Scheduling Algorithm
7. Process Synchronization:
   • Dining Philosophers' Problem using Semaphore
   • Producer Consumer Problem using Semaphore
8. Deadlock Avoidance:
   Banker's Algorithm
9. Linux Kernel:
   Configuration, compilation, and rebooting from the newly compiled kernel
10. File Allocation Strategies
    • Sequential
    • Indexed
    • Linked

Project:

Build the parts of an OS kernel by using teaching packages such as Nachos and Pintos.

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman – Board of Studies Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 106

References:

References Books

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons (Asia) Pvt. Ltd, Ninth Edition, 2018.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Pearson Education, Third Edition, 2015.
3. William Stallings, "Operating Systems: Internals and Design Principles", Pearson Education, Ninth Edition, 2018.
4. AchyutS.Godbole, AtulKahate, - "Operating Systems", McGraw Hill Education, 2016.

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS214.1	Demonstrate the ability to identify, define, and analyze complex problems using appropriate commands, System calls and programming	K3	1,2,3,4,5,11	1
R19CS214.2	Create solutions and execute them utilizing appropriate programming platforms.	K6	1,2,3,4,5,11	1
R19CS214.3	Choosing appropriate operating systems in virtualized environments to execute various applications	K3	1,2,3,4,5,11	1
R19CS214.4	Evaluate the advantages and disadvantages of different design options and consider the associated issues when designing operating systems.	K5	1,2,3,4,5,11	1
R19CS214.5	Acquire practical understanding of the interaction between programming languages, operating systems, architecture, and effectively utilize them.	K4	1,2,3,4,5,11	1

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS214.1	2	3	3	1	2	-	-	-	-	-	1	-	1	-	-
R19CS214.2	2	3	3	1	2	-	-	-	-	-	1	-	1	-	-
R19CS214.3	2	3	3	2	2	-	-	-	-	-	1	-	1	-	-
R19CS214.4	2	3	3	2	2	-	-	-	-	-	1	-	1	-	-
R19CS214.5	2	3	3	1	2	-	-	-	-	-	1	-	1	-	-
Course to PO	2	3	3	1	2	-	-	-	-	-	1	-	1	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS216	Full Stack Development Laboratory	L	T	P	C
		0	0	2	1

1. Course Description:

The comprehensive laboratory course is designed to provide hands-on experience with essential technologies and frameworks in Full Stack development. Students will gain proficiency in HTML5, CSS3, JavaScript, ReactJS, Node.js with Express.js, and the fundamentals of MongoDB. The course is

Chairman Board of Studies
Department of Computer Science and Engineering
Si...shwar College of Engineering (Autonomous)
Kin.........

Page | 107

structured to cover both front-end and back-end development, emphasizing a holistic approach to creating robust and scalable web applications

2. Course Objectives:

1. To learn HTML, CSS and JavaScript constructs
2. To learn ReactJS and NodeJS with ExpressJS frameworks
3. To understand Spring Boot backend framework
4. To learn MongoDB concepts.

3. Syllabus

List of Laboratory Experiments / Exercises

1. Develop a music streaming web application to provide users with a seamless and interactive music listening experience. Users should be able to discover, play, and share their favourite music in real-time. The application should support multiple features such as user authentication, personalized playlists, real-time updates on trending tracks, and social sharing capabilities
2. Build a video conferencing web application that facilitates seamless communication between individuals or groups through high-quality video and audio interactions and supports real-time features, user authentication, screen sharing to enhance the overall video conferencing experience
3. Develop a dynamic and engaging social media platform web application that connects users globally. The platform aims to provide a seamless and real-time social experience, allowing users to connect, share content, and interact with each other and should incorporate features such as user profiles, real-time feed updates, multimedia content sharing, instant messaging, and community building
4. Create a web application that constitutes a dynamic Content Management System (CMS) tailored for blogging that allows users to effortlessly create, manage, and share blog content and provides an intuitive interface, support multimedia content, and facilitate collaboration among multiple authors
5. Build a web application designed to serve as a real-time Project Management Dashboard to streamline project management processes, enhance collaboration, and provide stakeholders with a dynamic and comprehensive view of project progress. The application should offer real-time updates, intuitive navigation, and advanced project tracking features.
6. Design a web application to perform real-time analytics for data-driven decision-making. This web application aims to empower users to analyze, visualize, and derive insights from streaming data that will be suitable for industries requiring instantaneous data processing, such as finance, e-commerce environments
7. Develop a web application designed to revolutionize the job search process to provide job seekers with real-time access to a diverse range of job opportunities, personalized recommendations, and interactive tools to streamline the entire job searching experience
8. To develop an online crowdfunding web application to facilitate real-time creative financing for innovative projects. which acts as a catalyst for novel ideas by providing a dynamic platform where creators can present their visions, attract support, and turn aspirations into tangible achievements
9. Build a To-Do List web application elevates the task management experience through real-time collaboration and user authentication. This application provides users with an intuitive platform for creating, organizing, and collaborating on to-do lists in real-

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 108

	time, ensuring secure access and personalized task management
	10. Develop a chat web application to facilitate real-time communication and collaboration. The web application aims to provide users with a seamless and interactive platform for one-on-one and group chats, ensuring instant messaging, multimedia sharing, and a user-friendly experience
	11. Develop a comprehensive web application to empower users with a real-time expense tracking system for efficient money management that constitutes users with a user-friendly interface, real-time financial insights, and personalized budgeting features to help them make informed financial decisions and achieve their financial goals
	12. Design a gaming web application that offers a real-time multiplayer gaming experience to provide users with a diverse range of games, interactive features, and a social gaming environment, allowing players to connect, compete, and collaborate in real-time

References:

References Books:

1. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019.

2. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018.

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS216.1	Demonstrate the ability to identify, define, and analyze complex problems using appropriate algorithms, data structures, methodologies and tools	K6	1, 2, 3, 4, 5, 12	1, 2, 3
R19CS216.2	Design effective visual representations (UML diagrams/Flowchart) to solve the identified problems	K3	1, 2, 3, 4, 5, 12	1, 2, 3
R19CS216.3	Create Fullstack solutions and implement them using suitable programming platforms	K3	1, 2, 3, 4, 5, 12	1, 2, 3
R19CS216.4	Develop effective presentation skills to present and defend the designs and solutions	K3	1, 2, 3, 4, 5, 12	1, 2, 3
R19CS216.5	Understand issues related to privacy, security and accessibility and adhere to coding standards	K6	1, 2, 3, 4, 5, 12	1, 2, 3

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS216.1	2	2	3	2	3	-	-	1	3	2	1	3	2	3	3
R19CS216.2	2	2	3	2	3	-	-	1	3	2	1	3	2	3	3
R19CS216.3	2	2	3	2	3	-	-	1	3	2	1	3	2	3	3
R19CS216.4	2	2	3	2	3	-	-	1	3	2	1	3	2	3	3

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman – Board of Studies (Autonomous)
Sri Eshwar College of Engineering
Kinathukadavu, Coimbatore - 641202.

Page | 109

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS216.5	2	2	3	2	3	-	-	1	3	2	1	3	2	3	3
Course to PO	2	2	3	2	3	-	-	1	3	2	1	3	2	3	3

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS281	Project Using Design Thinking (Product / Software Development Life Cycle)	L	T	P	C
		0	0	2	1

1.Course Description:

The Project Using Design Thinking (Product/Software Development Life Cycle) course integrates design thinking principles into the product or software development lifecycle, fostering innovation and user- centricity throughout the project. Students learn to empathize with end-users, define problem statements, ideate potential solutions, prototype designs, and conduct iterative testing to gather feedback and refine their creations. The course emphasizes a multidisciplinary approach, encouraging collaboration between designers, developers, and stakeholders to ensure that the final product meets user needs and business objectives effectively. Through hands-on projects, students gain practical experience in applying design thinking methodologies within the context of the product or software development process, preparing them to address complex challenges and create impactful solutions in diverse industries.

2.Course Objectives:

1. Identify current problems in computer and communication engineering through literature survey.
2. Design and analyze solutions for identified problems using modern engineering tools.
3. Create innovative methodologies and develop working models to solve existing problems.
4. Apply appropriate software development methods to implement and deploy solutions for computer and communication-related issues.
5. Evaluate teamwork's role in project execution and estimate financial requirements for

3.Guidelines:

The student identifies the problems in the computer and communication engineering field by conducting a literature or industry survey. After that, the student finds the solution to solve those problems by applying modern engineering tools. Continuous review will be conducted based on approved rubrics to ensure ongoing progress and quality. After finding the solution, the student develops the working model, design, or simulation for evaluation. Each student shall finally submit a report covering background information, literature survey, problem statement, methodology, and use of modern tools within the stipulated date. Every project work must be guided by the institute faculty members.

4. Course Outcomes:

CO. No.	Course Outcome	BTL	PO	PSOs
R19CS281.1	Identify the problems in computer and communication engineering field by literature survey	K3	2, 3, 4, 6, 7, 9, 10, 11, 12	1, 2, 3
R19CS281.2	Design, analyze and solve the identified problems by using modern engineering tools	K6	2, 3, 4, 6, 7, 9, 10, 11, 12	1, 2, 3

R19CS281.3	Create innovative methodologies to solve the existing problems and developing the working models.	K6	2, 3, 4, 6, 7, 9, 10, 11, 12	1, 2, 3
R19CS281.4	Apply appropriate software development methods, to implement and deploy solutions for the computer and communication related	K3	2, 3, 4, 6, 7, 9, 10, 11, 12	1, 2, 3
R19CS281.5	Implement the role of team work in a project to find the solution and estimate the financial requirement of a project.	K5	2, 3, 4, 6, 7, 9, 10, 11, 12	1, 2, 3

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02
R19CS281.1	1	3	3	2	1	1	1	1	3	2	2	3	2	2
R19CS281.2	1	3	3	2	1	1	1	1	3	2	2	3	2	2
R19CS281.3	1	3	3	2	1	1	1	1	3	2	2	3	2	2
R19CS281.4	1	3	3	2	1	1	1	1	3	2	2	3	2	2
R19CS281.5	1	3	3	2	1	1	1	1	3	2	2	3	2	2
Course to PO	1	3	3	2	1	1	1	1	3	2	2	3	2	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19EM202	Advanced Logical Thinking	L	T	P	C
		0	0	2	1

1. Course Description

The objective of this course is to equip engineering students with a robust grasp of fundamental logical thinking concepts. Through a comprehensive exploration of essential theories and their intricate relationships, students will gain a deep understanding of how these principles are relevant across various fields. They will learn to effectively utilize these concepts to address diverse problems, mastering the ability to dissect complex issues into manageable parts and evaluate the accuracy and efficacy of their problem-solving approaches. Furthermore, students will be encouraged to devise innovative problems and scenarios that demand the application of these foundational principles, demonstrating their command and stimulating imaginative mathematical reasoning.

2. Course Objectives:

1. To recall and define key concepts related to fundamentals of aptitude.
2. To develop a thorough understanding of the principles and theories, including their significance and interrelationships.
3. To become proficient in applying the concepts to solve a wide range of problems across various contexts and disciplines.
4. To develop the skills to analyze complex problems, deconstructing them into manageable components for effective problem-solving.
5. To evaluate the validity and effectiveness of their problem-solving strategies, as well as the accuracy and reliability of their solutions.
6. To create original problems and scenarios that require the application of fundamentals, showcasing mastery and fostering creativity in mathematical thinking.

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman — Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 111

3. Syllabus

Unit-I: Permutations & Combinations

Fundamental Principles of Counting: Permutations & Combination, Number Generation Fundamentals; Digit repeater concepts: All possible ways; Recursion and Backtracking: N step Problems, Horse movement per N Queen Problem and Case Studies.

Unit-II: Probability

Thinking in Probabilities: Stock markets and Mutual funds, Positive Expectancy, Foundational concepts of money markets, Money Generator Vs Money multiplier; Power of Compounding: Rule of 72, Start Investing: Different asset class data set and Programming and Case Studies.

Unit-III: Time, Speed and Distance

Definition and Basics of Time, Speed and Distance; Relative speed: Problems based on Trains; Effective Speed: Problems based on Boats and Streams; Problems based on Races, Escalator problems; Xeno's Paradox and Case Studies.

Unit-IV: Mixtures & Allegations

Introduction to Mixtures: Multi variable mixing, Profit and Loss concept based on mixing; Liquid mixing concepts: Replacement problems and Repetitive iteration problems.

Unit-V: Clocks & Calendars

Introduction to design of clocks; Formula creation: Speed clock and Slow clock problems; Angle calculation; Calendars design: Concept of odd days, Day of a date and Calendar repetition logic; Data Arrangements; Data Sufficiency; Syllogism; Directions; Blood Relation; Number series and Visual Reasoning.

References:

Reference Books:

1. Dr. R S Aggarwal, Quantitative Aptitude, Revised Edition, S. Chand Publishing Company Ltd(s), 2022
2. Arun Sharma, How to prepare for Quantitative Aptitude for the CAT, 10th Edition, Tata McGraw-Hill Publishing Company Ltd, 2022

Online References:

1. https://www.hackerearth.com/
2. https://www.geeksforgeeks.org/
3. https://www.indiabix.com

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19EM202.1	Demonstrate the ability to recall and define key concepts related to fundamentals of aptitude.	K1	1	-
R19EM202.2	Develop a thorough understanding of the principles and theories, including their significance and interrelationships.	K2	1, 2, 3	-
R19EM202.3	Become proficient in applying the concepts to solve a wide range of problems across various contexts and disciplines.	K3	1, 4, 5	-

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 112

R19EM202.4	Develop the skills to analyze complex problems, deconstructing them into manageable components for effective problem-solving.	K4	2, 4, 9	-
R19EM202.5	Ability to evaluate the validity and effectiveness of their problem-solving strategies, as well as the accuracy and reliability of their solutions.	K5	4, 6, 8	-
R19EM202.6	Able to create original problems and scenarios that require the application of fundamentals, showcasing mastery and fostering creativity in mathematical thinking.	K6	2, 3, 12	-

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19EM202.1	3	2	-	-	-	-	-	-	-	-	-	1	-	-	-
R19EM202.2	3	3	2	-	-	-	-	-	-	-	-	1	-	-	-
R19EM202.3	3	-	-	2	2	-	-	-	-	-	-	1	-	-	-
R19EM202.4	-	3	-	3	-	-	-	-	2	-	-	1	-	-	-
R19EM202.5	-	-	-	3	-	2	-	2	-	-	-	1	-	-	-
R19EM202.6	-	3	2	-	-	-	-	-	-	-	-	1	-	-	-
Course to PO	1	2	1	1	-	-	-	-	-	-	-	1	-	-	-

"3"—High, "2"—Medium, "1"—Low, "—" — No Correlation

R19EM203	Summer Internship	L	T	P	C
		-	-	-	1

1. Course Description

"Summer Internship" provides students with the opportunity to gain practical work experience in a professional setting during the summer months. Through supervised placements in various industries, students will apply theoretical knowledge acquired in their academic studies to real-world scenarios. The internship aims to enhance students' professional skills, expand their networks, and foster personal and career development. Under the guidance of experienced mentors, interns will engage in hands-on projects, tasks, and responsibilities tailored to their academic background and career interests. Through reflection, feedback, and evaluation, interns will refine their skills, gain valuable insights into industry practices, and make meaningful contributions to their host organizations.

2. Course Objectives:

1. Exposure in an Industrial/professional work environment relevant to the student's field of study.
2. Develop the ability to apply practical skills and knowledge learned in academic coursework to real-world projects and tasks.
3. Network with professionals in the industry to explore career opportunities and build professional relationships.
4. Create awareness of current industrial technological developments relevant to the program domain.
5. Provide opportunities to understand the social, economic, and administrative considerations in organizations.

Chairman - Board of Studies
Chairman – Board of Studies
Department of Computer Science and Engineering
Eshwar College of Engineering (Autonomous)
Kinathukadavu Coimbatore - 641 202

Page | 113

3. Guidelines:

The Summer Internship/Industrial Training program offers students valuable opportunities to engage with real-world industrial environments aligned with their academic curriculum. Following completion of the IV Semester, students are required to obtain prior approval from the Head of the Department (HoD) to participate in these immersive learning experiences. The duration of the training spans two weeks during the summer vacation, providing students with focused insights into industry practices and technological advancements relevant to their field of study. Proof of participation, accompanied by a satisfactory completion certificate from the hosting organization, is mandatory to validate the learning experience.

Evaluation Process and Final Assessment

Upon completion of their internship or training, students are required to deliver a seminar based on their training report. This seminar is conducted before an expert committee formed by the concerned department in accordance with institutional norms. The evaluation process focuses on several key criteria to assess the student's performance comprehensively as per AICTE guidelines:

1. Quality of Content Presented
2. Proper Planning for Presentation
3. Effectiveness of Presentation
4. Depth of Knowledge and Skills
5. Additional Factors such as Attendance records, daily diaries, and departmental reports

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19EM203.1	Demonstrate an understanding of industry-specific practices, procedures, and terminology through immersion in a professional work environment	K3	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	-
R19EM203.2	Interpret and explain the relevance of theoretical concepts learned in academic coursework to practical tasks and projects encountered during the internship	K3	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	-
R19EM203.3	Apply acquired knowledge and skills to solve real-world problems, contribute to projects, and complete assigned tasks effectively within the internship setting	K3	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	-
R19EM203.4	Analyze and evaluate their internship experiences, reflecting on challenges faced, solutions implemented, and lessons learned to assess their own growth and development.	K4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	-
R19EM203.5	Synthesize their internship experiences, integrating knowledge gained from various sources, including academic coursework, mentorship, and practical application, to formulate strategies for future career development and success.	K4	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12	-

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 114

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19EM203.1	-	-	1	-	-	-	-	-	-	-	-	3	-	-	-
R19EM203.2	-	-	1	-	-	-	-	-	-	-	-	3	-	-	-
R19EM203.3	-	-	1	-	-	-	-	-	-	-	-	3	-	-	-
R19EM203.4	-	-	1	-	-	-	-	-	-	-	-	3	-	-	-
R19EM203.5	-	-	1	-	-	-	-	-	-	-	-	3	-	-	-
Course to PO	-	-	1	-	-	-	-	-	-	-	-	3	-	-	-

"3"—High, "2"—Medium, "1"—Low, "—" — No Correlation

R19MC202	Indian Constitution and Tradition	L	T	P	C
		1	0	0	NC

1. Course Description:

This course provides a comprehensive exploration of the Indian Constitution and Tradition, with a primary focus on understanding its historical evolution, guiding principles, organizational framework, and contemporary relevance. Students will delve into the intricate layers of India's constitutional legacy, examining the multifaceted influences of democratic governance.

2. Course Objectives:

1. Understand the foundational principles and historical context of the Indian Constitution and tradition.
2. Explore the role of tradition in shaping contemporary Indian constitutional law and governance.
3. Assess the interplay between constitutional amendments and traditional values in Indian society.
4. Critically reflect on the relevance and adaptability of Indian constitutional principles in a modern context.
5. Examine the evolution of constitutional rights and duties within the framework of Indian tradition.

3. Syllabus:

Unit-I: History of Indian Constitution

Meaning of the constitution law and constitutionalism - Historical perspective of the Constitution of India, Salient features and characteristics of the Constitution of India

Unit-II: Fundamental Rights and Duties

Scheme of the fundamental rights - Fundamental Duties and its legal status - Directive Principles of State Policy, Its importance and implementation

Unit-III: Federal Structure and Distribution of Powers

Federal structure and distribution of legislative and financial powers between the Union and the States - Parliamentary Form of Government in India - The constitution powers and status of the President of India - Amendment of the Constitutional Powers and Procedure

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 115

Unit-IV: Constitutional Amendments and Emergency Provisions
The historical perspectives of the constitutional amendments in India - Emergency Provisions: National Emergency, President Rule, Financial Emergency - Local Self Government - Constitutional Scheme in India

Unit-V: Right To Equality, Freedom, And Personal Liberty
Scheme of the Fundamental Right to Equality - Scheme of the Fundamental Right to certain Freedom under Article 19 - Scope of the Right to Life and Personal Liberty under Article 21

Text Books:

1. Sunil Khilnani, "The Idea of India", Penguin India Ltd., New Delhi.

2. Madhav Khosla, "The Indian Constitution", Oxford University Press. New Delhi, 2012.

References:

Reference Books:

1. Brij Kishore Sharma, "Introduction to the Indian Constitution", PHI, New Delhi

2. Sumantra Bose, "Transforming India: Challenges to the World's Largest Democracy", Picador India, 2013.

3. Atul Kohli, "Democracy and Discontent: India's Growing Crisis of Governability", Cambridge University Press, Cambridge, U. K., 1991.

4. M. P. Singh and Rekha Saxena, "Indian Politics: Contemporary Issues and Concerns", PHI, New Delhi, 2008, latest edition.

5. Rajni Kothari, "Rethinking Democracy", Orient Longman, New Delhi, 2005.

Video References:

1. https://www.youtube.com/watch?v=JrqpQvRQft0

2. https://www.youtube.com/watch?v=XrKEtEzqZ7g

3. https://www.youtube.com/watch?v=9yaf5TFp-DE

Web References:

1. https://en.wikipedia.org/wiki/Constitution_of_India

2. https://www.india.gov.in/my-government/constitution-india

3. https://byjus.com/free-ias-prep/sources-of-indian-constitution/

4. https://academic.oup.com/past/advance-article/doi/10.1093/pastj/gtad009/7147824

5. https://www.vifindia.org/article/2017/august/03/indian-civilisation-and-the-constitution

6. https://search.worldcat.org/title/constitution-of-india-a-contextual-analysis/oclc/1002722580

7. https://main.sci.gov.in/constitution

NPTEL/Online Courses:

1. https://archive.NPTEL.ac.in/noc/courses/noc20/SEM2/noc20-lw03/

2. https://archive.NPTEL.ac.in/courses/129106002/

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore - 641 202.

Page.| 116

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19MC202.1	Understand the characteristics of the Constitution of India.	K2	8, 9, 10	-
R19MC202.2	Understand the fundamental rights and duties.	K2	8, 9, 10	-
R19MC202.3	Understand the federal structure and distribution of legislative and financial powers.	K2	8, 9, 10	-
R19MC202.4	Understand the constitutional amendments and emergency provisions.	K2	8, 9, 10	-
R19MC202.5	Understand the fundamental right to equality, freedom, life and personal freedom.	K2	8, 9, 10	-

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19MC202.1	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-
R19MC202.2	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-
R19MC202.3	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-
R19MC202.4	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-
R19MC202.5	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-
R19MC202.6	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-
R19MC202.7	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-
R19MC202.8	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-
R19MC202.9	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-
R19MC202.10	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-
Course to PO	-	-	-	-	-	-	-	3	2	1	-	-	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 117

R19CS301	Automata Theory and Compiler Design	L	T	P	C
		3	1	0	4

1.Course Description

This course combines theoretical concepts with hands-on exercises, enabling students to design, implement, and optimize compilers effectively. By the end of the course, students will have a solid understanding of automated theory principles in compiler design and optimization.

2.Course Objectives

1. To understand fundamental concepts of automata theory
2. To Explore compiler design principles and code optimization techniques
3. To design and implement compilers
4. To Analyze and optimize code generation processes

3.Syllabus

Unit-I: Automata Fundamentals and Regular Expressions

Finite Automata: Deterministic Finite Automata , Non-deterministic Finite Automata , Finite Automata with Epsilon Transitions ; Regular Expressions - Conversion of Regular Expression into DFA using Subset construction method - Minimization of DFA - Proving Languages not to be Regular.

Unit-II: Context Free Grammar and Languages

CFG – Parse Trees – Ambiguity in Grammars and Languages – Definition of the Pushdown Automata – Languages of Pushdown Automata – Pumping Lemma for CFL - Introduction to Turing Machines.

Unit-III: Introduction to Compiler and Lexical Analysis

Compiler – Interpreter – Assembler – Language Processor - Phases of a compiler – Lexical Analysis – Role of Lexical Analyser – Specification of Tokens – Recognition of Tokens – Lex.

Unit-IV: Syntax Analysis

Role of Parser - Top Down Parsing - General Strategies Recursive Descent Parser - Predictive Parser - LL(1) - Parser-Shift Reduce Parser - LR Parser - SLR – CLR – LALR - YAAC.

Unit-V: Intermediate Code, Code Generation and Code Optimization

Issues in Code Generation - Design of a simple Code Generator - Principal Sources of Optimization – Peep-hole optimization – DAG - Optimization of Basic Blocks.

Text Books:

1. J.E.Hopcroft, R.Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", Second Edition, Pearson Education, 2003
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", Second Edition, Pearson Education, 2009

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 118

References
1. Martin, "Introduction to Languages and the Theory of Computation", Third Edition, TMH, 2003
2. Steven S. Muchnick, "Advanced Compiler Design and Implementation", Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003
3. V. Raghavan, "Principles of Compiler Design", Tata McGraw Hill Education Publishers, 2010
4. Allen I. Holub, "Compiler Design in C", Prentice-Hall Software Series, 1993
5. Randy Allen, Ken Kennedy, "Optimizing Compilers for Modern Architectures: A Dependence based Approach", Morgan Kaufmann Publishers, 2002

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS301.1	Design and analyze Deterministic and Non-deterministic Finite Automata, and demonstrate when languages are not regular	K3	1,2,3,4,5,12	-
R19CS301.2	Demonstrate proficiency in Lexical Analysis, including defining tokens, recognizing tokens, and utilizing tools like Lex	K3	1,2,3,4,5,12	-
R19CS301.3	Demonstrate proficiency in Lexical Analysis, including defining tokens, recognizing tokens, and utilizing tools like Lex	K3	1,2,3,4,5,12	-
R19CS301.4	Implement bottom-up parsing techniques such as shift-reduce parsing and LR parsing variants (SLR, CLR, LALR) using tools like Yacc, demonstrating proficiency at the BT level.	K3	1,2,3,4,5,12	-
R19CS301.5	Apply optimization strategies to enhance code quality and efficiency, demonstrating proficiency in code generation and optimization in a compiler context	K3	1,2,3,4,5,12	-

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS301.1	3	3	3	3	2	-	-	-	-	-	-	3	-	-	-
R19CS301.2	3	3	3	3	2	-	-	-	-	-	-	3	-	-	-
R19CS301.3	3	3	3	3	2	-	-	-	-	-	-	3	-	-	-
R19CS301.4	3	3	3	3	2	-	-	-	-	-	-	3	-	-	-
R19CS301.5	3	3	3	3	2	-	-	-	-	-	-	3	-	-	-
Course to PO	3	3	3	3	2	-	-	-	-	-	-	3	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202

R19IT302	Cloud Computing	L	T	P	C
		3	0	0	3

1. Course Description:

The fundamentals of cloud computing and virtualization are covered in this course; cloud computing is now one of the fields with the quickest rate of growth. The course will give the students a fundamental grasp of virtualization and the cloud, as well as how to move over it.

2. Course Objectives:

1. To impart to pupils the knowledge and skills necessary for using cloud computing.
2. To equip students with a solid understanding of cloud computing so they can begin utilizing and implementing cloud computing tools and services in their everyday lives.
3. To enable students exploring some important cloud computing driven commercial systems and applications.
4. To expose the students to frontier areas of Cloud Computing and information systems, while providing sufficient foundations to enable further study and research.

3. Syllabus:

Unit-I: Fundamentals of Cloud Computing

Cloud Computing Basics, History of Cloud Computing, Characteristic of cloud computing, **Cloud computing Technologies:** Virtualization, Service Oriented Architecture, Grid Computing, Utility Computing, Cloud Computing Infrastructure; **Cloud Development Models:** Public, Private, Hybrid, Community; **Cloud Service Models**: Infrastructure-as-a-Service, Platform-as-a-Service,Software-as–a-Service, Identity as a Service, Network as a Service; Challenges.

Unit-II: Cloud Virtualization

Characteristics of virtualized environments, **Taxonomy of virtualization techniques**:Application Virtualization, Network Virtualization, Desktop Virtualization, Storage Virtualization, Server Virtualization, Data virtualization; Virtualization and Cloud Computing, Pros and cons of Virtualization , **Xen**: Para virtualization, **VMware:** full virtualization, Microsoft Hyper-V

Unit-III: Cloud Technology

Aneka framework overview, **Anatomy of the Aneka container**: Fabric services, Foundation services, Application services; **Building Aneka clouds**: Infrastructure organization, Logical organization, Cloud deployment mode (Private, Public, Hybrid); **Cloud programming and management:**Aneka SDK, Management tools;**Cloud Platforms:**Amazon web services, Google AppEngine, Microsoft Azure

Unit-IV: Cloud Security

Cloud Security Challenges, **Software-as-a-Service Security**: Security Governance, Risk Management, Security Portfolio Management, Secure Software Development Life Cycle (SecSDLC), Forensics, Security Architecture Design, Data Privacy, Data Governance, Data Security, Application Security, Virtual Machine Security, Identity Access Management, Change Management, Physical Security. **Standards:**Standards for Application Developers, Standards for Messaging, Standards for Security.

Unit-V: Cloud Applications

Scientific applications: Healthcare, Biology, Geoscience; **Business and consumer applications**: CRM and ERP, Social networking, Media applications, Multiplayer online gaming; Energy efficiency in cloud, **Market-based management of clouds**: Market-oriented cloud computing, MOCC reference model; **Federated clouds/InterCloud**: Characterization, Cloud Federation Stack; **Third-party cloud services:** MetaCDN, SpotCloud

Chairman - Board of Studies
Chairman – Board of Studies Engineering
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 120

Text Books:

1. Rittinghouse, John W, and James F. Ransome, —Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.
2. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing‖, Tata Mcgraw Hill, 2013

References:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, —Distributed and Cloud Computing, From Parallel Processing to the Internet of Things‖, Morgan Kaufmann Publishers, 2012.
2. David E.Y. Sarna, —Implementing and Developing Cloud Application‖, CRC press 2011.
3. Lee Badger, Tim Grance, Robert Patt-Corner, Jeff Voas, NIST, —Draft cloudcomputing synopsis and recommendation‖, May 2011.
4. George Reese, —Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), OReilly, 2009.

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19IT302.1	Utilize the fundamental ideas of the cloud computing paradigm, including the features, benefits, and drawbacks of the many cloud computing models and services.	K3	1,2,3,4,12	1,2
R19IT302.2	Make use of virtualization for systems, networks, and storage and describe how it facilitates the cloud computing system model.	K3	1,2,3,4,12	1,2
R19IT302.3	Apply various cloud programming models to solve problems on the cloud.	K3	1,2,3,4,5,10,12	1,2
R19IT302.4	Analyze the core issues of cloud computing such as security, privacy, and interoperability	K4	1,2,3,4,5,10,12	1,2
R19IT302.5	Analyze appropriate cloud computing solutions and recommendations according to the applications used.	K4	1,2,3,4,5,10,12	1,2

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19IT302.1	1	2	2	2	-	-	-	-	-	-	-	2	2	2	-
R19IT302.2	1	2	2	2	-	-	-	-	-	-	-	2	2	2	-
R19IT302.3	1	2	2	2	3	-	-	-	-	2	-	2	2	2	-
R19IT302.4	1	2	2	2	2	-	-	-	-	2	-	2	2	2	-
R19IT302.5	1	2	2	2	3	-	-	-	-	2	-	2	2	2	-
Course to PO	1	2	2	2	3	-	-	-	-	2	-	2	2	2	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman – Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

R19CS302	Artificial Intelligence and Machine Learning	L	T	P	C
		3	0	0	3

1.Course Description:

The Artificial Intelligence and Machine Learning course provides students with a comprehensive understanding of both theoretical concepts and practical applications in the field of AI and ML. Through a series of modules, students will delve into the fundamentals of intelligent agents, problem-solving techniques, knowledge representation, and various learning algorithms.

2.Course Objectives:

1. To Learn about the Intelligent Agents and Problem-Solving Techniques in AI.
2. To Study the Knowledge Representation and Reasoning in AI.
3. To gain knowledge in various supervised learning algorithms.
4. To learn the various unsupervised Learning algorithms with real world applications.
5. To gain exposure in advanced learning techniques in ML.

3.Syllabus

Unit-I: Intelligent Agents and Problem-Solving Techniques

Applications of AI, Classification of AI systems with respect to environment. Problem solving agents: search algorithms, uninformed search strategies, Heuristic search strategies, Local search and optimization problems, Constraint Satisfaction Problems (CSP), Adversarial Search: Minimax algorithm – Alpha beta pruning.

Unit-II: Knowledge Representation and Reasoning

Automated Reasoning: Logic Agent, Knowledge Representation, Propositional logic, First Order Predicate Logic, inferences in first order logic, forward chaining, backward chaining, Representing Knowledge Representation using rules, Ontological Representations and applications.

Unit-III: Supervised Learning

Introduction to Machine Learning-Types; Regression Models: Linear Models for Regression, Common Regression Algorithms: Simple Linear Regression, Multiple Linear Regression, Bayesian linear regression, Common Classification Algorithms: Naive Bayes, Decision Trees – Random Forest model – Support Vector Machines, Maximum margin classifier.

Unit-IV: Ensemble Techniques and Unsupervised Learning

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Principal Component Analysis.

Unit-V: Neural Networks

Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, backpropagation,–Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning,batch normalization, regularization, dropout.

Text Books:
1. Stuart Russell and Peter Norvig, "Artificial Intelligence – A Modern Approach", Fourth Edition, Pearson Education, 2021.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

References:

Reference Books:

1. Dheepak Khemani, ―A first course in Artificial Intelligence‖, McGraw Hill Education Pvt Ltd., New Delhi, 2020.

2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", CRC Press, 2020.

Web Resources:

1. https://www.tutorialspoint.com/artificial_intelligence/index.htm
2. https://www.youtube.com/playlist?list=PL9ooVrP1hQOGHNaCT7_fwe9AabjZI1RjI
3. https://www.geeksforgeeks.org/machine-learning/
4. https://www.kaggle.com/learn/intro-to-machine-learning

Online Courses (NPTEL/SWAYAM):

1. https://onlinecourses.nptel.ac.in/noc24_cs08/preview
2. https://onlinecourses.nptel.ac.in/noc24_cs51/preview

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS302.1	Understand the intelligent agents and apply the Apply the various search techniques to real-time problems	K3	1, 3, 4,5, 9, 10,12	1,2
R19CS302.2	Use automated reasoning techniques to real world problems	K3	1, 3, 4,5, 9, 10,12	1,2
R19CS302.3	Apply the concepts behind supervised learning and their appropriateness	K3	1, 3, 4,5, 9, 10,12	1,2
R19CS302.4	Apply and build the unsupervised learning algorithms to various real-time data.	K3	1, 3, 4,5, 9, 10,12	1,2
R19CS302.5	Apply the advanced learning techniques to various real time data.	K3	1, 3, 4,5, 9, 10,12	1,2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS302.1	2	-	3	3	2	-	-	-	2	2	-	3	3	2	-
R19CS302.2	2	-	3	3	2	-	-	-	2	2	-	3	3	2	-
R19CS302.3	2	-	3	3	2	-	-	-	2	2	-	3	3	2	-
R19CS302.4	2	-	3	3	2	-	-	-	2	2	-	3	3	2	-
R19CS302.5	2	-	3	3	2	-	-	-	2	2	-	3	3	2	-
Course to PO	2	-	3	3	2	-	-	-	2	2	-	3	3	2	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

Chairman – Board of Studies
Department of Computer Science and Engineering
Sreenivasa College of Engineering (Autonomous)

Page | 123

R19EC253	Computer Networks	L	T	P	C
		3	0	2	4

1. Course Description:

Computer Networks examines the principles and protocols that enable communication between devices across networks, encompassing topics such as TCP/IP, routing algorithms, and network security. Students learn about network design, implementation, and management, preparing them to understand and troubleshoot modern networking environments. Practical exercises and case studies enhance comprehension of real-world network challenges and solutions.

2. Course Objectives:

1. To learn core networking and layering structures
2. To study the services, standards and access controls of Physical and data link layers
3. To learn the protocols and services layer 3 and 4 for routing and socket programming
4. To build a network for an application with security features

3. Syllabus:

Unit-I: Introduction

Basic Network Components – Transmission Modes –Network Topology – Message Delivery – Network Types –IEEE Standards -Basic Network commands – Network Performance parameters –Switching Techniques – Layering in Networks- OSI Architecture- TCP/IP Architecture

Unit-II: Physical and Data Link Layer

Physical Layer: Functions - Data and signals –Transmission Impairments -Transmission Media –Data Link Layer: Services – Link Layer addressing – Error Detection- Flow control – Link layer protocols - Media Access Control – Random Access – Ethernet – Types- VLAN - Network Function Virtualization

Unit-III: Network Layer

Services – IPV4 Addressing – sub netting- Protocols - Routing - Unicasting.– multicasting – Inter domain and Intra domain routing –Distance vector routing – link state routing –Next generation IP – IPV6-addressing – protocol- transition from IPV4 to IPV6

Unit-IV: Transport Layer

Services – TCP – Three ways Handshake -protocols – congestion control – UDP – services –applications-Socket Programming with TCP and UDP

Unit-V: Application Layer and Security

Services - Client server protocols– Email- DNS –Security – Goals- CIA Triad-OSI Security architecture -Firewalls- Securing E-mail-IP security-wireless security

List of Experiments

1. Verification of Boolean theorems using logic gates.
2. Implementation of half adder and full adder using logic gates
3. Implementation of Multiplexer and De-multiplexer using logic gates.
4. Verification of JK and D Flip-flops.
5. Implementation of SISO and PIPO 4-bit shift register using Flip- flops.
6. Construction and verification of 4 bit ripple counter.
7. Design and implementation of 2 bit ALU using various combinational circuits

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman – Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 124

Text Books:

1.	Behrouz A Forouzan, "Data Communications and Networking", McGraw Hill Education, 6th edition, 2022
2.	Andrew S. Tanenbaum "Computer Networks", Pearson Education India, 6th Edition, 2022

References:

Reference Books:

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Morgan Kaufmann Publishers, sixth Edition, 2021

2. William Stallings, "Data and Computer Communications", Pearson Education, Tenth Edition, 2017.

3. James F. Kurose, Keith W. Ross, "Computer Networking, A Top-Down Approach Featuring the Internet", Pearson Education, Sixth Edition, 2017

4. Ethical hacking and countermeasures v11 – Professional Series - CEH Handbook,2021

5. Richard Fox, Wei Hao, "Internet Infrastructure Networking, Web Services, and Cloud Computing", T& F, CRC Press, 2018.

Web Resources:

1. https://www.nesoacademy.org/cs/06-computer-networks/03-logical-addressing-and-subnetting/14-subnetting

2. https://www.youtube.com/watch?v=qZLPq5mebFMl

3. https://www.cisco.com/c/en_in/products/security/vpn-endpoint-security-clients/what-is-vpn.html#~how-a-vpn-works

4. https://www.checkpoint.com/cyber-hub/network-security/what-is-firewall/

NPTEL Courses:

1. Swayam –NPTEL –Computer Networks and Internet Protocol

2. Swayam –NPTEL - Demystifying Networking

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
U23EC384.1	Understand the core network requirements and layering structure of OSI and TCP/IP	K2	1,2,3,4,5,9	-
U23EC384.2	Interpret the services, standards, access control mechanism in physical and data link layer	K2	1,2,3,4,5,9	-
U23EC384.3	Use the addressing schemes and protocols for routing the information in networks	K3	1,2,3,4,5,9	-
U23EC384.4	Apply the services offered by Transport layer protocols for socket programming	K3	1,2,3,4,5,9	-
U23EC384.5	Develop a network and support an application with security features	K3	1,2,3,4,5,9	-

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore – 641 202.

Page | 125

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
U23EC382.1	3	1	3	3	1	-	-	-	2	-	-	-	-	-	-
U23EC382.2	3	1	3	3	2	-	-	-	2	-	-	1	-	-	-
U23EC382.3	3	1	3	3	3	-	-	-	2	-	-	2	-	-	-
U23EC382.4	3	1	3	3	3	-	-	-	2	-	-	3	-	-	-
U23EC382.5	2	3	3	3	3	-	2	2	2	-	3	3	-	-	-
Course to PO	3	2	3	3	3	-	2	2	2	2	2	2	-	-	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19IT311	Cloud Computing Laboratory	L	T	P	C
		0	0	2	1

1. Course Description:

This capstone course covers the most recent developments in cloud computing, Web3 decentralized applications. These technologies can be coupled to produce next-generation multi-cloud, creative, intelligent, autonomous, and networked (IAN) business solutions. Students will learn about services provided on the top "Big Clouds", namely Amazon AWS Cloud, Google Cloud, Microsoft Azure Cloud, IBM Cloud, Salesforce, and others. Related cloud services that are covered in the course include big data services, networking services, storage services, and computer and hosting services.

2. Course Objectives:

1. To familiarize the concepts of cloud computing and services
2. To develop web applications in cloud
3. To learn the design and development process involved in creating a cloud based application
4. To learn to implement and use parallel programming using Hadoop

3. List of Laboratory Experiments / Exercises:

1. Install Virtualbox/VMware Workstation with different flavours of linux orwindows OS on top of windows10.
2. Install a C compiler in the virtual machine created using virtual box andexecute Simple Programs.
3. Install Google App Engine. Create hello world app and other simple webapplications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithmthat is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to anothervirtual machine.
7. Find a procedure to launch virtual machine using trystack (OnlineOpenstack Demo Version).
8. Install Hadoop single node cluster and run simple applications like wordcount
9. Working with Mangrasoft Aneka Software.
10. Working in Cloud9 to demonstrate different language.

References:

1. Rittinghouse, John W., and James F. Ransome, Cloud Computing: Implementation, Management and Security, CRC Press, 2017.

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 126

2. RajkumarBuyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing, Tata McGraw Hill, 2013
3. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, —Distributed and Cloud Computing, From Parallel Processing to the Internet of Thingsǁ, Morgan Kaufmann Publishers, 2012.
4. David E.Y. Sarna Implementing and Developing Cloud Application, CRC press 2011.
5. https://www.coursera.org/browse/information-technology/cloud-computing
6. https://www.udemy.com/topic/cloud-computing/

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19IT311.1	Configure various virtualization tools such as Virtual Box, VMware workstation	K3	1,2,3,4,5,9,11,12	1,2
R19IT311.2	Design and deploy a web application in a PaaS environment	K3	1,2,3,4,5,9,11,12	1,2
R19IT311.3	Use cloud platforms in industry such as Amazon web services, Google AppEngine, Cloudsim and GAE launcher scientific applications.	K3	1,2,3,4,5,9,11,12	1,2
R19IT311.4	Implement Data intensive computing and Map-Reduce programming model	K3	1,2,3,4,5,9,11,12	1,2
R19IT311.5	Design and develop a cloud computing architecture and the Aneka cloud computing platform.	K3	1,2,3,4,5,9,11,12	1,2

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19IT311.1	2	2	3	3	3	-	-	-	3	-	3	3	2	2	-
R19IT311.2	2	2	3	3	3	-	-	-	3	-	3	3	2	2	-
R19IT311.3	2	2	3	3	3	-	-	-	3	-	3	3	2	2	-
R19IT311.4	2	2	3	3	3	-	-	-	3	-	3	3	2	2	-
R19IT311.5	2	2	3	3	3	-	-	-	3	-	3	3	2	2	-
Course to PO	2	2	3	3	3	-	-	-	3	-	3	3	2	2	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS311	Artificial Intelligence and Machine Learning Laboratory	L	T	P	C
		0	0	2	1

1.Course Description:

Artificial intelligence and machine learning laboratory course explores into the practical applications of AI and ML, focusing on supervised, unsupervised, and neural network techniques. Through a series of guided experiments and projects, students will gain a comprehensive understanding of how these methodologies are utilized in real-world scenarios. The course emphasizes practical implementation, ensuring students develop the skills necessary to tackle complex AI & ML problems

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 127

2.Course Objectives:
1. To learn the searching techniques in AI
2. To gain knowledge on Exploratory Data Analysis in ML
3. To gain knowledge in various supervised learning algorithms
4. To learn the various unsupervised Learning algorithms with real world applications
5. To study the concept of neural network and its applications

3.List of Laboratory Experiments / Exercises:

1. Perform Regression to Build a best model to predict the insurance charges.

   Dataset:https://www.kaggle.com/code/mariapushkareva/medical-insurance-cost-with-linear-regression/input

2. Build a best model with above 75% accuracy to perform classification aiming to predict whether a passenger survived or not based on various attributes.

   Dataset: Titanic: https:/www.kaggle.com/datasets/yasserh/titanic-dataset

3. Build a best model with above 95% accuracy for classification to predict whether a customer in bank will subscribe to a term deposit based on various client attributes and marketing campaign information.

   Dataset: Bank Marketing: https://www.kaggle.com/datasets/janiobachmann/bank-marketing-dataset

4. Build a best model with above 95% accuracy for classification to predict whether a patient is likely to develop cervical cancer based on various attributes.

   Dataset: Cervical Cancer Behaviour: https://www.kaggle.com/datasets/loveall/cervical-cancer-risk-classification

5. Perform Unsupervised Learning Technique to segment customers based on their purchasing behaviour using data for various attributes. (Hint:- Clustering Algorithms)

   Dataset: Mall Customer Segmentation: https://www.kaggle.com/datasets/vjchoudhary7/customer-segmentation-tutorial-in-python

6. Reduce the dimensionality of a high dimensional data using Principal Component Analysis, and visualize the data in a lower-dimensional space to gain insights into its structure.

   Dataset: Covid19: https://www.kaggle.com/code/wonduk/text-clustering-pca-eda-on-covid19-dataset.

7. Build and train a neural network model for on Twitter data, effectively classifying tweets into positive, negative, or neutral sentiments.

   Dataset: Twitter Sentiment: https://www.kaggle.com/datasets/saurabhshahane/twitter-sentiment-dataset

References:

1. https://www.geeksforgeeks.org/machine-learning/
2. https://www.kaggle.com/learn/intro-to-machine-learning
3. https://archive.ics.uci.edu/

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore - 641202

4. https://datasetsearch.research.google.com/

5. https://dataverse.harvard.edu/

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS311.1	Apply search techniques algorithm to solve complex problems in artificial intelligence.	K3	1,2,3,4,5,8,9,10,11,12	1,2
R19CS311.2	Apply the exploratory data analysis for the given complex problem.	K3	1,2,3,4,5,8,9,10,11,12	1,2
R19CS311.3	Apply the various supervised learning algorithm to solve real-time problems.	K3	1,2,3,4,5,8,9,10,11,12	1,2
R19CS311.4	Apply the various unsupervised learning algorithm to solve complex problems.	K3	1,2,3,4,5,8,9,10,11,12	1,2
R19CS311.5	Build a neural network model for a given complex problem.	K3	1,2,3,4,5,8,9,10,11,12	1,2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS311.1	3	1	3	2	3	-	-	1	3	2	2	3	3	2	-
R19CS311.2	3	1	3	2	3	-	-	1	3	2	2	3	3	2	-
R19CS311.3	3	1	3	2	3	-	-	1	3	2	2	3	3	2	-
R19CS311.4	3	1	3	2	3	-	-	1	3	2	2	3	3	2	-
R19CS311.5	3	1	3	2	3	-	-	1	3	2	2	3	3	2	-
Course to PO	3	1	3	2	3	-	-	1	3	2	2	3	3	2	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19MC201	Environmental Science	L	T	P	C
		2	0	0	NC

1. Course Description:

This course offers a foundational grasp of science in the realm of environmental perspective to understand and analyse the concepts of ecosystem function, biodiversity and its preservation, the increase of human population, water resources and management, pollution of the water, air, soil, climate change, energy resources and sustainability.

2. Course Objectives:

1. To get an understanding of the fundamentals of taxonomy, systematics, morphology, and taxonomy studies of plants and animals.

2. To impart knowledge about the stages at which an ecology develops as well as ecological classification.

3. Study of equipment, mechanisms, and approaches for pollution control

4. To address society's intended environmental protection demands, identify, formulate, analyze, and develop procedures and technologies and suitable solutions.

3. Syllabus
Unit-I: Environment and Ecosystem
Key environmental issues: their basic causes and sustainable solutions; concept of an ecosystem; structure and function of an ecosystem: producers, consumers and decomposers; energy flow in the ecosystem: food chains and food webs.
Unit-II: Environmental Pollution
Primary and secondary air pollutants: Air, Water, Marine and soil pollution: causes, effects and control measures.
Unit-III: Risk and Security of Environment
Heavy metals; E-waste and Hazardous waste management; green and blue revolution; GM crops: merits and demerits; ecological impacts of modern agriculture; Bio fertilizer technology; organic farming.
Unit-IV: Energy Resources
Non-renewable energy resources: oil, Natural gas, Coal; Renewable energy resources: Solar energy, Hydroelectric power, Wind, biomass and geothermal energy.
Unit-V: Social Issues and the Environment
Environmental ethics: Issues and possible solutions; water conservation: rain water harvesting, watershed management; Sustainable development: global climatic change, global warming; ozone layer depletion.

Text Books:

1. Babu E. and Tharaneeswaran V., "Environmental Science", V K Publishers, 2019.

2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

3. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

4. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.

References:

1. Sawyer C L McCarty P L and Parkin G E, Chemistry for Environmental Engineering. McGraw Hill, 1995.

2. Rajeshwar, K. and Ibanez, J. G., Environmental Electrochemistry Academic Press, 1997.

3. VanLoon G W and S.J. Duffy, Environmental Chemistry, Oxford university press, 2005

4. Casey. T.J. "Unit Treatment Processes in Water and Wastewater Engineering ", John Wiley & Sons, 2006.

5. Jeffrey Pierce J, Environmental pollution and control, Butterworth-Heinemann; 4th edn, 1997. 6. 6. 6. Resources Management, Hazardous waste Management, Mc-Graw Hill International edition, New York, 2001.

Journals:

1. https://link.springer.com/journal/10800

2. https://www.boffinaccess.com/journals/journal-water-technology-treatment-methods/editorial-board

3. https://benthamopen.com/TOTHERJ/home/

4. https://onlinelibrary.wiley.com/journal/15272648

Video References:

1. https://www.youtube.com/watch?v=ytxjYhcGNBs

2. https://www.youtube.com/watch?v=oSbUp3XYQX8

3. https://www.youtube.com/watch?v=FdRC8m6f57w

4. https://www.youtube.com/watch?v=1kUE0BZtTRc

Chairman - Board of Studies
Chairman – Board of Studies Engineering
Department of Computer Science Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore - 641 202.

Page | 130

5. https://www.youtube.com/watch?v=EuwMB1Dal-4

NPTEL Lectures:

1. https://nptel.ac.in/courses/105104099/
2. https://elearn.nptel.ac.in/shop/nptel/non-conventional-energy-resources/
3. https://youtu.be/LjFt7rlCU84

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19MC201.1	Analyze human interaction for the sustainability of a social eco-system	K4	1, 3,4, 6,7, 11	-
R19MC201.2	Examine the impact of pollution and hazardous chemical on environment and human health.	K4	1,2 ,4,5,6,8,12	-
R19MC201.3	Inspect the effect of different wastes and chemical on the environment and its mitigation methods.	K4	1,3,4,5,6,7,9,11, 12	-
R19MC201.4	Identify the application of natural resources for creating a good eco-system.	K3	1,2,3,4,5,7,8,9, 12	-
R19MC201.5	Apply the basic concepts to understand various environmental issues	K4	1,2,3,4,5,7,9,11, 12	-

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19MC201.1	2	2	2	2	2	2	1	-	1	-	1	-	-	-	-
R19MC201.2	2	2	2	2	3	2	-	1	-	-	-	1	-	-	-
R19MC201.3	1	1	3	2	2	1	1	-	1	-	1	-	-	-	-
R19MC201.4	1	2	2	2	3	2	-	1	-	-	-	1	-	-	-
R19MC201.5	2	2	2	1	1	1	1	-	2	-	2	-	-	-	-
Course to PO	2	2	2	2	2	2	1	1	1	-	1	1	-	-	-

"3"—High, "2"—Medium, "1"—Low, "- "—No Correlation

R19CS303	Object Oriented Analysis and Design	L	T	P	C
		3	0	0	3

1.Course Description

This course is a fundamental course that delves into the principles and practices of developing software systems using object-oriented methodologies. This course emphasizes understanding the problem domain, designing robust solutions, and implementing them efficiently. Students will gain insights into various phases of the software development lifecycle, from requirements gathering to deployment, with a focus on object-oriented concepts

2.Course Objectives

1. To understand the fundamental principles of object-oriented analysis and design

2. To apply object-oriented techniques to model complex systems using UML diagrams

3. To identify and apply appropriate design patterns to solve recurring design problems

4. To develop software solutions that meet specified requirements and quality standards

3.Syllabus

Unit-I: Introduction to Object-Oriented Analysis and Design

Overview of Object-Oriented Paradigm - Understanding Objects, Classes, and Relationships - Principles of Encapsulation, Inheritance, and Polymorphism - Importance of Modularity and Reusability in Object - Oriented Design

Case Study: Identification of users, transactions and administrative functions in Online Learning Administration System (LAS).

Unit-II: Requirements Analysis and Use Case Modelling

Software Requirements: Functional and Non-functional Requirements - User requirements - System requirements - Software requirements Document (ISO/IEC/IEEE 29148:2011). Requirements Elicitation and Analysis - Requirements Validation. Use Case Modeling: Identifying Actors and Use Cases - Writing Effective Use Case Descriptions - Use Case Diagrams and Scenarios - Prioritizing and Managing Requirements in Agile Environments

Case Study: Requirements Elicitation and Use Case Modelling for Online Learning Administration System (LAS).

Unit-III: Unified Process and Behavioural Modelling

Introduction to OOAD with OO Basics — Unified Process — UML diagrams. Basic Behavioural Modeling: Sequence Diagram: Identify the interaction between objects — Sequence diagram notations — Modelling synchronous and asynchronous messages — Conditional and Iterative behaviour — Activity diagram: Notations — Modelling parallel activities and concurrent behaviour — Control and object flow - State diagram: Notations - Hierarchical and concurrent states - Modeling complex behaviours using nested states and orthogonal regions

Case Study: Behavioural modelling — capturing interactions and activity roadmap for Learning Administration System.

Chairman - Board of Studies
Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 132

Unit-IV: Structural Modelling

Architectural Modelling - Class Diagram: Concept of class diagrams - Static structure and relationships in a system - Notations - Modelling Component level design – Modelling inheritance and interfaces in class diagrams - Constraints and stereotypes – Object diagram: Notations, Representation of object relationships and multiplicity. Component diagram: System components and their relationships - notation: components, interfaces, dependencies, and connectors - Modelling component deployment and distribution. Design Patterns: Creational – Structural Patterns - Behavioural Patterns - Applying Design Patterns to solve common design problems - Anti- patterns and Refactoring Techniques.

Case Study: Structural modelling – static structure and organization of the LAS system's architecture.

Unit-V: Modern Tools for Object Oriented Analysis and Design

UML modeling through plugins such as Papyrus or Object Aid using Eclipse IDE – Importing existing codebase and generating UML model using Argo/Star UML - Business process re-engineering (BPR), focusing on the analysis and design of workflows using Flowable/Activiti – Requirement Management and defect tracking using Redmine – Collaboration and documentation using Jupyter Notebook – Continuous Integration and Deployment using Jenkins.

Text Books:

1. Brett D. McLaughlin , David West and Gary Pollice, "Head First Object-Oriented Analysis and Design : A Brain Friendly Guide to OOA&D (Head First)", O'Reilly Media, Inc., 2011.
2. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: Using UML, Patterns and Java", Third Edition, Pearson Education, 2009.

References:

1. Roger S Pressman, "Software engineering – A Practitioner's Approach", Ninth Edition, Tata McGraw-Hill, 2019
2. James A. Crowder, Shelli Friess, "Agile Project Management: Managing for Success", Springer 2014.
3. Craig Larman, "An introduction to Object –Oriented Analysis and Design and Unified Process Appling UML and Patterns", 3rdedition, Pearson Education, New Delhi, India, 2005.
4. John W. Satzinger, Robert B Jackson, Stephen D Burd, "Object-Oriented Analysis and Design with the Unified Process", Cengage learning, India, 2004.

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS303.1	Compare various software process models and understand the fundamentals of object-oriented paradigms	K2	1,2,3,4,5,7,11,12	1,2,3
R19CS303.2	Analyze the complexity of the project and develop the project plan	K3	1,2,3,4,5,7,11,12	1,2,3
R19CS303.3	Construct UML behavioral diagrams for a project	K3	1,2,3,4,5,7,11,12	1,2,3
R19CS303.4	Construct UML structural diagrams for a project	K3	1,2,3,4,5,7,11,12	1,2,3

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 133

CO		K3	1,2,3,4,5,7,11,12	1,2,3
R19CS303.5	Demonstrate the knowledge on contemporary tools in object-oriented analysis and design			

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS303.1	3	3	3	3	1	-	1	-	-	-	3	3	1	2	3
R19CS303.2	3	3	3	3	3	-	1	-	-	-	3	3	2	2	3
R19CS303.3	3	3	3	3	3	-	1	-	-	-	3	3	3	2	3
R19CS303.4	3	3	3	3	1	-	1	-	-	-	3	3	1	2	3
R19CS303.5	3	3	3	3	3	-	1	-	-	-	3	3	3	2	3
Course to PO	3	3	3	3	2	-	1	-	-	-	3	3	2	2	3

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19IT303	Cryptography and Cyber Security	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides an in-depth exploration of cryptography and its fundamental role in ensuring the security and privacy of digital communication and data.

2.Course Objectives:

The main objective of this course is to introduce the working of various cryptographic methods and how to apply this knowledge to real-world applications. This course will also present an overview of Cyber Security.

3.Syllabus

Unit-I: Foundations of Security

Introduction to Security – types of Attacks - goals for security - security threat and vulnerability - cyber security models (the CIA triad, the star model) - classical encryption techniques: Substitution ciphers and transposition ciphers – DES – AES – RC4 – key distribution.

Case Study: Exploration of binaries, libraries (static and dynamic) and Make file in Kali Linux.

Unit-II: Public Key Cryptography and Hashing

Principles of public key crypto systems - RSA algorithm - key management and distribution: symmetric key distribution, Diffie-Hellman Key Exchange, elliptic curve cryptography, public key distribution - SSL - Message Authentication Codes: Authentication requirements, authentication functions, message authentication code, hash functions, birthday attacks and security of hash functions.

Case Study: Exploration of discretionary access control mechanism in operating Systems (linux)

Unit-III: Digital Signature and Network Security

Digital Signatures: Digital Signatures, Elgamal Digital Signature Techniques, Digital Signature Standards (DSS) - digital security, web security, end-end security - Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications – Kerberos, X.509 – Email Security – PGP – S/MIME – Firewall.

Case Study: Exploration of mandatory access control mechanism (SElinux or AppArmor)

Unit-IV: Cyber Security Essentials
Introduction to cyber-attacks - application security (design, development and testing), operations security, monitoring, identifying threats and remedial strategies - Data Privacy, Data breaches, preventing attacks and breaches with security controls - LAN attacks: ARP Cache poisoning - Ettercap/arpspoof, MAC flooding, Man in the middle attacks, Port Stealing, DHCP attacks, VLAN hopping.   **Case Study:** Exploring different types of Malwares and analysis (Static, Dynamic tools and Cuckoo sandbox)

Unit-V: Cyber Forensics
Classifications of Cyber Crimes against individuals, property and nation, Need for Digital forensics and steps in digital forensics (scientific methods), Number System: Binary, Decimal, Hexadecimal, ASCII, and Unicode representation of data, Incident handling and response with forensic triage, Ethical Hacking and future of cybercrime.   **Case Study:** Explore buffer overflows, format string attacks, Code injection and Return-to-libc attacks.

Text Books:
1. William Stallings, "Cryptography and Network Security – Principles and Practice", Eighth Edition, Pearson Education, 2020.

References:
1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.   2. Nina Godbole and SunitBelpure, Cyber Security: Understanding Cyber crimes, ComputerForeinsics and Legal Perspectives, Willey India Pvt.Ltd.

4.Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS304.1	Understand the foundational principles of cryptography and its historical significance in securing communication and data.	K2	1,2,3,4,5,7,12	1,2,3
R19CS304.2	Identify symmetric encryption algorithms and comprehend their respective strengths and weaknesses using Hashing.	K2	1,2,3,4,5,7,12	1,2,3
R19CS304.3	To apply various digital signature for network security to protect against the threats in the networks.	K3	1,2,3,4,5,7,12	1,2,3
R19CS304.4	Understand the fundamental principles, concepts, and terminology of cyber security, including common cyber threats and attack vectors.	K4	1,2,3,4,5,7,12	1,2,3
R19CS304.5	Explore the role of forensic analysis in incident response and recovery efforts, including identifying vulnerabilities and mitigating future risks.	K5	1,2,3,4,5,7,12	1,2,3

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS304.1	3	3	3	3	2	-	1	-	-	-	-	3	1	1	2
R19CS304.2	3	3	3	3	2	-	1	-	-	-	-	3	1	1	2

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore - 641 202.

Page | 135

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS304.3	3	3	3	3	2	-	1	-	-	-	-	3	1	1	2
R19CS304.4	3	3	3	3	2	-	1	-	-	-	-	3	1	1	2
R19CS304.5	3	3	3	3	2	-	1	-	-	-	-	3	1	1	2
Course to PO	3	3	3	3	2	-	1	-	-	-	-	3	1	1	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CB540	Software Project Management	L	T	P	C
		2	0	2	4

1. Course Description

This course aims to equip students with the necessary knowledge and skills to effectively manage software projects. It covers a wide range of topics including project planning, effort estimation, risk management, people management, project control, and the use of modern project management tools and practices such as DevOps. Students will learn how to navigate the complexities of software project management to deliver successful projects.

2. Course Objectives:

1. To introduce students to the fundamental concepts and techniques of software project management.
2. To enable students to understand and apply various methods for software effort estimation and activity planning.
3. To provide a comprehensive understanding of risk management and people management in the context of software projects
4. To teach students how to prepare effective project schedules and control mechanisms.
5. To familiarize students with the latest industry tools and standards in software project management.

3. Syllabus

Unit-I: Introduction

Introduction to Software Project Management - Software Projects - ways of categorizing software projects – problems with software projects – Project Life Cycle -Software Projects versus Other Types of Project – Contract Management and Technical Project Management – Activities – Plans, Methods and Methodologies – Requirement Specification – Management Control – Overview of Project Planning – Introduction to Step Wise Project Planning – Programme Management and Project Evaluation.

Unit-II: Software Effort Estimation and Activity Planning

Software Effort Estimation: Problems with Over and Under Estimates – Basis of Software Estimating – Techniques – Expert Judgment – Cosmic Full Function Points – A Procedural Code Oriented Approach –COCOMO: A Parametric Model – Activity Planning: Objectives – Project Schedules – Projects and Activities – Sequencing and Scheduling Activities – Network Planning Models – Formulating A Network Model – Identifying Critical Path – Shortening the Project Duration – Identifying Critical Activities – Activity-on-Arrow Networks.

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman – Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 136

Unit-III: Software Risk and People Management

Categories of Risk – Framework for Dealing with Risk – Risk Identification – Risk Assessment – Risk Planning – Risk Management – Evaluating Risks to the Schedule – Applying the PERT Technique – Monte Carlo Simulation – Critical Chain Concepts – Resource Allocation: Nature of Resources – Identifying Resource Requirements – Scheduling Resources – Creating Critical Paths – Counting the Cost – Cost Schedules – Scheduling Sequence.

Unit-IV: Software Project and Control

Creating the Framework – Collecting the Data: Partial Completion Reporting – Risk Reporting – Visualizing Progress: Gantt chart – Slip chart – Ball Charts – The Timeline – Cost Monitoring – Earned Value Analysis – Prioritizing Monitoring – Getting the Project Back to Target – Change Control.

Unit-V: Case Study – Project Management Tools & Devops

Introduction to Project Management tools-Trello – JIRA – ZohoProjects –Introduction to Devops – GITLAB-Issues-Milestones Tracking

Text Books:

1. Naresh Chauhan, "Software Testing principles and practice", Seventh Edition, Oxford University Press,2022.

2. Chandramouli and Dutt, ―Software Project Management‖, Pearson Education ,2015

References:

Reference Books:

1. Pressman R. S., ―Software Engineering – A Practitioner's Approach‖, Ninth Edition, McGraw HillPublishers, 2020.

2 Ramanathan Krishnan., ―Software Project Management ‖, Everest Publication, 2015

Journals:

1. Information and Software Technology

2. International Journal of Project Management

NPTEL Courses:

1. https://onlinecourses.nptel.ac.in/noc19_cs70/preview

2. https://nptelvideos.com/video.php?id=918

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CB540.1	Explain the various techniques for requirements, planning, and managing a technology project	K2	1, 2, 3, 4,12	1,2
R19CB540.2	Estimate the software effort and plan activities effectively	K3	1, 2, 3, 4,12	1,2
R19CB540.3	Explain the level of software risk and manage people effectively	K2	1, 2, 3, 4,12	1,2
R19CB540.4	Prepare effective project scheduling work products	K3	1, 2, 3, 4,12	1,2

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman – Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 137

R19CB540.5	Identify the latest industry knowledge, tools, and comply with the latest global standards for project management	K3	1, 2, 3, 4,12	1,2

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CB540.1	3	3	2	1	-	-	-	-	-	-	-	2	3	1	-
R19CB540.2	3	3	2	1	-	-	-	-	-	-	-	2	3	1	-
R19CB540.3	3	3	2	2	-	-	-	-	-	-	-	2	3	1	-
R19CB540.4	3	3	2	2	-	-	-	-	-	-	-	2	3	1	-
R19CB540.5	3	3	2	2	-	-	-	-	-	-	-	2	3	1	-
Course to PO	3	3	2	2	-	-	-	-	-	-	-	2	3	1	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CB534	Software Testing	L	T	P	C
		2	0	2	4

1. Course Description

This course provides a comprehensive overview of software testing principles, techniques, and methodologies essential for ensuring the quality and reliability of software systems. Topics include test planning, design, execution, and automation. Students able to determine the appropriate testing strategies and the procedure to design the test case

2. Course Objectives:

1. To understand the fundamental concepts of software testing to ensure the quality, reliability, and usability of software products.
2. To discuss the various software testing issues and solutions in functional (Black box) software testing.
3. To understand fundamental concept in level of testing in unit test, integration and system testing
4. To understand the fundamentals concept of test management principles
5. To improve testing efficiency, accuracy, and speed by automating repetitive and time-consuming manual testing tasks

3. Syllabus

Unit-I: Introduction to Software Testing

Introduction-Evolution of Software Testing-Software Testing –Myths and Facts – Goals of Software testing – Software Testing Definitions-Models of Software Testing- Effective Software Testing vs

Exhaustive Software Testing –Software Testing Terminology and Methodology- Verification and Validation.

Case study: Software testing process in a e-commerce website.

Unit-II: Testing Strategies

Dynamic Testing: Black-Box Testing Techniques- Boundary Value Analysis- Equivalence Class Testing-State Table-Based Testing- Decision Table-Based Testing- Cause-Effect Graphing Based Testing. White-Box Testing Techniques- Need of White-Box Testing- Static Testing –Structural Testing-Unit Code functionality Testing-Code coverage Testing-Code Complexity Testing-Challenges in White box Testing

Chairman - Board of Studies
Chairman – Board of Studies and Engineering
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

Page | 138

Case study: Testing strategies for a ride sharing mobile app

Unit-III: Levels of Testing

Different levels of testing - Unit Validation Testing - Integration Testing-Scenario Testing- Defect Bash -Function Testing- System Testing- Acceptance Testing - Regression Testing.

Case Study: Different level of testing in web based project management applications.

Unit-IV: Test Management

Test Management- Test Organization- Structure of Testing Group- Test Planning- Detailed Test Design and Test Specifications - Software Metrics- Testing Metrics for Monitoring and Controlling the Testing Process- Efficient Test Suite Management - Testing Process Maturity Models.

Case Study: Test management tool for a mobile banking application

Unit-V: Automation Testing Tool

Automation and Testing Tools- Need for Automation- Categorization of Testing Tools– Selection of Testing Tools. Introduction to JUnit – Overview – Test Framework –Application. Introduction to Selenium- Getting Started –Finding and Working with Element- Working with Selenium API.

Case Study: An automation testing tool for an E-commerce website.

Text Books:

1. Naresh Chauhan, "Software Testing principles and practice", Second Edition, Oxford University Press,2016 .

2. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2016

References:

Reference Books:

1.Paul Ammann and Jeff Offutt,"Introduction to Software Testing",Cambridge University Press,Second Edition,2017.

2.Unmesh Gundecha," Selenium Testing Tools Cookbook", Second Edition,Packt Publishing,2015

Journals:

1. Software Testing, Verification and Reliability
2 International Journal of Software Computing and Testing
3. Global Journal of Computing & Software Testing
4. A Critical Analysis of Software Testing Tools

Video References:

1. https://www.youtube.com/watch?v=qQfFp_GORpY
2. https://www.youtube.com/watch?v=7-1hz6vxpcw
3. https://www.youtube.com/watch?v=v-mIDYqotf8
4. https://www.youtube.com/watch?v=mcqoXuMoJp0
5. https://www.youtube.com/watch?v=sHpGvOlPfEw

NPTEL Courses:

1. https://onlinecourses.nptel.ac.in/noc24_cs47/preview
2. https://study.iitm.ac.in/ds/course_pages/BSCS3002.html

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Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641202.

Chairman – Board of Studies

Page | 139

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CB534.1	Understand all the activities, process and techniques carried out in testing process	K2	1,2,3,4,9,10,12	3
R19CB534.2	Understand the different types of testing strategies	K2	1,2,3,4,9,10,12	3
R19CB534.3	Identify all the testing levels carried out during the testing phase of an software	K3	1,2,3,4,9,10,12	3
R19CB534.4	Understand how to prepare test plan based on the requirements and specifications	K2	1,2,3,4,9,10,12	3
R19CB534.5	Apply the Automation testing tools in the production environment.	K3	1,2,3,4,9,10,12	3

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CB534.1	3	2	2	1	-	-	-	-	1	1	-	2	-	-	2
R19CB534.2	3	2	2	1	-	-	-	-	1	1	-	2	-	-	2
R19CB534.3	3	2	2	1	-	-	-	-	1	1	-	2	-	-	2
R19CB534.4	3	2	2	1	-	-	-	-	1	1	-	2	-	-	2
R19CB534.5	3	2	2	1	-	-	-	-	1	1	-	2	-	-	2
Course to PO	3	2	2	1	-	-	-	-	1	1	-	2	-	-	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS312	Object Oriented Analysis and Design Laboratory	L	T	P	C
		0	0	2	1

1.Course Description

This practical course aims to provide students with hands-on experience in applying object-oriented principles and methodologies to real-world software development scenarios. Through practical exercises, projects, and assignments, students will deepen their understanding of object-oriented concepts, design patterns, and software engineering best practices. By the end of the course, students should be proficient in utilizing various tools and techniques to analyse, design, implement, and test object-oriented software systems.

2.Course Objectives

1. To understand the essential tools and environments used in object-oriented software development, including IDEs, version control systems, and UML modeling tools.

2. To implement common design patterns such as Singleton, Factory Method, Observer, and

Strategy in practical scenarios and projects.

3. To create UML diagrams to visualize system structure, behavior, and interactions, and document design decisions effectively.

4. To translate design specifications into executable code and writing comprehensive test suites.

3.List of Laboratory Experiments / Exercises:

1. Environment Setup and Introduction to Tools
   - Setting up Integrated Development Environments (IDEs) such as IntelliJ IDEA, Eclipse, or Visual Studio Code.
   - Familiarization with UML modeling tools such as Lucid chart, Draw.io, Star UML, Argo UML or Visual Paradigm.

2. Document the Software Requirements Specification (SRS) for the identified system

3. Identify use cases and develop the Use Case model.
   - Identify the users
   - Identify the process
   - Define the constrains affecting the design.

4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram from that.
   - Define classes, attributes, operations.
   - Identify the association, aggregation, composition and generalization
   - Incorporate inheritance and interfaces to the class diagram.
   - Identify the object relationships and multiplicity.

5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
   - Use activation bars and return messages in sequence diagram.
   - Demonstrate synchronous, asynchronous and iterative behaviour in sequence diagram.

6. Draw relevant State Chart for system states and behaviour and Activity Diagrams for the business process and workflows
   - Define states, transitions, events, actions, and guards.
   - Demonstrate hierarchical and concurrent states in state diagrams (if applicable)
   - Demonstrate complex behaviours using nested states and orthogonal regions.

7. Creating component diagrams for system architecture and deployment scenarios.
   - Define the components.
   - Identify the interfaces, dependencies and connectors.

8. Creating composite structure diagrams for complex system elements

9. Test the software system for all the scenarios identified as per the use-case diagram

List of Sample Projects:

1. Digitalized Secure Banking.
2. Ecotourism management system.

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman – Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641202.

Page | 141

3. Natural Resources utilization management system for Agricultural Development.

4. Fisheries Resource Management System.

5. Autonomous Robot Aided Agriculture.

6. E-Waste Recycling System.

7. Learning Administration System (LAS)

8. Coffee Vending system.

9. Robotic Vacuum Cleaning system.

10. Insurance Management system.

11. Primary Health Centre (PHC) Monitoring and Management System.

12. Automated Healthcare monitoring system.

13. Asian Tourism Management system.

14. RFID based security system.

15. Inventory Management System for Car accessories.

16. Automated Food Ordering System.

17. Loan Automation System.

18. Investment scheme Guidelines System.

19. Sports Event Management System.

20. Automated Farming Assistance system.

References

1. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: Using UML, Patterns and Java", Third Edition, Pearson Education, 2009.

2. Roger S Pressman, "Software engineering – A Practitioner's Approach", Ninth Edition, Tata McGraw-Hill, 2019.

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS312.1	Develop and analyse requirements and Setting up Integrated Development Environments (IDEs) and version control systems for collaborative software development	K3	1,2,3,4,5,7,11,12	1,2,3
R19CS312.2	Implement OOP concepts including classes, objects, inheritance, polymorphism, and encapsulation in practical coding exercises	K3	1,2,3,4,5,7,11,12	1,2,3
R19CS312.3	Evaluate and select appropriate design patterns to solve specific design problems	K5	1,2,3,4,5,7,11,12	1,2,3
R19CS312.4	Create UML diagrams including class diagrams, sequence diagrams, activity diagrams, and state diagrams to visualize system architectures and behaviours	K6	1,2,3,4,5,7,11,12	1,2,3
R19CS312.5	Develop software prototypes and present outcomes, design decisions and implementation strategies	K3	1,2,3,4,5,7,11,12	1,2,3

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS312.1	3	3	3	3	3	-	1	-	-	-	3	3	2	2	3
R19CS312.2	3	3	3	3	3	-	1	-	-	-	3	3	3	2	3
R19CS312.3	3	3	3	3	1	-	1	-	-	-	3	3	1	2	3
R19CS312.4	3	3	3	3	3	-	1	-	-	-	3	3	3	2	3
R19CS312.5	3	3	3	3	3	-	1	-	-	-	3	3	2	2	3
Course to PO	3	3	3	3	3	-	1	-	-	-	3	3	3	2	3

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19IT312	Cryptography and Cyber Security Laboratory	L	T	P	C
		0	0	2	1

1.Course Description:

Cryptography & Cyber Security Laboratory course provides students with hands-on experience and practical skills in various aspects of cryptography & cyber security.

2.Course Objectives:

Develop practical skills in configuring and managing cyber security laboratory environments, including virtualized systems and network configurations. Apply cyber security concepts, principles, and best practices to identify, assess, and mitigate security vulnerabilities and threats within controlled laboratory environments.

3.Syllabus

1. Implement Random number generators using basic cryptographic techniques.
2. Implement attacks on SSL/TLS: SSL stripping, Drown and Poodle attack; Network packet creation and Manipulation using scapy and dpkt libraries.
3. Implement authentication, authorization and access control using PKI.
4. Implement ASLR, Heap-spraying, ROP, and use-after-free attacks using parrot.
5. Implement Defences against memory corruption exploits using SQL injection, XSS, and CSRF attacks.
6. Implement Malware, Sandboxing, DoS attacks using Kali Linux.
7. Implement Mobile malware, decompilation and analysis in jadex.
8. Implement OS security, Null-pointer dereferences and Code integrity in Local Host.
9. Implement the attack techniques: Network reconnaissance-Nmap and vulnerability audits - openVAS; DNS based attacks, Phishing – DNSTwist.
10. Implement the network based malware attacks: Remote access Trojan Poison Ivy and Domain name generation algorithm based Botnets.
11. Implement Network Sniffing - Wireshark and Password Cracking - John the Ripper.
12. Implement the file system of Android Mobile operating system and Malware Analysis (MobSF).

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman – Board of Studies ng (Autonomous)
Sri Eshwar College of Engineering
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Page | 143

Project:
Create Firewalls, Network intrusion detection and Honeypots and implement with a real time application.

References / Manual:
1. William Stallings, "Cryptography and Network Security – Principles and Practice", Eighth Edition, Pearson Education, 2020.
2. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
3. Nina Godbole and SunitBelpure, Cyber Security: Understanding Cybercrimes, Computer Foreinsics and Legal Perspectives, Willey India Pvt.Ltd.

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS312.1	Ability to set up and configure virtualized cyber security laboratory environments, demonstrating proficiency in managing systems and network configurations.	K3	1,2,3,5,8,9,10,11,12	1,2,3
R19CS312.2	Mastery of industry-standard cyber security tools and software for conducting network reconnaissance, vulnerability assessment, intrusion detection, and malware analysis.	K4	1,2,3,5,8,9,10,11,12	1,2,3
R19CS312.3	Proficient identification, assessment, and mitigation of security vulnerabilities and threats within simulated environments, applying cyber security concepts and best practices effectively.	K4	1,2,3,5,8,9,10,11,12	1,2,3
R19CS312.4	Ability to analyze and interpret results from cyber security tools and techniques, synthesizing findings into clear, concise, and technically accurate reports.	K5	1,2,3,5,8,9,10,11,12	1,2,3
R19CS312.5	Practical experience in applying cyber security concepts and techniques to real-world scenarios, preparing for roles in information security, penetration testing, incident response, and cyber defense.	K5	1,2,3,5,8,9,10,11,12	1,2,3

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS312.1	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2
R19CS312.2	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2
R19CS312.3	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2
R19CS312.4	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2
R19CS312.5	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2
Course to PO	3	3	3	-	3	-	-	1	2	1	2	3	3	2	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS381	Innovative / Multi-Disciplinary Project	L	T	P	C
		0	0	2	1

1. Course Description

The course is designed to equip you with the tools, techniques, and mindset needed to transform groundbreaking ideas into successful projects. Through a blend of theoretical insights and hands-on practice, you will learn to identify opportunities, develop creative solutions, and manage projects from inception to completion. Whether you're an aspiring entrepreneur, a business professional, or a creative thinker, this course will help you harness innovation to drive real-world impact. Join us and start turning your ideas into reality!

2. Course Objectives:

1. Exposure in an Industrial/professional work environment relevant to the student's field of study.
2. Develop the ability to apply practical skills and knowledge learned in academic coursework to real-world projects and tasks.
3. Network with professionals in the industry to explore career opportunities and build professional relationships.
4. Create awareness of current industrial technological developments relevant to the program domain.
5. Provide opportunities to understand the social, economic, and administrative considerations in organizations.

3. Guidelines:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. To train the students in preparing project reports and to face reviews and viva voce examination.

- The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the head of the department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the head of the department.

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS381.1	Understand the concepts of basic and advancements of engineering	K2	2,5,9,10,11,12	1,2,3
R19CS381.2	Apply the engineering concepts to identify the problems	K3	2,5,9,10,11,12	1,2,3
R19CS381.3	Analyze the complex challenging problem in the field of engineering	K4	2,5,9,10,11,12	1,2,3
R19CS381.4	Create the new ideas or methodology to find the solution of the problem	K6	2,5,9,10,11,12	1,2,3
R19CS381.5	Evaluate the understanding based on the oral presentation	K5	2,5,9,10,11,12	1,2,3

5. Course Articulation matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS381.1	-	2	-	-	2	-	-	-	3	2	2	2	2	2	2
R19CS381.2	-	2	-	-	2	-	-	-	3	2	2	2	2	2	2
R19CS381.3	-	2	-	-	2	-	-	-	3	2	2	2	2	2	2
R19CS381.4	-	2	-	-	2	-	-	-	3	2	2	2	2	2	2
R19CS381.5	-	2	-	-	2	-	-	-	3	2	2	2	2	2	2
Course to PO	-	2	-	-	2	-	-	-	3	2	2	2	2	2	2

"3"—High, "2"—Medium, "1"—Low, "—" — No Correlation

R19CS512	Advanced Java Programming	L	T	P	C
		3	0	0	3

1.Course Description:

This course delves into the advanced aspects of Java programming, designed for students who have a foundational understanding of Java and are looking to enhance their skills in developing robust, efficient, and scalable applications

2.Course Objectives:

1. Gain a comprehensive understanding of the evolution and features of the latest Java versions, and how these improvements impact modern software development practices

2. Enhance object-oriented programming skills and integrate functional programming techniques to process data efficiently and effectively.

3. Leverage the extensive Java Standard Library to write high-quality, maintainable, and efficient code, following industry best practices.

4. Develop advanced skills in concurrency and multi-threading to build high-performance, responsive applications that can handle multiple tasks simultaneously

5. Design and implement graphical user interfaces using the Abstract Window Toolkit (AWT) and Swing, creating interactive and user-friendly desktop applications

3.Syllabus:

Unit-I: JAVA Version and Context

An Overview of Java - Data Types, Variables, and Arrays – Operators - Control Statements - Java 8, 9, 10, and 11: what's happening? - Passing code with behavior parameterization

Unit-II: OOPS and Functional-Style Data Processing

Inheritance - Packages and Interfaces - Exception Handling - Enumerations, Auto boxing, and Annotations - I/O, Try-with-Resources - Lambda Expressions – Modules - Introducing streams - Working with streams – Collecting data with streams - Parallel data processing and performance

Unit-III: JAVA Library and Effective Programming

String Handling - Exploring java.lang - java.util Part 1: The Collections Framework - java.util Part 2: More Utility Classes - Collection API enhancements - Input/Output: Exploring java.io - Exploring NIO – Regular Expressions and Other Packages - Event Handling - Refactoring, testing, and debugging - Domain-specific languages using lambda

Unit-IV: Enhanced Java Concurrency

The Concurrency Utilities - Concepts behind Completable Future and reactive programming - Completable Future: composable asynchronous Programming - Reactive programming - Thinking functionally - Functional programming techniques - Blending OOP and FP

Unit-V: AWT and Gui Programming with Swing
Introducing the AWT: Working with Windows, Graphics, and Text - Using AWT Controls, Layout Managers, and Menus – Images - Introducing Swing - Exploring Swing - Introducing Swing Menus

Text Books:

1. Uttam Roy, "Advanced Java Programming", Oxford University Press,1st edition 2015
2. Raoul-Gabriel Urma, Mario Fusco, Alan Mycroft, "Modern Java in Action: Lambdas, streams, functional and reactive programming", Manning Publications; 2nd edition - 2018

References:

References Books:

1. Raoul-Gabriel Urma, Mario Fusco and Alan Mycroft, "Java 8 in Action", Dream tech Press; 1st edition 2014

NPTEL /Online Courses:

1. https://onlinecourses.nptel.ac.in/noc22_cs47/preview

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS512.1	Understand Java Language and Fundamentals	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS512.2	Understand object-oriented concepts and functional style data processing	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS512.3	Understand the java libraries and know effective programming with streams	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS512.4	Understand the enhanced java features	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS512.5	Create a system-based application using AWT and Swing	K3	1, 2, 3, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS512.1	3	3	3	-	2	-		-	-	-	-	2	2	2	-
R19CS512.2	3	3	3	-	2	-		-	-	-	-	2	2	2	-
R19CS512.3	3	3	3	-	2	-		-	-	-	-	2	2	2	-
R19CS512.4	3	3	3	-	2	-		-	-	-	-	2	2	2	-
R19CS512.5	3	3	3	-	2	-		-	-	-	-	2	2	2	-
Course to PO	3	3	3	-	2	-		-	-	-	-	2	2	2	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS513	ADVANCED DATA STRUCTURES	L	T	P	C
		3	0	0	3

1.Course Description:

This course provides an in-depth exploration of advanced data structures, essential for developing efficient and effective algorithms. Key topics include foundational concepts, spatial data structures, heaps, data structures for strings and union-find operations, and advanced design and analysis techniques. Students will gain the theoretical knowledge and practical skills necessary to implement and analyze complex data structures, enhancing their ability to solve sophisticated computational problems.

2.Course Objectives:

1. Gain a deep understanding of fundamental data structures and their theoretical underpinnings, enabling efficient problem-solving and algorithm design

2. Learn to implement and apply spatial data structures, such as quad trees and KD-trees, for managing and querying multidimensional data efficiently.

3. Develop expertise in various heap data structures, including binary heaps, Fibonacci heaps, and binomial heaps, and their applications in priority queue operations and graph algorithms

4. Understand and implement advanced data structures for string manipulation and pattern matching, as well as union-find structures for disjoint-set operations and dynamic connectivity.

5. Acquire advanced techniques for designing and analyzing data structures, including amortized analysis, randomized algorithms, and competitive analysis

3.Syllabus:

Unit-I: Foundations

Introduction: The Role of Algorithms in Computing-Analyzing Algorithms - Designing algorithms. Growth of Functions: Asymptotic Notation - Standard notations and common functions. Divide-and-Conquer: The maximum-subarray problem -Strassen's algorithm for matrix multiplication - The substitution method for solving recurrences - The recursion-tree method for solving recurrences - The master method for solving recurrences-Proof of the master theorem - Probabilistic Analysis and Randomized Algorithms.

Unit-II: Spatial Data Structures

Multidimensional Spatial Data Structures: introduction, point data, region data, Rectangle data. Quad trees and Octrees: Quad trees for point data, spatial queries with region quad tree. Interval trees, Segment trees, Range trees, and Priority Search Trees. Binary Space Partitioning Trees, R-trees

Unit-III: Heaps

Balanced Search Trees as Heaps- Array-Based Heaps- Heap-Ordered Trees and Half-Ordered Trees- Leftist Heaps- Binomial Heaps, Fibonacci Heaps, skew heaps, pairing heaps- Double-Ended Heap Structures and Multidimensional Heaps

Unit-IV: Data Structures for Strings and Union

Tries and Compressed Tries - Dictionaries Allowing Errors in Queries- Suffix Trees - Suffix Arrays - Union-Find/Merging Classes of a Partition - - List Splitting - Problems on Root-Directed Trees-

Chairman - Board of Studies
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Kinathukadavu, Coimbatore - 641202.

Chairman - Board of Studies

Page | 149

Maintaining a Linear Order

Unit-V: Advanced Design and Analysis Techniques

Recursion and Backtracking: Format of a Recursive Function - Recursion and Memory - Recursion versus Iteration-Dynamic Programming: levenshtien Algorithm – Sliding Window Algorithms-Pattern Matching Algorithm - Matrix-chain multiplication - Elements of dynamic programming - Longest common subsequence - Optimal binary search trees. Greedy Algorithms: An activity-selection problem - Elements of the greedy strategy - Huffman codes - Matroids and greedy methods - Fractional Knapsack Algorithm- Mackers Algorithm

Text Books:

1. Karumanchi Narasimha, "Data Structures and Algorithms Made Easy", Fifth Edition, Career Monk Publication, 2019

2. Peter Brass, Advanced Data Structures, First Edition, Cambridge University Press,2018

References:

References Books:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein "Introduction to Algorithms", Third Edition, The MIT Press Cambridge, Massachusetts London, England – 2009

2. Adam Drozdek, "Data Structures and Algorithms in Java", Cengage Learning, 4th Edition, 2013

Online Courses:

1. http://nsm.iitm.ac.in/cse/services/adv_dsa/

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS513.1	Understand algorithm analyzing techniques and asymptotic notation.	K2	1, 2, 3, 5, 7, 12	1, 2,3
R19CS513.2	Understand the tree structures used in spatial data structures concept.	K2	1, 2, 3, 5, 7, 12	1, 2,3
R19CS513.3	Understand the various concepts of heaps in data structures.	K2	1, 2, 3, 5, 7, 12	1, 2,3
R19CS513.4	Understand the data structures for strings and unions	K2	1, 2, 3, 5, 7, 12	1, 2,3
R19CS513.5	Apply the advanced design and analysis techniques	K3	1, 2, 3, 5, 7, 12	1, 2,3

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS513.1	3	3	3	-	2	-		-	-	-	-	2	2	2	2
R19CS513.2	3	3	3	-	2	-		-	-	-	-	2	2	2	2
R19CS513.3	3	3	3	-	2	-		-	-	-	-	2	2	2	2
R19CS513.4	3	3	3	-	2	-		-	-	-	-	2	2	2	2

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS513.5	3	3	3	-	2	-		-	-	-	-	2	2	2	2
Course to PO	3	3	3	-	2	-		-	-	-	-	2	2	2	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS514	COMPETITIVE PROGRAMMING	L	T	P	C
		3	0	0	3

1.Course Description:

This course is designed to equip students with the skills and knowledge required to excel in competitive programming contests. It covers a wide range of topics, including an introduction to competitive programming, advanced data structures, algorithmic techniques, advanced searching and graph techniques, and dynamic programming. Through rigorous practice and problem-solving, students will learn to implement efficient algorithms and develop strategies for tackling complex computational problems under time constraints

2.Course Objectives:

1. Understand the fundamentals of competitive programming, including problem-solving strategies, coding techniques, and the structure of programming contests.
2. Gain proficiency in implementing and utilizing advanced data structures such as segment trees, Fenwick trees, and suffix arrays to solve complex problems efficiently
3. Learn and apply key algorithmic techniques, including greedy algorithms, divide-and-conquer, and backtracking, to create optimal solutions for a variety of challenges
4. Explore and implement advanced searching methods and graph algorithms, such as depth-first search (DFS), breadth-first search (BFS), Dijkstra's algorithm, and Floyd-Warshall algorithm.
5. Master dynamic programming concepts and techniques to solve problems involving optimization and decision-making processes, enhancing the ability to tackle a wide range of computational problems.

3.Syllabus:

Unit-I: Introduction to Competitive Programming

Overview of Competitive Programming - Common Online Judges (Codeforces, AtCoder, CodeChef, etc.) - Input/Output techniques - Time and Space Complexity Analysis - Big O Notation - Common Complexity Classes - Basic Math and Number Theory for CP - Prime numbers, GCD, LCM, Factorization - Modular arithmetic - Introduction to Data Structures in CP (Arrays, Lists, Sets)

Example Problems: Sum of Two Numbers (Array manipulation) - Finding Prime Numbers (Number theory) - Fibonacci Numbers (Recursion and Dynamic Programming)

Unit-II: Advanced Data Structures

Stacks and Queues - Priority Queues and Heaps - Applications in CP - Trees and Graphs - Traversals (DFS, BFS) - Shortest Paths (Dijkstra's and Floyd-Warshall algorithms) - Advanced Data Structures

(Segment Trees, Fenwick Trees) - Applications in CP - Disjoint Set Union (Union-Find)

Example Problems: Implementing a Stack (Stacks) - Breadth-First Search (Graphs) - Shortest Path in a Graph (Dijkstra's algorithm).

Unit-III: Algorithmic Techniques

Greedy Algorithms - Applications in CP - Fractional Knapsack (Greedy) - Huffman Coding (Greedy) - Dynamic Programming (DP) - Bottom-up and Top-down DP - Knapsack Problems - Recursion and Memoization - Common DP Patterns - Examples of DP in CP - Divide and Conquer - Binary Search

Example Problems: Longest Increasing Subsequence (DP) - Binary Search (Binary Search) - Merge Sort (Divide and Conquer)

Unit-IV: Advanced Searching And Graph Techniques

Advanced Searching Algorithms (Ternary Search, Binary Indexed Tree) - Bit Manipulation - Number Theory Algorithms (Sieve of Eratosthenes, Modular Inverse) - Combinatorial in CP - Graph Algorithms (Strongly Connected Components, Topological Sort) - Advanced Topics in Trees (LCA, Diameter)

Examples: Ternary Search (Ternary Search) - Sieve of Eratosthenes (Number theory) - Finding Strongly Connected Components (Graph algorithms).

Unit-V: Dynamic Programming Techniques

Advanced Dynamic Programming Techniques - Bitmask DP - State Compression - Convex Hull DP - Advanced Graph Algorithms - Network Flows (Ford-Fulkerson, Edmonds-Karp) - Minimum Spanning Trees (Kruskal, Prim) - Articulation Points and Bridges - Advanced Data Structures - Persistent Data Structures - Trie and Suffix Trees - Treap and Cartesian Tree - Applications in Competitive Programming - Computational Geometry - Line Sweep Algorithms - Closest Pair of Points - Convex Hull (Graham Scan, Jarvis March)

Example Problems: Traveling Salesman Problem (Advanced DP) - Max Flow Min Cut (Network Flows) - Suffix Array Construction (Suffix Trees).

Text Books:

1. "Competitive Programming" (3rd Edition) by Steven Halim, Felix Halim , 2018 (3rd Edition)
2. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, 2009 (3rd Edition)

References:

NPTEL Courses:

1. https://onlinecourses.nptel.ac.in/noc22_cs59/preview

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS514.1	Understand the fundamentals of competitive programming	K2	1, 2, 3, 5, 7, 12	1, 2,3
R19CS514.2	Apply the advanced concepts in stack, queue and tree data structures techniques	K2	1, 2, 3, 5, 7, 12	1, 2,3
R19CS514.3	Apply the advanced algorithmic techniques in data structures.	K2	1, 2, 3, 5, 7, 12	1, 2,3
R19CS514.4	Apply the advanced searching and graph data structures techniques	K2	1, 2, 3, 5, 7, 12	1, 2,3

| R19CS514.5 | Apply the advanced dynamic programming techniques in data structures. | K3 | 1, 2, 3, 5, 7, 12 | 1, 2, 3 |

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS514.1	3	3	3	-	2	-	-	-	-	-	-	2	2	2	2
R19CS514.2	3	3	3	-	2	-	-	-	-	-	-	2	2	2	2
R19CS514.3	3	3	3	-	2	-	-	-	-	-	-	2	2	2	2
R19CS514.4	3	3	3	-	2	-	-	-	-	-	-	2	2	2	2
R19CS514.5	3	3	3	-	2	-	-	-	-	-	-	2	2	2	2
Course to PO	3	3	3	-	2	-	-	-	-	-	-	2	2	2	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS515	ADVANCED ALGORITHM TECHNIQUES	L	T	P	C
		3	0	0	3

1.Course Description:

This course offers an in-depth exploration of advanced algorithmic techniques crucial for solving complex computational problems. Students will learn sophisticated methods for algorithm analysis, study advanced algorithms and their applications, delve into graph algorithms and sorting networks, and master string matching techniques. Additionally, the course covers the theory of NP-completeness and strategies for designing approximation algorithms to address NP-hard problems effectively.

2.Course Objectives:

1. Develop a deep understanding of advanced techniques for analyzing the efficiency and complexity of algorithms, including amortized analysis, randomized analysis, and advanced asymptotic notations

2. Gain proficiency in advanced algorithms, such as network flow algorithms, linear programming, and their applications in solving real-world problems.

3. Learn to implement and analyze sophisticated graph algorithms, including advanced shortest path and network flow techniques, as well as the design and analysis of sorting networks.

4. Acquire expertise in string matching algorithms, such as the Knuth-Morris-Pratt (KMP) algorithm, Rabin-Karp algorithm, and their applications in text processing and bioinformatics

5. Understand the theory of NP-completeness and develop strategies for designing approximation algorithms to solve NP-hard problems efficiently

3.Syllabus:

Unit-I: Algorithms Analysis Techniques

Role of Algorithms in computing - Order Notation - Analysis of Algorithms (algorithm definitions,

Orders of Magnitude, Growth rates, Arithmetic and geometric series, harmonic numbers, sets, relations, functions, combinations) - Recurrences, Probabilistic Analysis and Randomized Algorithms - Sorting and Order Statistics: Heap sort, Quick sort and Sorting in Linear Time – Karger's Minimum Cut – Fisher Yates Shuffle.

Unit-II: Advanced Algorithms and Applications
Divide & Conquer - Karatsuba Algorithm – Dynamic Programming – Longest Common Subsequence – Longest Palindrome Subsequence – Longest Repeated Sir - Searching Techniques: Interpolation Search – Jump Search – Sublist Search - FFT - Huffman codes: Concepts, construction, Proof correctness of Huffman's algorithm; Representation of polynomials - Activity Selection Problem.

Unit-III: Graphs & Sorting Networks
Graph Algorithms - Johnson's Algorithm for sparse graphs – Comparison Networks - Zero-one principle - bitonic Sorting Networks - Merging Network - Sorting Network - inverting matrices - Solving system of linear Equations – Maximum Flow – Ford Fulkerson Algorithm - Maximum bipartite matching.

Unit-IV: String Matching
Naive String Matching, Kadane's algorithm, matching with finite Automata, Boyer – Moore algorithm. Clipping: Cyrus-Beck and Sutherland-Hodman Algorithms; Triangulating, monotonic polygons; wildcard pattern matching, Gift wrapping and Graham Scan; Removing hidden surfaces.

Unit-V: NP Completeness & Approximation Algorithms
Polynomial time, polynomial time verification, NP-Completeness and reducibility, NP-Hard, NP-Complete problems – Cook's Theorem - Approximation Algorithms- Vertex cover Problem, Travelling Sales person problem, Set covering problem, Hill Climbing.

Text Books:
1. Introduction to Algorithms," T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C. Stein, Third Edition, PHI

References:
References Books:
1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia publications pvt. Ltd 2. Design and Analysis Algorithms - Parag Himanshu Dave, Himanshu Bhalchandra Dave Publisher: Pearson 3. Algorithm Design: Foundations, Analysis and Internet examples, M.T. Goodrich and R. Tomassia, John Wiley and sons.

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS515.1	Understand recurrence relations for analyzing the algorithms	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS515.2	Understand greedy and graph algorithms	K2	1, 2, 3, 5, 7, 12	1, 2

R19CS515.3	Apply sorting techniques and matrix operations	K3			1, 2, 3, 5, 7, 12									1, 2		
R19CS515.4	Apply string matching techniques	K3			1, 2, 3, 5, 7, 12									1, 2		
R19CS515.5	Apply the concepts of NP Completeness and approximation algorithms	K3			1, 2, 3, 5, 7, 12									1, 2		

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS515.1	3	3	3	-	2	-	1	-	-	-	-	2	2	2	-
R19CS515.2	3	3	3	-	2	-	1	-	-	-	-	2	2	2	-
R19CS515.3	3	3	3	-	2	-	1	-	-	-	-	2	2	2	-
R19CS515.4	3	3	3	-	2	-	1	-	-	-	-	2	2	2	-
R19CS515.5	3	3	3	-	2	-	1	-	-	-	-	2	2	2	-
Course to PO	3	3	3	-	2	-	1	-	-	-	-	2	2	2	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS516	C# and .NET	L	T	P	C
		3	0	0	3

1.Course Description:

This course provides an in-depth introduction to C# programming, covering the basic structure and framework of C# applications. Students will learn key object-oriented concepts such as classes, inheritance, and polymorphism. The course includes practical experience in designing and developing web-based applications using standard controls within the .NET framework. Additionally, students will explore the ASP.NET framework to create robust web applications and gain an understanding of database concepts and management using C#.

2.Course Objectives:

1. Understand the foundational structure and framework of C# applications, including the syntax and core programming constructs.
2. Understand the key object-oriented programming concepts such as classes, objects, inheritance, polymorphism, and encapsulation within the context of C#.
3. Apply standard controls and components to design and develop dynamic web-based applications using the .NET framework.
4. Understand the ASP.NET framework and utilize it to create robust and scalable web applications.
5. Understand knowledge of database concepts and learn to create and manage databases using C#, including data manipulation and retrieval.

3.Syllabus:

Unit-I: .NET Framework

.Net Framework Overview- Architecture-.Net Framework class Libraries-CLR-Metadata-Interoperability-Assemblies-the .net Packaging system-CLR-MSIL-C# Programming Concepts-

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Coimbatore - 641 202

Page | 155

Predefined Types- Programming constructs –Data Types, Identifiers, variables, constants-value types and reference type, Constructors and methods, Conditional statements, loops, arrays -Collection classes-Array List, Hash Table, Stack, Queue, indexers and properties.

Unit-II: C# with Object Oriented Aspects

String class: methods and properties of string class, enumerations, boxing and unboxing, object-oriented concepts -Classes and Objects, Encapsulation, Inheritance, polymorphism, Interfaces, collections, Multithreading, data hiding, operator overloading, overriding Methods, Static Class members, Delegates and events, Exception Handling, garbage collector, generics and collection.

Unit-III: Standard Controls for Windows Application Development

Building windows application- Event Driven Programming, Creating Windows Forms, Using common controls-Labels, textboxes, buttons, check boxes, radio button, progress bar, combo box, list box. Components-timer, image list, Menus, Modal and Modeless Dialog Boxes, MDI, Mouse and keyboard event handling- Connecting Database –Stages in web forms processing– web form controls with ADO.NET- Validation controls.

Unit-IV: Web Application Development On .Net

Programming web application with web forms, ASP.NET introduction, working with XML and .NET, Creating Virtual Directory and Web Application, session management techniques, web.config, web services, passing datasets, returning datasets from web services, handling transaction, handling exceptions, returning exceptions from SQL Server.

Unit-V: .NET 5.0

Architecture – Features and design goals of .NET 5.0-Building.Net applications from command Line and Visual Studio-Creating and configuring Core 5.0 Web API server - Accessing Database using .NET5.0

Text Books:

1. Herbert Schildt, — "The Complete Reference: C# 4.0", Tata McGraw Hill, 2017.
2. Christian Nagel, Jay Glynn, Morgan Skinner, Professional C# 5.0 and .NET 4.5.1, John Wiley & Sons, 2014
3. C# 9 and .NET 5 – Modern Cross-Platform Development: Build intelligent apps, websites, and services with Blazor, ASP.NET Core, and Entity Framework Core using Visual Studio Code Paperback – Import, 10 November 2020

References:

References Books:
1. Dr. Ashutosh Kumar Bhatt "C # PROGRAMMING WITH. Net FRAMEWORK", First Edition, 2016
2. Ian Griffiths, Matthew Adams, Jesse Liberty, —Programming C# 4.0, Sixth Edition, O"Reilly, 2010.
3. RB Whitaker, —C# Player's Guide, Third Edition,2017

Video References:

NPTEL /Online Courses:

1. https://www.udemy.com/course/c-net-for-beginners/?couponCode=LETSLEARNNOWPP
2. https://www.coursera.org/learn/c-sharp-for-dot-net

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS516.1	Learn the basic structure and framework of a C# application	K2	1, 2, 3, 5, 7, 12	1, 2,3
R19CS516.2	Understand the object-oriented concepts in C# programming.	K2	1, 2, 3, 5, 7, 12	1, 2,3
R19CS516.3	Use the standard controls to Design and develop web based applications on .NET	K3	1, 2, 3, 5, 7, 12	1, 2
R19CS516.4	Understand the framework and create a web application using ASP.Net	K2	1, 2, 3, 5, 7, 12	1, 2,3
R19CS516.5	Understand the concepts of creating database using C#.	K2	1, 2, 3, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS516.1	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
R19CS516.2	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
R19CS516.3	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
R19CS516.4	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
R19CS516.5	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
Course to PO	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS517	GO LANG	L	T	P	C
		3	0	0	3

1.Course Description:

This course offers a comprehensive introduction to the Go programming language, covering its fundamental concepts such as syntax, data types, and core programming constructs. Students will explore the standard library functions and packages available in Go, and learn to implement concurrency using Goroutines and channels to create efficient, modular software solutions. The course also emphasizes the application of various data structures and algorithms to solve practical programming challenges, optimizing performance and efficiency. Additionally, students will develop full-stack web applications by integrating databases and creating RESTful APIs, leveraging Go's powerful capabilities for backend development.

2.Course Objectives:

1. Understand the fundamental concepts in the Go programming language, including its syntax, data types, and core programming constructs
2. Understand the standard library functions and packages available in Go
3. Implement concurrency using Goroutines and channels to develop efficient and modular software solutions in Go
4. Utilize various data structures and algorithms to address and solve practical programming challenges, optimizing performance and efficiency in Go applications
5. Develop full-stack web applications by integrating databases and creating RESTful APIs, leveraging Go's capabilities for backend development

3.Syllabus:

Unit-I: Foundation of Go Lang

Introduction to Go programming language and its features - Installation and setup of Go development environment - Writing and running basic Go programs - Data types, variables, and constants in Go - Control structures: loops and conditional statements

Unit-II: Functions and Packages

Function declaration, parameters, and return values - Variadic functions and multiple return values - Working with packages and creating custom packages - Scope and visibility of variables and functions - Error handling and panic and recover mechanisms

Unit-III: Concurrency and Goroutines

Introduction to concurrency and parallelism in Go - Goroutines: creation, scheduling, and synchronization - Channels: buffered and unbuffered, communication, and synchronization - Select statement and handling multiple channels - Mutexes and synchronization mechanisms

Unit-IV: Data Structures and Interfaces

Arrays, slices, and maps in Go - Working with user-defined types and structs - Pointers and memory management - Introduction to interfaces and their implementation - Polymorphism and type assertion

Unit-V: Web Development with Go

Introduction to web development in Go - HTTP server creation and routing - Working with templates and rendering dynamic content - RESTful API development - Database interaction using SQL and ORMs

Text Books:

1. "The Go Programming Language" by Alan A. A. Donovan and Brian W. Kernighan.

2. "Web Development with Go: Building Scalable Web Apps and RESTful Services" by Shiju Varghese

References:

References Books:

1. "Go in Action" by William Kennedy, Brian Ketelsen, and Erik St. Marti
2. "Concurrency in Go: Tools and Techniques for Developers" by Katherine Cox-Buday

Video References:
NPTEL /Online Courses:

1. https://www.coursera.org/learn/golang-getting-started

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS517.1	Understand the fundamentals concepts in GO Programming language	K2	1, 2, 3, 5, 7, 12	1, 2, 3
R19CS517.2	Understand the various functions and packages available in Go Language	K2	1, 2, 3, 5, 7, 12	1, 2, 3
R19CS517.3	Apply the concurrency and Goroutines for modular software solutions	K3	1, 2, 3, 5, 7, 12	1, 2
R19CS517.4	Apply data structures and algorithms to solve practical programming challenges in Go	K3	1, 2, 3, 5, 7, 12	1, 2, 3
R19CS517.5	Build full-stack web applications, integrating databases and RESTful APIs using Go	K5	1, 2, 3, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS517.1	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
R19CS517.2	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
R19CS517.3	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
R19CS517.4	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
R19CS517.5	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
Course to PO	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS518	R PROGRAMMING	L	T	P	C
		3	0	0	3

1.Course Description:

This course provides a comprehensive introduction to R programming, focusing on its application in data analysis and visualization. Students will learn the fundamentals of R, including syntax, data types, and basic operations, along with quantitative analysis techniques. The course covers how to use R functions for efficient data access, processing, and visualization, ensuring effective data manipulation and analysis. Emphasis is placed on understanding data visualization principles, statistical analysis, and probability concepts to interpret and present data effectively. Students will also gain skills in analyzing datasets to identify patterns and trends, creating data models using statistical methods. Additionally, the course includes designing and implementing custom plots and graphs for application-level simulations, utilizing R's advanced graphical packages.

2.Course Objectives:

1. Understand the fundamentals of R programming including syntax, data types, and basic

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operations, along with quantitative analysis techniques.

2. Make use of R functions to efficiently access, process, and visualize data by ensuring effective data manipulation and analysis.

3. Develop a strong grasp of data visualization principles, statistical analysis, and probability concepts to effectively interpret and present data.

4. Analyze datasets to identify patterns and trends, and create data models using statistical methods and R's modeling capabilities.

5. Design and implement custom plots and graphs tailored for specific application-level simulations, leveraging R's advanced graphical packages.

3.Syllabus:

Unit-I: Getting Started with R Programming

Getting Started - Numerics, Arithmetic, Assignment, and Vectors - Matrices and Arrays - Non-numeric Values - Lists and Data Frames - Special Values, Classes, and Coercion - Basic Plotting - Reading and Writing Files

Unit-II: Functions and Statements

Calling Functions - Conditions and Loops - Writing Functions - Exceptions, Timings, and Visibility

Unit-III: Statistics and Probability

Elementary Statistics - Basic Data Visualization – Probability - Common Probability Distributions

Unit-IV: Statistical Testing and Modelling

Sampling Distributions and Confidence - Hypothesis Testing - Analysis of Variance - Simple Linear Regression - Multiple Linear Regression - Linear Model Selection and Diagnostics.

Unit-V: Advanced Graphics

Advanced Plot Customization - Going Further with the Grammar of Graphics - Defining Colors and Plotting in Higher Dimensions - Interactive 3D Plots

Text Books:

1. Tilman M. Davies, "The book of R: A First Course in Programming and Statistics", No Starch Press, 2016

2. Norman Matloff, "The art of R programming: tour of statistical software", No Starch Press, 2011

References:

References Books:

1. Roger D. Peng, "R Programming for Data Science", Leanpub, 2020

2. Colin Gillespie and Robin Lovelace, "Efficient R Programming", O'Reilly, First Edition, December 2016

Video References:

NPTEL /Online Courses:

1. https://www.coursera.org/learn/r-programming

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS518.1	Understanding the basics of R Programming with quantitative analysis	K2	1, 2, 3, 5, 7, 12	1, 2, 3
R19CS518.2	Apply functions to access, process and visualize the data	K3	1, 2, 3, 5, 7, 12	1, 2, 3
R19CS518.3	Understanding the concept for data visualization and statistics and probability	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS518.4	Analyzing the data and create the data modelling.	K4	1, 2, 3, 5, 7, 12	1, 2, 3
R19CS518.5	Create the custom plotting graph for any application-level simulation using R.	K3	1, 2, 3, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS517.1	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
R19CS517.2	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
R19CS517.3	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
R19CS517.4	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
R19CS517.5	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2
Course to PO	3	3	3	-	3	-	3	1	1	1	1	3	2	2	2

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

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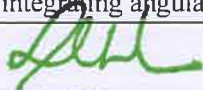
R19CS522	MVC Frameworks	L	T	P	C
		3	0	0	3

1.Course Description:

The course aims to equip students with the knowledge and skills necessary to design, develop, and deploy full-stack web applications using MVC frameworks. Students will gain a comprehensive understanding of MVC architecture and learn to implement basic web applications using various MVC frameworks. They will apply their knowledge by integrating AngularJS for frontend view components and configuring PostgreSQL for database management within the Django framework. By the end of the course, students will be proficient in developing and deploying secure full-stack web applications, leveraging both Angular and Django frameworks, and deploying them in diverse and secure cloud environments.

2.Course Objectives:

1. To understand MVC Framework Concepts
2. To develop frontend view components as part of their MVC-based web applications.
3. To configuring and Implementing Django with PostgreSQL.
4. To develop full-stack web applications.
5. To deploy applications in Secure Cloud Environments.

3.Syllabus:

Unit-I: Web Development and MVC

Web technologies - Client-side vs. Server-side Development - Understanding MVC Architecture - Explanation and roles - Benefits of using MVC pattern in web development - Overview of Angular, Django, and PostgreSQL - Setting up Development Environment - Differences between Angular, Django, and PostgreSQL - Open-source relational database management system

Project Work: Set up a basic web application using Angular, Django, and PostgreSQL with a simple MVC structure

Unit-II: View with Angular

AngularJS vs. Angular - Angular CLI - Components - Templates and interpolation - Data Binding - Property binding and event binding – Directives - Structural directives - Pipes - Services and Dependency Injection - Routing and Navigation - Forms and Form Validation

Project Work: Implement a multi-page application using Angular with routing and navigation

Unit-III: Back-End Development with Django and Postgresql

Introduction to Django - Models and Database Configuration with PostgreSQL - Django Admin Interface - Views and URL Patterns - Template Language (Django Templates) - Forms and Form Handling in Django - User Authentication and Permissions

Project Work: Develop a back-end API using Django and PostgreSQL to handle user registration and

authentication

Unit-IV: Full Stack Development and Integration

Building RESTful APIs with Django - Consuming API in Angular - Authentication and Authorization with JWT - Error Handling and Validation - Implementing CRUD Operations - File Uploads and Handling

Project Work: Create a full-stack web application integrating Angular and Django, allowing users to perform CRUD operations on data with authentication

Unit-V: Advanced Topics and Deployment

Real-time features with Web Sockets - Dockerizing Angular, Django, and PostgreSQL - Performance Optimization Techniques - Security Best Practices - Integrating with Third-Party Services (e.g., payment gateways) - Deployment of Angular, Django, and PostgreSQL applications

Project Work: Deploy the full-stack web application to a cloud platform (e.g., Heroku, AWS, Azure) with proper security measures and optimizations

Text Books:

1. Yakov Fain and Anton Moiseev ,"Angular Development with TypeScript" ,2018
2. William S. Vincent ,"Django for Beginners: Build websites with Python and Django",2020

References:

References Books:
1. Jeremy Wilken "Angular in Action" 2018
2. Daniel Roy Greenfeld and Audrey Roy Greenfeld ,"Two Scoops of Django: Best Practices for Django 3.x" ,2020

Video References:
1. https://www.youtube.com/watch?v=1IsL6g2ixak
2. https://www.youtube.com/watch?v=d--mEqEUybA
3. https://www.youtube.com/watch?v=uiPSnrE6uWE

NPTEL /Online Courses:
1. https://www.udemy.com/course/complete-aspnet-core-21-course/?couponCode=LETSLEARNNOWPP

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS522.1	To understand the concepts and implement the basic web application using various MVC frameworks	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS522.2	To implement the view components services using angularjs	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS522.3	To understand the configuration of postgreSQL and implement the Django framework	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS522.4·	To develop the full stack web application by integrating angular and Django frameworks	K3	1, 2, 3, 5, 7, 12	1, 2

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Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202

Page | 163

| R19CS522.5 | To deploy the full stack web application in various secure cloud environment | K3 | 1, 2, 3, 5, 7, 12 | 1, 2 |

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS522.1	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS522.2	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS522.3	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS522.4	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS522.5	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS523	Web Application Security	L	T	P	C
		3	0	0	3

1.Course Description:

The course aims to equip students with the knowledge and skills necessary to understand. develop. and maintain secure web applications. Students will gain a comprehensive understanding of web application security principles and practices, preparing them to implement secure development processes and deploy applications resilient to common cyber threats. By the end of the course, students will be proficient in designing and developing secure web applications utilizing secure APIs, conducting vulnerability assessments, penetration testing, and adopting a hacker's mindset to proactively defend against cyber threats.

2.Course Objectives:

1. To understand Web Application Security Fundamentals
2. To apply secure development methodologies to create and deploy web applications.
3. To design and develop secure web applications.
4. To understand the importance of vulnerability assessments and penetration testing.
5. To develop the ability to use appropriate tools and techniques to identify and mitigate security risks

3.Syllabus:

Unit-I: Fundamentals of Web Application Security

The history of Software Security – Recognizing Web Application Security Threats – Web Application Security – Authentication and Authorization – Secure Socket layer – Transport layer Security – Session Management –Input Validation – Attack Surface Reduction Rules of Thumb – Classifying and Prioritizing Threads.

Unit-II: Secure Development and Deployment
Web Applications Security – Security Testing – Security Incident Response Planning –The Microsoft Security Development Lifecycle (SDL) – OWASP Comprehensive Lightweight Application Security Process (CLASP) – The Software Assurance Maturity Model (SAMM)

Unit-III: Secure API Development
API Security – Session Cookies –Token Based Authentication – Securing Natter APIs: Addressing threats with Security Controls – Rate Limiting for Availability – Encryption – Audit logging – Securing service-to-service APIs: API Keys – OAuth2 – Securing Micro service APIs: Service Mesh – Locking Down Network Connections – Securing Incoming Requests.

Unit-IV: Vulnerability Assessment and Penetration Testing
Vulnerability Assessment Lifecycle – Vulnerability Assessment Tools: Cloud-based vulnerability Scanners – Host-based vulnerability scanners – Network-based vulnerability scanners – Database based vulnerability scanners –Types of Penetration Tests: External Testing – Web Application Testing – Internal Penetration Testing – SSID or Wireless Testing – Mobile Application Testing.

Unit-V: Hacking Techniques and Tools
Social Engineering – Injection – Cross-Site Scripting(XSS) – Broken Authentication and Session Management – Cross-Site Request Forgery – Security Misconfiguration – Insecure Cryptographic Storage – Failure to Restrict URL Access – Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite.

Text Books:

1. Andrew Hoffman. Web Application Security: Exploitation and Countermeasures for Modern
2. Web Applications, First Edition, O'Reilly Media, Inc, 2020
3. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, The McGrawHill Companies,2012.
4. Neil Madden, API Security in Action, Manning Publications Co., NY, USA,2020

References:

References Books:

1. Ravi Das and Greg Johnson, Testing and Securing Web Applications, Taylor & FrancisGroup, LLC, 2021.
2. Prabath Siriwardena, Advanced API Security, Apress Media LLC, USA,2020
3. Malcom McDonald, Web Security for Developers, No Starch Press, Inc,2020

Video References:

1. https://www.youtube.com/watch?v=-7OX58nHPb8
2. https://www.youtube.com/watch?v=ZqY4tQQXjnk

NPTEL /Online Courses:

1. https://nptel.ac.in/courses/106106248

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Page | 165

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS523.1	Understanding the basic concepts of web application security and the need for it	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS523.2	Be acquainted with the process for secure development and deployment of web applications	K3	1, 2, 3, 5, 7, 12	1, 2
R19CS523.3	Acquire the skill to design and develop Secure Web Applications that use Secure APIs	K3	1, 2, 3, 5, 7, 12	1, 2
R19CS523.4	Be able to get the importance of carrying out vulnerability assessment and penetration testing	K3	1, 2, 3, 5, 7, 12	1, 2
R19CS523.5	Acquire the skill to think like a hacker and to use hackers tool sets	K3	1, 2, 3, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS523.1	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS523.2	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS523.3	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS523.4	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS523.5	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS525	Flutter & Dart	L	T	P	C
		3	0	0	3

1.Course Description:

The course aims to equip students with the knowledge and skills necessary to develop mobile applications using Flutter and Dart programming language. Students will understand the features and installation process of Flutter, as well as grasp essential concepts in Dart programming and the basics of Flutter widgets. They will apply their learning by building simple Flutter applications using various widgets and layouts, including developing animations using Dart packages. Additionally, students will learn to integrate and utilize databases within Flutter applications to store and retrieve data.

2.Course Objectives:

1. To understand the Flutter features and installation
2. To understand the Dart Programming and basics of Widgets.
3. To build the simple Flutter application.
4. To develop the Flutter animation applications.
5. To develop the Flutter applications using Database.

3.Syllabus:

Unit-I: Introduction to Flutter

Introduction Flutter. Flutter Installation, Installation in Windows- Installation in Mac OS- Configuration of Flutter Development- Creating Simple Application in Android Studio - Architecture of Flutter Applications

Unit-II: Flutter Basics

Introduction to Dart Programming-Variables and Data types-keywords-Operators-Control flow statements and Loops- Functions-Exceptions- Object Oriented Programming-Classes-Introduction to Widgets- Widget Build Visualization.

Unit-III: Introduction to Layouts

Type of Layout Widgets- Single Child Widgets- Multiple Child Widgets- Advanced Layout Application-Introduction to Gestures- Statement Management in Flutter. Ephemeral State Management-Application State - scoped model- Navigation and Routing.

Unit-IV: Animation on Flutter

introduction to Animation Based Classes-Work flow of the Flutter Animation- Working Application-Android Specific Code on Flutter- Introduction to Package- Types of Packages- Using a Dart Package-Develop a Flutter Plug-in Package- Accessing Rest API- Basic Concepts- Accessing Product service API

Unit-V: Database Concepts

Working with Firebase platform- Setting up a Firebase Project-Configuring Firebase Emulators-Testing on Flutter- Deployment- Android Application- IOS Application- Development Tools- Widget Sets-Flutter Development with Visual Studio Code- Dart DevTools- Flutter SDK

Text Books:

1. Eric Windmill," Flutter in Action", Manning Publications, 2020.
2. Marco L. Napoli, "Beginning Flutter A Hands on Guide To App Development", John Wiley & Sons ,Inc, 2019

References:

References Books:

1. Rap Payne, "Beginning App Development with Flutter: Create Cross-Platform Mobile Apps",Apress,2019
2. Alessandro Biessek ,"Flutter for BeginnersAn Introductory Guide to Building Cross-platform Mobile Applications with Flutter and Dart 2",Packt Publishing,2019
3. Richard Rose ,"Flutter and Dart Cookbook",O'Reilly Media,2022.

Video References:

1. https://www.youtube.com/watch?v=GLSG_Wh_YWc
2. https://www.youtube.com/watch?v=Ej_Pcr4uC2Q

NPTEL /Online Courses:

1. https://www.udemy.com/course/learn-flutter-dart-to-build-ios-android-apps/?couponCode=LETSLEARNNOWPP

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS525.1	Understand the features and installation of Flutter	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS525.2	Understand the concepts in dart programming and basics of widgets.	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS525.3	Build simple Flutter application using simple widgets and layouts	K3	1, 2, 3, 5, 7, 12	1, 2
R19CS525.4	Develop Flutter animation applications using Dart packages	K3	1, 2, 3, 5, 7, 12	1, 2
R19CS525.5	Develop Flutter application using database	K3	1, 2, 3, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS525.1	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS525.2	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS525.3	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS525.4	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS525.5	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS526	Cloud Services Management	L	T	P	C
		3	0	0	3

1.Course Description:

The course aims to provide students with a comprehensive understanding of Cloud Service Management, enabling them to effectively design, deploy, and manage cloud-based services in a business environment. Students will gain proficiency in cloud service management terminology, concepts, and strategies, and compare these with traditional IT service management approaches. They will learn to identify and mitigate risks associated with adopting cloud services, while also exploring appropriate structures for designing and running cloud-based services. Moreover, students will develop the ability to illustrate the benefits of cloud-based services through practical applications to solve real-world problems, thereby driving adoption and maximizing business value..

2.Course Objectives:

1. To understand the Cloud Service Management Terminology & Concepts
2. To compare the Cloud Service Management with Traditional IT Service Management.
3. To identify, assess, and mitigate risks associated with adopting cloud services, ensuring

integration and operational continuity.

4. To design, deploy, and run the Cloud-Based Services.

5. To illustrate the benefits and driving adoption of Cloud-Based Services

3.Syllabus:

Unit-I: Cloud Service Management Fundamentals

Cloud Ecosystem - The Essential Characteristics - Basics of Information Technology Service Management and Cloud Service Management, Service Perspectives, Cloud Service Models, Cloud Service Deployment Models

Unit-II: Cloud Services Strategy

Cloud Strategy Fundamentals - Cloud Strategy Management Framework - Cloud Policy - Key Driver for Adoption - Risk Management - IT Capacity and Utilization - Demand and Capacity matching – Demand Queueing- Change Management - Cloud Service Architecture.

Unit-III: Cloud Service Management

Cloud Service Reference Model - Cloud Service Life Cycle - Basics of Cloud Service Design - Dealing with Legacy Systems and Services - Benchmarking of Cloud Services -Cloud Service Capacity Planning – Cloud Service Deployment and Migration - Cloud Marketplace - Cloud Service Operations Management.

Unit-IV: Cloud Service Economics

Pricing models for Cloud Services – Freemium - Pay Per Reservation - Pay per User - Subscription based Charging - Procurement of Cloud-based Services - Capex vs Opex Shift - Cloud service Charging – Cloud Cost Models.

Unit-V: Cloud Service Governance & Value

IT Governance Definition - Cloud Governance Definition - Cloud Governance Framework - Cloud Governance Structure - Cloud Governance Considerations - Cloud Service Model Risk Matrix - Understanding Value of Cloud Services - Measuring the value of Cloud Services - Balanced Scorecard - Total Cost of Ownership

Text Books:

1. Thomas Erl, Ricardo Puttini, ZaighamMohammad, "Cloud Computing: Concepts, Technology & Architecture",Prentice Hall Press, United States 2013.

2. Thomas Erl, Robert Cope, Amin Naserpour, "Cloud Computing Design Patterns", PearsonPublisher, 2017.

3. EnamulHaque, "Cloud Service Management and Governance: Smart Service Management in Cloud Era", Enel Publications, 2020.

References:

References Books:

1. Praveen Ayyappa , "Economics of Cloud Computing", LAP Lambert Academic Publishing, 2020.

2. Rajkumar Buyya, ChristianVechhiola, S. Thamarai Selvi, "Mastering Cloud Computing Foundations and Applications Programming", Morgan Kaufmann Publisher, 2013.

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Sri Shivar College of Engineering (Autonomous)
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Page | 169

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS526.1	Understand Cloud Service Management terminology& concepts	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS526.2	Understandand compare cloud service management with traditional IT service management	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS526.3	Identify strategies to reduce risk and eliminate issues associated with adoption of cloud services	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS526.4	Identify appropriate structures for designing, deploying and running cloud-based services in a business environment	K3	1, 2, 3, 5, 7, 12	1, 2
R19CS526.5	Illustrate the benefits and drive the adoption of cloud-based services to solve real world problems	K2	1, 2, 3, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS526.1	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS526.2	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS526.3	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS526.4	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS526.5	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS528	Docker and Kubernetes	L	T	P	C
		3	0	0	3

1.Course Description:

The course aims to provide students with a comprehensive understanding and practical skills necessary to work with Docker and Kubernetes, focusing on deploying microservices-based applications efficiently. Students will learn the basics of microservices architecture and understand the fundamental concepts of Docker containers. They will explore Docker's architecture, installation, and how to create container images for web applications. Additionally, students will gain proficiency in deploying, administering, and leveraging the Kubernetes platform to orchestrate containerized applications effectively. By the end of the course, students will be capable of creating and managing Kubernetes pods,

deployments, and services, utilizing Kubernetes' advantages for scalable and resilient application deployments.

2.Course Objectives:

1. To understand the basics of Microservices
2. To understand the basics of Docker and Container.
3. To install Docker and create Container images.
4. To understand, Deploy, and Administer Kubernetes.
5. To create pods, deployments, and services with Kubernetes

3.Syllabus:

Unit-I: Introduction to Microservices

Introduction to Microservices- Microservices Concepts-Microservices Anti Patterns-Microservices Advantages and Drawbacks - Microservices Architecture

Unit-II: Introduction to Dockers & Containers

Evolution of Dockers & Containers-Differences between VM's and Containers-Docker Use Cases-Benefits of using Containers-Working with Docker Commands-Installing & Configuring Docker toolbox on Windows- Images & Layers-Container Layers

Unit-III: Docker :Images, Docker Networking & Orchestration

Working with Docker Images-Building own Images using Dockerfile-Working with Docker Volumes and Docker Networking-Overview of Registries- Public and Private-Deep Dive into Docker Hub-Other Public & Private Registries-Defining and running multi-container applications-Overview of Docker Swarm-Build your own Docker Swarm Cluster-Filtering & Scheduling Containers

Unit-IV: Introduction to Kubernetes

Evolution of Kubernetes - Kubernetes Architecture- Kubernetes Master-Components of Kubernetes Master- Node Components- Installing & Configuring Kubernetes locally via Minikube-Creating Kubernetes Cluster in Google Cloud-Creating Kubernetes Cluster in AWS Cloud

Unit-V: Deploying Applications on Kubernetes Cluster

Deploying applications on Kubernetes Cluster- Introduction to Pods-Pods Lifecycle-Working with Pods to manage multiple containers-Deploying Pods via Replication Controllers- Labels and Selectors-Scale out deployment using Replicas-Horizontal Pod Autoscaling-Load Balancing-Rolling Updates- Working with StatefulSet-Pod Management policies-OnDelete& Rolling Update Strategies-Cluster DNS-Persistent Volumes

Text Books:

1. Nisarg Vasavada, Dhwani Sametriya "Cracking Containers with Docker and Kubernetes:The Definitive Guide to Docker, Kubernetes, and the Container Ecosystem Across Cloud and On-premises",First Edition 2022
2. Scott Surovich, Marc Boorshtein "Kubernetes and Docker - An Enterprise Guide:Effectively

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Page | 171

Containerize Applications, Integrate Enterprise Systems, and Scale Applications in Your Enterprise", First Edition 2020		

References:

References Books:

1. Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui-Chuan Chloe Lee, Ke-Jou Carol Hsu,"DevOps: Puppet, Docker, and Kubernetes", First Edition 2017

2. Candel Jose Manuel Ortega, "DevOps and Containers Security", BPB Publications, March 2020

Video References:

1. https://www.youtube.com/watch?v=GbqTq_Cj_6w

2. https://www.youtube.com/watch?v=rOTqprHv1YE

3. https://www.youtube.com/watch?v=X48VuDVv0do

NPTEL /Online Courses:

1. https://www.udemy.com/course/docker-kubernetes-the-practical-guide/?couponCode=LETSLEARNNOWPP

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS528.1	Understand basics of Microservices	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS528.2	Understand basics of Dockers and Containers	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS528.3	Explore how to install Docker and the concepts around its architecture and create Docker container images for web applications.	K3	1, 2, 3, 5, 7, 12	1, 2
R19CS528.4	Understand, deploy and administer Kubernetes Platform	K3	1, 2, 3, 5, 7, 12	1, 2
R19CS528.5	Create Pods, deployments as well as services using Kubernetes and its advantages	K3	1, 2, 3, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS528.1	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS528.2	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS528.3	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS528.4	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS528.5	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS529	UI Design with Figma	L	T	P	C
		3	0	0	3

1. Course Description

This course on UI/UX Design using Figma is designed to equip participants with essential skills and knowledge in creating intuitive and user-centered digital experiences. Through a theoretical learning and hands-on practical exercises, students will delve into the core principles of UI/UX design and their critical role in shaping user interactions and satisfaction.

2. Course Objectives:

1. Understand and apply fundamental UI/UX design principles to create effective and user-friendly digital interfaces.
2. Utilize Figma's features and tools proficiently to design, prototype, and collaborate on UI/UX projects.
3. Conduct user research and usability testing to inform design decisions and improve user experiences.
4. Develop wireframes, mockups, and interactive prototypes that align with user needs and business goals.
5. Analyze and critique existing digital products to identify strengths and areas for improvement in their design.

3. Syllabus

Unit-I: Foundations of UI/UX Design

Introduction to UI/UX Design: Overview of UI/UX Design - Importance of User-Centric Design - Key Principles and Concepts - Role of UI/UX Designer. Understanding Users and Research: - User Personas and User Stories- Conducting User Research- Usability Testing- User Interviews and Surveys

Unit-II: Information Architecture and Wire-framing

Information Architecture and Wire-framing: Introduction to Information Architecture (IA)- Site Maps and User Flows- Wire-framing Tools and Techniques. Visual Design Principles: Colour Theory and Psychology- Typography in UI Design- Iconography and Imagery- Visual Hierarchy.

Unit-III: : UI Design and Interaction

UI Design Tools: Introduction to UI Design Software- Hands-on Practice with UI Design Tools- Creating Basic UI Elements. Interaction Design and Prototyping -Principles of Interaction Design- Micro-interactions- Advanced Prototyping Techniques - Animations in UI/UX Design.

Unit-IV: Responsive Design and Design Systems

Responsive Design and Design Systems: Introduction to Responsive Design- Mobile-First Design- Design Systems and Component Libraries. Usability Testing and Feedback - Importance of Usability Testing- Planning and Conducting Usability Tests- Analysing and Incorporating User Feedback- Iterative Design Process

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Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Page | 173

Unit-V: Advanced Topics and Career Development
Accessibility in UI/UX Design: Understanding Accessibility- Designing for Different Abilities- WCAG Guidelines- Testing for Accessibility. Portfolio Building and Career Advice:- Creating a UI/UX Design Portfolio- Job Search Strategies- Interview Preparation- Industry Networking

Text Books:

1. Fabio Staiano - Designing and Prototyping Interfaces with Figma_ Learn essential UX_UI design principles by creating interactive prototypes for mobile, tablet, and desktop (2022)

References:

Reference Books:

1. Rob Fitzpatrick, 'The Mom Test'.

2. Gojko Adzic and David Evans, 'Fifty Quick Ideas to Improve Your User Stories',2013 - 2014 Neuri Consulting LLP.

Video References:
1. https://www.youtube.com/watch?reload=9&v=JGLfyTDgfDc
2.https://www.youtube.com/watch?v=BOt3MNB71gI&list=PLjiHFwhbHYlEmPhn68XdG2p2k4X47X R-8

NPTEL /Online Courses:
1.   https://www.udemy.com/course/learn-figma/
2.   https://www.figma.com/resource-library/design-basics/

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS529.1	Understand the foundational principles of UI/UX design and its significance in creating user-centric experiences.	K2	1,2,3,4,5,12	1,2,3
R19CS529.2	Demonstrate proficiency in information architecture and wireframing techniques for effective interface design.	K3	1,2,3,4,5,12	1,2,3
R19CS529.3	Develop skills in UI design, interaction design, and prototyping to create engaging user interfaces.	K3	1,2,3,4,5,12	1,2,3
R19CS529.4	Master responsive design principles and design systems to ensure consistent user experiences across devices.	K4	1,2,3,4,5,12	1,2,3
R19CS529.5	Demonstrate proficiency in accessibility guidelines and career readiness skills for UI/UX design roles.	K4	1,2,3,4,5,12	1,2,3

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS529.1	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
R19CS529.2	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
R19CS529.3	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
R19CS529.4	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS529.5	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
Course to PO	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2

"3"—High, "2"—Medium, "1"—Low, "—" — No Correlation

R19CS530	Groovy on Grails	L	T	P	C
		3	0	0	3

1. Course Description

This course on Groovy and Grails is designed to provide participants with a deep understanding of both the Groovy programming language and the Grails framework. Through a mix of theoretical lessons and hands-on exercises, students will master the essential skills required to develop and secure dynamic web applications.

2. Course Objectives:

1. Learn the fundamental concepts of the Groovy programming language.
2. Utilize various features and constructs of Groovy to enhance coding efficiency.
3. Apply the Grails framework to build robust web applications.
4. Navigate and manage the Grails project environment for successful application deployment.

3. Syllabus

Unit -I Introduction to Groovy

Overview of the Groovy programming language, Syntax and semantics of Groovy, Data types, operators, and control structures in Groovy, Groovy scripting and shell scripting, Functional programming features in Groovy

Unit II Groovy Features and Enhancements

Closures and higher-order functions, Metaprogramming and AST transformations, Groovy builders and DSLs (Domain-Specific Languages), Concurrency and parallel programming in Groovy, Unit testing and debugging in Groovy

Unit III Grails Framework

Overview of the Grails framework, Architecture and components of a Grails application, Understanding GORM (Grails Object-Relational Mapping), Building RESTful APIs with Grails, Managing dependencies and plugins in Grails

Chairman - Board of Studies
Department of Computer Science and Engineering
Chairman - Board of Studies
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore - 641 202.

Page | 175

UNIT IV Grails Development Essentials

Setting up a development environment for Grails, Creating and configuring a Grails project, understanding controllers, views, and models in Grails, Handling requests and responses in a Grails application, Working with databases and migrations in Grails

UNIT V Advanced Techniques in Grails

Authentication and authorization in Grails applications, Internationalization and localization in Grails, Performance optimization and caching strategies, Securing Grails applications against common security vulnerabilities, Continuous integration and deployment with Grails applications

Text Books:

1.Ken Kousen , "Making Java Groovy", Manning Publication,1st Edition,2024.

References:

Reference Books:

1. Burt Beckwith, "Programming Grails: Best Practices for Experienced Grails Developers" ,O Reilly Publication,2013.

2. https://guides.grails.org/grails4/creating-your-first-grails-app/guide/index.html

Video References:

1. https://www.youtube.com/watch?v=_lLJJp9RksA

NPTEL /Online Courses:

1. https://www.knowledgehut.com/web-development/groovy-and-grails

4. Course Outcomes

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS530.1	Understand the fundamental concept of Groovy programming language	K2	1,2,3,4,5,12	1,2,3
R19CS530.2	Understand the various features, constitute in Groovy programming language	K2	1,2,3,4,5,12	1,2,3
R19CS530.3	Understand and apply the framework in grails.	K3	1,2,3,4,5,12	1,2,3
R19CS530.4	Analyze the grail project environment and deploy the applications.	K4	1,2,3,4,5,12	1,2,3
R19CS530.5	Analyze the authentication, authorization and security vulnerabilities in grail environment.	K4	1,2,3,4,5,12	1,2,3

5. Course Articulation matrix

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS529.1	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
R19CS529.2	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS529.3	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
R19CS529.4	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
R19CS529.5	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2
Course to PO	2	2	3	2	2	-	-	-	-	-	-	3	2	3	2

"3"—High, "2"—Medium, "1"—Low, "—" — No Correlation

PROFESSIONAL ELECTIVE VERTICAL III
ARTIFICIAL INTELLIGENCE

R19CS531	DEEP LEARNING	L	T	P	C
		3	0	0	3

1.Course Description:

This course offers a comprehensive introduction to the field of deep learning, one of the most impactful and rapidly evolving areas in artificial intelligence and machine learning. Students will develop a strong foundation in the basic concepts of deep learning, as well as practical skills in designing, implementing, and analyzing various deep learning models. The course will cover visualization techniques, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Deep Generative Models, and reinforcement learning, emphasizing their applications and ethical considerations in real-world scenarios.

2.Course Objectives:

1. Gain a comprehensive understanding of neural networks, fuzzy logic, and genetic algorithms, including their foundational concepts and principles.
2. Utilize visualization techniques to interpret deep learning models.
3. Develop Recurrent Neural Networks (RNNs) for sequential data analysis and Implement Deep Generative Models for tasks like image synthesis.
4. Evaluate the effectiveness and applications of Deep Generative Models.
5. Apply reinforcement learning models to decision-making scenarios.

3.Syllabus:

Module-I: Deep Learning Fundamentals

Deep Feed-Forward Neural Networks – Gradient Descent – Back-Propagation and Other Differentiation Algorithms – Vanishing Gradient Problem – Mitigation – Rectified Linear Unit (ReLU) – Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestors Accelerated Gradient Descent – Regularization for Deep Learning – Dropout – Adversarial Training – Optimization for Training Deep Models

Illustrative Programs: Recognize images using backpropagation and stochastic gradient descent, Adversarial training to improve model robustness

Module -II: Visualization and Understanding CNN

Convolutional Neural Networks (CNNs): Introduction to CNNs; Evolution of CNN Architectures: AlexNet, ZFNet, VGG, Hands-on: Building and fine-tuning CNNs. Visualization of Kernels; Backprop-to-image/ Deconvolution Methods; Deep Dream, Hallucination, Neural Style Transfer; CAM, Grad-CAM

Illustrative Program: Implementing a CNN architecture for image classification, Object detection model using the YOLO

Module -III: Recurrent Neural Networks

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks - LSTM and GRU – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders

Illustrative Program: sentiment analysis classifier, Chatbot using seq2seq model

Module -IV: Deep Generative Models

Deep Generative Models: Review of (Popular) Deep Generative Models: GANs, VAEs Variants and Applications of Generative Models in Vision: Applications: Image Editing, Inpainting, Super resolution, 3D Object Generation, Security.

Illustrative Program: 3D Object Generation, Text-to-Image Generation

Module -V: Advanced Deep Learning Applications

Introduction to Reinforcement Learning-Markov Decision Processes-Deep Reinforcement Learning-Deep Q-Networks (DQN)-Policy Gradients-Ethical Considerations and Future Directions-Ethical Issues in Deep Learning-Bias and Fairness-Future Trends in Deep Learning

Illustrative Program: Building an RL Agent to Balance the CartPole Game

Text Books:

1. S.N. Sivanandam & S.N. Deepa, Principles of Soft Computing, Wiley Publications, 2nd Edition, 2011.
2. S. Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2009.

References:

References Books:

1. Ian J. Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017
2. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.
3. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.
4. Goodfellow, Y, Bengio, A. Courville, "Deep Learning", MIT Press, 2016

Video References:

1. https://www.youtube.com/watch?v=5tvmMX8r_OM
2. https://www.youtube.com/watch?v=YRhxdVk_sIs
3. https://www.youtube.com/watch?v=UNmqTiOnRfg
4. https://www.youtube.com/watch?v=deyOX6Mt_As

NPTEL /Online Courses:

1. https://shorturl.at/5NgSs

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4. Course Outcomes:

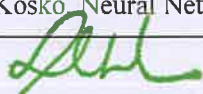| CO. No.	Course Outcome	BTL	POs	PSOs
R19CS531.1	Understand the basic concepts of deep learning	K2	1, 2, 3, 5, 7, 12	1,2
R19CS531.2	Understand the concepts of visualization and Convolutional Neural Networks	K3	1, 2, 3, 5, 7, 12	1,2
R19CS531.3	Design and implement Recurrent Neural Network and Deep generative model	K3	1, 2, 3, 5, 7, 12	1,2
R19CS531.4	Design and implement Deep generative model	K4	1, 2, 3, 5, 7, 12	1,2
R19CS531.5	Apply reinforcement learning models and ethical principles in practical scenarios	K3	1, 2, 3, 5, 7, 12	1,2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS531.1	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS531.2	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS531.3	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS531.4	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS531.5	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS532	Soft Computing	L	T	P	C
		3	0	0	3

1.Course Description:

This course provides an in-depth exploration of soft computing techniques, which are essential for solving complex real-world problems that are not amenable to traditional computational approaches. Students will gain a comprehensive understanding of various soft computing methodologies, including neural networks, fuzzy logic, genetic algorithms, rough sets, and support vector machines. The course is designed to not only understand these concepts theoretically but also to apply them practically to diverse problem-solving scenarios.

2.Course Objectives:

1. Understand the basic principles and concepts of neural networks, fuzzy logic, and genetic algorithms.

2. Distinguish and apply different neural network architectures such as Hopfield Networks, Convolutional Neural Networks (CNN), and Recurrent Neural Networks (RNN) to solve complex problems.

3. Design and implement rule-based fuzzy control systems for applications requiring modeling of

uncertainty and imprecision.

4. Apply genetic algorithms to optimization and search problems, understanding their mechanisms and evaluating their effectiveness.

5. Understand and explain advanced concepts such as rough sets and support vector machines, and their applications in data analysis and machine learning.

3.Syllabus:

Module-I: Introduction to Soft Computing

Introduction: Introduction to soft computing, application areas of soft computing, classification of soft computing techniques, structure & functioning of biological brain & Neuron, and concept of learning/training. Model of an Artificial Neuron, transfer/activation functions, perceptron, perceptron learning model, binary & continuous inputs, linear separability.

Module -II: Multilayer Neural Networks

Association, Aggregation, Composition, Polymorphism; Inheritance, Basics, Types of Inheritance, Super, static & final keywords with inheritance and polymorphism; Overloading Vs Overriding , Static and Dynamic Binding ; Abstraction , Abstract Classes and Interfaces , Encapsulation , Packages , Access modifiers

Module -III: Fuzzy Systems

Fuzzy set theory, fuzzy sets and operations, membership functions, concept of fuzzy relations and their composition, concept of fuzzy Measures. Fuzzy logic: fuzzy rules, inferencing. Fuzzy Control system: selection of membership functions, Fuzzification, rule-based design & inferencing, defuzzification, applications of fuzzy system

Module -IV: Genetic Algorithm

Concepts, creation of offspring, working principle, encoding, fitness functions, reproduction, genetic modeling. Generation cycle & convergence of GA, application areas of GA.

Module -V: Advanced Soft Computing Techniques

Rough Set Theory - Introduction, Set approximation, Rough membership, Attributes, optimization. SVM - Introduction, obtaining the optimal hyper plane, linear and nonlinear SVM classifiers. Introduction to Swarm Intelligence, Swarm Intelligence Techniques: Ant Colony Optimization, Particle Swarm Optimization, Bee Colony Optimization.

Text Books:

1. S.N. Sivanandam & S.N. Deepa, Principles of Soft Computing, Wiley Publications, 2nd Edition, 2011.

2. S. Rajasekaran & G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic & Genetic Algorithms, Synthesis & applications, PHI Publication, 1st Edition, 2009.

References:

References Books:

1. Bart Kosko, Neural Network & Fuzzy System, PHI Publication, 1st Edition, 2009.

Chairman – Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202

Page | 181

2. George J Klir, Bo Yuan, Fuzzy sets & Fuzzy Logic, Theory & Applications, PHI Publication, 1st Edition, 2009.

3. Martin T Hagen, Neural Network Design, Nelson Candad, 2nd Edition, 2008.

Video References:

1. https://www.youtube.com/watch?v=aircAruvnKk

2. https://www.youtube.com/watch?v=uMAU8LicxJI

3. https://www.youtube.com/watch?v=9zfeTw-uFCw

4. https://www.youtube.com/watch?v=efR1C6CvhmE

5. https://www.youtube.com/watch?v=ZL5rNB9TFgU

NPTEL /Online Courses:

1. https://www.coursera.org/lecture/rough-set-theory/introduction-to-rough-set-theory-Rn2yI

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS532.1	Understand the concepts of soft computing techniques like neural networks, fuzzy logic and genetic algorithms	K2	1, 2, 3, 5, 7, 12	1,2
R19CS532.2	Understand and apply different neural network architectures like Hopfield, CNN, RNN	K2	1, 2, 3, 5, 7, 12	1,2
R19CS532.3	Apply fuzzy logic to build rule-based fuzzy control systems	K3	1, 2, 3, 5, 7, 12	1,2
R19CS532.4	Apply genetic algorithms to optimization and search problems	K3	1, 2, 3, 5, 7, 12	1,2
R19CS532.5	Interpret the concepts of rough sets, support vector machines	K2	1, 2, 3, 5, 7, 12	1,2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS532.1	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS532.2	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS532.3	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS532.4	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS532.5	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS533	**COMPUTER VISION**	L	T	P	C
		3	0	0	3

1.Course Description:

This course delves into advanced topics in computer vision, focusing on recognition methodology and

practical implementation techniques. Students will gain a deep understanding of segmentation, area extraction, region analysis, object model recognition, and knowledge-based vision frameworks. The course emphasizes hands-on application through projects and exercises, enabling students to implement these techniques effectively.

2.Course Objectives:

1. Gain a comprehensive understanding of recognition methodologies in computer vision, including pattern recognition and object detection techniques.

2. Develop the ability to apply segmentation techniques to binary images to isolate and identify objects of interest.

3. Implement algorithms for extracting areas and performing detailed region analysis on binary images, enhancing proficiency in image processing tasks.

4. Apply various techniques for recognizing object models in images, such as feature-based matching and template matching methods.

5. Gain practical experience in implementing general frameworks and knowledge-based approaches in computer vision, fostering advanced understanding and application skills.

3.Syllabus:

Module-I: Recognition Methodology

Recognition Methodology: Conditioning, Labeling, Grouping, Extracting, and Matching. Edge detection, Gradient based operators, Morphological operators, Spatial operators for edge detection. Thinning, Region growing, region shrinking, Labeling of connected components

Module -II: Binary Machine Vision

Binary Machine Vision: Thresholding, Segmentation, connected component labelling, Hierarchal segmentation, Spatial clustering, Split & merge, Rule based Segmentation, Motion based segmentation

Module -III: Binary Area Extraction and Region Analysis

Area Extraction: Concepts, Data structures, Edge, Line Linking, Hough transform, Line fitting, Curve fitting (Least square fitting). Region Analysis: Region properties, External points, Spatial moments, Mixed spatial gray level moments, Boundary analysis: Signature properties, Shape numbers

Module -IV: Object Model Recognition and Matching

Facet Model Recognition: Labeling lines, understanding line drawings, Classification of shapes by labeling of edges, Recognition of shapes, consisting labeling problem, Back tracking, Perspective Projective geometry, Inverse perspective Projection, Photogrammetry. From 2D to 3D, Image matching: Intensity matching of ID signals, Matching of 2D image, Hierarchical image matching - Object Models and Matching: 2D representation, Global vs. Local features

Module -V: General Frameworks and Knowledge Based Vision

General Frame Works for Matching: Distance relational approach, ordered structural matching, View class matching, Models database organization. General Frame Works: Distance. relational approach, Ordered. Structural matching, View class matching, Models database organization. Knowledge Based Vision: Knowledge representation, Control-strategies, Information Integration

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Chairman - Board of Studies and Engineering
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Page | 183

Text Books:
1. E.R Davies, "Computer Vision: Principle, Algorithms, Applications, Learning. Academic Press,2017.
2. David A. Forsyth, Jean Ponce, "Computer Vision: A Modern Approach 2e", Prentice Hall, 2015.
References:
References Books:
1. Harry Wechsler, "Computational Vision (Computer Science and Scientific Computing" Academic Press,2014.
2. Simon J.D. Prince, "Computer Vision: Models, Learning, and Inference, Cambridge University Press ,2012.
3. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", Brooks/Cole,2007.
Video References:
1. https://www.youtube.com/watch?v=4WBQRNvD0_I
2. https://www.youtube.com/watch?v=FNHayuOaNkE
3. https://www.youtube.com/watch?v=z55QvA7g5Kc
4. https://www.youtube.com/watch?v=5rsFJmvMd6U
5. https://www.youtube.com/watch?v=8ACD3WpJKiY
NPTEL /Online Courses:
1. https://onlinecourses.nptel.ac.in/noc23_cs126/preview

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS533.1	Understand the concepts of Recognition Methodology.	K2	1, 2, 3, 5, 7, 12	1,2
R19CS533.2	Implement the concepts of segmentation for binary Image.	K3	1, 2, 3, 5, 7, 12	1,2
R19CS533.3	Implement the concepts of Area extraction and region Analysis for binary Image.	K3	1, 2, 3, 5, 7, 12	1,2
R19CS533.4	Demonstrate the various object Model recognition and matching techniques in computer vision.	K3	1, 2, 3, 5, 7, 12	1,2
R19CS533.5	Implement the general frameworks and knowledge-based vision	K3	1, 2, 3, 5, 7, 12	1,2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS533.1	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS533.2	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS533.3	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS533.4	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS533.5	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS534	GENERATIVE AI	L	T	P	C
		3	0	0	3

1.Course Description:

The course covers language modeling techniques, including neural language models and the transformer architecture, providing students with the skills to create advanced text generation applications. Additionally, the course explores advanced generative models and their real-world applications in various domains such as healthcare and scientific research. Students will learn about reinforcement learning, meta-learning, and few-shot learning, applying these techniques to develop innovative AI solutions.

2.Course Objectives:

1. To provide a foundational understanding of Generative AI concepts and models
2. To explore advanced techniques in Natural Language Processing (NLP)
3. To develop proficiency in ChatGPT and Prompt Engineering:
4. To apply language modeling techniques for effective text generation:
5. To implement advanced generative AI and reinforcement learning techniques in real-world applications

3.Syllabus:

Unit-I: Introduction to Generative AI

Introduction to Generative AI-Importance and Applications-Types of Generative models-Autoencoders and Variational Autoencoders (VAEs)-Generative Adversarial Networks (GANs)-Autoregressive Models-Generative Neural Networks and RBMs-Applications of Generative AI in Various Domains-Data Augmentation and Anomaly Detection-Text Generation and Language Modeling   .

Unit-II: Advanced Natural Language Processing

Foundations of Advanced NLP-Word Embeddings and Representation Learning-Sequence-to-Sequence Models-Encoder-Decoder Architectures-Advanced Text Generation and Understanding-Language Generation Models-Advanced NLP Applications- Emerging Trends in NLP

Unit-III: Introduction to ChatGPT & Prompt Engineering

Introduction to ChatGPT-Fine-Tuning and Specialization-Generating Human-Like Text- Prompt Engineering for Effective Interaction-Understanding Prompt Engineering-Designing Effective Prompts-

Chairman - Board of Studies
Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore - 641 202.

Page | 185

Fine-Tuning with Prompts-Customizing Model Output-Applications and Practical Exercises-

Unit-IV: Text Generation and Language Models

Introduction to Text Generation and Language Models-Language Modeling Fundamentals-Neural Language Models and Basics-Advanced Language Models-Transformer Architecture-Techniques for Text Generation-Advanced Text Generation Techniques-Multimodal Language Models-Multimodal Language Models-Cutting-Edge Advances and Future Directions

Unit-V: Advanced Generative AI

Foundations of Advanced Generative AI-Generative Models-Hierarchical and Structured Generative Models-Generative AI in Real-World Applications-Generative AI in Healthcare-Reinforcement Learning and Generative Models-Meta-Learning and Few-Shot Learning-Practical Implementations and Industry Applications-Generative AI for Scientific Applications

Text Books:

1. Numa Dhamani, Maggie Engler "Introduction to Generative AI" Manning Publications
2. Steven Bird,Ewan Klein & Edward Loper "Natural Language Processing with Python" O'REILLY publications.

References:

References Books:

1. Joseph Babcock, Raghav Bali "Generative AI with Python and TensorFlow 2: Create images, text, and music with VAEs, GANs, LSTMs, Transformer models" PACKT Publishing.
2. Iqbal Hussain "Introduction to Prompt Engineering with ChatGPT: A Beginner's Guide" Amazon Kindle edition
3. Jacob Emerson "Ripples of Generative AI: How Generative AI Impacts, Informs, and Transforms Our Lives" Amazon Kindle Edition.

NPTEL /Online Courses:

1. https://www.coursera.org/learn/introduction-to-generative-ai
2. https://www.coursera.org/learn/generative-ai-with-llms

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS534.1	Understand the fundamental concepts of Generative AI	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS534.2	Understand basics of advanced NLP	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS534.3	Understand the concepts of ChatGPT and Prompt Engineering	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS534.4	Apply language modelling techniques for text generation	K3	1, 2, 3, 5, 7, 12	1, 2
R19CS534.5	Apply reinforcement learning techniques in advanced Applications	K3	1, 2, 3, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS534.1	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS534.2	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS534.3	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS534.4	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS534.5	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS535	NATURAL LANGUAGE PROCESSING	L	T	P	C
		3	0	0	3

1.Course Description:

This course provides a comprehensive introduction to Natural Language Processing (NLP), focusing on techniques and algorithms that enable computers to understand, interpret, and generate human language. Topics covered include text preprocessing, language modeling, sentiment analysis, named entity recognition, machine translation, and deep learning approaches for NLP tasks.

2.Course Objectives:

1. Gain proficiency in text preprocessing techniques essential for cleaning and preparing textual data for analysis

2. Master language modeling approaches to predict and generate coherent sequences of text.

3. Develop skills in sentiment analysis and named entity recognition for extracting insights from text data

4. Acquire knowledge of machine translation techniques to facilitate communication across different languages

5. Explore advanced deep learning models for NLP tasks, enabling the development of state-of-the-art language processing applications.

3.Syllabus:

Unit-I: Introduction

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

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Department of Computer Science and Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Page | 187

Unit-II: Word Level Analysis
Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Unit-III: Syntactic Analysis
Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures

Unit-IV: Semantics and Pragmatics
Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

Unit-V: Discourse Analysis and Lexical Resources
Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC)

Text Books:
1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.   2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Pythonǁ, First Edition, O_Reilly Media, 2009.

References:
1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.   2. Richard M Reese, —Natural Language Processing with Javaǁ, O_Reilly Media, 2015.   3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS535.1	Tag a given text with basic Language features	K3	1, 2, 3, 5, 7, 12	1, 2,3
R19CS535.2	Design an innovative application using NLP components	K3	1, 2, 3, 5, 7, 12	1, 2,3
R19CS535.3	Implement a rule based system to tackle morphology/syntax of a language	K3	1, 2, 3, 5, 7, 12	1, 2,3
R19CS535.4	Design a tag set to be used for statistical processing for real-time applications	K3	1, 2, 3, 5, 7, 12	1, 2,3

R19CS535.5	Compare and contrast the use of different statistical approaches for different types of NLP applications	K3	1, 2, 3, 5, 7, 12	1, 2,3

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS535.1	3	3	3	-	1	-	2	-	-	-	-	3	2	2	1
R19CS535.2	3	3	3	-	1	-	2	-	-	-	-	3	2	2	1
R19CS535.3	3	3	3	-	1	-	2	-	-	-	-	3	2	2	1
R19CS535.4	3	3	3	-	1	-	2	-	-	-	-	3	2	2	1
R19CS535.5	3	3	3	-	1	-	2	-	-	-	-	3	2	2	1
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	2	2	1

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS536	Game Theory	L	T	P	C
		3	0	0	3

1.Course Description:

This course offers a comprehensive introduction to game theory, focusing on the analysis of strategic interactions and decision-making processes in various scenarios. Students will learn to understand and apply key concepts of game theory, including strategic games, equilibria, and the distinction between cooperative and non-cooperative games. Through a structured exploration of games with perfect and imperfect information, Bayesian games, and mechanism design, students will gain the skills to model and solve real-world problems using game-theoretic approaches.

2.Course Objectives:

1. To provide a foundational understanding of strategic games and equilibria
2. To explore games with perfect information
3. To introduce games with imperfect information
4. To delve into non-cooperative game theory
5. To apply game theory in mechanism design and practical applications

3.Syllabus:

Unit-I: Introduction

Introduction – Making rational choices: basic s of Games – strategy – preferences – payoffs – Mathematical basics – Game theory – Rational Choice – Basic solution concepts-non-cooperative versus cooperative games – Basic computational issues – finding equilibria and learning in games Typical application areas for game theory.

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Kinathukadavu, Coimbatore - 641 202.

Page | 189

Unit-II: Games with Perfect Information
Games with Perfect Information — Strategic games — prisoner's dilemma, matching pennies - Nash equilibria —mixed strategy equilibrium — zero-sum games.
Unit-III: Games with Imperfect Information
Games with Imperfect Information – Bayesian Games – Motivational Examples – General Definitions – Information aspects – Illustrations – Extensive Games with Imperfect – Information – Strategies – Nash Equilibrium – Beliefs and sequential equilibrium – Illustrations – Repeated Games – The Prisoner's Dilemma – Bargaining
Unit-IV: Non-Cooperative Game Theory
Non-cooperative Game Theory — Self-interested agents — Games in normal form — Analyzing games: from optimality to equilibrium — Computing Solution Concepts of Normal — Form Games — Computing Nash equilibria of two-player, zero-sum games —Computing Nash equilibria of two-player, general- sum games — Identifying dominated strategies
Unit-V: Mechanism Design
Aggregating Preferences – Social Choice – Formal Model – Voting – Existence of social functions – Ranking systems – Protocols for Strategic Agents: Mechanism Design – Mechanism design with unrestricted preferences – Efficient mechanisms – Vickrey and VCG mechanisms (shortest paths) – Combinatorial auctions – profit maximization Computational applications of mechanism design – applications in Computer Science – Google's sponsored search – eBay auctions – K-armed bandits.
Text Books:
1. M. J. Osborne, "An Introduction to Game Theory", Oxford University Press, 2003.
References:
References Books:
1. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani, "Algorithmic Game Theory", Cambridge University Press, 2007

2. M. J. Osborne and A. Rubinstein, "A Course in Game Theory", MIT Press, 1994.

3. A.Dixit and S. Skeath, "Games of Strategy", W W Norton & Co Inc, 3rd Edition 2009.

4. YoavShoham, Kevin Leyton-Brown, "Multi agent Systems: Algorithmic, Game- Theoretic, and Logical Foundations", Cambridge University Press, 2008.

5. Zhu Han, Dusit Niyato, Walid Saad, Tamer Basar and Are Hjorungnes, "Game Theory in Wireless and Communication Networks", Cambridge University Press, 2012.

NPTEL /Online Courses:

1. https://www.coursera.org/learn/game-theory-2

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS536.1	Understand the notion of a strategic game and equilibria and identify the characteristics of main applications of these concepts.	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS536.2	Understand the usage of games with perfect information.	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS536.3	Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real-world situation.	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS536.4	Identify the concepts involved in non-cooperative game theory	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS536.5	Implement a typical Virtual Business scenario using Game theory.	K3	1, 2, 3, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS536.1	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS536.2	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS536.3	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS536.4	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS536.5	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

R19CS538	ETHICS IN AI	L	T	P	C
		3	0	0	3

1.Course Description:

This course provides an in-depth exploration of the ethical considerations and implications of artificial intelligence (AI). Students will gain a foundational understanding of morality and ethics in the context of AI and its impact on society, psychology, the legal system, the environment, and trust. The course examines international ethical initiatives, the design of autonomous systems, and the ethical challenges associated with real-world AI applications. Through the study of roboethics, AI standards, and regulations, students will learn about the ethical responsibilities of professionals working with AI technologies. Additionally, the course addresses societal issues and national and international strategies for AI, preparing students to navigate and contribute to the ethical landscape of AI development and deployment.

2.Course Objectives:

1. To provide a foundational understanding of morality and ethics in AI
2. To explore ethical initiatives and real-time application challenges in AI
3. To understand the design of autonomous systems and address ethical harms
4. To introduce the concepts of roboethics and professional responsibility
5. To address societal issues and strategies related to AI ethics

3.Syllabus:

Unit-I: Ethics Fundamentals

Definition of morality and ethics in AI-Impact on society-Impact on human psychology-Impact on the legal system-Impact on the environment and the planet-Impact on trust

Unit-II: Ethical Initiatives in AI

International ethical initiatives-Ethical harms and concerns-Case study: healthcare robots, Autonomous Vehicles Warfare and weaponization.

Unit-III: AI Standards and Regulations

Model Process for Addressing Ethical Concerns During System Design - Transparency of Autonomous Systems-Data Privacy Process- Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems

Unit-IV: Roboethics

Robot- Roboethics - Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility - Roboethics Taxonomy.

Unit-V: Ethics- Challenges and Opportunities

Challenges - Opportunities- ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI

Text Books:

1. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield," The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service Scientific Foresight Unit (STOA) PE 634.452 – March 2020
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

References:

References Books:

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017

2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020

NPTEL /Online Courses:

1. https://nptel.ac.in/courses/106102220

4. Course Outcomes:

CO. No.	Course Outcome	BTL	POs	PSOs
R19CS538.1	Learn about morality and ethics in AI	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS538.2	Acquire the knowledge of real time application ethics, issues and its challenges.	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS538.3	Understand the ethical harms and learn the Design of Autonomous and Semi-Autonomous Systems	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS538.4	Understand the concepts of Roboethics and Morality with professional responsibilities	K2	1, 2, 3, 5, 7, 12	1, 2
R19CS538.5	Learn about the societal issues in AI with National and International Strategies on AI	K2	1, 2, 3, 5, 7, 12	1, 2

5. Course Articulation Matrix:

CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PSO 01	PSO 02	PSO 03
R19CS538.1	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS538.2	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS538.3	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS538.4	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
R19CS538.5	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-
Course to PO	3	3	3	-	1	-	2	-	-	-	-	3	3	3	-

"3"—High, "2"—Medium, "1"—Low, "-"—No Correlation

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