KPRIET
Learn Beyond

B.E.–Computer Science and Engineering

Curriculum and Syllabi

Regulations 2019

I. Vision and Mission of the Institute

Vision

To become a premier institute of academic excellence by imparting technical, intellectual and professional skills to students for meeting the diverse needs of the industry, society, the nation and the world at large.

Mission

- Commitment to offer value-based education and enhancement of practical skills
- Continuous assessment of teaching and learning process through scholarly activities
- Enriching research and innovative activities in collaboration with industry and institute of repute
- Ensuring the academic process to uphold culture, ethics and social responsibility

II. Vision and Mission of the Department

Vision

To foster the students by providing learner centric teaching environment, continuous learning, research and development to become thriving professionals and entrepreneurs to excel in the field of computer science and contribute to the society.

Mission

The Mission of the Department is to

- Providing value based education and contented learning experience to the students.
- Educating the students with the state of art technologies and cultivating their proficiency in analytical and designing skills.
- Enabling the students to achieve a successful career in Computer Science and Engineering or related fields to meet the changing needs of various stakeholders.
- Guiding the students in research by nurturing their interest in continuous learning towards serving the society and the country.

III. Program Educational Objectives (PEOs)

The Program Educational Objectives (PEOs) of the Computer Science and Engineering (CSE) represent major accomplishments that the graduates are expected to achieve after three to five years of graduation.

PEO1: Obtain knowledge in cutting edge technologies in the field of computer science, necessary to solve real time problems through value based education.

PEO2: Possess skills for team building, leadership quality and ethical values necessary to function productively and professionally.

PEO3: Develop innovative ideas to establish themselves as professionals and entrepreneurs in computing industry.

PEO4: Continue to learn new technologies through higher studies and research.

IV. Program Outcomes (POs)

Graduates of Computer Science and Engineering will be able to

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

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

PO 2 Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO 3 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 the public health and safety, and the cultural, societal, and environmental considerations.

PO 4 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.

PO 5 Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO 6 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.

PO 7 Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9 Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10 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.

PO 11 Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12 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.

V. Program Specific Outcomes (PSOs)

Graduates of Computer Science and Engineering will be able to

PSO 1: An ability to identify and analyse data management system like data acquisition, big data so as to facilitate the students in solving problems using the techniques of data analytics.

PSO 2: An ability to apply design and development principles of hardware and software in emerging technology environments like cloud computing and cyber forensics.

Dr. P. Thangaraj M.E., Ph.D
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KPR Institute of Engineering and Technology
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VI. PEO/PO Mapping

Following three levels of correlation should be used:

1: Low

2: Medium

3: High

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	3	3	3	2	2	2	2	2	3	3	2
PEO2	3	3	3	-	-	2	1	2	2	3	3	3
PEO3	3	3	3	3	-	2	2	2	1	3	3	3
PEO4	3	3	3	3	3	3	3	1	2	3	3	2

Dr. P. Thangaraj M.E., Ph.D
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VII. Mapping of Course Outcomes with Program Outcomes

SEM	Subject	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
SEM I	Language Elective – I*	-	-	-	-	-	✓	✓	-	✓	✓	-	-	-	-
	Calculus and Differential Equations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Engineering Physics - I	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	-
	Engineering Chemistry - I	✓	✓	-	-	-	-	✓	-	✓	✓	-	✓	-	-
	Problem Solving using Python Programming	✓	✓	✓	-	-	-	-	✓	✓	✓	-	✓	-	-
	Electronic Devices	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Workshop	✓	✓	✓	-	✓	-	-	-	-	-	-	✓	-	-
SEM II	Language Elective – II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Fourier series and partial differential equations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Basics of Electrical Engineering	✓	✓	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	-
	Computational Thinking	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	-	-
	Digital Logic and Design	✓	✓	✓	-	-	-	-	-	✓	✓	-	✓	-	-
	Numerical Aptitude and Verbal Ability I	✓	-	-	-	-	-	-	-	-	✓	-	-	-	-
	Engineering Graphics	✓	✓	-	-	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Digital Logic and Design Laboratory	✓	✓	✓	-	-	-	-	✓	✓	✓	-	✓	-	-
SEM III	Ethics and Holistic Life	-	-	-	-	-	✓	✓	✓	✓	✓	-	✓	-	-
	Discrete Mathematics	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	-
	Computer Architecture and Microprocessors	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	-	✓
	Data structures	✓	✓	✓	-	-	-	-	✓	✓	✓	-	✓	-	-
	Software Engineering	✓	✓	✓	✓	-	-	-	-	✓	✓	✓	✓		✓
	Application Development Practices	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	-

Dr. P. Thangaraj M.E., Ph.D
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	Numerical Aptitude and Verbal Ability II	✓	-	-	-	-	-	-	-	-	✓	-	-	-	-
	Data Structures Laboratory	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	-	✓	✓	-
	Case Tools Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
SEM IV	Probability and Queuing Theory	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	-
	Operating Systems	✓	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	-	-
	Design and Analysis of Algorithm	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓	✓	-
	Theory of Computation	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓	✓	-
	Database Management Systems	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	-
	OOPS and Advanced Data Structures	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	✓	-
	Operating Systems Laboratory	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	-	✓
	Database Management Systems Laboratory	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	-
SEM V	Linear Algebra and Number Theory	✓	✓	-	-	-	-	-	-	-	-	-	✓	-	-
	Artificial Intelligence	✓	✓	✓	✓	✓	✓	✓	-	-	✓	-	✓	✓	-
	Web Technologies	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	-
	Computer Networks	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	-	✓
	Web Technologies Laboratory	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	-
	Artificial Intelligence Laboratory	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	-
SEM VI	Principles of Management	✓	✓	-	✓	-	✓	-	✓	✓	✓	✓	✓	-	-
	Compiler Design	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	-	✓
	Cloud Computing	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	✓	-	✓
	Mobile Application Development Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓
	Mini Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Dr. P. Thangaraj M.E., Ph.D
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Arasur, Coimbatore- 641 407

	Technical Seminar	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	✓	✓
SEM VII	Software Project Management	✓	✓	✓	✓	-	✓	-	✓	-	✓	✓	✓	-	✓
	Cryptography and network Security	✓	✓	✓	✓	-	✓	-	✓	-	-	-	✓	-	✓
	Security Laboratory	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	-	✓
SEM VIII	Project work	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
TRACK I	Wireless Sensor Networks	✓	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓
	Next Generation Networks	✓	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓
	Virtualization Techniques	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	-	✓
	Software Defined networks	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	-	✓
	Blockchain Technologies	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	-	✓
	Internet of Things	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	-	✓
	Mobile Computing	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓
	Soft Computing	✓	✓	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓
	Edge Computing	✓	✓	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓
	Fog Computing	✓	✓	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓
	GPU Computing	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	-	✓
	Vehicular Networks	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	-	✓
	Mobile Adhoc Networks	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	-	✓
TRACK II	Advanced Java Programming	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	-	✓
	C# and .Net Programming	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	-	✓
	Multi Core Architecture	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	-	✓
	Computer Graphics	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	-	✓
	Multimedia Technologies	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	-	✓

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
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	Graph Theory and its applications	✓	✓	✓	✓	-	✓	-	-	-	✓	-	✓	-	✓
	Agile Software Development	✓	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	-	✓
	Service Oriented Architecture and Microservices	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	-	✓
	Software Testing	✓	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	-	✓
	Software Quality Assurance	✓	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	-	✓
	UI/UX Design	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓	-	✓
	Information Storage Management	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	-	✓
TRACK III	Digital Image Processing	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	Pattern Recognition	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	-
	Human Computer Interaction	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	-	✓
	Extended Reality	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓
	Natural Language Processing	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	-
	Information Retrieval	✓	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	-
	Machine Learning-I	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	-
	Deep Learning	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	-
	Data Visualization	✓	✓	✓	✓	✓	✓	-	-	-	✓	-	✓	✓	-
	Machine Learning-II	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	-
	Cognitive Science & Analytics	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	-
	Video Processing and Analysis	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	-
	Social Network Analysis	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	-

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

B.E. COMPUTER SCIENCE AND ENGINEERING

REGULATIONS – 2019

CHOICE BASED CREDIT SYSTEM

CURRICULUM FOR I - VIII SEMESTERS

SEMESTER I

SEMESTER IV	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1		Language Elective I*	HSM	1	0	2	2
2	U19MA101	Calculus and Differential Equations	BS	3	1	0	4
3	U19PH102	Engineering Physics – I	BS	3	0	0	3
4	U19CY101	Engineering Chemistry - I	BS	2	0	2	3
5	U19CSG01	Problem Solving using Python Programming	ES	2	0	2	3
6	U19CS101	Electronic Devices	ES	3	0	0	3
PRACTICALS							
7	U19CS102	Workshop	ES	0	0	4	2
			TOTAL	14	1	10	20

*** U19LE101-Basic English / U19LE102-Communicative English**

SEMESTER II

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1		Language Elective II**	HSM	1	0	2	2
2	U19MA203	Fourier Series and Partial Differential Equations	BS	3	1	0	4
3	U19EEG02	Basics of Electrical Engineering	ES	3	0	0	3
4	U19CSG02	Computational Thinking	ES	2	0	2	3
5	U19CS201	Digital Logic and Design	ES	3	0	0	3
6	U19CA001	Numerical Aptitude and Verbal Ability I	EEC	1	0	0	1
PRACTICALS							
7	U19MEG01	Engineering Graphics	ES	1	0	4	3
8	U19CS203	Digital Logic and Design Laboratory	ES	0	0	2	1
			TOTAL	14	1	10	20

**** U19LE201- Advanced Communicative English/ U19LE20* Other languages**

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER III

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1	U19CS301	Ethics and Holistic Life	HSM	3	0	0	3
2	U19MA304	Discrete Mathematics	BS	3	1	0	4
3	U19CS302	Computer Architecture and Microprocessors	PC	3	0	0	3
4	U19CS303	Data Structures	PC	3	0	0	3
5	U19CS304	Software Engineering	PC	3	0	0	3
6	U19CS305	Application Development Practices	PC	2	0	2	3
7	U19CA002	Numerical Aptitude and Verbal Ability II	EEC	1	0	0	1
PRACTICALS							
8	U19CS307	Data Structures Laboratory	PC	0	0	2	1
9	U19CS308	Case Tools Laboratory	PC	0	0	4	2
			TOTAL	18	1	8	23

SEMESTER IV

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1	U19MA404	Probability and Queuing Theory	BS	3	0	0	3
2	U19CS401	Operating Systems	PC	3	0	0	3
3	U19CS402	Design and Analysis of Algorithms	PC	3	0	0	3
4	U19CS403	Theory of Computation	PC	3	0	0	3
5	U19CS404	Database Management Systems	PC	3	0	0	3
6	U19CS405	OOPS and Advanced Data Structures	PC	2	0	2	3
PRACTICALS							
7	U19CS406	Operating Systems Laboratory	PC	0	0	2	1
8	U19CS407	Database Management Systems Laboratory	PC	0	0	4	2
			TOTAL	17	0	8	21

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
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SEMESTER V

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
		THEORY					
1	U19MA501	Linear Algebra and Number Theory	BS	2	0	0	2
2	U19CS501	Artificial Intelligence	PC	3	0	0	3
3	U19CS502	Web Technologies	PC	3	0	0	3
4	U19CS503	Computer Networks	PC	2	0	2	3
5	-	Professional Elective I	PE	3	0	0	3
6	-	Open Elective I	OE	3	0	0	3
7	-	Open Elective II	OE	3	0	0	3
		PRACTICALS					
8	U19CS504	Web Technologies Laboratory	PC	0	0	2	1
9	U19CS505	Artificial Intelligence Laboratory	PC	0	0	2	1
			TOTAL	19	0	6	22

SEMESTER VI

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
		THEORY					
1	U19CS601	Principles of Management	HSM	3	0	0	3
2	U19CS602	Compiler Design	PC	3	0	0	3
3	U19CS603	Cloud Computing	PC	2	0	2	3
4	-	Professional Elective II	PE	3	0	0	3
5	-	Professional Elective III	OE	3	0	0	3
6	-	Open Elective III	OE	3	0	0	3
		PRACTICALS					
7	U19CS604	Mobile Application Development Lab	PC	0	0	4	2
8	U19CS605	Mini Project	EEC	0	0	2	1
9	U19CS606	Technical Seminar	EEC	0	0	2	1
			TOTAL	17	0	10	22

Dr. P. Thangaraj M.E., Ph.D
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SEMESTER VII

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1	U19CS701	Software Project Management	HSM	3	0	0	3
2	U19CS702	Cryptography and Network Security	PC	3	0	0	3
3	-	Professional Elective IV	PE	3	0	0	3
4	-	Professional Elective V	PE	3	0	0	3
5	-	Professional Elective VI	PE	3	0	0	3
6	-	Open Elective IV	OE	3	0	0	3
PRACTICALS							
7	U19CS703	Security lab	PC	0	0	2	1
			TOTAL	18	0	2	19

SEMESTER VIII

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
THEORY							
1	-	Professional Elective 7	PE	3	0	0	3
2	-	Professional Elective 8	PE	3	0	0	3
PRACTICALS							
3	U19CS801	Project	EEC	0	0	20	10
			TOTAL	6	0	20	16

INDUSTRIAL INTERNSHIP

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U19CSI01	Industrial Training / Industrial Internship	EEC	0	0	0	2
			TOTAL	**0**	**0**	**0**	**2**

*Four Weeks during any semester vacation from III to VI Semester

TOTAL CREDITS: 165

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
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PROFESSIONAL ELECTIVES (PE)

TRACK I						
NETWORKING AND COMPUTING						
Sl.No.	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
1	U19CSP01	Wireless Sensor Networks	3	0	0	3
2	U19CSP02	Next Generation Networks	3	0	0	3
3	U19CSP03	Virtualization Techniques	3	0	0	3
4	U19CSP04	Software Defined networks	3	0	0	3
5	U19CSP05	Blockchain Technologies	3	0	0	3
6	U19CSP06	Internet of Things	3	0	0	3
7	U19CSP07	Mobile Computing	3	0	0	3
8	U19CSP08	Soft Computing	3	0	0	3
9	U19CSP09	Edge Computing	3	0	0	3
10	U19CSP10	Fog Computing	3	0	0	3
11	U19CSP11	GPU Computing	3	0	0	3
12	U19CSP12	Vehicular Networks	3	0	0	3
13	U19CSP13	Mobile Adhoc Networks	3	0	0	3
TRACK II						
PROGRAMMING, MULTIMEDIA AND SOFTWARE ENGINEERING						
Sl.No.	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
1	U19CSP14	Advanced Java Programming	3	0	0	3
2	U19CSP15	C# and .Net Programming	3	0	0	3
3	U19CSP16	Multi Core Architecture	3	0	0	3
4	U19CSP17	Computer Graphics	3	0	0	3
5	U19CSP18	Multimedia Technologies	3	0	0	3
6	U19CSP19	Graph Theory and its applications	3	0	0	3
7	U19CSP20	Agile Software Development	3	0	0	3
8	U19CSP21	Service Oriented Architecture and Microservices	3	0	0	3
9	U19CSP22	Software Testing	3	0	0	3
10	U19CSP23	Software Quality Assurance	3	0	0	3
11	U19CSP24	UI/UX Design	3	0	0	3

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Professor and Head
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KPR Institute of Engineering and Technology
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12	U19CSP25	Information Storage Management	3	0	0	3

TRACK III

DATA SCIENCE AND INTELLIGENT SYSTEMS

Sl.No.	COURSE CODE	COURSE TITLE	L	T	P	C
1	U19CSP26	Digital Image Processing	3	0	0	3
2	U19CSP27	Pattern Recognition	3	0	0	3
3	U19CSP28	Human Computer Interaction	3	0	0	3
4	U19CSP29	Extended Reality	3	0	0	3
5	U19CSP30	Natural Language Processing	3	0	0	3
6	U19CSP31	Information Retrieval	3	0	0	3
7	U19CSP32	Machine Learning-I	3	0	0	3
8	U19CSP33	Deep Learning	3	0	0	3
9	U19CSP34	Data Visualization	3	0	0	3
10	U19CSP35	Machine Learning-II	3	0	0	3
11	U19CSP36	Cognitive Science & Analytics	3	0	0	3
12	U19CSP37	Video Processing and Analysis	3	0	0	3
13	U19CSP38	Social Network Analysis	3	0	0	3
GATE ELECTIVES						
1	U19CSP39	Comprehension I	3	0	0	3
2	U19CSP40	Comprehension II	3	0	0	3

HUMANITIES AND SCIENCES (HSM)

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U19LE101/ U19LE102	Basic English/ Communicative English	HSM	1	0	2	2
2	U19LE201	Advanced Communicative English	HSM	1	0	2	2
3	U19CS301	Ethics and Holistic Life	HSM	3	0	0	3
4	U19CS601	Principles of Management	HSM	3	0	0	3
5	U19CS701	Software Project Management	HSM	3	0	0	3

Dr. P. Thangaraj M.E., Ph.D
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BASIC SCIENCES (BS)

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U19MA101	Calculus and Differential Equations	BS	3	1	0	4
2	U19PH102	Engineering Physics – I	BS	3	0	0	3
3	U19CY101	Engineering Chemistry - I	BS	2	0	2	3
4	U19MA203	Fourier Series and Partial Differential Equations	BS	3	1	0	4
5	U19MA304	Discrete Mathematics	BS	3	1	0	4
6	U19MA404	Probability and Queuing Theory	BS	3	0	0	3
7	U19MA501	Linear Algebra and Number Theory	BS	2	0	0	2

ENGINEERING SCIENCES (ES)

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U19CSG01	Problem Solving using Python Programming	ES	2	0	2	3
2	U19CS101	Electronic Devices	ES	3	0	0	3
3	U19CS102	Workshop	ES	0	0	4	2
4	U19EEG02	Basics of Electrical Engineering	ES	3	0	0	3
5	U19CSG02	Computational Thinking	ES	2	0	2	3
6	U19CS201	Digital Logic and Design	ES	3	0	0	3
7	U19MEG01	Engineering Graphics	ES	1	0	4	3
8	U19CS203	Digital Logic and Design Laboratory	ES	0	0	2	1

PROFESSIONAL CORE (PC)

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1.	U19CS302	Computer Architecture and Microprocessors	PC	3	0	0	3
2.	U19CS303	Data Structures	PC	3	0	0	3
3.	U19CS304	Software Engineering	PC	3	0	0	3
4.	U19CS305	Application Development Practices	PC	2	0	2	3
5.	U19CS307	Data Structures Laboratory	PC	0	0	2	1
6.	U19CS308	Case Tools Laboratory	PC	0	0	4	2

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7.	U19CS401	Operating Systems	PC	3	0	0	3
8.	U19CS402	Design and Analysis of Algorithms	PC	3	0	0	3
9.	U19CS403	Theory of Computation	PC	3	0	0	3
10.	U19CS404	Database Management Systems	PC	3	0	0	3
11	U19CS405	OOPS and Advanced Data Structures	PC	2	0	2	3
12	U19CS406	Operating Systems Laboratory	PC	0	0	2	1
13	U19CS407	Database Management Systems Laboratory	PC	0	0	4	2
14	U19CS501	Artificial Intelligence	PC	3	0	0	3
15	U19CS502	Web Technologies	PC	3	0	0	3
16	U19CS503	Computer Networks	PC	2	0	2	3
17	U19CS504	Web Technologies Laboratory	PC	0	0	2	1
18	U19CS505	Artificial Intelligence Laboratory	PC	0	0	2	1
19	U19CS602	Compiler Design	PC	3	0	0	3
20	U19CS603	Cloud Computing	PC	2	0	2	3
21	U19CS604	Mobile Application Development Lab	PC	0	0	4	2
22	U19CS702	Cryptography and Network Security	PC	3	0	0	3
23	U19CS703	Security lab	PC	0	0	2	1

PROFESSIONAL ELECTIVES (PE)

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
PROFESSIONAL ELECTIVES I							
1	U19CSP01	Wireless Sensor Networks	PE	3	0	0	3
2	U19CSP14	Advanced Java Programming	PE	3	0	0	3
3	U19CSP20	Agile Software Development	PE	3	0	0	3
4	U19CSP26	Digital Image Processing	PE	3	0	0	3
5	U19CSP27	Pattern Recognition	PE	3	0	0	3
PROFESSIONAL ELECTIVES II							
1	U19CSP02	Next Generation Networks	PE	3	0	0	3
2	U19CSP13	Mobile Adhoc Networks	PE	3	0	0	3
3	U19CSP15	C# and .Net Programming	PE	3	0	0	3
4	U19CSP30	Natural Language Processing	PE	3	0	0	3

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5	U19CSP28	Human Computer Interaction	PE	3	0	0	3
PROFESSIONAL ELECTIVES III							
1	U19CSP07	Mobile Computing	PE	3	0	0	3
2	U19CSP09	Edge Computing	PE	3	0	0	3
3	U19CSP17	Computer Graphics	PE	3	0	0	3
4	U19CSP29	Extended Reality	PE	3	0	0	3
5	U19CSP39	Comprehension I	PE	3	0	0	3
PROFESSIONAL ELECTIVES IV							
1	U19CSP04	Software Defined networks	PE	3	0	0	3
2	U19CSP10	Fog Computing	PE	3	0	0	3
3	U19CSP18	Multimedia Technologies	PE	3	0	0	3
4	U19CSP32	Machine Learning-I	PE	3	0	0	3
5	U19CSP40	Comprehension II	PE	3	0	0	3
PROFESSIONAL ELECTIVES V							
1	U19CSP05	Block chain Technologies	PE	3	0	0	3
2	U19CSP08	Soft Computing	PE	3	0	0	3
3	U19CSP19	Graph Theory and its applications	PE	3	0	0	3
4	U19CSP22	Software Testing	PE	3	0	0	3
5	U19CSP34	Data Visualization	PE	3	0	0	3
PROFESSIONAL ELECTIVES VI							
1	U19CSP12	Vehicular Networks	PE	3	0	0	3
2	U19CSP21	Service Oriented Architecture and Micro services	PE	3	0	0	3
3	U19CSP23	Software Quality Assurance	PE	3	0	0	3
4	U19CSP31	Information Retrieval	PE	3	0	0	3
5	U19CSP33	Deep Learning	PE	3	0	0	3
PROFESSIONAL ELECTIVE VII							
1	U19CSP11	GPU Computing	PE	3	0	0	3
2	U19CSP24	UI/UX Design	PE	3	0	0	3
3	U19CSP25	Information Storage Management	PE	3	0	0	3

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4	U19CSP36	Cognitive Science & Analytics	PE	3	0	0	3
5	U19CSP37	Video Processing and Analysis	PE	3	0	0	3
PROFESSIONAL ELECTIVES VIII							
1	U19CSP03	Virtualization Techniques	PE	3	0	0	3
2	U19CSP06	Internet of Things	PE	3	0	0	3
3	U19CSP16	Multi Core Architecture	PE	3	0	0	3
4	U19CSP38	Social Network Analysis	PE	3	0	0	3
5	U19CSP35	Machine Learning-II	PE	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

Sl.No.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	C
1	U19CA001	Numerical Aptitude and Verbal Ability I	EEC	1	0	0	1
2	U19CA002	Numerical Aptitude and Verbal Ability II	EEC	1	0	0	1
3	U19CS605	Mini Project	EEC	0	0	2	1
4	U19CS606	Technical Seminar	EEC	0	0	2	1
5	U19CS801	Project	EEC	0	0	2	10
6	U19CSI01	Internship	EEC	0	0	0	2

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VIII. Scheme of Credit distribution – Summary

Sl.No	Stream	Credits/Semester								Credits	%
		I	II	III	IV	V	VI	VII	VIII		
1.	Humanities and Social Sciences including Management (HSM)	2	2	3	-	-	3	3	-	13	7%
2.	Basic Sciences (BS)	10	4	4	3	2	-	-	-	23	14%
3.	Engineering Sciences(ES)	8	13	-	-	-	-	-	-	21	13%
4.	Professional Core (PC)	-	-	15	18	11	8	4	-	56	34%
5.	Professional Elective (PE)	-	-	-	-	3	6	9	6	24	15%
6.	Open Electives (OE)	-	-	-	-	6	3	3	-	12	7%
7.	Employability Enhancement Courses (EEC)	-	1	1	-	-	2	-	10	14	10%
8.	Industrial Training/ Internship	-	-	-	-	-	-	-	-	2	
9.	Mandatory Non-Credit Course (MNC)	-	-	-	-	-	-	-	-	-	-
Total		**20**	**20**	**23**	**21**	**22**	**22**	**19**	**16**	**165**	**100**

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SEMESTER I

U19LE101	BASIC ENGLISH	Category: HS			
		L	T	P	C
		1	0	2	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To read the text, understand and write the meaning under Technical, Business, Social and Academic contexts
- To listen and comprehend monologues, dialogues and discussions
- To speak effectively with appropriate use of words and participate in discussions

UNIT I BASICS FOR COMMUNICATION 9

Regular & Irregular Verbs – Modal Verbs – Prepositions – Tenses – Subject Verb Agreement – Spotting Errors – Homonyms & Homophones – Phrasal Verbs – Single word substitute – Word formation – Reported Speech

UNIT II LISTENING 9

Listening for specific Information – Listening to short texts – Listening to product description and process – Listening to formal and informal Conversations – Listening to announcements – Listening Comprehension

UNIT III SPEAKING 9

Introducing oneself – Seeking and sharing information – JAM – Enquiry – Asking for clarification – Describing a place, person, process, product and experience – Current affairs – Making presentations

UNIT IV READING 9

Reading for information – Skimming – Scanning – Predicting the content – Reading comprehension – Reading short texts – Proof reading(editing)

UNIT V WRITING 9

Memo – Email – Letter writing (formal and informal) – Dialogue writing – Descriptive writing – Instructions – Filling forms of application – Paraphrasing

LIST OF EXPERIMENTS

1. Listening for information
2. Listening to announcements
3. Listening to stories
4. Song based listening
5. Listening to conversations
6. Self-Introduction
7. Just a Minute
8. Story narration
9. Picture description
10. Movie review

Contact Periods:

Lecture: 15 Periods Tutorial: – Periods Practical: 30 Periods Total: 45 Periods

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TEXT BOOKS:

1. Mindscapes: "English for Technologist and Engineers", Orient BlackSwan, 2014
2. Sudharshana N P and Savitha C, "English for Technical Communication", First Edition, Cambridge University Press, 2016

REFERENCES:

1. Murphy, Raymond, "Intermediate English Grammar", Second Edition, Cambridge University Press, 2009
2. Means, Thomas L, "English and Communication for Colleges", First Edition, Cengage, 2017
3. "Using English: A Coursebook for Undergraduate Engineers and Technologists" Orient BlackSwan, 2017

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Practice appropriate vocabulary required for spoken and written communication	Understand
CO2	Comprehend and answer questions and take part in conversations	Understand
CO3	Participate in discussions and presentations	Apply
CO4	Understand the meaning of the content present in letters, reports and newspaper	Understand
CO5	Draft letters, e-mails and make notes with appropriate use of words	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	1	-	2	2	-	-	-	-
CO2	-	-	-	-	-	2	1	-	2	2	-	-	-	-
CO3	-	-	-	-	-	2	1	-	2	2	-	-	-	-
CO4	-	-	-	-	-	2	1	-	2	2	-	-	-	-
CO5	-	-	-	-	-	2	1	-	2	2	-	-	-	-
CO	-	-	-	-	-	2	1	-	2	2	-	-	-	-
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)					3: Substantial (High)			

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
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SEMESTER I

U19LE102	COMMUNICATIVE ENGLISH	Category: HS			
		L	T	P	C
		1	0	2	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop the ability to read, write and comprehend various texts
- To enhance the listening skills to understand conversations and deliberations on diverse contexts
- To make effective presentations and demonstrate concepts within a team

UNIT I BASICS FOR COMMUNICATION 9

Active and Passive – Conditionals – Reported speech – Degrees of comparison – Phrases and clauses – Idioms – Kinds of sentences – Connectives and Discourse markers – Purpose statements

UNIT II LISTENING 9

Listening to TED talks – Listening to product description – Listening to orations – Listening to news – Radio based listening

UNIT III SPEAKING 9

Group discussion – Extempore – Technical seminar – Product and process description – Role play – Conversation and etiquettes – Short group conversation – Narrating a story – Formal and informal discussions

UNIT IV READING 9

Pre-reading and Post-reading – Intensive reading – Extensive reading – Newspaper reading – Reading longer texts – Reviewing company profile – Reading strategies – Interpreting visual graphics

UNIT V WRITING 9

Interpreting charts and graphs – Recommendations – Minutes of meeting – Job application and cover letter – Report writing – Drafting circulars (Business contexts)

LIST OF EXPERIMENTS

1. Listening to TED talks
2. Listening to product description
3. Listening to news
4. Radio based listening
5. Listening to oration
6. Self-Introduction
7. Role play
8. Extempore
9. Presentation
10. Group discussion

Contact Periods:

Lecture: 15 Periods Tutorial: – Periods Practical: 30 Periods Total: 45 Periods

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REFERENCES:

1. Murphy, Raymond, "Intermediate English Grammar", Second Edition, Cambridge University Press, 2009
2. Means, Thomas L, "English and Communication for Colleges", First Edition, Cengage 2017
3. "Using English: A Coursebook for Undergraduate Engineers and Technologists" Orient BlackSwan, 2017

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Make use of relevant vocabulary in formal and informal contexts	Apply
CO2	Infer and exhibit the ability to listen various professional interactions	Understand
CO3	Express views and perceptions in a technical forum	Understand
CO4	Interpret a given text and relate the content effectively	Understand
CO5	Frame coherent and cohesive sentences in select contexts	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	1	-	1	1	-	-	-	-
CO2	-	-	-	-	-	2	1	-	1	1	-	-	-	-
CO3	-	-	-	-	-	2	1	-	1	1	-	-	-	-
CO4	-	-	-	-	-	2	1	-	1	1	-	-	-	-
CO5	-	-	-	-	-	2	1	-	1	1	-	-	-	-
CO	-	-	-	-	-	2	1	-	1	1	-	-	-	-
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)					3: Substantial (High)			

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Department of Computer Science and Engineering
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SEMESTER I

U19MA101	CALCULUS AND DIFFERENTIAL EQUATIONS	Category: BS			
		L	T	P	C
		3	1	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- Understand the concepts of matrices and calculus which will enable them to model and analyze physical phenomena involving continuous change
- Apply and summarize the methodologies involved in solving problems related to fundamental principles of calculus
- Develop confidence to model mathematical pattern and give appropriate solutions

UNIT I MATRICES **9 + 3**

Eigenvalues and Eigenvectors – Properties (without proof) – Cayley Hamilton theorem (without proof) – Diagonalization using orthogonal transformation – Applications: Elastic membrane

UNIT II DIFFERENTIAL CALCULUS **9 + 3**

Curvature – Radius of curvature (Cartesian form only) – Center of curvature – Circle of curvature – Evolute and Envelope of plane curves

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9 + 3**

Partial derivatives – Total derivative – Jacobians – Taylor's series expansion – Extreme values of functions of two variables – Lagrange multipliers method

UNIT IV INTEGRAL CALCULUS **9 + 3**

Evaluation of definite and improper integrals – Applications of definite integrals – Surface areas – Volume of revolutions

UNIT V ORDINARY DIFFERENTIAL EQUATIONS **9 + 3**

Second and Higher order linear differential equations with constant coefficients – variable coefficients – Euler-Cauchy equation – Legendre's equation – Method of variation of parameters – Applications

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Total: 60 Periods

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Pvt Ltd, New Delhi, 2018
2. Grewal B S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2017

REFERENCES:

1. Bali N P and Dr Manish Goyal, "A text book of Engineering Mathematics", 12th edition, Laxmi Publications,2016
2. Thomas G B and Finney R L, "Calculus and Analytic Geometry", 14th edition, Pearson Education India, 2018
3. Maurice D Weir, Joel Hass, Christopher Heil, "Thomas Calculus", 14th edition, Pearson Education, India, 2018
4. James Stewart, "Calculus: Early Transcendental", 7th Edition, Cengage Learning, New Delhi, 2015

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COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Apply the knowledge of matrices with the concepts of eigenvalues to study their problems in core areas	Apply
CO2	Study the behavior of a function at infinity, knowledge on curvature with its properties in Cartesian form	Apply
CO3	Develop competency in applying the idea of Lagrange multipliers to find extreme of functions with constraints	Apply
CO4	Compute area and volume using definite and improper integrals	Apply
CO5	Model the problems, when the particle changes with respect to its velocity, acceleration using higher order differential equations	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	1	-	-
CO	3	2	-	-	-	-	-	-	-	-	-	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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Department of Computer Science and Engineering
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SEMESTER I

U19PH102	ENGINEERING PHYSICS - I	Category: BS			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Higher Secondary Physics

COURSE OBJECTIVES:

- To acquire the knowledge of electron transport properties in conductors and semiconductors
- To understand the types of magnetic, superconducting materials and its applications
- To understand the concepts of quantum structures and smart materials for engineering applications

UNIT I CONDUCTING MATERIALS 9

Classical free electron theory – Expression for electrical conductivity – Expression for Thermal conductivity – Wiedemann - Franz law – Success and failures– Electrons in metals – Fermi-Dirac statistics – Fermi distribution function – Variation with temperature – Density of energy states – Energy bands in solids (Qualitative)

UNIT II SEMICONDUCTING MATERIALS 9

Introduction – Direct and indirect band gap semiconductors – Intrinsic semiconductors – Carrier concentration in intrinsic semiconductors – Determination of a band gap of a semiconductor – Law of mass action – Extrinsic semiconductors – Carrier concentration in N-type semiconductor – P-type semiconductors (Qualitative) – Hall effect – Determination of Hall coefficient – Applications

UNIT III MAGNETIC MATERIALS 9

Magnetic dipole – Magnetic permeabillity – Susceptibility – Classification of magnetic materials – Ferromagnetism – Domain theory – Hysteresis – Hard and soft magnetic materials – Ferrites – Structure – Applications – Magnetic principles in data storage devices – Magnetic bubble memories – Hall effect – Magnetic hard disc drives (GMR sensor)

UNIT IV SUPERCONDUCTING MATERIALS 9

Superconductors – Meissner effect – Persistent current – Critical temperature – Critical magnetic field – Isotope effect – Type I, Type II superconductors – Cooper pair – BCS theory of Superconductivity – High temperature superconductors – Josephson effect – SQUID – Cryotron – Magnetic levitation

UNIT V QUANTUM STRUCTURES AND SMART MATERIALS 9

Introduction – Electron density in bulk material – Size dependence of Fermi energy – Quantum confinement – Quantum structures – SiC – SMA – Phases – Characteristics – Applications – GAN – Rheological materials

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Kasap. S.O., "Principles of Electronic Materials and Devices", First Edition, McGraw-Hill Education, New Delhi, 2015
2. Kittel.C., "Introduction to Solid State Physics", First Edition, Wiley, New Delhi, 2015

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REFERENCES:

1. Hanson. G.W, "Fundamentals of Nanoelectronics", First Edition, Pearson Education, New Delhi,2012
2. A.K. Bandyopathyay, "Nanomaterials", New Age International Publishers, New Delhi, 2010
3. Pallab Bhattacharya, "Semiconductor Opto Electronic Devices", First Edition, PHI Leering Private Limited, New Delhi, 2017

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Outline the basic ideas of classical and quantum electron theories and energy band structures	Understand
CO2	Classify the semiconductors and its applications	Understand
CO3	Summarise the concept of the magnetic materials for data storage applications	Understand
CO4	Explain the properties of superconducting materials and its applications	Understand
CO5	Use the properties of quantum structures and smart materials to apply it in the field of engineering.	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO	3	2	1	-	-	-	-	-	-	-	-	1	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER I

UI9CY101	ENGINEERING CHEMISTRY I	Category: ES			
		L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the fundamentals of water technology and electrochemistry
- To understand basic knowledge of corrosion of metals and change of phases in alloys
- To acquire knowledge about the preparation, properties and applications of nanomaterial

UNIT I WATER 6

Hardness of water – types – problems in hardness calculations – estimation of hardness by EDTA – boiler feed water – boiler trouble (scale, sludge, priming, foaming and caustic embrittlement) – softening methods – internal treatment (phosphate & calgon) – external treatment (deionization process) – desalination of water- reverse osmosis

UNIT II ELECTROCHEMISTRY 6

Electrochemical cells – types – galvanic cells – redox reactions – EMF – concept of electrode potential - electrodes (Standard Hydrogen and Calomel electrode) – Nernst equation (derivation only) – electrochemical series and its applications – estimation of iron by potentiometry, determination of pH by pH metry

UNIT III CORROSION AND ITS CONTROL 6

Types – chemical corrosion – electrochemical corrosion (galvanic & differential aeration) – factors influencing corrosion – corrosion control methods – sacrificial anode and impressed current method – protective coating – electroplating – Ni plating

UNIT IV PHASE RULE AND ALLOYS 6

Phase rule – explanation of terms – advantages and limitations of phase rule – application of phase rule to one component system (water) – reduced phase rule – two component system (simple eutectic system - Lead – silver system) – alloys – definition – purpose of making alloys – ferrous (stainless steel), heat treatment – non-ferrous alloys (Brass -Dutch metal, German Silver)– composition, properties and uses

UNIT V NANOCHEMISTRY AND ITS APPLICATIONS 6

Types – properties of nanomaterials – size dependent properties – general methods of synthesis – top down (laser ablation and CVD) – bottom up (solvothermal and precipitation) – Application of nanotechnology (medicine, electronics, defence and agriculture)

LIST OF EXPERIMENTS

1. Determination of total, permanent and temporary hardness of a given sample water by EDTA method
2. Determination of chloride content in the water sample
3. Estimation of ferrous ion by potentiometric titration
4. Determination of strength of HCl by pH metric method
5. Determination of corrosion rate by weight loss method
6. Electroplating of Cu and electroless plating of Cu
7. Estimation of Copper in Brass by EDTA method

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Professor and Head
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KPR Institute of Engineering and Technology
Arasur, Coimb... 641 407

8. Determination of phase and degrees of freedom in $CuSO_4$. $5H_2O$/KI and water / $FeCl_3.12H_2O$ / phenol-water
9. Preparation of nano ruby (Al_2O_3-Cr) by combustion method
10. Preparation of nano ZnO by co-precipitation method

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

TEXT BOOKS:

1. Jain P C and Monika Jain, "Engineering Chemistry", 16th edition, Dhanpat Rai Publishing Company, Pvt. Ltd., New Delhi, 2015
2. Vairam S, Kalyani P and Suba Ramesh, "Engineering Chemistry", 2nd edition, Wiley India Pvt. Ltd., New Delhi, 2013

REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", 2nd edition, Scientific International Pvt. Ltd, New Delhi, 2014
2. Prasanta Rath, "Engineering Chemistry", 1st edition, Cengage Learning India, Pvt. Ltd, Delhi, 2015
3. Shikha Agarwal, "Engineering Chemistry, Fundamentals and Applications", 1st edition, Cambridge University Press, 2015

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

Cos	Statements	K-Level
CO1	Apply the principles of water technology in treatment of industrial and domestic water and estimate the various constituents of industrial water	Apply
CO2	Describe the utilization of electrochemical principles for chemical cells and determine experimentally the EMF of the cells	Understand
CO3	Outline the corrosion process and prevention methods that is adopted in industries	Understand
CO4	Examine the number of phases, components and variants in different heterogeneous systems, construct the phase diagrams and ferrous alloys, composition and applications and relate the change in properties due to heat treatment	Understand
CO5	Classify the different nano materials, recall their properties and relate them to applications.	Understand

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	2	-	1	1	-	1	-	-
CO2	3	1	-	-	-	-	2	-	1	1	-	1	-	-
CO3	3	1	-	-	-	-	2	-	1	1	-	1	-	-
CO4	3	1	-	-	-	-	2	-	1	1	-	1	-	-
CO5	3	1	-	-	-	-	2	-	1	1	-	1	-	-
CO	3	1	-	-	-	-	2	-	1	1	-	1	-	-
Correlation levels:	1: Slight (Low)				2: Moderate (Medium)					3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER I

U19CSG01	PROBLEM SOLVING USING PYTHON PROGRAMMING	Category: ES			
		L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn basics of computers and problem-solving techniques
- To understand syntax and semantics of python programming
- To develop simple python programs

UNIT I COMPUTER BASICS AND PROBLEM-SOLVING STRATEGIES 6

Introduction to Computers: Characteristics – Classification – Applications – Components – Hardware and Software – Algorithms – Algorithmic building blocks – Notations: Pseudo code– Flow chart – Programming language – Programming Paradigms – Computational thinking

UNIT II LANGUAGE BASICS 6

Python interpreter and interactive mode – Tokens – Data types – Numbers and math functions – Input and Output operations – Comments – Reserved words – Indentation – Operators and expressions – Precedence and associativity – Type conversion – Debugging – Common errors in Python – Classes and objects

UNIT III CONTROL STATEMENTS, FUNCTIONS AND MODULES 6

Selection/Conditional branching statements: if – if-else – Nested-if – elif statements – Iterative statements: while – for loop – break – continue and pass statements – Functions: Function Definition and Function call – Variable scope and Lifetime – Return statement – Lambda functions or Anonymous functions – Recursion – Modules and Packages

UNIT IV PYTHON DATA STRUCTURES 6

Strings: Slicing – Immutability – Built-in string methods and functions – Concatenating – Appending and Multiplying strings – String modules – Regular expressions – List: Creation – Accessing values – Slicing – List methods – In-built functions for Lists – Tuples: Creation – Operations on tuples – Traversing – Indexing and Slicing – Tuple assignment – In-built functions for tuples – Sets: Creation – Operations – Dictionaries: operations and methods

UNIT V EXCEPTION AND FILE HANDLING 6

Exceptions: Errors and Exceptions – Handling exception – Built-in and User-defined exceptions – Files: Types – Operations: Open – Read – Write – Close

LIST OF EXPERIMENTS

1. Algorithms, flowchart and pseudo code
2. Language basics
3. Input and output statements
4. Looping and decision-making statements
5. String operations
6. Recursive functions
7. Python data structures
8. Searching and Sorting
9. Generating histogram

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

10. File and exception handling

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

TEXT BOOKS:

1. Reema Thareja, "Python programming: Using problem solving approach" 1st edition, Oxford University Press, 2017
2. Roland Backhouse, "Algorithmic Problem Solving", 1st edition, John Wiley & Sons, 2011

REFERENCES:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, O'Reilly Publishers, 2016
2. Ashok Namdev Kamthane and Amit Ashok Kamthane, "Programming and Problem Solving with Python", 1st edition, McGraw Hill Education, 2018
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach". 1st edition, Pearson India Education Services Pvt. Ltd., 2016

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Interpret computer basics and algorithmic solutions for a given problem	Understand
CO2	Demonstrate the usage of data types, operators and expressions in python programming	Apply
CO3	Design python programs using functions, modules and packages	Apply
CO4	Develop programs using python data structures	Apply
CO5	Demonstrate the usage of exceptions and file handling	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	2	2	2	-	2	-	-
CO2	3	3	2	-	-	-	-	2	2	2	-	2	-	-
CO3	3	3	3	-	-	-	-	2	2	2	-	2	-	-
CO4	3	3	2	-	-	-	-	2	2	2	-	2	-	-
CO5	3	3	2	-	-	-	-	2	2	2	-	2	-	-
CO	3	2	2	-	-	-	-	2	2	2	-	2	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)							3: Substantial (High)			

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER I

U19CS101	ELECTRONIC DEVICES	Category: BS			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the operation of basic semiconductor devices and SMPS
- To acquire the knowledge of different transistors
- To learn the principle of amplifiers

UNIT I SEMICONDUCTOR DEVICES AND ITS APPLICATIONS 9

Semiconductor diodes-PN junction and Zener diode-construction – operation and characteristics – Applications – half wave, full wave and bridge rectifiers – Voltage regulator – SMPS

UNIT II BIPOLAR JUNCTION TRANSISTORS 9

BJT – types and operations – Input and output characteristics of CE, CB, CC – Early effect – Current equations – Biasing – Transistor as an amplifier and switch

UNIT III FIELD EFFECT TRANSISTORS 9

JFETs – Drain and Transfer characteristics – Current equations – Pinch off voltage and its significance – MOSFET – Characteristics – Threshold voltage – Channel length modulation – D-MOSFET, E-MOSFET – Characteristics – MOSFET as a switch

UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9

Metal-Semiconductor Junction – MESFET- Varactor diode – Tunnel diode – SCR: Construction, operation – Static characteristics – Switching characteristics

UNIT V OPERATIONAL AMPLIFIERS AND ITS APPLICATIONS 9

Introduction to operational amplifier – characteristics of op-amp – inverting amplifier – non inverting amplifier – summer – voltage follower – integrator – differentiator – comparator – instrumentation amplifier

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. David A. Bell," Electronic devices and circuits", Oxford University higher education, 5th edition 2008
2. Robert L. Boylestad, "Electronic Devices and Circuit Theory" Pearson education-10th edition, 2009

REFERENCES:

1. D.RoyChoudhry, Shail Jain, "Linear Integrated Circuits", 4th New Age International Pvt. Ltd, 2000
2. M. H. Rashid, "Power Electronics circuits devices and applications", 3rd edition, PHI, 2004

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Illustrate the operation and characteristics of basic semiconductor devices and SMPS	Understand
CO2	Compare different configurations of bipolar junction transistors	Understand
CO3	Interpret the construction of field effect transistors and its types	Understand
CO4	Describe the operation of special semiconductor devices	Understand
CO5	Infer the applications of operational amplifier	Understand

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO	2	1	-	-	-	-	-	-	-	-	-	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER I

U19CS102	WORKSHOP	Category: ES			
		L	T	P	C
		0	0	4	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire fundamentals of mechanical and civil engineering
- To understand the basics of electrical and electronics engineering
- To learn the PC assembling configuration and troubleshooting

LIST OF EXPERIMENTS

1. Study of welding, fitting and carpentry (Mechanical)
2. Study of pipeline joints, its location and function, valves, taps, coupling, union, reducers, elbows, in house hold fitting (Display and Explanation) (Civil)
3. Exercise:

   Demonstration of

   a. Basic pipeline connection

   b. Pipe connection with different joining components

   c. Mixed pipe connections with joints
4. House wiring (Display and Demonstration) (EEE & ECE)
5. Earthing practices and its significances (Demonstration)
6. Measurements and energy using energy meter (Demonstration)
7. Functionalities of RPS/AFO/CRO (Demonstration / Application)
8. Identifying electronic components and understanding PCB glossary. (Display and Explanation)
9. Conversion of schematic into PCB layout and PCB fabrication. (Display and Explanation)
10. Practicing of soldering and Desoldering. (Display and Explanation)
11. Assembling a SMPS in a cabinet, fixing a processor in a mother board (CSE)
12. Assembling RAM in a motherboard, pinning a cooling fan in a mother board
13. Assembling a hard disc drive in a cabinet, assembling a CD/DVD ROM in a cabinet. Fixing motherboard in a cabinet
14. Connecting the cables from the SMPS to motherboard, hard disc, drives & etc., establishing data connection to motherboard, hard disc, drives. Fixing wires for power restart switches, fixing wires for power & HDD LED's, fixing wires for external USB and Audio connections.
15. Hardware troubleshooting
16. Operating system and software installation
17. Configuration of internet

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Assemble/ setup and upgrade personal computer systems	Apply
CO2	Troubleshoot system, software, and hardware problems; configure legacy devices; develop and maintain compatibility with other network operating system platforms; boot a computer when windows OS is not functioning	Apply
CO3	Prepare configuration management of windows operating system	Apply
CO4	Discuss networking gateways and crimping methods	Apply
CO5	Configure and troubleshoot network problems	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	1	-	-	-	-	-	-	1	-	-
CO2	3	2	3	-	1	-	-	-	-	-	-	1	-	-
CO3	3	2	3	-	1	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	1	-	-	-	-	-	-	1	-	-
CO5	2	1	1	-	1	-	-	-	-	-	-	1	-	-
CO	3	2	2	-	1	-	-	-	-	-	-	1	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER II

U19LE201	ADVANCED COMMUNICATIVE ENGLISH	Category: HS			
		L	T	P	C
		1	0	2	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To foster their ability to develop communicative strategies and skills
- To strengthen the learners to evocate their listening skills and enhance writing ability
- To exhibit proactive reading strategies and speaking techniques

UNIT I LANGUAGE ADEPTNERS 9

Cloze test – Sentence completion – Relative clause – Transformation of sentences – Common errors – Discourse markers – Formal and Informal expressions – Framing questions – Figures of speech

UNIT II LISTENING 9

Listening to announcements – Interviews – Group discussions– Dialogues – News items – Documentaries – IELTS – GRE – TOEFL based listening

UNIT III SPEAKING 9

Real life situations through role play – Language use – Pronunciation – Stress and Intonation – Narrating events – Presentation – Group discussion

UNIT IV READING 9

Reading strategies – Reading comprehension – Reading short stories – Journal articles – Inferring editorial column – Cloze reading

UNIT V WRITING 9

Book review – Guided writing – Writing gadget review – Free writing – Rephrasing – Interpreting text – Email writing – Process description

LIST OF EXPERIMENTS

1. Listening for announcements
2. Listening to dialogues
3. Listening to documentaries
4. Listening to interviews
5. IELTS based listening
6. Role play
7. Product description
8. Group discussion
9. Book review
10. General presentation

Contact Periods:

Lecture: 15 Periods Tutorial: – Periods Practical: 30 Periods Total: 45 Periods

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

TEXT BOOKS:

1. K N Shoba, Lourdes JoavaniRayen, "Communicative English", First Edition, Cambridge University Press, 2017
2. Sudharshana N P and Savitha C, "English for Technical Communication", First Edition, Cambridge University Press, 2016

REFERENCES:

1. Murphy, Raymond, "Intermediate English Grammar", Second Edition, Cambridge University Press, 2009
2. Means, Thomas L, "English and Communication for Colleges", First Edition, Cengage, 2017
3. "Using English: A Course book for Undergraduate Engineers and Technologists", Orient BlackSwan, 2017

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Learning the effective reading strategy	Understand
CO2	Express opinions in real life situations	Understand
CO3	Construct academic and professional writing	Apply
CO4	Impart the listening ability in self learning	Apply
CO5	Adept to the needs of the second language learner in a grammatical context	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO2	-	-	-	-	-	2	-	2	-	2	-	1	-	-
CO3	-	-	-	-	-	2	-	-	2	2	-	-	-	-
CO4	-	-	-	-	-	-	-	-	2	2	-	1	-	-
CO5	-	-	-	-	-	-	2	2	-	2	-	1	-	-
CO	-	-	-	-	-	2	2	2	2	2	-	1	-	-
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)					3: Substantial (High)			

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER II

U19MA203	FOURIER SERIES AND PARTIAL DIFFERENTIAL EQUATIONS	Category: BS			
		L	T	P	C
		3	1	0	4

PRE–REQUISITES:

- U19MA101–Calculus and Differential Equations

COURSE OBJECTIVES:

- To understand vector calculus, which extends the basic concepts of Differential Calculus to Vector functions
- To apply Fourier series for periodic signals
- To apply and summarize the mathematical aspects that contribute to the solution of one-dimensional wave and heat equations

UNIT I MULTIPLE INTEGRALS 9 + 3

Double integrals – Change of order of integration – Triple integrals – Applications: Areas and Volume

UNIT II VECTOR CALCULUS 9 + 3

Gradient – Divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem – Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds

UNIT III FOURIER SERIES 9 + 3

Dirichlet's conditions – General Fourier series – Odd and Even functions – Half Range Series – Parseval's Identity – Harmonic analysis

UNIT IV PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Formation of Partial Differential Equations – Singular integrals – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Solution methods for second order homogeneous equations with constant coefficients

UNIT V BOUNDARY VALUE PROBLEMS 9 + 3

Classification of Partial Differential Equations – Fourier Series solutions of one-dimensional wave equation – one dimensional equation of heat conduction

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Total: 60 Periods

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics",10th edition, Wiley India Pvt Ltd, 2018
2. Grewal B. S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2017

REFERENCES:

1. Bali N. P. and Manish Goyal, "A text book of Engineering Mathematics", 12th Edition, Laxmi Publications, 2016
2. Wylie C. R. and Barrett L. C, "Advanced Engineering Mathematics", 6th Edition, Tata McGraw-Hill, New Delhi, 2016
3. Narayanan S, Manicavachagom Pillay T. K. and Ramanaiah G, "Advanced Mathematics for Engineering Students", Vol. II & III, 2nd edition, S. Viswanathan Publishers Pvt. Ltd, Chennai, 1998

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Sketch graph, differentiate, integrate and solve applied problems involving parametric equations	Apply
CO2	Analyze vector functions to find derivatives, tangent lines, integrals, arc length and curvature	Apply
CO3	Identify the periodicity of a function and formulate the same as a combination of sine and cosine	Apply
CO4	Use Partial Differential Equation through mathematical models	Apply
CO5	Analyze solutions boundary value problems in partial differential equations	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO	3	2	-	-	-	-	-	-	-	-	-	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER II

U19EEG02	BASICS OF ELECTRICAL ENGINEERING	Category: ES			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire the knowledge on basics of electrical circuits and machines
- To understand the operating principles of measuring instruments
- To explain the concept of illumination and domestic utilization of electrical energy

UNIT I BASIC CONCEPTS OF ELECTRIC CIRCUITS 9

Active elements – DC and AC sources – Passive elements – Elements in series and parallel connections – Star and delta conversion – Ohm's law and Kirchhoff's laws – Mesh and Nodal analysis – Power, power factor and energy

UNIT II DC AND AC MOTORS 9

Construction, principle of operation, characteristics and applications: DC motors – Single phase and three phase induction motors. **(Qualitative Analysis only)**

UNIT III MEASURING INSTRUMENTS AND PROTECTING DEVICES 9

Construction and working: MC meter – PMMC meter, MI meter – attraction and repulsion type, Wattmeter – Single element – Electrodynamo meter type – single phase energy meter. **(Qualitative Analysis only)**

UNIT IV ILLUMINATION 9

Importance of lighting – properties of good lighting scheme – types of lamps – lighting calculations – basic design of illumination schemes for residential, street lighting and factory lighting

UNIT V DOMESTIC UTILIZATION OF ELECTRICAL ENERGY 9

Types of fuses – switches – MCB, relays and cables – Grounding - Earthing – Types – Need for grounding and earthing – Lightning arrestors – types – Residential and industrial wiring – Installed and Generation Capacity of electricity in TN and India. **(Qualitative Analysis only)**

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Sudhakar A. and Shyam Mohan S.P., "Circuits and Network Analysis and Synthesis", 5th edition, McGraw Hill Education, New Delhi, 2017
2. Rajput R.K., "Electrical Machines", 6th edition, Laxmi Publications, 2016
3. Sawhney A.K., "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Co, 2010

REFERENCES:

1. Wadhwa C.L., "Generation, Distribution and Utilization of Electrical Energy", New Age International Pvt. Ltd, 2015
2. Sunil S. Rao, "Switchgear and Protection", 2nd edition, Khanna Publishers, 2018
3. Uppal S.L., "Electrical Wiring, Estimating and Costing", 8th edition, Khanna Publishers, 2018

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Apply basic laws to solve an electric network	Apply
CO2	Interpret the operating principles, characteristics and applications of DC motors and induction motors	Understand
CO3	Explain the construction and operation of measuring instruments	Understand
CO4	Estimate the lighting calculations for good illumination	Apply
CO5	Discuss the concept of electrical wiring with protection schemes	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	2	1	1	1	1	-	-	-	1	1	-	-
CO5	3	2	1	-	1	1	1	-	-	-	1	1	-	-
CO	3	2	1	1	1	1	1	-	-	-	1	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER II

U19CSG02	COMPUTATIONAL THINKING	Category: ES			
		L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- U19CSG01: Problem Solving Using Python Programming

COURSE OBJECTIVES:

- To formulate problems in a way that enables the use of a computer to solve them
- To logically organize and analyze data
- To identify, analyze and implement possible solutions with the goal of achieving the most efficient and effective combination of steps and resources

UNIT I PRINCIPLES OF COMPUTATIONAL THINKING 6

Programming – Algorithmic thinking – Bitwise and Boolean algebra – Compiler vs interpreter – Pseudo coding – Problem definition – Data collection – Problem decomposition – Abstraction – Flowcharting – Name binding – Selection – Repetition – Modularization – Sample exercise problems and deriving solutions.

UNIT II DATA ORGANIZATION & PROCESSING USING PYTHON 6

Operators – Variables and Data types – Loops and conditions – Nested loop – Strings – Euclid's algorithm – Arrays – Functions – Recursion

UNIT III REVERSE ENGINEERING & SOLUTIONS 6

Algorithm Tracing Technique (simulating execution) – Best practices – keeping it simple – documentation style – idioms – DRY code – naming conventions – and comments – Debugging Anticipating output from pseudo code

UNIT IV APPLIED COMPUTATIONAL THINKING 6

Operating systems basics – Networking basics – Database Management System (DBMS) – SQL – No SQL – JSON – API – XML

UNIT V EFFICIENCY ANALYSIS AND BENCHMARKING 6

Algorithm efficiency – Time complexity in programs – Mathematical preliminaries – Asymptotic analysis – Recurrence relations – Algorithm design paradigms – Divide and conquer algorithms – Dynamic programming – and Greedy algorithms

LIST OF EXPERIMENTS

1. Print the difference of indices of largest and smallest number in an array
2. Length of the longest substring without repeating characters
3. Prime factors of a given number
4. Product of the sum of diagonals of an array
5. The greatest common divisor (GCD) of two numbers – with & without Euclid's algorithm
6. Finding output of sequencing and looping puzzles
7. Finding output of pattern matching puzzles
8. Using only indexing technique- storing and retrieving Array elements (without library functions)
9. Add, subtract, multiply, and check for equality in the two given matrices (without library functions)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

10. Utilize the Pythagorean Theorem to calculate a third side of a right triangle, given the other two sides
11. Time complexity analysis – Tower of Hanoi (using Recursion) – 3 rods and n disks
12. Time complexity analysis – Tower of Hanoi (using Recursion) – 4 rods and n disks

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

TEXT BOOKS:

1. David Riley and Kenny Hunt, "Computational thinking for modern solver", Kindle Edition, Chapman & Hall/CRC, 2014
2. Karl Beecher," Computational Thinking: A beginner's guide to problem solving and programming", Kindle Edition, BCS, The Chartered Institute for IT, 2017

REFERENCES:

1. Paul Curzon and Peter William Mcowan," Power of Computational Thinking, The: Games, Magic and Puzzles To Help You Become A Computational Thinker", Kindle Edition, World Scientific Publishing Europe Ltd, 2017
2. Fabrizio Luccio, Paolo Ferragina," Computational Thinking: First Algorithms, Then Code", Kindle Edition, Springer,2018
3. Jane Krauss, Kiki Prottsman, "Computational Thinking and Coding for Every Student: The Teacher's Getting-Started Guide" Kindle Edition, SAGE Publications, 2016
4. GUVI Technical Learning Platform, Certifications, Assessments and FDP/FEM for KPRIET

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Understand the basic principles of Computational thinking	Understand
CO2	Examine the data organization and processing using Python	Apply
CO3	Understand the basic algorithm tracing techniques	Understand
CO4	Explore the basics of operating system, networking, database management system, API and XML	Analyze
CO5	Determine efficiency of algorithms	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	2	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	2	2	2	-	-	-	-	-	-	2	-	-
CO4	3	–	–	2	2	-	-	-	-	-	-	2	-	-
CO5	3	3	3	2	–	-	-	-	-	-	-	2	-	-
CO	3	2	2	2	2	-	-	-	-	-	-	2	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER II

U19CS201	DIGITAL LOGIC AND DESIGN	Category: ES			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire the basics of digital systems
- To understand various combinational and sequential logic circuits
- To learn memory and programmable logic devices

UNIT I DIGITAL SYSTEMS AND BINARY NUMBERS 9

Digital systems – Binary numbers – Number-base conversions – Octal and hexadecimal numbers – Complements of numbers – Signed binary numbers – Binary codes – Binary storage and registers – Binary logic – Logic gates

UNIT II BOOLEAN ALGEBRA AND SIMPLIFICATION 9

Introduction – Basic definitions – Axiomatic definition of Boolean algebra – Basic theorems and Properties of Boolean algebra – Boolean functions – Canonical and standard forms – K-map method – Four variable K-map – Don't-care conditions – NAND and NOR implementation – Quine McCluskey method

UNIT III COMBINATIONAL LOGICS AND CIRCUITS 9

Introduction – Combinational circuits – Analysis procedure – Design procedure – Binary adder and subtractor – Decimal adder – Binary multiplier – Magnitude comparator – Decoders – Encoders – Multiplexers – Demultiplexers

UNIT IV SEQUENTIAL LOGICS AND CIRCUITS 9

Introduction – Sequential circuits – Storage elements: Latches and Flip-Flops (RS, T, D, JK, and JKMS) – Analysis of clocked sequential circuits – State reduction and assignment – Design procedure – Registers – Shift registers – Ripple counters – Synchronous counters

UNIT V MEMORY AND PROGRAMMABLE LOGIC 9

Introduction – Random-access memory – Memory decoding – Error detection and correction – Read-only memory – Programmable logic array – Programmable array logic – Sequential programmable devices

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog", 6th edition, Pearson Education, 2018
2. C. H. Roth Jr., Larry L. Kinney "Fundamentals of Logic Design", 7th edition, Cengage Learning, 2014

REFERENCES:

1. Donald P Leach, Albert Paul Malvino, Goutam Saha, "Digital Principles and Applications", 8th edition, Tata McGraw Hill Education Pvt. Ltd., 2016
2. Raj Kamal, "Digital Systems Principles and Design", 1st edition, Pearson Education, 2014
3. Donald D. Givone, "Digital Principles and Design", 7th edition, McGraw-Hill, 2010

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

Cos	Statements	K-Level
CO1	Apply the principles of number systems and binary codes to perform arithmetic and code conversions	Apply
CO2	Make use of theorems and postulates of Boolean algebra, K-Map and tabulation techniques for simplification of logic functions	Understand
CO3	Design and implement different combinational logic circuits	Apply
CO4	Design and Analyse different sequential logic circuits	Analyze
CO5	Build various digital circuits using programmable logic devices	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	2	2	-		-	-
CO2	3	3	2	-	-	-	-	-	2	2	-		-	-
CO3	3	3	3	-	-	-	-	-	2	2	-	2	-	-
CO4	3	3	3	-	-	-	-	-	2	2	-	2	-	-
CO5	3	3	3	-	-	-	-	-	2	2	-	2	-	-
CO	3	3	3	-	-	-	-	-	2	2	-	2	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER II

U19MEG01	ENGINEERING GRAPHICS	Category: ES			
		L	T	P	C
		1	0	4	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- The students will be exposed to standards and conventions followed in preparation of engineering drawings
- The students will understand the concepts of orthographic and isometric projections using CAD software to know the memory units and programmable logic
- The students will develop the ability of producing engineering drawings and conveying the information through drawings using CAD software

BASICS OF ENGINEERING DRAWING AND CAD (Not for examination) 3

Introduction – drawing instruments and its uses – sheet layout – BIS conventions – lines – lettering and dimensioning practices lines – Co-ordinate points, axes – poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. agency, parallelism, inclination and perpendicularity

UNIT I CONICS, SPECIAL CURVES AND PROJECTION OF POINTS 3+12

Construction of parabola, ellipse and hyperbola using eccentricity method – construction of involutes for squares and circles – Construction of Tangent and normal to the above curves – Introduction – method of projection – planes of projection – reference line and notations – Orthographic Projection of points: Points in all the four quadrants

UNIT II PROJECTION OF STRAIGHT LINES AND SURFACES 3+12

Projection of straight lines: Lines inclinedto HP/VP plane – inclined to both HP and VP planes (straight lines are assumed to be in first quadrant only) – Projection of planes: Projection of square, rectangle, pentagon, hexagon and circular plane – inclined to both the plane by change of position method

UNIT III PROJECTION OFSOLIDS 3+12

Introduction – Projection of solids: prisms, pyramids, cylinders and cones with axis inclined to both the planes. (Solids resting on HP only)

UNIT IV DEVELOPMENT OF LATERAL SURFACES OF SOLIDS 3+12

Introduction – Cutting plane, sectional views of right regular solids resting with base on HP: prisms, pyramids, cylinder and cone and true shapes of the sections – Development of lateral surfaces of right regular prisms, pyramids, cylinders, cones resting with base on HP only – Development of their frustums and truncations.

UNIT V ORTHOGRAPHIC AND ISOMETRICPROJECTIONS 3+12

Orthographic projection: Simple machine components using free hand sketching – Isometric projection: Simple Solid exercises and combination of solids

Contact Periods:

Lecture: 15 Periods Tutorial: – Periods Practical: 60 Periods Total: 75 Periods

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

TEXT BOOKS:

1. ND Bhat & VM Panchal, "Engineering Drawing", Gujarat, 51st edition, Charotar Publishing House, 2013
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", First Edition, New Age International (P) Limited, 2010

REFERENCES:

1. Natarajan K.V., "A text book of Engineering Graphics", First Edition, Dhanalakshmi Publishers, Chennai, 2017
2. Sam Tickoo, "AutoCAD 2013 for Engineers and Designers", First Edition, Dreamtech Press, 2013
3. M.H. Annaiah & Rajashekar Patil, "Computer Aided Engineering Drawing", 4th Edition, New Age International Publishers 2012
4. Basant Aggarwal, "Engineering Drawing", 1st edition, Tata McGraw Hill Education Private Limited, 2010
5. D.M. Kulkarni, A.P. Rastogi, A.K. Sarkar, "Engineering Graphics with AutoCAD", Revised Edition, PHI Learning Private Limited, New Delhi, 2010

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

Cos	Statements	K-Level
CO1	Sketch curves, orthographic projections of points as per BIS conventions.	Apply
CO2	Illustrate the orthographic projections of straight lines and plane surfaces	Apply
CO3	Depict the orthographic projections of solids, lateral surfaces of frustums, truncated solids and its development	Apply
CO4	Translate pictorial and isometric views of simple objects to orthographic views	Apply
CO5	Convert the orthographic views into isometric projections	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	2	-	-	-	-	1	-	1	-	-
CO2	3	2	-	-	2	-	-	-	-	1	-	1	-	-
CO3	3	2	-	-	2	-	-	-	-	1	-	1	-	-
CO4	3	2	-	-	2	-	-	-	-	1	-	1	-	-
CO5	3	2	-	-	2	-	-	-	-	1	-	1	-	-
CO	3	2	-	-	2	-	-	-	-	1	-	1	-	-
Correlation levels:	1: Slight (Low)				2: Moderate (Medium)					3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER II

U19CS203	DIGITAL LOGIC AND DESIGN LAB	Category: ES			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To study and implement Boolean Theorems and Boolean Functions
- To implement various combinational logic circuits
- To implement various sequential logic circuits

LIST OF EXPERIMENTS

1. Verification of Boolean Theorems and implementation of Boolean Functions
2. Design and implement half adder, full adder and parallel binary adder
3. Design and implement BCD adder
4. Realization of Boolean Function using multiplexer
5. Realization of Boolean Function using decoder
6. Construct and implement 2-bit magnitude comparator
7. Design and implement code converters
8. Design and implement ripple counters
9. Design and implement synchronous counters
10. Design and implement 4-bit shift register

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Verify truth tables of Boolean theorems	Understand
CO2	Implement combinational circuits using MSI devices	Apply
CO3	Build combinational logic circuits for a given application using logic gates, multiplexers, decoders and encoders	Apply
CO4	Build sequential logic circuits for a given application using logic gates and flip flops	Apply
CO5	Design different types of counters and registers using flip-flops	Analyze

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	1	-	-
CO2	3	3	2	-	-	-	-	1	-	-	-	1	-	-
CO3	3	3	3	-	-	-	-	1	-	-	-	1	-	-
CO4	3	3	3	-	-	-	-	1	1	1	-	1	-	-
CO5	3	3	3	-	-	-	-	1	1	1	-	1	-	-
CO	3	3	3	-	-	-	-	1	1	1	-	1	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER III

U19CS301	ETHICS AND HOLISTIC LIFE	Category: HS			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the importance of human life and ethical decision making capability
- To learn various ability like leadership, personal and social responsibilities
- To understand the human welfare development and responsibilities

UNIT I HUMAN LIFE, ITS AIM AND SIGNIFICANCE 9

Importance of human values – The concept of a successful life – Happy life and a meaningful life – Ethical and decision making capability and its development: Meaning of Ethical dilemma – Stress management – Sharing real life experiences

UNIT II CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT 9

Intellectual, Emotional, Creative, Ethical – spiritual development – Aesthetic sense – Self-dependency – Activeness – Development of positive attitude – Planning and prioritizing – Time management

UNIT III HARMONY IN PERSONAL AND SOCIAL LIFE 9

Concept of personal and group Ethics; Balance between rights and duties – welfare of self and welfare of all – Interpersonal Skills – Creating a value-based work culture in hostel – classroom and other places in the campus and society

UNIT IV CHARACTER, RIGHTEOUSNESS AND VIRTUES FOR A MEANINGFUL LIFE 9

Attitude – Egolessness – Humility – Righteousness – Purity – Sharing – Truthfulness – Integrity – Self-restraint – Self-control – Sense of responsibility – Empathy – Love – Compassion – Maitri / Comradeship – Cooperation – Tolerance

UNIT V DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE 9

Science – Technology – Consumerism – Relation with Nature and Environment – New Dimension of Global Harmony: Democracy, Equality, Social Justice

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. S. K. Chakraborty, Debangshu Chakraborty, "Human Values and Ethics, In search of Organisational Integrity", Himalaya Publishing House, 2013
2. World Community Service Centre, 'Value Education', Vethathiri publications, Erode, 2011

REFERENCES:

1. A. N. Tripati, "Human Values", First Edition, New Age International, 2009
2. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Understand the significance of human life	Understand
CO2	Understand the qualities required to become a leader	Understand
CO3	Understand the harmony involved in personal and social life	Understand
CO4	Understand the importance of self-control and sense of responsibility	Understand
CO5	Understand the relation with nature and environment	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2	-	3	1	1	-	3	-	-
CO2	-	-	-	-	-	3	-	3	1	1	-	3	-	-
CO3	-	-	-	-	-	3	-	3	1	1	-	3	-	-
CO4	-	-	-	-	-	3	-	3	2	2	-	3	-	-
CO5	-	-	-	-	-	3	3	3	2	2	-	3	-	-
CO	-	-	-	-	-	2.8	3	3	1.4	1.4	-	3	-	-
Correlation levels:	1: Slight (Low)					2: Moderate (Medium)						3: Substantial (High)		

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER III

U19MA304	DISCRETE MATHEMATICS	Category: BS			
		L	T	P	C
		3	1	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of mathematical logic for analyzing propositions and proving theorems
- To understand the concepts of Permutations, Combination and Pigeonhole principle and apply it in logical reasoning
- To apply the concepts of Graph Theory, Lattices and Boolean Algebra in networks

UNIT I LOGIC **9 + 3**

Propositional logic – Propositional equivalences – Inconsistency Predicates – Quantifiers – Rules of inference – Introduction to proofs – Method of proofs

UNIT II COMBINATORICS **9 + 3**

Basics of counting – Pigeonhole principle – Permutations and Combinations – Recurrence Relations – Generating functions – Inclusion and Exclusion principle – Mathematical Induction

UNIT III GRAPH **9 + 3**

Graphs and graph models – Graph terminology and special types of Graphs – Matrix representation of graphs and Graph isomorphism – Connectivity – Euler and Hamilton paths – Shortest path

UNIT IV ALGEBRAIC STRUCTURES **9 + 3**

Algebraic systems – Semi Groups and Monoids – Groups – Subgroups – Homomorphism's Normal subgroup and cosets – Lagrange's Theorem – Rings and Fields (Definitions)

UNIT V LATTICES AND BOOLEAN ALGEBRA **9 + 3**

Partial ordering – Posets – Lattices – Properties of lattices – Lattices as algebraic systems – Sub lattices – Boolean Algebra – Applications: Switching circuits

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Total: 60 Periods

TEXT BOOKS:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2016
2. Tremblay J. P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", 7th Edition, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2011

REFERENCES:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, Delhi, 2014
2. Thomas Koshy, "Discrete Mathematics with Applications", 1st edition, Elsevier Publications, 2008
3. Seymour Lipschutz and Mark Lipson, "Discrete Mathematics", 3rd Edition, Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2010

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO5	3	3	1	-	-	-	-	-	-	-	-	1	-	-
CO	3	2.2	1	-	-	-	-	-	-	-	-	1	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Analyze logical propositions via truth tables	Analyze
CO2	Apply basic counting techniques to solve combinatorial problems	Apply
CO3	Apply graph theory models of data structures to solve problems of connectivity and constraint satisfaction	Apply
CO4	Distinguish the characteristics of Group, Rings and Field	Apply
CO5	Use homomorphism of Lattices and Boolean Algebra and apply it in switching circuits.	Apply

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER III

U19CS302	COMPUTER ARCHITECTURE AND MICROPROCESSORS	Category: ES			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the architecture of the computer
- To learn the design aspects of I/O and Memory Interfacing circuits
- To learn assembly language programming using 8086 microprocessors

UNIT I STRUCTURED COMPUTER ORGANIZATION AND CENTRAL PROCESSING UNIT 9

Evolution of generation of computers and multilevel machines – Introduction to types of computers – CPU organization and data path in a simple – Von Neumann architecture and instruction execution – Principles of RISC and CISC and their design principles – Features and evolution of Intel x86 architecture – Performance assessment of processors

UNIT II MEMORY SYSTEM 9

Basic concepts and internal organization of static and dynamic memory chips and modules – Structure of larger memories – Synchronous DRAM and its bus cycle – Characteristics of memory systems and memory hierarchy – Cache memory principles – SSD and flash memory organization and read operation – Principles and operation of magnetic disks – Features of IDE and SCSI disks – Overview of DMA operation

UNIT III I/O ORGANIZATION 9

Bus Structure – operation of synchronous and asynchronous buses and bus arbitration – Features of USB and its architecture – Features and configuration of PCI and PCIe buses – Overview of programmed I/O and interrupt driven I/O techniques

UNIT IV 8086 ARCHITECTURE 9

General operation of a computer – 8086 Architecture – Pin details of 8086 – Addressing modes – Instruction formats – Basic 8086 configurations – minimum mode, maximum Mode – Introduction to Raspberry Pi

UNIT V ASSEMBLY LANGUAGE PROGRAMMING 9

Assembler instruction format – Data Transfer instructions – Arithmetic Instructions – Branch Instructions – loop instructions – NOP and HLT instructions – Flag manipulation instructions – Logical instructions – Shift instructions – Rotate instructions – Byte and string manipulation – Assembly Language Programs – Cross compilers

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Andrew S Tanenbaum and Todd Austin, Structured Computer Organization, Sixth edition, Pearson, 2013
2. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family – Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2016

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. William Stallings, "Computer Organization and Architecture Designing for Performance", 8th edition, Prentice Hall, 2010
2. Carl Hamacher, "Computer Organization and Embedded Systems", 6th edition, McGraw Hill, 2012

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Elaborate the basic structure and operation of a digital computer	Understand
CO2	Summarize the operations of memory systems.	Understand
CO3	Clarify the operation of I/O bus and its configuration	Understand
CO4	Discuss the basic concepts, architecture, data transfer schemes and instruction set architecture of 8086 microprocessor	Understand
CO5	Develop and implement the programs on 8086 microprocessors	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	-	-	-	-	1	-	2	-	2
CO2	2	1	-	1	-	-	-	-	-	1	-	2	-	2
CO3	2	1	-	1	-	-	-	-	-	1	-	2	-	2
CO4	2	1	-	1	-	-	-	-	-	2	-	2	-	2
CO5	3	2	2	2	2	-	-	-	-	2	-	3	-	3
CO	2.2	1.2	2	1.2	2	-	-	-	-	1.4	-	2.2	-	2.2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER III

U19CS303	DATA STRUCTURES	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To write simple programs using C programming constructs
- To understand arrays, pointers and use functions and structures
- To learn and construct List, Stack, Queue Abstract Data Types (ADTs) and Trees

UNIT I PROGRAMMING FUNDAMENTALS IN C LANGUAGE 9

Structure of C program – Data Types – Storage classes – Constants – Enumeration Constants – Keywords – Operators: Precedence and Associativity – Expressions – Input / Output statements – Assignment statements – Decision making statements – Switch statement – Looping statements – Pre-processor directives – Strings: declaration – initialization – operations on strings

UNIT II ARRAYS AND POINTERS 9

Introduction to Arrays: Declaration, Initialization – One dimensional array – Two dimensional arrays – Multi dimensional arrays – Pointers: Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers

UNIT III FUNCTIONS AND STRUCTURES 9

Introduction to functions: Function prototype – function definition – function call – Call by value – Call by reference – function types – Built-in functions – Recursive functions – Structure – Nested structures – Self-referential structures

UNIT IV LINEAR DATA STRUCTURES 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation - singly linked lists – doubly-linked lists – circularly linked lists – Stack ADT – Operations – Applications – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue – Sorting – Searching

UNIT V NON-LINEAR DATA STRUCTURES – TREES 9

Trees – Binary Trees – Complete binary tree – Full binary tree – Skewed binary tree – Binary tree representation and binary tree traversals – Binary Search Trees – Operations in binary search tree – AVL Trees – Rotations

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Reema Thareja, "Programming in C", 1st edition, Oxford University Press, 2018
2. Reema Thareja, "Data structures using C", 1st edition, Oxford University Press, 2014

REFERENCES:

1. Pradip Dey, Manas Gosh, "Programming in C", 1st edition, Oxford University Press, 2018
2. Herbert Schildt, "C: The Complete Reference", 4th edition, McGraw Hill Education, 2017
3. R. Venkatesan, S. Lovelyn Rose, "Data Structures", 2nd edition, Wiley, 2019

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Apply the programming fundamentals in C language with basic operations	Apply
CO2	Analyze the use of arrays and pointers to write simple C programs	Analyze
CO3	Apply the concept of functions and structures in C	Apply
CO4	Analyze the implementation of List ADTs, Stack, Queue, searching and sorting in C	Analyze
CO5	Apply the nonlinear data structures using tree concept in C	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	2	-	2	2	-
CO2	3	3	2	2	-	-	-	-	-	3	-	3	3	-
CO3	3	2	3	1	-	-	-	-	-	2	-	2	2	-
CO4	3	3	2	2	-	-	-	-	-	3	-	3	3	-
CO5	3	2	2	1	-	-	-	-	-	2	-	2	2	-
CO	3	2.4	2.2	1.4	-	-	-	-	-	2.4	-	2.4	2.4	-
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER III

U19CS304	SOFTWARE ENGINEERING	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the phases in a software project development
- To understand fundamental concepts of requirements engineering and analysis modeling
- To study various software design, testing and maintenance methodologies

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 9

Introduction to Software Engineering – Software Process – Perspective and Specialized Process Models – Introduction to Agility – Agile process – Extreme programming–XP Process

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional and Non-Functional – User requirements – System requirements – Software Requirements Document – Requirement Engineering Process: Feasibility Studies – Requirements elicitation and analysis – requirements validation – requirements management – Classical analysis: Structured system Analysis – Petri Nets – Data Dictionary

UNIT III SOFTWARE DESIGN 9

Design process – Design Concepts – Design Model – Design Heuristic – Architectural Design – Architectural styles – Architectural Design – Architectural Mapping using Data Flow – User Interface Design: Interface analysis – Interface Design – Component level Design: Designing Class based components – traditional Components

UNIT IV TESTING AND MAINTENANCE 9

Software testing fundamentals – white box testing – basis path testing – control structure testing – black box testing – Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing And Debugging – Software Implementation Techniques: Coding practices – Refactoring-Maintenance and Reengineering – BPR model – Reengineering process model – Reverse and Forward Engineering

UNIT V PROJECT MANAGEMENT 9

Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision – COCOMO I & II Model – Project Scheduling – Scheduling – Earned Value Analysis Planning – Project Plan – Planning Process – RFP Risk Management – Identification – Projection – Risk Management – Risk Identification – RMMM Plan – CASE TOOLS

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering – A Practitioner"s Approach", 8th edition, Mc Graw-Hill International Edition, 2015
2. Ian Sommerville, "Software Engineering", 10th edition, Pearson Education Asia, 2013

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. Rajib Mall, "Fundamentals of Software Engineering", 3rd edition, Prentice Hall of India Pvt Ltd, 2009
2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010
3. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Identify the key activities in managing a software project and compare different process models	Understand
CO2	Utilize the requirements engineering and Analysis Modelling	Apply
CO3	Apply systematic procedure for software design and deployment	Apply
CO4	Compare and contrast the various testing and maintenance	Apply
CO5	Manage project schedule, estimate project cost and effort required	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	1	2	2	2	-	1
CO2	3	2	1	1	-	-	-	-	1	3	3	3	-	1
CO3	3	2	2	2	-	-	-	-	1	3	3	3	-	2
CO4	3	2	2	2	-	-	-	-	2	3	3	3	-	2
CO5	3	2	2	2	2	-	-	-	2	3	3	3	-	2
CO	2.8	1.8	1.6	1.6	2	-	-	-	1.4	2.8	2.8	2.8	-	1.6
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER III

U19CS305	APPLICATION DEVELOPMENT PRACTICES	Category: ES			
		L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- U19CSG02-Computational Thinking

COURSE OBJECTIVES:

- To analyze the requirements for and create and implement the principles of web page development
- To create and use cascading style sheets (CSS) with various positioning
- To know how to insert multimedia files in a web page

UNIT I INTRODUCTION 6

HTML Editors – CSS JS – Basics – Formatting – Quotations – Meta tags

UNIT II CASCADING STYLE SHEETS 6

Introduction to CSS – Basics – Text – fonts – icons – links – Box Model – Backgrounds – Borders – Margins – Positioning

UNIT III CSS POSITIONING 6

Comments – Links – Images – Tables – Lists – Padding – Height – Width – Inline Styles – Visibility – Positioning – Layers – z-index

UNIT IV CSS3 6

Classes & ID – Media, Video, Audio, Youtube – CSS3 – Rounded Corner, Border Images – Multi Background – Multi Columns – CSS3 – Color – Gradients – Shadow – Text – 2d & 3d Transform – Animation – Media Query

UNIT V HTML5 6

Introduction to HTML5 – Form Elements – HTML5 Features – SVG – Canvas – Local Storage – Add – Display – Edit – Update – Delete – Clear

LIST OF EXPERIMENTS

1. Create a web page with the following using HTML
   a. To embed an image map in a web page
   b. To fix the hot spots and show all the related information when the hot spots are clicked
   c. Create a web page with all types of Cascading style sheets
   d. Design of web pages – Use of Cascading style sheets to style the way a webpage looks
   e. Incorporating multimedia into a webpage (Text / Audio / Image / Video / Animation)
   f. Designing a static website using content management frameworks

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

TEXT BOOKS:

1. Thomas A Powal, HTML & CSS: The Complete Reference, 5th edition, McGraw Hill Education, 2017
2. Andy Harris, "HTML5 and CSS3 All-in-One for Dummies", 3rd edition, John Wiley & Sons, 2015
3. Mark A Lassoff, "HTML and CSS for Beginners with Html5",1st edition Learntoprogram TV, Inc, 2015

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. John Dean, Web Programming with HTML5, CSS, and JavaScript Pap/Psc, 1st edition, Jones and Bartlett Learning,2019
2. Jon Duckett, HTML & CSS Design and Build and Websites, 1st edition, John Wiley & Sons, 2011
3. Web reference: Course "HTML & CSS" – www.guvi.in

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Describe the purpose of HTML and CSS in web development	Understand
CO2	Use CSS to control text styles and layout	Apply
CO3	Use HTML to construct a web page with paragraphs, divs, images, links, and lists	Apply
CO4	Add styles to a web page with CSS3 IDs, classes and multimedia options	Apply
CO5	Make use of HTML5 and its features to develop a website	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	-	-	1	2	2	-	1	1	-
CO2	3	2	2	2	2	2	-	1	2	2	-	2	2	-
CO3	3	2	3	2	3	2	-	1	2	2	-	2	2	-
CO4	3	2	3	2	3	2	-	1	2	2	-	2	2	-
CO5	3	2	3	2	2	2	-	1	2	2	-	2	2	-
CO	2.8	1.8	2.8	1.8	2.5	2	-	1	2	2	-	1.8	1.8	-
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER III

U19CS307	DATA STRUCTURES LABORATORY	Category: PC			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To write simple programs using C programming constructs with arrays and pointers
- To learn applications in C using functions and structures
- To understand linear data structures List, Stack and Queue ADTs (Abstract Data Types) using C

LIST OF EXPERIMENTS

1. Write a C program to get various shape information (Circle, Square, Rectangle, etc.,) and print the area and circumference.
2. Design a simple mathematical calculator using C.
3. Create a C application to get employee information for a reputed school and print the pay-slip of employees. Consider various possible roles in the school and perform the pay-slip generation.
4. Design and develop a health application that computes the Body Mass Index (BMI) of the individuals given with height and weight of persons and suggest the diet plan.
5. Design and develop a number converter that performs the decimal number into binary, octal and hexadecimal numbers using user defined functions and vice-versa.
6. Create a word processor which could perform the following on a paragraph:
   - Find the total number of words.
   - Capitalize the first word of each sentence.
   - Replace a given word with another word.
7. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using structures and pointers.
8. Creation of Array and linked list implementation of Stack and Queue ADTs
9. Choose an appropriate data structure and create a token system for banking service (withdrawal, deposit and money transfer).
10. Create a food delivering system which allocates the path for delivery of food using appropriate data structures.
11. Create a book rack allocation system in a library, which allocates appropriate space for the books based on category using appropriate data structures.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Apply the programming fundamentals in C language with basic operations	Apply
CO2	Analyze the use of arrays and pointers to write simple C programs	Analyze
CO3	Apply the concept of functions and structures in C	Apply
CO4	Analyze the implementation of List ADTs, Stack, Queue, searching and sorting in C	Analyze
CO5	Apply the nonlinear data structures using tree concept in C	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	1	2	2	-	3	2	-
CO2	3	3	2	2	-	-	-	1	2	2	-	3	3	-
CO3	3	2	3	2	-	-	-	1	2	2	-	3	2	-
CO4	3	3	2	2	-	2	1	1	2	2	-	3	3	-
CO5	3	2	2	2	-	-	1	1	2	2	-	3	2	-
CO	3	2.4	2.2	2	-	2	1	1	2	2	-	3	2.4	-
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of [illegible]
KPR Institute of [illegible] and Technology
Arasur, Coimbatore- 641 407

SEMESTER III

U19CS308	CASE TOOLS LABORATORY	Category: ES			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To collect the functional and nonfunctional requirements for a software system
- To design the system using the UML diagrams for the given specification
- To learn with testing techniques and test the software system thoroughly for all scenarios

LIST OF EXPERIMENTS

1. Identify a software system that needs to be developed
2. Document the Software Requirements Specification (SRS) for the identified system
3. Identify use cases and develop the Use Case model
4. Identify the conceptual classes and develop a Domain Model and also derive a Class Diagram
5. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence and Collaboration Diagrams
6. Draw relevant State Chart and Activity Diagrams for the same system
7. Implement the system as per the detailed design
8. Test the software system for all the scenarios identified as per the usecase diagram
9. Improve the reusability and maintainability of the software system by applying appropriate design patterns
10. Implement the modified system and test it for various scenarios

SUGGESTED DOMAINS FOR MINI-PROJECT:

1. Android task monitoring
2. Fingerprint-based ATM system
3. Image encryption using AES algorithm
4. Fingerprint voting system
5. Weather forecasting system
6. Railway tracking and arrival time prediction system
7. Android Patient Tracker
8. Opinion mining for social networking platforms
9. Automated payroll system with GPS tracking and image capture
10. Data leakage detection system
11. Credit card fraud detection
12. AI shopping system
13. Camera motion sensor system

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

14. e-Learning platform
15. Smart health prediction system

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Perform OO analysis and design for a given problem specification	Analyze
CO2	Use the UML analysis and design diagrams	Analyze
CO3	Apply appropriate design patterns	Apply
CO4	Create code from design	Apply
CO5	Test the compliance of the software with the SRS	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	-	2	-	1	2	2	3	3	-	2
CO2	3	3	2	3	3	2	-	1	2	2	3	3	-	2
CO3	3	2	2	2	3	2	-	1	2	2	2	2	-	1
CO4	3	2	2	3	3	2	2	1	2	2	2	2	-	1
CO5	3	3	2	3	3	2	2	1	2	2	3	3	-	2
CO	3	2.6	2	2.8	3	2	2	1	2	2	2.6	2.6	-	1.6
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)						

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER IV

U19MA404	PROBABILITY AND QUEUEING THEORY	Category: BS			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the mathematical concepts of probability, one and two dimensional random variables and distributions
- To understand the concepts of random processes which are widely used in IT fields
- To learn the concept of queueing models in the field of engineering

UNIT I PROBABILITY 9

Probability – Axioms of probability – Conditional probability – Total probability – Baye's theorem – Discrete and continuous random variables – Moments – Moment generating functions

UNIT II DISTRIBUTION FUNCTIONS 9

Binomial, Poisson, Exponential, Uniform and Normal distributions–Applications

UNIT III TWO – DIMENSIONAL RANDOM VARIABLES 9

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression

UNIT IV RANDOM PROCESSES 9

Classification – Stationary Process – Markov Process – Poisson Process – Discrete parameter Markov Chain

UNIT V QUEUEING MODELS 9

Markovian Queues – Birth and Death Processes – Single and Multiple server Queueing models – Little's formulas with finite waiting rooms

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Oliver C. Ibe, "Fundamentals of Applied probability and Random processes", 2nd edition, Elsevier, 2014
2. Gross D and HarrisC. M, "Fundamentals of Queueing Theory", 4th edition Wiley, 2012

REFERENCES:

1. AllenA. O, "Probability, Statistics and Queueing Theory with computer applications", 2nd edition, Elsevier, 2005
2. TahaH. A, "Operations Research", 9th edition, Pearson Education, 2014
3. TrivediK. S, "Probability and Statistics with Reliability, Queueing and computer science Applications", 2nd edition, John wiley and sons, 2012
4. Narayanan S, Manicavachagom PillayT. K and Ramanaiah G, "Advanced Mathematics for Engineering Students", Vol. II & III, 2nd edition, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Apply probability theory and random variable as a need for the analysis of random experiment	Apply
CO2	Use discrete and continuous probability distributions including requirements, mean and variance for making decisions	Apply
CO3	Distinguish correlation and linear regression in two dimensional random variables	Apply
CO4	Apply Poisson and Markov Process in low pass and band pass noise models	Apply
CO5	Compute the traffic intensity, blocked traffic and the utilization of some queuing systems	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	1	-	-
CO	3	2	1	-	-	-	-	-	-	-	-	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER IV

U19CS401	OPERATING SYSTEMS	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the basic concepts and functions of operating systems, processes and threads
- To study Scheduling algorithms and deadlocks
- To understand various memory management schemes, I/O management and file systems

UNIT I OPERATING SYSTEM OVERVIEW 9

Computer System Overview – Basic Elements – Instruction Execution – Interrupts – Memory Hierarchy – Cache Memory – Direct Memory Access – Operating system overview – objectives and functions – System Calls – System Programs – OS Generation and System Boot.

UNIT II PROCESS MANAGEMENT 9

Processes – CPU Scheduling – Process synchronization – Deadlock Detection – Deadlock Prevention – Deadlock Avoidance – Deadlock Recovery.

UNIT III MEMORY MANAGEMENT 9

Main Memory – Swapping – Paging – Segmentation – Virtual Memory – Demand paging – Page Replacement.

UNIT IV STORAGE MANAGEMENT 9

File System structure – Allocation methods – free space management – Disk Structure, Disk Scheduling, Swap - Space Management.

UNIT V CASE STUDY 9

Linux System – Design Principles – Kernel Modules – Process Management – Mobile OS – iOS and Android – Architecture and SDK Framework – Media Layer – Services Layer – Core OS Layer – File System – Docker and LXC Study.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th edition, John Wiley and Sons Inc., 2012

REFERENCES:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems: A Spiral Approach", 1st edition, Tata McGraw Hill Edition,2010.
2. Achyut S.Godbole, Atul Kahate, "Operating Systems", 3rd edition, Mc Graw Hill Education, 2016.
3. Neil Smyth, "iPhone iOS 4 Development Essentials Xcode", 4th edition, Payload Media, 2011.

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Describe the important computer system resources and the role of operating system in their management	Understand
CO2	Exemplify the various CPU scheduling algorithms and deadlock mechanisms	Understand
CO3	Experiment various page replacement algorithms	Apply
CO4	Make use of different storage management and file system structure for various problems	Apply
CO5	Identify the need to create the special purpose operating systems Linux, Android, and iOS	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	1	-	2	-	1
CO2	2	1	1	1	-	-	-	-	-	2	-	2	-	1
CO3	3	2	2	2	-	-	-	-	-	2	-	3	-	2
CO4	3	2	2	2	-	-	-	-	-	3	-	3	-	2
CO5	3	2	2	2	3	-	-	-	-	3	-	3	-	2
CO	2.6	1.6	1.6	1.6	3	-	-	-	-	2.2	-	2.6	-	1.6

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER IV

U19CS402	DESIGN AND ANALYSIS OF ALGORITHMS	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- U19CS303: Data Structures

COURSE OBJECTIVES:

- To understand the fundamental concepts in analysis of algorithms and efficiency
- To learn the various searching and sorting algorithms
- To understand graph algorithms and design techniques

UNIT I PROBLEM SOLVING 9

Introduction – Fundamentals of Algorithmic Problem Solving-Important Problem types – Sorting problem – searching problems – combinatorial problems – Geometric Problems – Numerical problems – Fundamental Data structures – Trees and Graphs.

UNIT II FUNDAMENTALS OF ANALYSIS OF ALGORITHM EFFICIENCY 9

Analysis Framework – Asymptotic notations – Basic Efficiency classes – Mathematical Analysis of Non – recursive Algorithm – Mathematical Analysis of Recursive Algorithm – Fibonacci Numbers – Empirical Analysis of Algorithms.

UNIT III ANALYSIS OF SORTING AND SEARCHING ALGORITHMS 9

Brute Force Strategy – Selection Sort and Bubble Sort – Sequential Search and Brute - force string matching – Closest pair and convex hull problem – Divide and conquer – Quick Sort – Binary Search – Closest pair and convex hull problem.

UNIT IV ANALYSIS OF GRAPH ALGORITHMS 9

Balanced Search trees – AVL Trees – Dynamic Programming – Warshalls and Floyd Algorithm – Optimal Binary Search trees – Greedy Technique – Prims Algorithm – Kruskals Algorithm – Dijkstra Algorithm.

UNIT V ALGORITHM DESIGN TECHNIQUES TO NP COMPLETE AND NP HARD PROBLEMS 9

Limitations of algorithm power – Decision tree – P, NP and NP complete problems Coping with limitation of algorithm power – Backtracking – N-Queens Problem – Hamiltonian Circuit problem – Approximation algorithms for NP hard problems.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. R Anany Levitin, "Introduction to the Design and Analysis of Algorithms", 3rd edition, Pearson Education Asia, 2019
2. A A Putambekar, "Design and Analysis of Algorithms", 1st edition, Technical Publications, 2015

REFERENCES:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, "Introduction to Algorithms", 3rd edition, PHI Pvt. Ltd., 2015
2. Sara Baase and Allen Van Gelder, "Computer Algorithms Introduction to Design and Analysis", 1st edition, Pearson Education Asia, 2016

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

3. A.V.Aho, J.E. Hopcroft and J.D.Ullman, The Design and Analysis of Computer Algorithms", 1st edition, Pearson Education Asia, 2013

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Apply the fundamental concepts of algorithmic problem-solving types	Apply
CO2	Analyze the fundamentals of the algorithm efficiency for real world problems	Analyze
CO3	Examine the searching and sorting techniques in the analysis of algorithms	Analyze
CO4	Implement the graph algorithms with dynamic programming	Apply
CO5	Apply the algorithm design techniques for P and NP problems	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	1	-	2	1	-
CO2	3	3	2	3	-	-	-	-	-	2	-	3	2	-
CO3	3	3	2	3	-	-	-	-	-	2	-	2	1	-
CO4	3	2	1	2	-	-	-	-	-	1	-	3	2	-
CO5	3	2	1	2	-	-	-	-	-	1	-	2	1	-
CO	3	2.4	1.4	2.4	-	-	-	-	-	1.4	-	2.4	1.4	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER IV

U19CS403	THEORY OF COMPUTATION	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- U19MA304: Discrete Mathematics

COURSE OBJECTIVES:

- To study the concept of finite automata with its types and construction
- To understand the context free grammar for any given language
- To learn Turing machines, decidable and undecidable problems

UNIT I FUNDAMENTALS OF FINITE AUTOMATA 9

Introduction – Finite State Systems – Finite Automata – Deterministic Finite Automata (DFA) – Non-deterministic Finite Automata (NFA) – Finite Automata with Epsilon Transitions – Equivalence of NFA and DFA – Equivalence of NFAs with and without Epsilon moves

UNIT II REGULAR EXPRESSIONS AND LANGUAGES 9

Regular Expressions – Equivalence of Finite Automata and Regular Expressions – Pumping lemma for regular sets – Closure properties of regular languages – Equivalence and minimization of automata

UNIT III GRAMMARS 9

Introduction to Grammar – Types of grammar – Context Free Grammars (CFGs) and Languages (CFLs) – Derivations and languages – Ambiguity – Relationship between derivation and derivation trees – Simplification of CFG – Elimination of useless symbols – Unit productions – Null productions – Normal forms – Greiback Normal Form (GNF) – Chomsky Normal Form (CNF)

UNIT IV PUSHDOWN AUTOMATA 9

Pushdown Automata – Definitions – Moves – Instantaneous descriptions – Deterministic pushdown automata – Equivalence of Pushdown automata and CFL – Pumping lemma for CFL – Closure properties of CFL

UNIT V TURING MACHINE AND UNDECIDABILITY 9

Turing Machines (TM) – Programming Techniques for TM – Non Recursive Enumerable (RE) Language – Undecidable Problem with RE – Undecidable Problems about TM – Post's Correspondence Problem – The Class P and NP

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. J.E.Hopcroft, R.Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", 6th edition, Pearson Education, 2016.
2. John C Martin, "Introduction to Languages and the Theory of Computation", 3rd edition, Tata McGraw Hill, 2013.

REFERENCES:

1. H.R.Lewis and C.H.Papadimitriou, "Elements of the theory of Computation", 2nd edition, Prentice Hall of India, 2010
2. Peter Linz, "An Introduction to Formal Language and Automata", 3rd edition, Narosa Publishers, 2011

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

3. Micheal Sipser, "Introduction to Theory of Computation", 3rd edition, Cengage Publishers, 2014

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Construct finite automata for a given language with its types	Apply
CO2	Prove the equivalence of languages described by finite automata and regular expressions	Apply
CO3	Construct CFG for a given language, simplify and transform to a normal form	Apply
CO4	Design Push Down Automata, convert into CFG and vice-versa	Apply
CO5	Construct Turing machine and prove the undecidability or complexity of a variety of problems	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	2	-	2	1	-
CO2	3	2	-	1	-	-	-	-	-	2	-	1	1	-
CO3	3	2	2	1	-	-	-	-	-	2	-	1	1	-
CO4	3	2	2	1	-	-	-	-	-	2	-	2	1	-
CO5	3	3	2	2	-	-	-	-	-	2	-	2	2	-
CO	3	2.2	2	1.2	-	-	-	-	-	2	-	1.6	1.2	-
Correlation levels:		1: Slight (Low)		2: Moderate (Medium)				3: Substantial (High)						

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER IV

U19CS404	DATABASE MANAGEMENT SYSTEMS	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the fundamentals of data models and to represent a database system using ER diagrams
- To study SQL and relational database design
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design

UNIT I RELATIONAL DATABASE 9

Introduction – Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL – Dynamic SQL

UNIT II DATABASE DESIGN 9

Entity – Relationship model – E-R Diagrams – Enhanced-ER Model – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms – Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT III TRANSACTIONS 9

Transaction Concepts – ACID Properties – Schedules – Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery – Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery

UNIT IV IMPLEMENTATION TECHNIQUES 9

RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query optimization using Heuristics and Cost Estimation

UNIT V NoSQL DATABASE SYSTEMS 9

Introduction to NoSQL Database Systems – Classifications of NoSQL Databases: Graph Databases – Key - Value Stores – Document Stores – Columnar Databases – NoSQLvs SQL – Limitations of NoSQL – MongoDB Document Model

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth and S. Sudharshan, "Database System Concepts", 6th edition, Tata McGraw Hill, 2011
2. RamezElmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", 6th edition, Pearson Education, 2010

REFERENCES:

1. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", 8th edition, Pearson Education, 2012
2. Raghu Ramakrishnan, "Database Management Systems", 4th edition, Tata McGraw Hill, 2010
3. G.K.Gupta, "Database Management Systems", 1st edition Tata McGraw Hill, 2011

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to:

COs	Statements	K-Level
CO1	Explain the fundamentals of Database Management Systems	Understand
CO2	Formulate solutions to real time problems using SQL	Analyze
CO3	Apply normalization techniques for database design.	Apply
CO4	Apply concurrency control and recovery mechanisms.	Apply
CO5	Compare the various storage and optimization mechanisms	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	1	-	2	2	-
CO2	3	2	2	3	2	-	-	-	-	2	-	3	3	-
CO3	2	1	2	2	2	-	-	-	-	1	-	2	3	-
CO4	3	2	1	2	2	-	-	-	-	1	-	2	3	-
CO5	2	1	1	2	3	-	-	-	-	1	-	2	2	-
CO	2.4	1.4	1.5	2.3	2.3	-	-	-	-	1.2	-	2.2	2.6	-
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER IV

U19CS405	OBJECT ORIENTED PROGRAMMING AND ADVANCED DATA STRUCTURES	Category: PC			
		L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- U19CS303: Data structures

COURSE OBJECTIVES:

- To learn Object Oriented Programming concepts and the principles of packages, inheritance and interface
- To study exceptions and use I/O streams and use hierarchical data structures with its operations
- To learn the usage of graphs and its applications

UNIT I INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 6

Object Oriented Programming – Concepts – OOP in Java – Characteristics of Java – Java Environment – Structure – Compilation – Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods – access specifiers – static members – Comments – Data Types – Variables – Operator – Control Flow – Arrays – Packages

UNIT II INHERITANCE AND INTERFACES 6

Inheritance – Super classes – sub classes – Protected members – constructors in sub classes – the Object class – abstract classes and methods- Interfaces – defining an interface, implementing interface – differences between classes and interfaces – extending interfaces – Object cloning –inner classes – Array Lists – Strings

UNIT III EXCEPTION HANDLING AND I/O 6

Exceptions – exception hierarchy – throwing and catching exceptions – built in exceptions – creating own exception – Stack Trace Elements – Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files

UNIT IV HIERARCHICAL DATA STRUCTURES 6

Red-Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion – B-Trees: Definition of B-trees – Basic operations on B-Trees – Deleting a key from a B-Tree – Fibonacci Heaps: structure – Mergeable – heap operations

UNIT V GRAPHS 6

Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components – Minimum Spanning Trees: Kruskal and Prim – Single-Source Shortest Paths: – Dijkstra's Algorithm – The Floyd-Warshall Algorithm

LIST OF EXPERIMENTS

1. Write a Java program that prints all real solutions to the quadratic equation ax2+bx+c = 0. Read in a, b, c and use the quadratic formula. If the discriminate b2-4ac is negative, display a message stating that there are no real solutions?
2. The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1, 1. Every subsequent value is the sum of the 2 values preceding it. Write a Java program that uses both recursive and non-recursive functions to print the nth value of the Fibonacci sequence?
3. Write a program that creates a user interface to perform integer division. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the

Result field when the Divide button is clicked. If Num1 and Num2 were not integers, the program would throw a Number Format Exception. If Num2 were zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box.

4. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
5. Write a Java program that reads a line of integers and then displays each integer and the sum of all integers. (Use StringTokenizer class)?
6. Create an exception class named AgeOutOfRangeException extended from the class Exception. This class should contain a constructor with no parameter to call the Exception class constructor with the message "You are older than the requested age (25 years)".
7. Write a Java program to create Fibonacci Heap and perform the basic operation.
8. Write a Java program to implement and perform the BFS and DFS on a graph.

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th edition, McGraw Hill Education, 2018.
2. Mark allen Weiss, "Data Structures and Algorithm Analysis in JAVA", 3rd edition, Pearson Publication, 2012.

REFERENCES:

1. Cay S. Horstmann, Gary cornell, "Core Java Volume – I Fundamentals", 9th edition, Prentice Hall, 2013.
2. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd edition, Pearson, 2015.
3. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", 1st edition, Pearson Education, Reprint 2006.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

Cos	Statements	K-Level
CO1	Apply OOPs concepts to develop Java programs	Apply
CO2	Apply Java program using the concepts of inheritance and interfaces	Apply
CO3	Analyze Java applications using exceptions and I/O streams	Analyze
CO4	Apply the tree concepts to solve computing problems	Apply
CO5	Construct graph structure with its algorithms to solve problems	Apply

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	1	2	2	-	2	1	-
CO2	3	2	2	2	2	-	-	1	2	2	-	2	1	-
CO3	3	3	3	3	2	-	-	1	2	2	-	3	1	-
CO4	3	2	2	2	1	-	-	1	2	2	-	2	2	-
CO5	3	2	2	2	1	-	-	1	2	2	-	2	2	-
CO	3	2.2	2.2	2.2	1.6	-	-	1	2	2	-	2.2	1.4	-
Correlation levels:		1: Slight (Low)		2: Moderate (Medium)				3: Substantial (High)						

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER IV

U19CS406	OPERATING SYSTEMS LABORATORY	Category: PC			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn Unix commands and shell programming
- To implement various CPU Scheduling Algorithms and Process Management
- To implement Deadlock handling, Memory Management and File handling mechanisms

LIST OF EXPERIMENTS

1. Basics of UNIX commands
2. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Write C programs to simulate UNIX commands like cp, ls, grep, etc.
4. Shell Programming
5. FCFS and SJF scheduling algorithm, read the number of processes/jobs in the system, their CPU burst times. The scheduling is performed on the basis of arrival time of the processes irrespective of their other parameters. Each process will be executed according to its arrival time. Calculate the waiting time and turnaround time of each of the processes accordingly and print the Gantt chart.
6. Round robin scheduling algorithm, read the number of processes/jobs in the system, their CPU burst times, and the size of the time slice. Time slices are assigned to each process in equal portions and in circular order, handling all processes execution. This allows every process to get an equal chance. Calculate the waiting time and turnaround time of each of the processes accordingly and print the Gantt chart.
7. Developing Application using Inter Process Communication (using shared memory, pipes or message queues)
8. In a multiprogramming environment, several processes may compete for a finite number of resources. A process requests resources; if the resources are not available at that time, the process enters a waiting state. Sometimes, a waiting process is never again able to change state, because the resources it has requested are held by other waiting processes. To avoid this situation, implement Bankers Algorithm
9. A producer process produces information that is consumed by a consumer process. One solution to the producer-consumer problem uses shared memory. To allow producer and consumer processes to run concurrently, there must be available a buffer of items that can be filled by the producer and emptied by the consumer. This buffer will reside in a region of memory that is shared by the producer and consumer processes. A producer can produce one item while the consumer is consuming another item. The producer and consumer must be synchronized, so that the consumer does not try to consume an item that has not yet been produced. Implement the same using semaphore

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

10. One of the simplest methods for memory allocation is to divide memory into several fixed-sized partitions. Each partition may contain exactly one process. In this multiple-partition method, when a partition is free, a process is selected from the input queue and is loaded into the free partition. When the process terminates, the partition becomes available for another process. The operating system keeps a table indicating which parts of memory are available and which are occupied. Finally, when a process arrives and needs memory, a memory section large enough for this process is provided. When it is time to load or swap a process into main memory, and if there is more than one free block of memory of sufficient size, then the operating system must decide which free block to allocate. Best-fit strategy chooses the block that is closest in size to the request. First-fit chooses the first available block that is large enough. Worst-fit chooses the largest available block. Implement First fit and Best fit memory management schemes
11. Page replacement is basic to demand paging. It completes the separation between logical memory and physical memory. With this mechanism, an enormous virtual memory can be provided for programmers on a smaller physical memory. There are many different page-replacement algorithms. Every operating system probably has its own replacement scheme. A FIFO replacement algorithm associates with each page the time when that page was brought into memory. When a page must be replaced, the oldest page is chosen. If the recent past is used as an approximation of the near future, then the page that has not been used for the longest period of time can be replaced. This approach is the Least Recently Used (LRU) algorithm. LRU replacement associates with each page the time of that page's last use. When a page must be replaced, LRU chooses the page that has not been used for the longest period of time. Least frequently used (LFU) page-replacement algorithm requires that the page with the smallest count be replaced. The reason for this selection is that an actively used page should have a large reference count. Write the C program to simulate the same
12. One of the responsibilities of the operating system is to use the hardware efficiently. For the disk drives, meeting this responsibility entails having fast access time and large disk bandwidth. Both the access time and the bandwidth can be improved. To achieve the same implement Disk management using Algorithms such as FCFS, SSTF, SCAN and C-SCAN

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Develop programs using UNIX system calls	Apply
CO2	Implement various CPU scheduling algorithms for a given set of processes	Apply
CO3	Construct programs to demonstrate inter-process communication using shared memory, pipes and message queues	Analyze
CO4	Apply page replacement algorithms and dynamic storage allocation for memory management	Apply
CO5	Implement disk scheduling algorithms like FCFS, SSTF, SCAN and C-SCAN	Apply

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	1	2	2	-	3	-	1
CO2	3	2	2	2	-	-	-	1	2	2	-	2	-	1
CO3	3	3	2	3	-	-	-	1	2	2	-	3	-	2
CO4	3	2	2	2	-	-	-	1	2	2	-	2	-	1
CO5	3	2	2	2	-	-	-	1	2	2	-	2	-	1
CO	3	2.2	2	2.2	2	-	-	1	2	2	-	2.4	-	1.2
Correlation levels:		1: Slight (Low)		2: Moderate (Medium)					3: Substantial (High)					

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER IV

U19CS407	DATABASE MANAGEMENT SYSTEMS LABORATORY	Category: PC			
		L	T	P	C
		0	0	4	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand data definitions and data manipulation commands
- To learn the use of nested and join queries
- To understand functions, procedures and procedural extensions of data bases

LIST OF EXPERIMENTS

1. Hospital Management System:

Aim:

XYZ hospital is a multi-specialty hospital that includes a number of departments, rooms, doctors, nurses, compounders, and other staff working in the hospital. Patients having different kinds of ailments come to the hospital and get checkup done from the concerned doctors. If required they are admitted in the hospital and discharged after treatment. The aim of this case study is to design and develop a database for the hospital to maintain the records of various departments, rooms, and doctors in the hospital. It also maintains records of the regular patients, patients admitted in the hospital, the checkup of patients done by the doctors, the patients that have been operated, and patients discharged from the hospital.

Description:

In hospital, there are many departments like Orthopedic, Pathology, Emergency, Dental, Gynecology, Anesthetics, I.C.U., Blood Bank, Operation Theater, Laboratory, M.R.I., Neurology, Cardiology, Cancer Department, Corpse, etc. There is an OPD where patients come and get a card (that is, entry card of the patient) for check up from the concerned doctor. After making entry in the card, they go to the concerned doctor's room and the doctor checks up their ailments. According to the ailments, the doctor either prescribes medicine or admits the patient in the concerned department. The patient may choose either private or general room according to his/her need. But before getting admission in the hospital, the patient has to fulfill certain formalities of the hospital like room charges, etc. After the treatment is completed, the doctor discharges the patient. Before discharging from the hospital, the patient again has to complete certain formalities of the hospital like balance charges, test charges, operation charges (if any), blood charges, doctors' charges, etc. Next we talk about the doctors of the hospital. There are two types of the doctors in the hospital, namely, regular doctors and call on doctors. Regular doctors are those doctors who come to the hospital daily. Calls on doctors are those doctors who are called by the hospital if the concerned doctor is not available.

Ex.1: Use Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements to implement the hospital management database.

Ex.2: Discover insights from the hospital management database using Simple queries, Nested queries, Sub queries and Joins

Ex.3: Create useful Views, Sequences and Synonyms on hospital management database.

Ex.4: Implement Implicit and Explicit PL SQL Cursors to update, copy and count the tuples in the hospital management database.

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

2. Applications of PL/ SQL Procedures:

Ex.1: Product Sales Database Application

Consider the following relational schema for a Product Sales database application: Product (Prodid, Prodesc, Price, and Stock) Purchase (Purid, Proid, qty, supplierName) Sales (Saleid, Proid, qty, custname) Develop a procedure named Product_Sales that accepts a prodid and displays all the sales and purchase records of it.

Ex.2: Company Database Application

Consider the following relational schema for a company database application: EMPLOYEE (ENO, NAME, GENDER, DOB, DOJ, DESIGNATION, BASIC, DEPT_NO, PAN, SENO) Develop a procedure Staff_Increment that will accept staff number and increment amount as input and update the basic pay of the staff in the staff table.

Ex.3: Student Details Application

Consider the relation stu_details (reg_no, stu_name, DOB, address, city). Write a PL/SQL program to find the address of a particular student using functions.

Ex.4: Loan Database Application

Consider the following relational schema for a Loan database application: Customer (Custid, Custname, Age, phno) Loan (Loanid, Amount, Custid). Develop a function named Customer_Loan which accepts Loanid as input and displays Custid, CustName and loan_amount.

3. Developing Triggers:

Create a trigger for an Account relation such that whenever a record is inserted in the Account table the same record also gets inserted in the backup table.

Refer Tables:

Account (accnt_no,cst_id,acnt_type,last_trans_date,balance)

Account_bckup(accnt_no,last_trans_date,balance)

Loan (ln_id,cst_id,ln_amount,ln_date)

4. Company Database Application – Exception Handling

Consider the following relational schema for a company database application: EMPLOYEE (ENO, NAME, GENDER, DOB, DOJ, DESIGNATION, BASIC, DEPT_NO, PAN, SENO) Develop a procedure Staff_Increment that will accept staff number and increment amount as input and update the basic pay of the staff in the staff table. Also include exception in the procedure that will display a message "Staff has basic pay null" if the basic pay of the staff is null and display a message "No such staff number" if the staff number does not exist in the staff table.

5. Railway Reservation

Aim:

The railway reservation system facilitates the passengers to enquire about the trains available on the basis of source and destination, booking and cancellation of tickets, enquire about the status of the booked ticket, etc. The aim of case study is to design and develop a database maintaining the records of different trains, train status, and passengers. The record of train includes its number, name, source, destination, and days on which it is available, whereas record of train status includes dates for which tickets can be booked, total number of seats available, and number of seats already booked. The database has been developed and tested on the Oracle.

Description:

Passengers can book their tickets for the train in which seats are available. For this, passenger has to provide the desired train number and the date for which ticket is to be booked. Before booking a ticket for a passenger, the validity of train number and booking date is checked. Once the train number and booking date are validated, it is checked whether the seat is available. If yes, the ticket is booked with confirm status and corresponding ticket ID is generated which is stored along with other details of the passenger. After all the available tickets are booked, certain numbers of tickets are booked

with waiting status. If waiting lot is also finished, then tickets are not booked and a message of non-availability of seats is displayed. The ticket once booked can be cancelled at any time. For this, the passenger has to provide the ticket ID (the unique key). The ticket ID is searched and the corresponding record is deleted. With this, the first ticket with waiting status also gets confirmed.

List of Assumptions:

Since the reservation system is very large in reality, it is not feasible to develop the case study to that extent and prepare documentation at that level. Therefore, a small sample case study has been created to demonstrate the working of the reservation system. To implement this sample case study, some assumptions have been made, which are as follows:

- The number of trains has been restricted to 5.
- The booking is open only for next seven days from the current date.
- Only two categories of tickets can be booked, namely, AC and General.
- The total number of tickets that can be booked in each category (AC and General) is
- The total number of tickets that can be given the status of waiting is 2.

Normalize the database and implement the same using oracle.

6. Painting Hire Business System:

A local businesswoman has decided to start her own Internet business, called Masterpieces Ltd, hiring paintings to private individuals and commercial companies. Because of your reputation as a database designer, she has called upon your services to design and implement a database to support her new business. At the initial planning meeting, to discuss the design, the following user requirements were requested. The system must be able to manage the details of customers, paintings and those paintings currently on hire to customers. Customers are categorized as B (bronze), S (silver), G (gold) or P (platinum). These categories entitle a customer to a discount of 0%, 5%, 10% or 15% respectively. Customers often request paintings by a particular artist or theme (eg animal, landscape, seascape, naval, still-life, etc). Over time a customer may hire the same painting more than once. Each painting is allocated a customer monthly rental price defined by the owner. The owner of the painting is then paid 10% of that customer rental price. Any paintings that are not hired within six months are returned to the owner. However, after three months, an owner may resubmit a returned painting. Each painting can only have one artist associated with it. Several reports are required from the system. Three main ones are:

i. For each customer, a report showing an overview of all the paintings they have hired or are currently hiring
ii. For each artist, a report of all paintings submitted for hire
iii. For each artist, a returns report for those paintings not hired over the past six months

Remember to identify key attributes and any foreign key attributes. Implement the above scenario in MongoDB NoSQL database. Create an application using Python to access the data in the MongoDB.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 60 Periods Total: 60 Periods

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Design and implement a database schema for a given problem-domain	Apply
CO2	Populate and query a database	Apply
CO3	Apply SQL for database manipulation	Apply
CO4	Create and maintain tables using PL/SQL	Apply
CO5	Prepare reports on database	Apply

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	3	-	1	2	2	-	3	2	-
CO2	3	2	2	2	3	3	-	1	2	2	-	3	3	-
CO3	3	2	2	2	3	3	-	1	2	2	-	3	3	-
CO4	3	2	2	2	3	3	-	1	2	2	-	3	2	-
CO5	3	2	2	2	3	3	-	1	2	2	-	3	3	-
CO	3	2	2	2	3	3	-	1	2	2	-	3	2.6	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER V

U19MA501	LINEAR ALGEBRA AND NUMBER THEORY	Category: BS			
		L	T	P	C
		2	0	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand and apply the concepts of vector spaces, linear combination and inner product spaces
- To acquire knowledge in the basic concepts of number theory
- To understand the concepts of multiplicative functions

UNIT I VECTOR SPACES 6

Vector spaces – Subspaces – Linear Combinations and Linear system of equations – Linear dependence and independence – Bases and Dimensions

UNIT II LINEAR TRANSFORMATION AND INNER PRODUCT SPACES 6

Linear transformation – Null spaces and Ranges – Dimension theorem – Matrix representation of a linear transformation – Inner product – Norms – Gram Schimdt Orthogonalization process

UNIT III DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS 6

Division algorithm – Base – b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM

UNIT IV DIOPHANTINE EQUATIONS AND CONGRUENCES 6

Linear Diophantine equations – Congruence's – Linear Congruence's –Applications: Divisibility tests – Modular exponentiation – Chinese remainder theorem – 2 x 2 linear systems

UNIT V CLASSICAL THEOREMS AND MULTIPLICATIVE FUNCTIONS 6

Wilson's theorem – Fermat's little theorem – Euler's theorem – Euler's Phi functions –Tau and sigma functions

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: – Periods Total: 30 Periods

TEXT BOOKS:

1. Friedberg A. H, Insel A. J. and Spence L, "Linear Algebra", Fourth Edition, Prentice Hall of India, New Delhi,2004
2. Koshy T, "Elementary Number Theory with Applications", Second Edition, Elsevier Publications, New Delhi, 2002

REFERENCES:

1. Kolman B. Hill D. R, "Introductory Linear Algebra", First Edition, Pearson Education, New Delhi, 2009
2. Kumaresan S, "Linear Algebra – A Geometric Approach", Prentice – Hall of India, New Delhi, Reprint, First Edition, 2010
3. Lay D.C, "Linear Algebra and its Applications", Fifth Edition, Pearson Education, 2015

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Apply the fundamental concepts of advanced algebra and their role in modern mathematics	Apply
CO2	Solve the problems on linear transformation and to construct the inner product space to find the orthogonal and orthonormal basis using orthogonalization method	Apply
CO3	Determine the accurate and efficient use of advanced algebraic techniques	Apply
CO4	Use the Chinese remainder theorem to solve a system two or more simultaneous linear congruences	Apply
CO5	Apply integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO	3	2	-	-	-	-	-	-	-	-	-	1	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER V

U19CS501	ARTIFICIAL INTELLIGENCE	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- U19MA304 - Discrete Mathematics

COURSE OBJECTIVES:

- To learn the basics of Artificial Intelligence and searching techniques for solving problems
- To acquire basic knowledge on reasoning and decision making under uncertainty
- To understand various learning, communicating, perceiving and acting techniques

UNIT I ARTIFICIAL INTELLIGENCE AND PROBLEM SOLVING 9

Over view and Historical Perspective of AI – Physical Symbol Systems and Scope of Symbolic AI – Agents – Solving Problems by Searching – Adversarial Search and Games – Constraint Satisfaction Problems

UNIT II KNOWLEDGE, REASONING AND DECISION MAKING UNDER UNCERTAINTY 9

Logical Agents – First-Order Logic – Inference in First-Order Logic – Knowledge Representation – Automated Planning: Classical Planning – Hierarchical Planning – Probabilistic Reasoning – Making Simple Decisions – Decision Networks

UNIT III LEARNING 9

Forms of Learning – Supervised and Unsupervised Learning – Learning Decision Trees – Model Selection and Optimization – Linear Regression and Logistic Regression Classification – Developing Machine Learning Systems – Learning with Complete Data – Deep Learning – Simple Feed-forward Networks – Passive and Active Learning

UNIT IV COMMUNICATING, PERCEIVING, AND ACTING (Text Classification) 9

Passive and Active Reinforcement Learning – Natural Language Processing – Language Models – Grammar – Parsing – Complications of Real Natural Language – Natural Language Tasks – Limitations of NLP Models – Pre-training and Transfer Learning – Using Computer Vision

UNIT V APPLICATIONS OF ARTIFICIAL INTELLIGENCE 9

Robotics – Robot Hardware – Reinforcement Learning in Robotics – Robotic Application Domains – AI in Business Intelligence – AI in E-Learning – AI in Medical Application

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Stuart Russell, S. J.,Peter Norvig, "Artificial intelligence: A modern approach" ,Fourth Edition , Pearson,2020.
2. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Third Edition, Mc-Graw Hill, 2015
3. Sebastian Raschka and Vahid Mirjalili, "Python Machine Learning", Third Edition, Packt,2019

REFERENCES:

1. Richard E. Neapolitan, Xia Jiang, "Artificial Intelligence with an Introduction to Machine Learning", Second Edition, Chapman and Hall/CRC,2018.
2. Mariusz Flasiński," Introduction to Artificial Intelligence", Second Edition, Springer,2018

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

3. Aurélien Géron," Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", Second Edition, Oreilly,2019
4. Neil Wilkins," Artificial Intelligence: An Essential Beginner's Guide to AI, Machine Learning, Robotics, The Internet of Things, Neural Networks, Deep Learning, Reinforcement Learning, and Our Future", First Edition, CRC,2018

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Explain the basics of AI and problem-solving approaches	Understand
CO2	Apply the basics of knowledge, reasoning, and decision making under uncertainty techniques	Apply
CO3	Implement various supervised and unsupervised learning techniques	Apply
CO4	communicating, perceiving and acting techniques	Understand
CO5	Explore the applications of Artificial Intelligence	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	-	-	-	-	2	-	1	1	-
CO2	3	2	2	2	3	-	-	-	-	3	-	2	2	-
CO3	3	2	2	2	3	-	-	-	-	2	-	2	3	-
CO4	2	1	3	1	3	-	-	-	-	2	-	1	2	-
CO5	3	2	3	2	3	2	2	-	-	3	-	2	3	-
CO	2.6	1.6	2.5	1.6	3	2	2	-	-	2.4	-	1.6	2.2	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER V

U19CS502	WEB TECHNOLOGIES	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand web architecture and web languages
- To learn program for web client and web server objects
- To learn web application development techniques

UNIT I WEB ESSENTIALS 9

Evolution of web – Web architecture – HTML – XHTML – Editing XHTML – XHTML validation service – Linking – CSS – Inline style – embedded style Sheet – Conflicting style sheet – linking external style sheet

UNIT II CLIENT-SIDE SCRIPTING 9

JavaScript Basics – Arrays – Functions – JavaScript objects – HTML DOM – DOM objects and collections – Events – Regular Expressions – Form Validation – JSON – JQuery

UNIT III CLIENT SERVER COMMUNICATION 9

HTTP – Request/Response Model – HTTP Methods – RESTful APIs – AJAX – Using XML and the DOM – AJAX with JSON – Full scale Ajax enabled application – Dojo Toolkit

UNIT IV WEB SERVER AND STORAGE 9

Node.js – NPM – Callbacks – Events – Express framework – Cookies – Sessions – Scaling MongoDB – Manipulating and accessing MongoDB documents from Node js

UNIT V ADVANCED JAVA FRAMEWORK 9

Spring Boot – Spring Foundation – Integrated Spring – Creating and consuming REST Services – Reactive Spring – Thymeleaf – Spring MVC

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Deitel H.M. and Deitel P.J., "Internet and World Wide Web How to program", Sixth Edition, Pearson International, 2020
2. Brad Dayley, "Node.js, MongoDB, and AngularJS Web Development", Sixth Edition, Addison Wesley, 2014

REFERENCES:

1. AsimHussain, "Anjular: From Theory and Practice", Second Edition, Code craft, 2017
2. Craig Walls, "Spring in Action", Fifth Edition, Manning Publication, 2018
3. Uttam K.Roy, "Web Technologies", Second edition, Oxford University Press, 2011

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Explain essentials techniques for web application	Understand
CO2	Apply client and server-side scripting languages for client server communication	Apply
CO3	Apply HTTP Methods for client server communication	Apply
CO4	Implement web server storage and manipulating techniques	Apply
CO5	Develop web application using Spring framework	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	2	1	-
CO2	3	2	2	1	3	-	-	-	-	-	1	3	2	-
CO3	3	2	2	1	2	-	-	-	-	-	1	3	2	-
CO4	3	2	3	1	3	-	-	-	-	-	2	3	2	-
CO5	3	2	3	2	3	-	-	-	-	-	3	3	2	-
CO	2.8	1.8	2.5	1.3	2.8	-	-	-	-	-	1.8	2.8	1.8	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

Dr. P. Thangaraj M.E., Ph.D

Department of Engineering

KPR Institute of Engineering and Technology

Arasur, Coimbatore- 641 407

SEMESTER V

U19CS503	COMPUTER NETWORKS	Category: PC			
		L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge about protocol layering and physical layer performance
- To describe the functions of data link and network layers
- To outline transport layer services and application layer protocols

UNIT I PHYSICAL LAYER 6

Networks – Protocol layering and standards – Layered tasks – OSI Model – TCP/IP Protocol suite – Physical Layer – Performance – Transmission media – Basics of packet, circuit and virtual circuit switching

UNIT II DATA-LINK LAYER & MEDIA ACCESS 6

Link layer Introduction – DLC Services – Link Layer Protocols – Flow and Error Control Mechanisms – HDLC – PPP – Media Access Control – Wired LANs – Ethernet – Bridges and LAN Switches – Wireless LANs – Bluetooth – Connecting Devices

UNIT III NETWORK LAYER 6

Internet Protocol – Internetworking – IPv4 - Subnetting – IPv6 – Routing Techniques: Distance vector (RIP) – Link state (OSPF) – Inter-domain Routing (BGP) – Basics of IP support protocols (ARP, RARP, DHCP, ICMP) – Network Address Translation (NAT)

UNIT IV TRANSPORT LAYER 6

UDP – TCP – Congestion Control and Resource Allocation – TCP Congestion Control – Congestion Avoidance Mechanisms – Quality of Service – Integrated Services – Differentiated Services – Network Traffic Analysis

UNIT V APPLICATION LAYER 6

Domain Name System (DNS) – Electronic Mail (SMTP, MIME, IMAP) –Telnet – File Transfer (FTP) – REST– WWW (HTTP, HTTPS) – SNMP– SSH

LIST OF EXPERIMENTS

1. Learn to use commands like tcpdump, netstat, ipcofig, nslookup and traceroute
2. Simulation using Virtual Lab-IIT Bombay
   a. Fabrication of Cables
   b. Peer to Peer Topology and Star Topology
   c. IPv4 Addressing and Subnetting
3. Applications using TCP sockets like: Chat Program and File Transfer
4. Study of Packet tracer and Network simulators

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

TEXT BOOKS:

1. Behrouz A Forouzan, "Data Communications and Networking", Fifth Edition, Tata McGraw–Hill, New Delhi, 2015
2. J.F. Kurose, K.W. Ross, "Computer Networking: A Top-Down Approach", Fifth Edition, Addison-Wesley, 2017

REFERENCES:

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers Inc., 2012
2. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson Education, 2013
3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open-Source Approach", First Edition, McGraw Hill Publisher, 2011

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Summarize the network models and functionality of physical layer	Understand
CO2	Examine Data-Link Layer Protocols and Media Access Control methods	Analyze
CO3	Analyze the IP addresses and routing protocols.	Analyze
CO4	Inspect transport layer protocols and Quality of Services	Analyze
CO5	Interpret the significance of different application layer protocols	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	-	-	1	2	2	-	1	-	2
CO2	3	3	2	2	2	-	-	1	2	2	-	2	-	3
CO3	3	3	2	2	2	-	-	1	2	2	-	2	-	3
CO4	3	3	2	2	2	-	-	1	2	2	-	2	-	3
CO5	3	3	2	2	2	-	-	1	2	2	-	2	-	3
CO	2.8	2.6	1.8	1.8	1.8	-	-	1	2	2	-	1.8	-	2.8

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER V

U19CS504	WEB TECHNOLOGIES LABORATORY	Category: PC			
		L	T	P	C
		0	0	1	2

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the web architecture and web languages
- To learn to code for web client and web server objects
- To apply web development environment and methodology in real time scenarios

LIST OF EXPERIMENTS

1. Use DHTML to perform the following.
   a. Design the spotlight section of KPRIET home page. Use Box properties of CSS
   b. To create a web page which includes a map and display the related information when a hot spot is clicked in the map
   c. Create a web page which displays an image "logo.jpg" and the text "This is image of our college logo".

      Place three buttons in the web page which performs the following on clicking them

      To right align the image.

      To change the height, width and border of the image to 250, 350 and 3 pixels respectively

      To change the source and alternate text of the image to "logo.jpg" and "The image cannot be loaded" respectively.
2. Design the following using JavaScript and DOM
   a. Given an array of words, write a javascript code to count the number of vowels and number of consonants in each word. Use Regular Expressions
   b. Include Image Slide Show Digital clock, Survey Poll to make your webpage Dynamic
3. Develop a web application to implement online quiz system using AJAX.
4. Create a popup Login form using jQuery which appears at the center of screen on loading the page after a specified time interval. Include Captcha text in the login page.
5. a. Validate the Event Registration Form given below using jQuery for the following conditions.

      All fields are mandatory

      Zip code should be exactly five digits

      Email validation

   b. Create a JSON file for a list of cities. Provide autocomplete option for city field using the JSON file as source
6. Create a MongoDB collection of "books" with the following details: Title, ISBN (unique id), Authors, Publication, Year of Publication and Price.

   Write commands for the following:

   a. Insert a new document with multiple authors
   b. Update a document with change in price

Dr. P. Thangaraj M.E., Ph.D.
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

c. Remove documents with year of publication lesser than 1990.

7. Design a spring boot application with student registration form which takes student name, register number, DOB, program, email id, temporary address, permanent address, phone number. Validate the following using jquery:

   a. Mobile number should be exactly 10 digits

   b. Register number should have alphabets and numbers only

   c. Name should not exceed 30 characters and can be only alphabets.

   d. Email validation

   e. Provide a checkbox saying "Permanent address is same as temporary address". If checked, the value of permanent address should be added automatically from temp address. And should be in disabled mode.

8. Design a spring boot application for shopping cart.

9. Develop an Online Banking Web application over Thymeleaf with the following scenarios.

   Initially the login page should contain only user id field. On entering the user id, if only the user id exists, password field should be displayed on successful login, display the account summary with the following details retrieved from the database:

   Account no, Account type and Available Balance On the left side top of the page display the Current date, Last Login date and UserName and User Id. The session should expire on logout or if the page is idle for more than 2 minutes

10. Design an online book store using Thymeleaf which has the following features (create and use

    a MongoDB database based on the application)

    a. Search option based on Title, Author or ISBN

    b. On retrieving the results, display the book details in table format with the Price field in sorted order

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Apply DHTML tags to design spotlight section of any homepage	Apply
CO2	Design web applications using java script and DOM	Apply
CO3	Create pop-up menu using Captcha text using jQuery	Apply
CO4	Create JSON files for various applications	Apply
CO5	Design Spring boot application for designing forms	Apply

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	1	-	1	2	2	-	2	1	-
CO2	3	2	2	2	3	1	-	1	2	2	-	2	2	-
CO3	3	2	2	2	2	2	-	1	2	2	-	2	2	-
CO4	3	2	2	2	3	3	-	1	2	2	-	2	2	-
CO5	3	2	2	2	2	3	-	1	2	2	-	2	3	-
CO	3	2	2	2	2.4	2	-	1	2	2	-	2	2	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER V

U19CS505	ARTIFICIAL INTELLIGENCE LABORATORY	Category: PC			
		L	T	P	C
		0	0	4	2

PRE–REQUISITES:

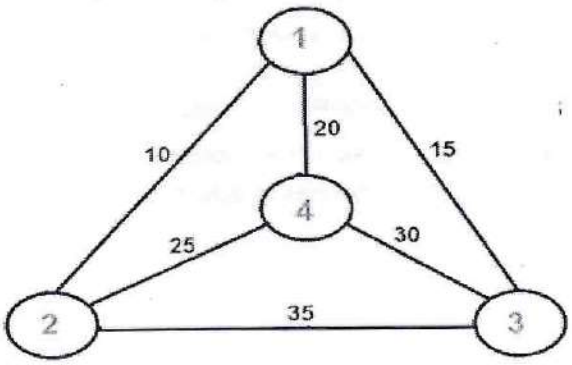
- U19CSG01- Problem Solving Using Python Programming

COURSE OBJECTIVES:

- To acquire knowledge on generic problem-solving approaches to a wide range of real-world problems
- To apply Hill climbing and Decision tree algorithms for real time applications
- To implement transfer learning approaches for predicting outcomes

LIST OF EXPERIMENTS

1. Implement Breadth First Search(BFS) to solve Tic -Tac -Toe problem as stated below : Tic-tac-toe is a board game. It has two players. Each player has an mark depicting a knought (O) or a cross (X). The board is divided into 3X3 cells and each cell can be occupied by one mark. Three marks of same type appear in a row either vertically or horizontally or diagonally, the user of that mark will be declared winner by the system. If all the squares of the board are filled and no user is the winner then the game is declared as draw by the system.
2. Apply Depth First Search algorithm to solve 8 Queens problem as stated: There are eight queens on an 8×8 chessboard. The queens need to be placed , such that none of them attack one another (no two are in the same row, column, or diagonal).
3. Apply Simple Hill Climbing algorithm for solving to solve Travelling Salesman Problem (TSP): Given a set of cities and distances as shown in figure below, between every pair of cities, the problem is to find the shortest possible route that visits every city exactly once and returns to the starting point.



Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

4. Using State space search technique, solve the Water Jug problem Stated Below:
   You are given two jugs, a 4-gallon one and 3-gallon one. Neither has any measuring marked on it. There is a pump, which can be used to fill the jugs with water. How can we get exactly 2 gallons of water into 4-gallon jug? Develop state space for this problem described as the set of ordered pairs of integers (X, Y) such that X = 0, 1, 2, 3 or 4 and Y = 0, 1, 2 or 3; X is the number of gallons of water in the 4-gallon jug and Y the quantity of water in the 3-gallon jug.
5. Given a dataset with two inputs (X,Y) of height in centimetres and weight in kilograms. Classify the gender either as male or female based on the threshold values(If height >180cm & Weight >80 kg then output should be 'male') by implementing any classification algorithm. Once done, please point out which algorithm has provided better performance.
6. A real estate agents want help to predict the house price for regions in the USA. He gave you the dataset to work on and you decided to use the Linear Regression Model. Create a model that will help him to estimate the house he want to sell. Use related datasets from UCI Machine Learning Repository.
7. Discover a meaningful information in heart disease dataset available in UCI Machine Learning library for better diagnosis of heart attack using linear regression technique with Python built-in libraries. Evaluate your model using suitable criteria. Which evaluation technique will be appropriate here?
8.
9. Implement VGG-19(Visual Geometry Group) transfer learning technique to detect the spread of Corona virus disease over a region.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Implement breadth first and depth first techniques for solving problems	Apply
CO2	Apply hill climbing and randomized search algorithms for gaming applications	Apply
CO3	Demonstrate Simulated annealing technique for solving problems	Apply
CO4	Classify dataset using decision tree algorithm	Apply
CO5	Apply transfer learning techniques to detect the spread of Corona virus	Apply

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	3	2	-	1	2	2	1	2	3	-
CO2	3	2	3	2	3	2	-	1	2	2	1	2	2	-
CO3	3	2	3	2	3	3	-	1	2	2	1	2	3	-
CO4	3	2	3	2	3	3	-	1	2	2	1	3	3	-
CO5	3	2	3	2	3	3	-	1	2	2	1	2	3	-
CO	3	2	3	2	3	2.6	-	1	2	2	1	2.2	2.8	-
Correlation levels:	1: Slight (Low)				2: Moderate (Medium)						3: Substantial (High)			

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER VI

U19CS601	PRINCIPLES OF MANAGEMENT	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand cognizance about importance of management principles
- To learn the functions and responsibilities of managers, HR related activities
- To understand the position of self and company goals towards business

UNIT I FRAMEWORK OF MANAGEMENT 9

Introduction: Concept of Management – Nature of Management – Levels of Management – Effective Management – Development of Management: Classical approaches – Nonclassical approaches – Contemporary approaches – Challengers for managers – Modern Management techniques

UNIT II PLANNING 9

Nature and purpose of planning – Planning premises – Types of planning – Objectives – Strategy – Policies – Planning premises – Procedure, Methods and Rules – Planning Tools and Techniques – Decision making steps and process

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization Structure – Line and Staff Authority – Departmentalization – Delegation of Authority – Interpersonal and Intergroup Conflicts – Human Resource Management: HR Planning – Recruitment – Selection – Training and Development

UNIT IV DIRECTING 9

Principles of Directing – Supervision – Directing and Human Factor – Organizational Culture – Motivation: Motivation theories – Motivational Applications – Leadership: Theories and Styles of leadership – Communication: Process of communication – Barrier in communication – Effective communication

UNIT V CONTROLLING 9

System and process of controlling – Types of Control – Design of Effective Control Systems – Information Systems – Control Techniques at Operational Level – Control Techniques – Management Practices of Prominent Business Leaders

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. L. M. Prasad, "Principles and Practice of Management", Tenth Edition, Sultan Chand & Sons, 2020
2. P. C. Tripathi and P. N. Reddy, "Principles of Management", Fourth Edition, Tata McGraw Hill, 2010

REFERENCES:

1. Robbins, S. "Management", Thirteen Edition, Pearson Education, New Delhi, 2017
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management", Seventh Edition, Pearson Education, 2011

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

3. Robert Kreitner and Mamata Mohapatra, "Management", Seventh Edition, Biztantra, 2008

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

Cos	Statements	K-Level
CO1	Explain the concepts of management	Understand
CO2	Infer planning process and its tools & techniques	Understand
CO3	Interpret the concepts of organizing and staffing in management	Understand
CO4	Demonstrate directing and leadership quality in management	Apply
CO5	Illustrate management concept of controlling	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	1	-	1	2	1	-	1	-	-
CO2	2	1	-	2	-	1	-	1	2	2	-	1	-	-
CO3	2	1	-	2	-	1	-	1	2	2	2	1	-	-
CO4	3	2	-	-	-	2	-	2	3	2	1	2	-	-
CO5	2	1	-	-	-	1	-	1	2	1	1	1	-	-
CO	2.2	1.2	-	1.7	-	1.2	-	1.2	2.2	1.6	1.3	1.2	-	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER VI

U19CS602	COMPILER DESIGN	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- U19CS403: Theory of Computation

COURSE OBJECTIVES:

- To acquire knowledge on lexical analyzer and syntax analyzer
- To learn the generation of intermediate code and target code
- To apply optimization techniques in phases of compiler

UNIT I PRINCIPLES OF COMPILER 9

Compilers: Structure of a compiler – Cousins of the Compiler – Grouping of Phases in to passes – Compiler construction tools – Science of Building a Compiler – Applications of Compiler Technology

UNIT II LEXICAL ANALYSIS 9

Lexical Analysis: Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – A language for Specifying Lexical Analyzer – Scanner Generator (FLEX) – Finite Automata – From a regular expression to an NFA and DFA – Minimization of DFA

UNIT III SYNTAX ANALYSIS 9

Role of the parser – Writing Grammars – Context-Free Grammars – Top-Down parsing – Recursive Descent Parsing – Predictive Parsing – Bottom-up parsing – Shift Reduce Parsing – LR Parsers – SLR Parser – Canonical LR Parser – LALR Parser – YACC

UNIT IV INTERMEDIATE CODE GENERATION 9

Syntax - Directed definitions – Construction of Syntax Trees – Intermediate languages – Declarations – Assignment Statements – Boolean Expressions – Case Statements – Back patching – Type Checking – Type system – Type checker – Type expression – Type conversion

UNIT V CODE GENERATION AND CODE OPTIMIZATION 9

Issues in the design of code generator – Runtime Storage management – Basic Blocks and Flow Graphs – A simple Code generator – DAG representation of Basic Blocks – peephole optimization– Principle Sources of Optimization – Optimization of basic Blocks – Loops in flow graph – Overview of LLVM

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, Monica S. Lam, "Compilers Principles, Techniques and Tools", Second Edition, Pearson Education Asia, 2014
2. Allen I. Holub, "Compiler Design in C", First Edition, Pearson Education, 2015

REFERENCES:

1. Kenneth C. Louden, "Compiler Construction: Principles and Practice", Second Edition, Thompson Learning, 2006.
2. J.P. Bennet," Introduction to Compiler Techniques", Second Edition, Tata McGraw- Hill, 2003.

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

3. C. N. Fischer and R. J. LeBlanc, "Crafting a compiler with C", First Edition, Benjamin Cummings, 2010.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Interpret the structure of a compiler	Understand
CO2	Design a lexical analyser to identify the tokens in a program	Apply
CO3	Construct a parser through the application of grammar	Apply
CO4	Perform type checking to develop Intermediate code for the given source program	Apply
CO5	Translate given intermediate code to target code and apply various code optimization techniques to intermediate code and target code	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	2	-	3	-	1
CO2	3	2	2	2	2	-	-	-	-	2	-	2	-	2
CO3	3	2	2	2	2	-	-	-	-	2	-	2	-	2
CO4	3	2	1	2	-	-	-	-	-	2	-	2	-	2
CO5	3	2	2	2	-	-	-	-	-	2	-	2	-	2
CO	2.8	1.8	1.6	1.8	2	-	-	-	-	2	-	2.2	-	1.8

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER VI

U19CS603	CLOUD COMPUTING	Category: PC			
		L	T	P	C
		2	0	2	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire cloud technologies and architecture
- To learn popular cloud services – AWS, GCP, Azure
- To understand resource management, fault tolerance and security aspects of Cloud

UNIT I CLOUD ENABLING TECHNOLOGIES AND ARCHITECTURE 9

Distributed Computing and Enabling Technologies – Cloud Fundamentals – Definition – Evolution – Architecture – Applications – deployment and service models – Virtualization: Issues – architectures – Internals of virtual machine monitors/Hypervisors – virtualization of data centers

UNIT II CLOUD COMPUTING SYSTEMS 9

Amazon EC2 and S3 – Google App Engine and Microsoft Azure – Build Private/Hybrid Cloud using open source tools – Deployment of Web Services from Inside and Outside a Cloud Architecture – Map Reduce and its extensions to Cloud Computing – HDFS – GFS – Spark

UNIT III RESOURCE MANAGEMENT AND LOAD BALANCING 9

Distributed Management of Virtual Infrastructures – Server consolidation – Dynamic provisioning and resource management – Resource Optimization – Resource dynamic reconfiguration – Scheduling Techniques for Advance Reservation – Capacity Management SLA Requirements – Load Balancing techniques

UNIT IV INTEROPERABILITY AND FAULT TOLERANCE 9

Interoperability and Service Monitoring: Issues with interoperability – Vendor lock-in – Interoperability approaches – SLA Management – Metering Issues – and Report generation – Migration and Broad Aspects of Migration into Cloud – Migration of virtual Machines and techniques – Fault Tolerance Mechanisms

UNIT V SECURITY 9

Vulnerability Issues and Security Threats – Application-level Security – Data level Security and Virtual Machine level Security – Infrastructure Security and Multi-tenancy Issues – IDS: host-based and network-based – Security-as-a-Service – Dockers – Kubernetes – Introduction – Case Study on Open Source & Commercial Clouds -Eucalyptus-Microsoft Azure-Amazon EC2

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

LIST OF EXPERIMENTS

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Create, Deploy and Launch Virtual Machines in OpenStack
6. Creating a Warehouse Application in SalesForce.com.
7. Install Hadoop single node cluster and run simple applications like Wordcount
8. Sign up for a free account in aws, create and launch your VM in the EC2 Cloud and perform web hosting in the VM
9. Create a free account in IBM cloud and develop and IoT application with Node-RED
10. Create a free account in Microsoft Azure cloud and develop a bot for business applications

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Total: 60Periods

TEXT BOOKS:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing Principles and Paradigms", Second Edition, Wiley Publishers, 2015
2. Barrie Sosinsky, "Cloud Computing Bible", First Edition, Wiley Publishers, 2010

REFERENCES:

1. Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, "Mastering Cloud computing", First Edition, McGraw Hill, 2013
2. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", First Edition, O'Reilly, 2010
3. Toby Velte, Antohy T Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", First Edition, McGraw Hill, 2009

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

Cos	Statements	K-Level
CO1	Interpret distributed system concepts and the architecture of cloud	Understand
CO2	Explore the popular cloud services – AWS, GCP, Azure	Apply
CO3	Examine resource management and Load balancing of cloud systems	Apply
CO4	Inspect cloud interoperability and fault tolerance mechanisms	Apply
CO5	Discuss security aspects in cloud and multitenancy	Understand

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE ARTICULATION MATRIX:

COs \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	2	3	-	-	1	2	2	-	2	-	2
CO2	3	2	3	3	3	-	-	1	2	2	2	3	-	3
CO3	3	2	3	3	3	-	-	1	2	2	1	3	-	3
CO4	3	2	3	3	3	-	-	1	2	2	1	3	-	3
CO5	2	1	2	2	3	-	-	1	2	2	2	2	-	2
CO	2.6	1.6	2.6	2.6	3	-	-	1	2	2	1.5	2.6	-	2.6
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER VI

U19CS604	MOBILE APPLICATION DEVELOPMENT LAB	Category: PC			
		L	T	P	C
		0	0	4	2

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the mobile application development frameworks for Android.
- To understand the various android UI layout and controls.
- To create different applications and publish over cloud using the android frameworks.

LIST OF EXPERIMENTS

1. Write an android program to demonstrate scroll view and list view.
2. Develop an application that uses GUI components, Font and Colors.
3. Develop an application that uses a menu with 3 options for dialling a number, opening a website and to send an SMS. On selecting an option, the appropriate action should be invoked using intents.
4. Develop an application that shows names as a list and on selecting a name it should show the details of the candidate on the next screen with a "Back" button. If the screen is rotated to landscape mode (width greater than height), then the screen should show list on left fragment and details on right fragment instead of second screen with back button. Use Fragment transactions and Rotation event listener.
5. Create an UI listing the diploma engineering branches. If user selects a branch name, display the number of semesters and subjects in each semester.
6. Use content providers and permissions by implementing read phonebook contacts with content providers and display in the list.
7. Create an application that will have spinner with list of animation names. on selecting animation name, that animation should affect on the images displayed below.
8. Write an android program to demonstrate a Menu with name File with New and Open as menu items. Give toast messages on click of each menu item.
9. Write an android program to switch from one activity to another using Intent. When the activity is changed disable the use of back button to avoid going to previous activity.
10. Develop a native calculator application to incorporate the linear layout with two input and one output text box. The input text box accepts only integer and floating-point values and the result is printed on the output text box.
11. Develop an application that shows the current location's latitude and longitude continuously as the device is moving (tracking). Also, the application that shows the current location on Google maps

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

12. Create an application that uses a text file to store user names and passwords (tab separated fields and one record per line). When the user submits a login name and password through a screen, the details should be verified with the text file data and if they match, show a dialog saying that login is successful. Otherwise, show the dialog with Login Failed message.

Mini project:

- Android Phone Theft Security With GPS Tracking
- Automated Payroll With GPS Tracking And Image Capture
- Railway Ticket Booking System Using QR Code
- Android General Knowledge Chatbot
- Android Campus Recruitment System
- Android Based Encrypted SMS System
- Vehicle Number Plate Recognition using Android
- Android Paper Free Document Sharing App Project

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Total: 60 Periods

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Create mobile applications using graphical user interface.	Apply
CO2	Create the anatomy of an Android application.	Apply
CO3	Develop android WiFi features and advance android development	Analyze
CO4	Develop mobile applications for built in app trigger.	Apply
CO5	Create the android geo location-based services.	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	2	-	1	2	2	1	1	-	1
CO2	3	2	2	2	3	2	-	1	2	2	1	1	-	1
CO3	3	2	2	2	3	2	-	1	2	2	1	2	-	2
CO4	3	3	3	3	3	3	-	1	2	2	2	1	-	1
CO5	3	2	3	2	3	2	1	1	2	2	1	1	-	2
CO	3	2.2	2.4	2.2	3	2.2	1	1	2	2	1.2	1.2	-	1.4

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER VI

U19CS605	MINI PROJECT	Category: EEC			
		L	T	P	C
		0	0	2	1

COURSE OBJECTIVES:

- To identify the real-life problems and to design solutions using the concepts of computer science and engineering.
- To develop communication skills to work in a collaborative environment.
- To demonstrate ethical and professional attributes.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Apply theoretical knowledge and technical skills to addressing real-world problems	Apply
CO2	Analyze project requirements, divide complex problems into tasks, and select appropriate technologies and tools for implementation	Apply
CO3	Evaluate the effectiveness, functionality, and usability of the project	Apply
CO4	Collaborate with team members, demonstrating effective teamwork, time management, and project coordination skills throughout the project's lifecycle	Apply
CO5	Communicate project progress, findings, and outcomes effectively through written reports, presentations, and demonstrations	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	1	2	2	2	2	2	3	3	2	2
CO2	2	3	3	3	3	1	1	2	2	2	3	3	2	2
CO3	3	3	2	3	3	1	1	2	2	2	3	3	2	2
CO4	-	-	-	-	-	1	1	2	3	3	3	3	2	2
CO5	-	-	-	-	2	2	2	2	2	3	3	3	2	2
CO	2.7	3	2.3	3	2.3	1.4	1.4	2	2.2	2.4	3	3	2	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER VI

U19CS606	TECHNICAL SEMINAR	Category: EEC			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To identify a topic or problem related to the curriculum.
- To represent the collected detail in the form of charts, block diagrams etc.
- To demonstrate the analysis with better professionalism, communication and technical skills utilizing different tools in the presentation and report.

Contact Periods:

Lecture: Periods Tutorial: Periods Practical: 30 Periods Total: 30 Periods

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Demonstrate expertise in the subject matter.by gaining deeper understanding of the chosen technical topic	Understand
CO2	Apply critical thinking and analytical skills to evaluate and synthesize complex technical information	Apply
CO3	Make effective presentations using ICT tools to deliver engaging and informative seminars	Apply
CO4	Explain technical concepts clearly to a diverse audience by effective oral and written communication skills	Understand
CO5	Employ research skills by sourcing, organizing, and citing relevant information to support seminar content	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	3	1	1	-	1	3	2	1	2	2	2
CO2	3	3	2	3	1	2	-	1	2	2	2	3	2	2
CO3	1	1	1	1	3	1	-	1	2	3	1	3	2	2
CO4	2	2	2	2	2	1	-	1	3	3	2	3	2	2
CO5	2	3	2	3	2	1	-	2	2	2	1	3	2	2
CO	2.2	2.4	1.6	2.4	1.8	1.2	-	1.2	2.4	2.4	1.4	3	2	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER VII

U19CS701	SOFTWARE PROJECT MANAGEMENT	Category: PC			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- U19CS304-Software Engineering

COURSE OBJECTIVES:

- To understand the Software Project Planning and Evaluation techniques and software development life cycle
- To study about the activity planning and risk management principles

UNIT I PROJECT EVALUATION AND PROGRAMME MANAGEMENT 9

Importance of Software Project Management – Software project and other types of projects – Activities – Plans-Methodologies – Setting Objectives – Management Control – Project portfolio Management – Risk evaluation – Strategic programme Management – Benefits management –Stepwise Project Planning

UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming- Basics of Software estimation – Bottom-up estimating – Top-down approach – Estimation by analogy – COCOMO II Parametric Productivity Model

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling –Network Planning models – Risk identification – Assessment – Risk Planning - Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules

UNIT IV RESOURCE ALLOCATION AND CONTROL 9

Resource Requirements – Scheduling Resources – Creating Critical path – Cost Schedule – Scheduling sequence – Framework for Monitoring and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis-Change control – Software Configuration Management

UNIT V MANAGING PEOPLE IN SOFTWARE PROJECTS AND TOOLS 9

Managing people – Organizational behaviour – Best methods of staff selection – Motivation –Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Leadership – Case study of Software Project Management Tools

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Bob Hughes, Mike Cotterell, Rajib Mall, "Software Project Management", Sixth Edition, McGraw Hill, 2020.
2. Robert K. Wysocki, "Effective Software Project Management", Second Edition Wiley Publication, 2018

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. Walker Royce, "Software Project Management", First Edition, Addison-Wesley, 2015
2. Gopalaswamy Ramesh, "Managing Global Software Projects", Fourteenth Edition, McGraw Hill Education (India), 2016
3. Subramanian Chandramouli and Saikat Dutt, "Software Project Management", First Edition, Pearson, 2015

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Describe the basic project management concepts, framework and the process models	Understand
CO2	Analyze about software process models and software effort estimation techniques	Analyze
CO3	Estimate the risks involved in various project activities with activity Planning	Apply
CO4	Analyze the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles	Analyze
CO5	Apply Staffing in Software Projects with teams and leadership qualities	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	1	-	3	-	3	2	3	-	1
CO2	3	3	2	3	-	2	-	3	-	3	3	3	-	2
CO3	3	2	1	2	-	1	-	3	-	3	2	3	-	1
CO4	3	3	2	3	-	2	-	3	-	3	3	3	-	2
CO5	3	2	1	2	-	1	-	3	-	3	2	3	-	1
CO	2.8	2.2	1.4	2.2	-	1.4	-	3	-	3	2.4	3	-	1.4

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER VII

U19CS702	CRYPTOGRAPHY AND NETWORK SECURITY	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- U19CS503- Computer Networks

COURSE OBJECTIVES:

- To acquire knowledge on Cryptography Theories, Algorithms and Systems
- To understand necessary approaches and techniques to build secure computer networks
- To acquire knowledge on security practices

UNIT I CRYPTOGRAPHY PRINCIPLES 9

Security trends – Need for Security at Multiple levels – Security Policies – Model of network security – Security attacks – services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques – transposition techniques – steganography – product cryptosystem – cryptanalysis

UNIT II SYMMETRIC KEY CRYPTOGRAPHY 9

Mathematics: Algebraic structures – Modular arithmetic – Euclid's algorithm – Congruence and matrices – Groups – Rings – Fields – Finite fields – Symmetric key Chiders: SDES – DES – Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – AES – RC4 – Key distribution

UNIT III PUBLIC KEY CRYPTOGRAPHY 9

Mathematics: Primes – Primality Testing – Factorization – Euler's totient function – Fermat's and Euler's Theorem – CRT– Exponentiation and logarithm – Asymmetric key Chiders: RSA cryptosystem – Key management – Diffie Hellman key exchange – ElGamal cryptosystem – Elliptic curve cryptography

UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – MD5 – SHA – Digital signature and authentication protocols – DSS – Entity Authentication: Biometrics – Passwords – Challenge Response protocols – Authentication applications – Kerberos – X.509

UNIT V SECURITY PRACTICE AND SYSTEM SECURITY 9

Electronic Mail security – PGP– S/MIME – IP security: Overview of IPSec – IP and IPv6 – Authentication Header – Encapsulation Security Payload (ESP) – Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding) – Web Security – System Security: Intruders – Malicious software – viruses – Firewalls

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security – Principles and Practices", Seventh Edition Pearson Education, 2017
2. Charles P Fleeger and Shari Lawrence P fleeger, "Security in Computing", Fourth Edition, Pearson Education, 2015

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. Atul Kahate, "Cryptography and Network Security", Second Edition, Tata McGraw Hill, 2008
2. Behrouz A.Foruzan, "Cryptography and Network Security", Second Edition, Tata McGraw Hill, 2007
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, "Network Security: PRIVATE Communication in a PUBLIC World", Second Edition, Prentice Hall

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Describe the fundamentals of networks security, security architecture, threats and vulnerabilities.	Understand
CO2	Construct symmetric cryptographic algorithms from hard problems in mathematics	Analyze
CO3	Construct public key cryptographic algorithms from hard problems in mathematics.	Analyze
CO4	Identify appropriate algorithms for assuring message integrity and authentication.	Analyze
CO5	Explain various Security practices and System security standards.	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	-	1	-	-	-	-	-	1	-	2
CO2	3	3	2	3	-	2	-	-	-	-	-	1	-	2
CO3	3	3	2	3	-	2	-	-	-	-	-	2	-	3
CO4	3	3	1	3	-	2	-	2	-	-	-	2	-	3
CO5	2	1	1	2	-	1	-	2	-	-	-	2	-	2
CO	2.6	2.2	1.4	2.6	-	1.6	-	2	-	-	-	1.6	-	2.4

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER VII

U19CS703	SECURITY LABORATORY	Category: PC			
		L	T	P	C
		0	0	2	1

PRE–REQUISITES:

- U19CS503 - Computer Networks

COURSE OBJECTIVES:

- To learn different cipher techniques
- To implement the algorithms DES, AES, RSA
- To use network security tools

LIST OF EXPERIMENTS

1. Perform encryption, decryption using the following substitution techniques

(i) Ceaser cipher, (ii) playfair cipher, iii) Hill Cipher, iv) Vigenere cipher

2. Perform encryption and decryption using following transposition techniques

    i) Rail fence

    ii) Row & Column Transformation

3. Apply DES algorithm for practical applications.

4. Apply AES algorithm for practical applications.

5. Suppose Alice wants her friends to encrypt email messages before sending them to her. Computers represent text as long numbers (01 for "A", 02 for "B" and so on), so an email message is just a very big number. Implement RSA Encryption Scheme to encrypt and then decrypt electronic communications.

6. The first requirement is for institutions, governments, or enterprises that need to assure their constituents that forms or documents are authentic and have maintained their integrity. The second requirement is for employees, customers, or citizens that need to provide approval or acknowledgement that a document or form has been read and approved or agreed to in principal. Implement the solution for above said requirements.

7. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 60 Periods Total: 60 Periods

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Develop code for classical Encryption Techniques to solve the problems.	Analyze
CO2	Build cryptosystems by applying symmetric and public key encryption algorithms.	Analyze
CO3	Construct code for authentication algorithms.	Apply
CO4	Develop a signature scheme using Digital signature standard.	Apply
CO5	Demonstrate the network security system using open-source tools	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	1	-	1	2	2	1	2	-	3
CO2	3	3	3	3	2	1	-	1	2	2	1	2	-	3
CO3	3	2	2	2	2	1	-	1	2	2	1	1	-	3
CO4	3	2	2	2	2	2	-	1	2	2	2	1	-	3
CO5	3	2	2	2	3	2	-	1	2	2	2	1	-	3
CO	3	2.4	2.4	2.4	2.2	1.4	-	1	2	2	1.4	1.4	-	3

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

SEMESTER VIII

U19CS801	PROJECT WORK	Category: EEC			
		L	T	P	C
		0	0	20	10

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To identify the real-life problems and to design solutions using the concepts of computer science and engineering
- To develop communication skills to work in a collaborative environment
- To demonstrate ethical and professional attributes

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Demonstrate the ability to find real-world problems in existing research and suggest practical solutions	Apply
CO2	Select appropriate tools and technologies for project implementation, aligning choices with project objectives	Apply
CO3	Exhibit effective teamwork and collaboration, both within a team and while working individually, throughout the project's lifecycle	Apply
CO4	Assess project results and make improvements for future enhancements and innovations	Analyze
CO5	Communicate project progress, findings, and outcomes through written reports, presentations, and demonstrations.	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	1	3	3	2	2	2	2	3	2	2
CO2	3	2	3	3	3	1	1	2	2	2	2	3	2	2
CO3	1	-	-	-	-	1	1	2	2	3	1	3	2	2
CO4	2	3	2	3	3	1	1	2	3	2	2	3	2	2
CO5	-	-	-	-	2	2	2	2	2	3	2	3	2	2
CO	2.3	2.7	2.3	3	2.3	1.6	1.6	2	2.2	2.4	1.8	3	2	2
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

PROFESSIONAL ELECTIVES

U19CSP01	WIRELESS SENSOR NETWORKS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the issues and challenges in the design of wireless sensor networks
- To interpret the WSN network architecture and energy management
- To analyze principle of MAC, Routing Protocols and QoS for sensor networks

UNIT I SENSOR NETWORK ARCHITECTURE 9

Sensors – Requirements – Challenges – Applications – Sensor node architecture – Sensor network architecture – Network protocol stack – Communication standards – IEEE 802.11: MAC layer – physical layer – IEEE 802.15.4: MAC layer – physical layer – Zigbee: Network layer – Application layer – 6LoWPAN

UNIT II INFORMATION GATHERING 9

Routing – Flat based routing algorithm – SPIN – Directed Diffusion – Rumor routing – Hierarchical routing – LEACH – TEEN and APTEEN – Localization – Beacon based – Beacon free – Geographical routing – GPSR – GEAR – Face routing – Modified SPIN

UNIT III ENERGY MANAGEMENT IN WSN 9

Duty cycling – Independent sleep/wakeup schemes – Asynchronous schemes – TDMA based MAC protocols – Contention based MAC protocols – Sensor MAC – Timeout MAC – Berkeley MAC –Hybrid MAC protocols – Energy aware routing – Geographic energy aware routing.

UNIT IV WSN SECURITY 9

Challenges – attacks in WSN – Attack categorization – Protection against attacks – Cryptography in WSN – Key management in distributed and hierarchical WSN – Attacks on routing protocols – Countermeasures – Intrusion detection in WSN

UNIT V QUALITY OF SERVICE AND OPERATING SYSTEMS FOR WSN 9

QoS building blocks – QoS provisioning – Topology management – Localization – Data aggregation – Load balancing – Coverage – Synchronization – Operating Systems – Tiny OS – Contiki OS – Magnet OS – Mantis OS

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Rastko R. Selmic, Vir V. Phoha, Abdul Serwadda, "Wireless Sensor Networks - Security, Coverage, and Localization", First Edition, Springer International Publishing, 2016
2. Nandini Mukherjee, Sarmistha Neogy, Sarbani Roy ,"Building Wireless Sensor Networks: Theoretical and Practical Perspectives", First Edition, CRC Press, 2015

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, "Ad Hoc and Sensor Networks: Theory and Applications", Second Edition, World Scientific Publishing, 2011
2. C.Siva Ram Murthy and B.S.Manoj, "Ad Hoc Wireless Networks – Architectures and Protocols", First Edition, Pearson Education, 2008
3. Waltenegus Dargie, Christian Poellabauer, "Fundamentals of Wireless Sensor Networks Theory and Practice", First Edition, John Wiley and Sons, 2010
4. Holger Karl, Andreas Willing, "Protocols and Architectures for Wireless Sensor Networks", First Edition, John Wiley & Sons, Inc., 2005

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Explain the architecture and protocol design principle of sensor networks.	Understand
CO2	Analyze routing protocols developed for wireless sensor networks.	Analyze
CO3	Analyze and classify energy management schemes in sensor networks.	Analyze
CO4	Describe the security issues in sensor networks.	Understand
CO5	Interpret the QoS and various WSN operating systems.	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	2	-	2
CO2	3	3	1	2	-	-	-	-	-	-	-	1	-	3
CO3	3	3	1	2	-	2	1	-	-	-	-	1	-	3
CO4	2	1	1	1	1	-	-	-	-	-	-	1	-	2
CO5	2	1	1	1	3	-	-	-	-	-	-	1	-	2
CO	2.4	1.8	1	1.5	2	2	1	-	-	-	-	1.2	-	2.4
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP02	NEXT GENERATION NETWORKS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- U19CS503 – Computer Networks

COURSE OBJECTIVES:

- To understand the next generation networks architecture
- To understand IP networking and use multiservice protocols for next generation networks
- To learn about 5G networks

UNIT I OVERVIEW OF NEXT GENERATION NETWORKS 9

Introduction to next generation networks – Communicating in the new Era – New Era of Networking -Technologies influencing change – IP Everywhere – Optical fiber anywhere – building blocks for NGN – Multi service Flexible Networks architecture – VPNs – Optical Networks – NGN Services

UNIT II IP NETWORKING 9

Global IP Networks – IP influence and confluence – Mobility Networks – Global capacity – Globally Resilient IP – Beyond IP – Technology Brief – IP Networks-Business Drivers – Success factors – Applications and Service Value

UNIT III MULTI SERVICE PROTOCOLS 9

Multi service Networks – Origin of multi service ATM – switching-Next Generation Multi service Networks-MPLS – Frame Based MPLS – Cell based MPLS – MPLS services and their benefits – Multi Service Provisioning Platforms (MSPP) – Multi Service Switching Platform (MSSP)

UNIT IV NEXT GENERATION NETWORKS APPLICATION 9

Next generation networks Applications – Internet connectivity – E-commerce-call centre – third party – Application service provision – UMTS – WAP – WiMAX – integrated billing – security and directory enable networks

UNIT V 5G NETWORK 9

Introduction to 5G – 5G network architecture – Role of Software Defined Networks – Network function virtualization in 5G enabling technologies for emerging 5G networks – IoT relation to 5G – 5G wireless propagation channel models

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Neill Wilkinson, "Next Generation Networks Services, Technologies and Strategies", First Edition, Wiley, 2017
2. Robet Wood, "Next Generation Network Services", First Edition, Pearson, 2015

REFERENCES:

1. Jingming Li Salina, "Next Generation Networks: Perspectives and Potentials", First Edition, Wiley,2017
2. Huber JF, "Mobile Next Generation Networks", IEEE Multimedia Vol. 11, Issue I Jan- March 2004
3. J.C. Crimi, "Next Generation Network (NGN) Service", Telecoolia Technologies white paper refer www.telecodia.com

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Explain the basic concepts of next generation networks and it's Applications	Understand
CO2	Explore IP networks influence and applications	Apply
CO3	Discuss Multi service protocols types and their benefits	Apply
CO4	Explain the various applications of next generation networks	Apply
CO5	Analyze 5G enabling technologies for emerging 5G networks	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	-	1	-	2
CO2	3	2	1	2	-	-	-	-	-	-	-	2	-	3
CO3	3	2	1	2	-	-	-	-	-	-	-	2	-	3
CO4	3	2	1	2	-	-	-	-	-	-	-	2	-	3
CO5	3	3	3	3	3	2	2	-	-	-	-	2	-	3
CO	2.8	2	1.4	2	3	2	2	-	-	-	-	1.8	-	2.8
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP03	VIRTUALIZATION TECHNIQUES	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the virtualization concepts and its types
- To learn WAN & VLAN architecture and its virtualization
- To acquire knowledge on virtualization technologies

UNIT I VIRTUALIZATION CONCEPTS 9

System Architectures – Virtual Machine Basics – Process Virtual Machines – System Virtual Machines – Taxonomy of Virtual Machines – Emulation: Basic Interpretation – Threaded Interpretation – Pre-Coded & Direct Interpretation – Binary Translation – Full and Para – Virtualization – Types of Hypervisors – Types of Virtualization

UNIT II SERVER VIRTUALIZATION 9

Server Virtualization – Partitioning Techniques – Hardware Virtualization – Virtual Hardware – Types of Server Virtualization – Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform

UNIT III NETWORK VIRTUALIZATION 9

Design of Scalable Enterprise Networks – Virtualizing the Campus – WAN Design – WAN Architecture – WAN virtualization – Virtual Enterprise Transport Virtualization – VLANs and Scalability – Theory Network Device Virtualization Layer 2 – VLANs Layer 3 VRF Instances Layer 2 – VFIs Virtual Firewall Contexts

UNIT IV STORAGE VIRTUALIZATION 9

Hardware Devices – SCSI – SCSI Communication – Using SCSI Buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI SAN Backup & Recovery Techniques – RAID – Classic Storage Model – SNIA

UNIT V APPLYING VIRTUALIZATION 9

Comparison of Virtualization Technologies: Shared Kernel – Enterprise Solutions: VMware Server First Edition – ESXi – Citrix XenServer – Microsoft Virtual PC – Microsoft Hyper-V – Virtual Box – Case study: Migration to Open-source based messaging service (Exim, Dovecot and SOGo)

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Second Edition, Elsevier/Morgan Kaufmann Publishers, 2015.
2. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", Second Edition, Berkeley: Apress, 2016

REFERENCES:

1. William von Hagen, "Professional Xen Virtualization", First Edition, Wrox Publications, 2014
2. Matthew Portnoy, "Virtualization Essentials", Second Edition, Wiley, 2015.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", Sixth Edition, Addison-Wesley, Publications, 2012

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Create a virtual machine and extend it to a virtual network.	Analyze
CO2	Discuss various virtual machine products.	Analyze
CO3	Perform server virtualization.	Apply
CO4	Explain the concept of network virtualization.	Understand
CO5	Discuss various tasks in storage virtualization.	Understand

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3	-	-	-	-	-	-	2	-	3
CO2	3	3	2	3	3	-	-	-	-	-	-	2	-	3
CO3	3	2	2	2	3	-	-	-	-	-	-	2	-	3
CO4	2	1	1	1	3	-	-	-	-	1	-	2	-	2
CO5	2	1	1	1	3	-	-	-	-	1	-	2	-	2
CO	2.6	2	1.6	2	3	-	-	-	-	1	-	2	-	2.6
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP04	SOFTWARE DEFINED NETWORKS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge on SDN Concepts
- To learn SDN Programming principles
- To develop SDN Applications

UNIT I SDN FUNDAMENTALS 9

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Centralized and Distributed Control and Date Planes – SDN Architecture – Plane Separation (Data/Control/application)

UNIT II OPEN FLOW AND SDN CONTROLLERS 9

Open Flow Specification – Drawbacks of Open SDN – SDN via APIs – SDN via Hypervisor – Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts

UNIT III DATA CENTRES 9

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

UNIT IV SDN PROGRAMMING 9

Programming SDNs: Northbound Application Programming Interface – Current Languages and Tools – Composition of SDNs – Network Functions Virtualization (NFV): Concepts – Implementation and Applications

UNIT V SDN APPLICATIONS 9

Juniper SDN Framework – IETF SDN Framework – Open Daylight Controller – Floodlight Controller - Bandwidth Calendaring – Data Centre Orchestration – Open Sourcing SDN

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Paul Goransson, Chuck Black, Trimothy Culver," Software Defined Networks: A Comprehensive Approach", Second Edition, Morgan Kaufmann, 2016
2. Thomas D. Nadeau, Ken Gray, "SDN: Software Defined Networks", First Edition, O'Reilly Media, Inc., 2013

REFERENCES:

1. Oswald Coker and Siamak Azodolmolky," Software Defined Networking with Open Flow", Second Edition, Packet Publishing, 2017
2. Vivek Tiwari," SDN and Open Flow for Beginners", First Edition, Amazon Digital Services, Inc., 2013
3. Fei Hu, Editor," Network Innovation through Open Flow and SDN: Principles and Design", First Edition, CRC Press, 2014

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Categorize SDN Controllers and the evolution of SDN.	Understand
CO2	Choose the relevant data center for SDN	Understand
CO3	Make use of SDN solutions in networking scenarios.	Apply
CO4	Experiment with SDN Programming.	Apply
CO5	Develop various applications of SDN.	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	-	1	-	2
CO2	2	1	1	1	-	-	-	-	-	-	-	1	-	2
CO3	3	2	2	2	1	-	-	-	-	-	-	1	-	3
CO4	3	2	2	2	2	-	-	-	-	-	-	2	-	3
CO5	3	2	2	2	2	-	-	-	-	-	2	2	-	3
CO	2.6	1.6	1.6	1.6	1.7	-	-	-	-	-	2	1.4	-	2.6
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP05	BLOCKCHAIN TECHNOLOGIES	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- U19CS503-Computer Networks

COURSE OBJECTIVES:

- To Understand the basics of distributed database and cryptography
- To Integrate ideas from Blockchain Technology
- To Design, build and deploy smart contracts and distributed applications

UNIT I BASICS 9

Distributed Database – Hadoop Distributed File System – Distributed Hash Table – ASIC resistance – Cryptography: Hash function – Digital signature – Memory Hard Algorithm

UNIT II BLOCKCHAIN 9

Introduction to Blockchain – Advantage over conventional distributed database – Blockchain Network – Mining Mechanism – Distributed Consensus – Merkle Patricia Tree – Gas Limit – Transactions and Fee – Anonymity – Reward – Chain Policy – Life of Blockchain application – Soft & Hard Fork – Private and Public blockchain

UNIT III DISTRIBUTED CONSENSUS 9

Nakamoto consensus – Proof of Work – Proof of Stake – Proof of Burn – Difficulty Level – Sybil – Attack – Energy utilization and alternate

UNIT IV CRYPTOCURRENCY 9

History – Distributed Ledger – Bitcoin – Bitcoin protocols – Mining strategy and rewards – Ethereum – Construction – DAO – Smart Contract – GHOST – Vulnerability – Attacks – Sidechain – Namecoin

UNIT V BLOCKCHAIN APPLICATIONS 9

Internet of Things – Medical Record Management – Application of Blockchain in Government – Blockchain use cases – Finance

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press, 2016.
2. Xu, Xiwei, Weber, Ingo, Staples, Mark, Architecture for Blockchain Applications, Springer, 2019.

REFERENCES:

1. Andreas M. Antonopoulos, "Mastering Bitcoin: Programming the Open Blockchain", Second Edition, O'Reilly, 2017
2. Pradip Dey, Manas Gosh, "Programming in C", First Edition, Oxford University Press, 2018

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Explain the basic concepts of Database systems	Understand
CO2	Explore the design principles of Bitcoin and Ethereum	Understand
CO3	Describe emerging abstract models for Blockchain Technology	Understand
CO4	Implement Hyperledger Fabric and Ethereum platform to Block chain Application	Analyze
CO5	Design, build, and deploy a distributed application	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	1	-	-	-	-	-	-	1	-	2
CO2	2	1	1	2	2	-	-	-	-	-	-	1	-	2
CO3	2	1	1	2	2	-	-	-	-	-	-	1	-	2
CO4	3	3	3	3	3	3	-	-	-	-	1	2	-	3
CO5	3	3	3	3	3	3	-	-	-	-	2	2	-	3
CO	2.4	1.8	2	2.5	2.2	3	-	-	-	-	1.5	1.4	-	2.4
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP06	INTERNET OF THINGS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the protocols and architecture of IoT Ecosystems
- To be aware of the IoT enabled solutions and Data Management
- To comprehend the Security and privacy policies of IoT Frameworks and their applications

UNIT I IoT ECO SYSTEMS, ARCHITECTURE AND PROTOCOLS 9

Internet of Things: Definition Evolution – IoT Architectures – Resource Management-IoT Data Management and Analytics – Communication Protocols: IEEE802.15.4 – BAC Net Protocol – MQTT – Modbus – KNX – Zigbee – XMPP – DDS – AMQP – LwM2M

UNIT II IoT ENABLERS AND SOLUTIONS 9

Open Source Semantic Web Infrastructure for managing IoT Resources in cloud – Device Collaboration framework for Intelligence Applications – Programming Frameworks for IoT– Virtualization as Enabling Technology for Cloud of Things

UNIT III IoT DATA AND KNOWLEDGE MANAGEMENT 9

Architecture for deploying CPS in the cloud and the expansion of IoT – Extending the possibilities of the IoT by Cloud Computing – IoT Architecture for Selected Use cases: eHealth – Precision Agriculture – Domotic – Stream Processing in IoT

UNIT IV IoT RELIABILITY, SECURITY AND PRIVACY 9

IoT Reference Model – IoT Security Overview – Security Frameworks for IoT – Privacy in IoT Networks – IoT Characteristics and Reliability Issues – Addressing Reliability – Governing IoT: Issues – Approaches and new paradigms

UNIT V IoT APPLICATIONS 9

Applied IoT– Internet of Vehicles and Applications – Cloud based Smart Facility Management – Developing Live IoT Applications: Setting up development environment – Building the program in Visual Studio – Simple Hello World Application – Devices as HTTP Client – Device as HTTP Server

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Rajkumar Buyya , Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms" ,First Edition , Morgan Kaufmann publisher, 2018.
2. Cuno Pfister, "Getting Started with the Internet of Things: Connecting Sensors and Microcontrollers to the Cloud (Make: Projects)", First Edition, LLC Publication, 2016.

REFERENCES:

1. Vijay Madisetti and Arshdeep Bhaga, "Internet of Things (A Hands-On-Approach)", First Edition, VPT, 2014
2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", First Edition, Apress Publications, 2013
3. Alessandro Bassi, Martin Bauer, Martin Fiedler, Thorsten Kramp, Rob van Kranenburg, Sebastian Lange, Stefan Meissner, "Enabling things to talk – Designing IoT solutions with the IoT Architecture Reference Model", Springer Open, 2016

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Explore the IoT Ecosystem, its Architecture and Basic Protocols	Understand
CO2	Comprehend the IoT enabled Infra structure and programming frameworks for IoT	Understand
CO3	Describe the IoT data and knowledge management	Understand
CO4	Explain the Security frameworks of IoT and its reliability issues	Understand
CO5	Develop basic IoT applications	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	1	-	-	-	-	-	2	-	2
CO2	2	1	1	2	2	1	-	-	-	-	-	2	-	2
CO3	2	1	1	2	2	1	-	-	-	-	-	2	-	2
CO4	2	1	1	2	2	2	-	-	-	-	-	2	-	2
CO5	3	2	2	2	3	3	-	-	-	-	2	3	-	3
CO	2.2	1.2	1.2	1.8	2	1.6	-	-	-	-	2	2.2	-	2.2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor & Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP07	MOBILE COMPUTING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To outline the basic concepts of mobile telecommunication system
- To acquire knowledge about the network, transport and application layer protocols for Mobile Networks
- To describe about different mobile platforms M-commerce and Security Issues

UNIT I APPLICATIONS AND GENERATIONS 9

Introduction to Mobile Computing – Applications of Mobile Computing – Generations of Mobile Communication Technologies – Multiplexing – Spread spectrum – MAC Protocols – SDMA – TDMA – FDMA – CDMA

UNIT II MOBILE TELECOMMUNICATION SYSTEM 9

Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS – UMTS – Architecture – Handover – Security

UNIT III MOBILE NETWORK LAYER 9

Mobile IP – DHCP – AdHoc – Proactive protocol – DSDV – Reactive Routing Protocols – DSR – AODV – Hybrid routing – ZRP – Multicast Routing – ODMRP – Vehicular Ad Hoc networks VANET – MANET Vs VANET – Security

UNIT IV MOBILE TRANSPORT AND APPLICATION LAYER 9

Mobile TCP – Traditional TCP-Classical TCP – TCP over 2.5/3G wireless networks – Wireless Application Protocol: Architecture – WDP – WTLS – WTP – WSP – WAE – WTA Architecture – WML

UNIT V MOBILE PLATFORMS AND APPLICATONS 9

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS – Android – BlackBerry – Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", Second Edition, PHI Learning publishers, 2018
2. Prasant Kumar Pattnaik, Rajib Mall," Fundamentals of Mobile Computing", First Edition, PHI Learning Publishers, 2012

REFERENCES:

1. Dharma Prakash Agarval, Qing and a Zeng, "Introduction to Wireless and Mobile systems", Third Edition, Thomson Asia Pvt Ltd, 2015
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Second Edition, Springer, 2016
3. William.C.Y. Lee," Mobile Cellular Telecommunications-Analog and Digital Systems", Third Edition, Tata McGraw Hill Edition, 2015

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Examine the basics of mobile telecommunication systems	Apply
CO2	Illustrate the generations of telecommunication systems in wireless networks	Apply
CO3	Determine the functionality of IP and network layer in mobile framework.	Analyze
CO4	Explain the functionality of TCP and WAP process in Mobile.	Analyze
CO5	Summarize the various mobile operating systems and M-commerce	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	1	-	3
CO2	3	2	2	2	-	-	-	-	-	-	-	1	-	3
CO3	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO4	3	3	3	3	-	-	-	-	-	-	-	2	-	3
CO5	3	3	3	3	2	2	-	-	-	-	-	2	-	3
CO	3	2.6	2.6	2.6	2	2	-	-	-	-	-	1.6	-	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj, M.E., Ph.D
Professor & Head
Department of Computer Science & Engineering
Dean, KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP08	SOFT COMPUTING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn suitable soft computing techniques for real time applications
- To understand genetic algorithm concepts in the given dataset
- To study soft computing techniques for complex problems

UNIT I FUZZY SET THEORY 9

Introduction to Neuro Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Member Function Formulation and parameterization – Fuzzy Rules and Fuzzy Reasoning - Fuzzy Inference Systems – Mamdani Fuzzy Models

UNIT II NEURAL NETWORKS 9

Supervised Learning Neural Networks – Perceptron – Adaline – Backpropagation Multilayer perceptron – Radial Basis Function Networks – Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self – Organizing Networks

UNIT III NEURO FUZZY MODELLING 9

Adaptive Neuro – Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – learning Methods that Cross – fertilize ANFIS and RBFN – Coactive Neuro – Fuzzy Modelling – Framework – Neuron Functions for Adaptive Networks

UNIT IV GENETIC ALGORITHMS 9

Basic Concepts – Working Principles – Encoding – Fitness Function – Reproduction – Inheritance Operators – Cross Over – Inversion and Deletion – Mutation Operator – Bit-wise Operators – Convergence of Genetic Algorithm

UNIT V APPLICATIONS OF SOFT COMPUTING 9

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency prediction – Fuzzy sets and Genetic Algorithm in Game Playing – Soft Computing for Colour Recipe Prediction

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Jyh Shing Roger Jang, Cheun Tsai Sun, Eiji Mizutani, "Neuro Fuzzy and Soft Computing-A Computational Approach to Learning and Machine Intelligence", Pearson Prentice Hall, 2019
2. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications and Programming Techniques", Addison Wesley, 2018

REFERENCES:

1. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 2015.
2. Samir Roy and Udit Chakraborty, "Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms", Pearson Education, 2018
3. Kwang H.Lee, "First course on Fuzzy Theory and Applications", Springer, 2015

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Apply the fundamental concepts of soft computing based on fuzzy set theory	Apply
CO2	Examine the functionalities of the specialized Neural Network	Analyze
CO3	Apply neuro fuzzy modelling with its algorithms	Apply
CO4	Analyze the working principle of genetic algorithms with its functionalities	Analyze
CO5	Apply the advance concepts of soft computing in real life applications	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	-	2	-	3
CO2	3	3	1	3	-	-	-	-	-	-	-	2	-	3
CO3	3	2	2	2	1	-	-	-	-	-	-	2	-	3
CO4	3	3	1	3	1	-	-	-	-	-	1	2	-	3
CO5	3	2	2	2	1	2	2	-	-	-	2	2	-	3
CO	3	2.4	1.4	2.4	1	2	2	-	-	-	1.5	2	-	3
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)			

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of ... Engineering
KPR ... Technology
Arasur, Coimbatore- 641 407

U19CSP09	EDGE COMPUTING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge on Edge Computing Architectures and Models
- To understand Edge Computing technologies
- To develop applications in Edge Computing

UNIT I EDGE COMPUTING ARCHITECTURES 9

An overview of edge computing – Open challenges – Edge computing in a cloudisation mode – Standard reference architecture – Edge computing as a VNF – CloudPath – Cloud4Home – Femto Clouds – Scalable and Secure On loading of Edge Functions Using AirBox

UNIT II EDGE COMPUTING MODELS 9

Big data analytical models – Data security and privacy models – Networking models and protocols for edge computing – Computing and storage models for edge computing – Resource allocation models for edge computing

UNIT III DISTRIBUTED TECHNOLOGIES FOR EDGE COMPUTING 9

Distributed big data computing platforms for edge computing: Big data processing – Big data processing platforms – Big data processing at the edge – Challenges and opportunities – Distributed execution platforms for edge computing

UNIT IV COLLABORATIVE AND EMERGING TECHNOLOGIES FOR EDGE COMPUTING 9

Edge computing: ecosystem and players – computing and networking collaborations in edge computing – use cases and applications in collaborative edge computing – platforms and prototypes of collaborative edge computing – Server less architecture for edge computing

UNIT V EDGE COMPUTING APPLICATIONS 9

Smart cities enabled by edge computing – Smart healthcare systems enabled by edge computing – Smart hospitals enabled by edge computing – Smart grids enabled by edge computing – Smart surveillance for public safety enabled by edge computing

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Javid Taheri, Shuiguang Deng, "Edge Computing: Models, technologies and applications", First Edition, The Institution of Engineering and Technology, 2020
2. Jie Cao, Quan Zhang, Weisong Shi, "Edge Computing: A Primer", First Edition, Springer International Publishing, 2018

REFERENCES:

1. Ajit Singh, "Edge Computing: Simply in Depth", First Edition, Amazon Digital Services LLC, KDP Print, 2019
2. Wu, Jie, Chang, Wei (Eds.), "Fog/Edge Computing for Security, Privacy, and Applications", First Edition, Springer International Publishing, 2020

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Describe the key architectures in edge computing	Understand
CO2	Examine the various edge computing models	Apply
CO3	Analyze some popular platforms for Big Data processing, with a focus on edge computing	Analyze
CO4	Review Collaborative and Emerging technologies for edge computing	Apply
CO5	Examine the applications of edge computing	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	1	-	-	-	-	-	2	-	2
CO2	3	2	1	2	-	1	-	-	-	-	-	1	-	3
CO3	3	3	2	3	-	2	-	-	-	-	-	2	-	3
CO4	3	2	1	2	2	2	-	-	-	-	1	1	-	3
CO5	3	2	1	2	1	3	2	-	-	-	2	1	-	3
CO	2.8	2	1.25	2	1.5	1.8	2	-	-	-	1.5	1.4	-	2.8
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP10	FOG COMPUTING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge on the concepts of Fog Computing
- To understand optimization techniques and data management in Fog Computing
- To study application development in Fog Computing

UNIT I FOG COMPUTING FUNDAMENTALS 9

Concepts – Principles and related paradigms – Fog Computing in the IoT environment – Fog Computing in the realm of Cloud Computing – Fog Computing in a developing world context

UNIT II OPTIMIZATION PROBLEMS IN FOG COMPUTING 9

Case for optimization in Fog Computing – Formal modelling framework for Fog Computing – Optimization opportunities along the Fog architecture and service life cycle – Towards a taxonomy of optimization problems in Fog Computing – Optimization techniques

UNIT III DATA MANAGEMENT IN FOG COMPUTING 9

Background – Fog data management – Future research and direction – Predictive analysis to support Fog application deployment: Predictive analysis with Fog Torch – Example – Related work

UNIT IV FOG COMPUTING IN BIG DATA ANALYTICS AND HEALTH MONITORING 9

Data Analytics in the Fog – Prototypes and evaluation – Architecture – Configurations – an architecture of a health monitoring IoT based system with Fog Computing – Fog Computing services in smart E – Health gateways – System implementation

UNIT V FOG COMPUTING IN SMART SURVEILLANCE AND SMART TRANSPORTATION APPLICATIONS 9

Human Object Detection – Object Tracking – Lightweight Human Detection – Data - Driven Intelligent Transportation Systems – Mission-Critical Computing Requirements of Smart Transportation Applications – Fog Computing for Smart Transportation Applications

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Mahmood, Zaigham (Ed.)," Fog Computing – Concepts, Frameworks and Technologies", First Edition, Springer, 2018
2. Rajkumar Buyya, Satish Srirama," Fog and Edge Computing: Principles and Paradigms", First Edition, Wiley Publications, 2019

REFERENCES:

1. Ivan Stojmenovic, Sheng Wen, "The Fog Computing Paradigm: Scenarios and Security Issues", Proceedings of the 2014 Federated Conference on Computer Science and Information Systems, pp. 1–8

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

2. Wu, Jie, Chang, Wei (Eds.), "Fog/Edge Computing for Security, Privacy, and Applications", First Edition, Springer International Publishing, 2020

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Comprehend Fog Computing models and opportunities and challenges	Understand
CO2	Analyze the various optimization metrics in Fog computing	Analyze
CO3	Explain Fog data management.	Understand
CO4	Realize Fog Computing in Big Data Analytics and Health monitoring	Apply
CO5	Examine the application of Fog Computing in object tracking and smart transportation	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	-	2	-	2
CO2	3	3	1	2	-	-	-	-	-	-	-	1	-	3
CO3	2	1	1	1	-	-	-	-	-	-	-	1	-	3
CO4	3	2	2	3	2	3	-	-	-	-	2	2	-	3
CO5	3	2	2	2	2	3	2	-	-	-	2	2	-	3
CO	2.6	1.8	1.4	1.8	2	3	2	-	-	-	2	1.6	-	2.8
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP11	GPU COMPUTING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn basics of parallel programming
- To understand graphics processing units (GPU) architecture
- To practice on GPU programming tools

UNIT I GPU ARCHITECTURE 9

Evolution of GPU architectures – GPU Memory – System issues: cache and data management – languages and compilers – stream processing – GPU – CPU load balancing – Understanding parallelism with GPU – CUDA Hardware overview – Synchronization across CPU and GPU

UNIT II DATA - PARALLEL EXECUTION MODEL AND MEMORY HANDLING WITH CUDA 9

Threads – Blocks – Grids – Warps – Block Scheduling – Memory Handling with CUDA: Shared Memory – Global Memory – Constant Memory – Texture Memory

UNIT III CUDA PROGRAMMING AND OPTIMIZING CUDA APPLICATIONS 9

Using CUDA – Multi CPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem decomposition – Memory Considerations – Transfers – Thread Usage – Resource Contentions

UNIT IV PROGRAMMING ISSUES 9

Common Problems: CUDA Error Handling – Parallel Programming Issues – Synchronization – Data Dependences and Race Conditions – Algorithmic Issues – Finding and Avoiding Errors

UNIT V OPENCL BASICS 9

OpenCL Standard – Platform Model – Execution Model – Kernels and OpenCL Programming Model – OpenCL Memory Model – OpenCL Runtime with an Example – Vector Addition using OpenCL – Basics of OpenAcc

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs (Applications of GPU Computing)", First Edition, Morgan Kaufmann, 2014
2. David R. Kaeli, PerhaadMistry, Dana Schaa, Dong Ping Zhang, "Heterogeneous computing with OpenCL", Third Edition, Morgan Kauffman, 2015

REFERENCES:

1. David B. Kirk, Wen-mei W. Hwu, "Programming Massively Parallel Processors – A Hands on Approach", Third Edition, Morgan Kaufmann, 2016
2. Nicholas Wilt, "CUDA Handbook: A Comprehensive Guide to GPU Programming", First edition, Addison - Wesley, 2013

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

3. Jason Sanders, Edward Kandrot, - "CUDA by Example: An Introduction to General Purpose GPU Programming", First edition, Addison – Wesley, 2010

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Discuss the concepts of GPU Architecture	Understand
CO2	Examine the concepts of parallel programming	Apply
CO3	Implement the programs in GPUs	Apply
CO4	Debug and profile parallel programs in GPUs	Analyze
CO5	Apply the basics of OpenCL	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	-	1	-	2
CO2	3	2	1	1	2	-	-	-	-	-	-	2	-	3
CO3	3	2	2	1	2	-	-	-	-	-	-	2	-	3
CO4	3	3	2	2	1	-	-	-	-	-	-	2	-	3
CO5	3	2	-	1	2	-	-	-	-	-	-	1	-	3
CO	2.8	2	1.5	1.2	1.8	-	-	-	-	-	-	1.6	-	2.8

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP12	VEHICULAR NETWORKS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To comprehend the basic communication concepts of vehicular networks
- To acquire the knowledge of intelligent vehicular networks
- To develop an exposition of the challenges in implementing a vehicular network from computation and communication perspective.

UNIT I INTELLIGENT VEHICULAR COMMUNICATION 9

Background of transportation networks – evaluation of transportation models – vehicular network standards – Vehicular communication technologies

UNIT II INTELLIGENT TRANSPORTATION SYSTEM 9

Intelligent Transportation System (ITS) – ITS applications and enabling technologies – Emerging ITS applications – ITS protocols and standards – ITS market segmentations – case study

UNIT III VEHICULAR NETWORK (VN) MODEL 9

V2V (Vehicle-to-Vehicle) – V2I (Vehicle-to-Infrastructure) – V2X (Vehicle-to-Everything) – Cluster based vehicular networks – Vehicle platooning – Vehicular cloud – Hybrid sensor – vehicular networks – Vehicular Positioning System

UNIT IV BIGDATA FOR VN 9

Road traffic data – Collision rate model – Vehicle XML device collaboration with Big Data – real-time capturing and understanding of electric vehicles – Vehicle Trajectory Processing – Big Data Mining

UNIT V FUTURE TRENDS AND CHALLENGES IN VN 9

Next generation vehicular networks – vehicular mobility with IEEE 802.11 networks through predictive handovers – Real-time path planning – cryptographic solutions for vehicular networks –vehicular mobility modeling technique

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Paul, Anand, Naveen Chilamkurti, Alfred Daniel, and Seungmin Rho, "Intelligent vehicular networks and communications: fundamentals, architectures and solutions", First Edition, Elsevier, 2017
2. Peter Chong, Ivan Wang-HeiHo. "Vehicular Networks: Applications, Performance Analysis and Challenges", First Edition, Nova Science, 2019

REFERENCES:

1. Chen, Wai, ed, "Vehicular communications and networks: Architectures, protocols, operation and deployment", First Edition, Elsevier, 2015
2. Stephan Olariu, Michele C. Weigle,"Vehicular Networks: From Theory to Practice", First Edition, Taylor & Francis, 2013
3. Christoph Sommer, Falko Dressler, "Vehicular Networking", First Edition, Cambridge University Press, 2014

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Infer the fundamentals of intelligent vehicular networks	Understand
CO2	Identify the implementation issues in Intelligent Transportation System	Understand
CO3	Outline the modelling aspects of vehicular networks	Analyze
CO4	Assess required big data model for vehicular networks	Apply
CO5	Interpret the technology trends in intelligent VN	Apply

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	-	-	-	-	-	-	1	-	2
CO2	2	1	1	2	-	-	-	-	-	-	-	1	-	2
CO3	3	3	1	2	1	-	-	-	-	-	-	1	-	3
CO4	3	2	2	2	2	-	-	-	-	-	-	2	-	3
CO5	3	2	2	2	2	-	-	-	-	-	-	1	-	3
CO	2.6	1.8	1.5	1.8	1.7	-	-	-	-	-	-	1.2	-	2.6

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP13	MOBILE ADHOC NETWORK	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To interpret the principles and impact of mobile ad hoc networks.
- To acquire knowledge on various MAC and routing protocols for mobile networks.
- To analyze issues and its challenges of security and optimization of cross layer

UNIT I BASICS OF ADHOC NETWORK 9

Introduction to ad-hoc networks – definition – characteristics features – applications – Characteristics of wireless channel – ad-hoc mobility model – indoor and outdoor models

UNIT II MEDIUM ACCESS PROTOCOLS 9

Design issues – goals and classification – Contention based protocols – with reservation –scheduling algorithms – protocols using directional antennas – IEEE standards: 802.11a – 802.11b – 802.11g – 802.15 – HIPERLAN

UNIT III NETWORK PROTOCOLS 9

Design issues – goals and classification – Proactive vs reactive routing – unicast routing algorithms – Multicast routing algorithms – hybrid routing algorithm – energy aware routing algorithm – hierarchical routing – QoS aware routing

UNIT IV END – END DELIVERY AND SECURITY 9

Issues in designing – Transport layer classification – adhoc transport protocols–Security issues in adhoc networks – issues and challenges – network security attacks – secure routing protocols

UNIT V CROSS LAYER DESIGN 9

Cross layer Design: Need for cross layer design – cross layer optimization – parameter optimization techniques – cross layer cautionary perspective – Integration of adhoc with Mobile IP networks

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. C. Siva Ram Murthy and B. S. Manoj, "Ad hoc Wireless Networks Architecture and Protocols", Second Edition, Pearson Edition, 2017
2. Subir Kumar Sarkar, T.G. Basavaraju, C. Puttamadappa, "Ad Hoc Mobile Wireless Networks, Principles, Protocols, and Applications", Second Edition, CRC Press, 2019

REFERENCES:

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, "Mobile ad-hoc networking", First Edition, Wiley-IEEE press, 2004
2. Yu, F. Richard, "Cognitive Radio Mobile Adhoc Network ", First Edition, Springer-Verlag ,2012.
3. Marc Esquius-Morote, Aihuang Guo, "Evaluation of MANET Routing Protocols in realistic Environments", First Edition, 2013.

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 6

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

Cos	Statements	K-Level
CO1	Describe the basic concepts of Mobile adhoc networks terminologies	Understand
CO2	Summarize mobile adhoc network applications and associated MAC Protocols	Understand
CO3	Describe various IEEE Standards using ADHOC Network.	Understand
CO4	Analyze the Security issues in ADHOC network	Analyze
CO5	Analyze and Optimize the Cross Layer Design	Analyze

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	2
CO2	2	1	1	1	-	-	-	-	-	-	-	1	-	2
CO3	2	1	1	1	-	-	-	-	-	-	-	1	-	2
CO4	3	2	2	2	-	-	-	-	-	-	-	2	-	3
CO5	3	2	2	2	-	-	-	-	-	-	-	2	-	3
CO	2.4	1.4	1.5	1.5	-	-	-	-	-	-	-	1.4	-	2.4

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP14	ADVANCED JAVA PROGRAMMING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn advanced Java programming concepts
- To understand concepts needed for distributed and multi-tier applications
- To understand issues in enterprise applications development

UNIT I JAVA PACKAGES AND SWING COMPONENTS 9

Java I/O streaming – Utility Packages – Input Output Packages – Inner Classes – Java Database Connectivity – Servlets – RMI – Swing – Java Script Basics

UNIT II NETWORK PROGRAMMING 9

Sockets – secure sockets – custom sockets – UDP datagrams – multicast sockets – URL classes – Reading data from the server – writing data – configuring the connection – Reading the header – telnet application – Java Messaging services

UNIT III APPLICATIONS IN DISTRIBUTED ENVIRONMENT 9

Remote method Invocation – activation models – RMI custom sockets – Object Serialization – RMI – IIOP implementation – CORBA – IDL technology – Naming Services – CORBA programming Models – JAR file creation

UNIT IV MULTI-TIER APPLICATION DEVELOPMENT 9

Remote method Invocation – activation models – RMI custom sockets – Object Serialization – RMI – IIOP implementation – CORBA – IDL technology – Naming Services – CORBA programming Models – JAR file creation

UNIT V ENTERPRISE APPLICATIONS 9

Server Side Component Architecture – Introduction to J2EE – Session Beans – Entity Beans – Persistent Entity Beans – Applications

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Elliotte Rusty Harold, "Java Network Programming", Second Edition, O'Reilly publishers, 2016
2. Andrew Lee Rubinger, Bill Burke, "Enterprise JavaBeans 3.1", Sixth Edition, Tata McGraw-Hill, 2015

REFERENCES:

1. Patrick Naughton, "Complete reference: JAVA2", First Edition, Tata McGraw-Hill, 2013
2. Uttam.K.Roy, "Advanced Java Programming", First edition, Tata McGraw-Hill, 2015
3. R. Nageswara Rao, "Core Java: An Integrated Approach", Third Edition, Dreamtech press, 2016

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Interpret the Java utility packages, swing components	Understand
CO2	Explain the various networking classes supports Java	Understand
CO3	Analyse the CORBA programming models and IIOP implementation	Analyze
CO4	Identify the server side application development to develop a multi-tier application	Apply
CO5	Implement the server side component architecture using Java Beans	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	2	-	-	-	-	1	-	2	-	2
CO2	2	1	1	1	2	-	-	-	-	1	-	2	-	2
CO3	3	3	3	3	3	-	-	-	-	2	-	3	-	3
CO4	3	2	2	2	3	-	-	-	-	2	-	3	-	3
CO5	3	2	2	2	3	-	-	-	-	2	-	3	-	3
CO	2.6	1.8	1.8	1.8	2.6	-	-	-	-	1.6	-	2.6	-	2.6

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP15	C # AND .NET PROGRAMMING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn basic programming in C# and the object-oriented programming concepts.
- To understand and enhance skills in writing Windows applications, ADO.NET and ASP .NET.
- To learn the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET

UNIT I C# AND .NET PLATFORM 9

Introducing C# – Building Blocks of the .NET Platform – Literals-Variables-Data Types – Operators – checked and unchecked operators – Expressions – Branching-Looping-Methods – implicit and explicit casting – Constant – Arrays – Array Class – Array List – String – String Builder – Structure – Enumerations – boxing and unboxing

UNIT II OBJECT ORIENTED ASPECTS OF C# 9

Introducing classes and objects – constructors and its types – Inheritance – properties – indexers – index overloading – operator overloading – interfaces – polymorphism – delegates – events – errors and Exception Handling – threading

UNIT III APPLICATION DEVELOPMENT ON .NET 9

Building windows application – Creating our own window forms with events and controls – menu creation, inheriting window forms – SDI and MDI application – Dialog Box (Modal and Modeless) – accessing data with ADO.NET – SQL Server with ADO.NET – handling exceptions – validating controls

UNIT IV WEB BASED APPLICATION DEVELOPMENT ON .NET 9

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

UNIT V CLR AND .NET FRAMEWORK 9

Assemblies – Versioning – Attributes – Reflection – Viewing meta data – Type discovery – Reflection on type – Marshalling – Remoting – Security in .NET

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Herbert Schildt, "The complete Reference C# 4.0", First Edition, McGraw-Hill, 2016
2. E. Balagurusamy, "Programming in C#", Fourth Edition, Tata McGraw-Hill, 2017

REFERENCES:

1. Mark J.Price ,"C# 8.0 and .NET Core 3.0 - Modern Cross-Platform Development", Fourth Edition, Packt Publishers,2019
2. Joydip Kanjilal," Mastering C# 8.0", First Edition, Tata McGraw-Hill, 2019
3. Mark Michaelis, "Essential C# 3.0: For .NET Framework 3.5", Second Edition, Pearson Education,2010

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Elucidate how C# fits into .NET framework and the basic structure of C# application	Understand
CO2	Develop programs by knowing the object-oriented aspects of C#	Apply
CO3	Develop, debug, compile, and run a simple application using C# on .NET	Apply
CO4	Develop Web based applications using .NET	Apply
CO5	Explain the foundations of CLR and .NET framework	Understand

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	-	-	-	-	-	1	1	-	1
CO2	3	2	2	2	2	-	-	-	-	-	1	2	-	1
CO3	3	2	2	2	2	-	-	-	-	-	2	2	-	1
CO4	3	2	3	2	2	2	-	-	-	-	1	2	-	2
CO5	2	1	1	1	2	-	-	-	-	-	1	1	-	1
CO	2.6	1.6	1.8	1.6	1.8	2	-	-	-	-	1.2	1.6	-	1.2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP16	MULTICORE ARCHITECTURE	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the need for multi-core processors, and their architecture
- To understand the challenges in parallel and multi-threaded programming
- To learn about parallel programming paradigms and design parallel solutions

UNIT I MULTI-CORE PROCESSORS 9

Introduction to single core to multi-core architectures – SIMD and MIMD systems – Interconnection networks – Symmetric and Distributed Shared Memory Architectures – Cache coherence – Performance Issues – Parallel program design

UNIT II PARALLEL PROGRAM CHALLENGES 9

Performance and Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexeslocks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes)

UNIT III SHARED MEMORY PROGRAMMING 9

OpenMP Execution Model – Memory Model – OpenMP Directives – Work-sharing Constructs – Library functions – Handling Data and Functional Parallelism – Handling Loops – Performance Considerations

UNIT IV DISTRIBUTED MEMORY PROGRAMMING 9

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

UNIT V PARALLEL PROGRAM DEVELOPMENT 9

Case studies – n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Peter S. Pacheco, "An Introduction to Parallel Programming", First Edition, Morgan-Kauffman/Elsevier, 2017.
2. Darryl Gove," Multicore Application Programming for Windows, Linux, and Oracle Solaris", First Edition, Pearson, 2016

REFERENCES:

1. Victor Alessandrini, "Shared Memory Application Programming, Concepts and Strategies in Multicore Application Programming", First Edition, Morgan Kaufmann, 2015
2. Yan Solihin, "Fundamentals of Parallel Multicore Architecture", First Edition, CRC Press, 2015
3. Michael J Quinn, "Parallel programming in C with MPI and OpenMP", First Edition, Tata McGraw Hill, 2016

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Describe multicore architectures and identify their characteristics and challenges.	Understand
CO2	Identify the issues in programming Parallel Processors.	Apply
CO3	Write programs using OpenMP and MPI.	Apply
CO4	Design parallel programming solutions to common problems.	Apply
CO5	Compare and contrast programming for serial processors and programming for parallel processors.	Analyze

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	2	-	1	-	1
CO2	3	2	1	2	-	-	-	-	-	-	-	1	-	2
CO3	3	2	2	2	2	-	-	-	-	-	-	1	-	2
CO4	3	2	2	2	2	-	-	-	-	-	-	1	-	2
CO5	3	3	2	3	2	-	-	-	-	-	-	1	-	2
CO	2.8	2	1.6	2	2	-	-	-	-	2	-	1	-	1.8

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP17	COMPUTER GRAPHICS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire the knowledge about graphics hardware devices and software
- To describe the concepts of two- and three-dimensional transformations
- To outline the basics of illumination, colour models and animation techniques

UNIT I GRAPHICS FUNDAMENTALS 9

Overview of graphics systems – Video display devices – Raster and Random scan systems – Graphics monitors and Workstations – Input and Hard copy Devices – Graphics Software: Output primitives – points and lines – line drawing algorithms – loading the frame buffer – line function – circle and ellipse generating algorithms – Pixel addressing and object geometry

UNIT II TWO DIMENSIONAL GRAPHICS 9

2D geometric transformations – Matrix representations and homogeneous coordinates – composite transformations – 2D viewing – viewing pipeline, viewing coordinate reference frame – window-to-viewport transformation – 2D viewing functions – clipping operations – point – line and polygon clipping algorithms

UNIT III THREE DIMENSIONAL GRAPHICS 9

3D object representations – Polygon Surfaces-Tables Meshes – Plane equations – Quadratic surfaces – Blobby objects – Spline representations – Bezier curves and surfaces – B-Spline curves and surfaces – 3D geometric and modelling transformations – 3D viewing – pipeline – coordinates – Projections – Clipping; Visible surface detection methods

UNIT IV ILLUMINATON AND COLOR MODELS 9

Light sources – basic illumination models – halftone patterns and dithering techniques – Properties of light – Standard primaries and chromaticity diagram; Intuitive color concepts – RGB color model – YIQ color model – CMY color model – HSV color model – HLS color model – Color selection

UNIT V ANIMATIONS AND REALISM 9

Animation Graphics – Design of Animation sequences – animation function – raster animation – key frame systems – motion specification – morphing – tweening – Computer graphics Realism: Tiling the plane - Koch curves – C curves – Dragons –space filling curves – Grammar based models – fractals – turtle graphics – ray tracing

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M, "Computer Graphics", First Edition, Prentice Hall, 2007
2. Steve Marschner, Peter Shirley, "Fundamentals of Computer Graphics", Fourth Edition, CRC Press, 2015

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. Donald Hearn and M. Pauline Baker, Warren Carithers, "Computer Graphics with Open GL", Fourth Edition, Pearson Education, 2010
2. John F. Hughes, Andries Van Dam, Morgan Mc Guire, David F. Sklar," Computer Graphics: Principles and Practice", Third Edition, Addison Wesley Professional, 2013
3. Jeffrey McConnell, "Computer Graphics: Theory into Practice", First Edition, Jones and Bartlett Publishers, 2006

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Illustrate graphics input and output primitives.	Understand
CO2	Construct 2D geometric transformations on objects	Apply
CO3	Construct 3D geometric transformations on objects	Apply
CO4	Examine illumination models and colour models	Understand
CO5	Apply animation techniques to real world problems	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	-	-	-	-	2	-	2	-	1
CO2	3	2	1	1	1	-	-	-	-	3	-	2	-	1
CO3	3	2	1	1	1	-	-	-	-	3	-	2	-	1
CO4	2	1	1	1	1	-	-	-	-	2	-	2	-	1
CO5	3	2	2	2	2	-	-	-	-	3	-	3	-	1
CO	2.6	1.6	1.2	1.2	1.2	-	-	-	-	2.6	-	2.2	-	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP18	MULTIMEDIA TECHNOLOGIES	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge on basic elements, file handling techniques of Multimedia
- To understand the concept of multimedia on the web and authoring tools
- To study multimedia applications with an added exposure to some of the popular tools / software

UNIT I BASIC ELEMENTS 9

Creation – Editing – Design – Usage – Tools and Hardware – File Formats for Text – Image / Graphics – Audio – Video – Multimedia data interface standards – Multimedia databases

UNIT II MULTIMEDIA FILE HANDLING 9

Compression and decompression – Data and file format standards – Multimedia I/O technologies – Digital voice and audio – Video image and animation – Full motion video – Storage and retrieval technologies

UNIT III MULTIMEDIA ON THE WEB 9

Hypertext – Hypermedia – Hypermedia Structures and Formats – Web Graphics – Web Design Guidelines – HTML5 – Plugins – Multimedia Networking

UNIT IV AUTHORING TOOLS 9

Authoring – Story Boarding – Metaphors – Card / Page – Icon – Timeline – Tools – Adobe Dream Weaver CC – Flash – Edge Animate CC – Camatasia Studio 8 – Claro – E-Learning Authoring Tools – Articulate – Elucidate

UNIT V MULTIMEDIA APPLICATIONS 9

Multimedia Databases – Content Based Information Retrieval, Multimedia Communications – Multimedia Information Sharing and Retrieval – Applications – Augmented Reality – Virtual Reality – Multimedia for Portable Devices – Collaborative Multimedia Applications

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Prabhat K. Andleigh and Kiran Thakrar, "Multimedia Systems Design", First Edition, Pearson, 2015

REFERENCES:

1. Ze - Nian Li, Mark S Drew and Jiangchuan Liu," Fundamentals of Multimedia", Second Edition, Springer, 2014
2. ParagHavaldar and Gerard Medioni, "Multimedia Systems - Algorithms, Standards and Industry Practices", First Edition, Course Technology, Cengage Learning, 2010
3. Nigel Chapman and Jenny Chapman, "Digital Multimedia", Third Edition, Wiley, 2009
4. Ralf Steinmetz and KlaraNahrstedt, "Multimedia Computing, Communications and Application", First Edition, Pearson, 2005

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Identify the basic elements of multimedia and file formats	Understand
CO2	Interpret Conceptual knowledge to solve issues related to emerging electronic technologies and graphic design	Understand
CO3	Illustrate the importance of web-based multimedia usage	Understand
CO4	Apply authoring tools for web and e-learning	Apply
CO5	Implement various software programs used in the creation of multimedia	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	2	-	-	-	-	-	-	2	-	1
CO2	2	1	1	2	2	-	-	-	-	-	-	2	-	1
CO3	2	1	1	1	3	-	-	-	-	-	-	2	-	1
CO4	3	2	2	2	3	2	-	-	-	-	2	3	-	2
CO5	3	2	2	2	2	2	-	-	-	-	2	3	-	2
CO	2.4	1.4	1.4	1.6	2.4	2	-	-	-	-	2	2.4	-	1.4

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP19	GRAPH THEORY AND ITS APPLICATIONS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire the fundamental concepts in graph theory, trees and spanning trees
- To lean the principles of cut-sets and connectivity to solve network flow problems
- To familiarize planarity, graph coloring, matching and covering

UNIT I INTRODUCTION 9

Graphs – Introduction – Applications of graphs – Finite and infinite graphs – Incidence and degree – Isolated vertex – Pendent vertex and Null graph – Isomorphism – Sub graphs – Walks – Paths – Circuits – Connectedness – Components – Euler graphs – Hamiltonian paths and circuits – The travelling salesman problem

UNIT II TREES AND FUNDAMENTAL CIRCUITS 9

Trees – Properties of trees – Pendant vertices in a tree – Distance and centers in tree – Rooted and binary trees – Spanning trees – Fundamental circuits – Finding all spanning trees of a graph – Spanning trees in a weighted graph

UNIT III CUT SETS AND CUT VERTICES 9

Cut sets – Properties of cut set – All cut sets – Fundamental circuits and cut sets – Connectivity and separability – Network flows – Max-flow Min-cut theorem – 1-Isomorphism: Operations and related theorems – 2-Isomorphism: Operations and related theorems

UNIT IV PLANARITY 9

Combinational and geometric graphs – Planer graphs – Kuratowski's two graphs – Different representations of a planer graph: Regions, Euler's formula – Spherical embedding – Detection of planarity – Homeomorphic graphs

UNIT V COLORING, COVERING AND PARTITIONING 9

Chromatic number – Chromatic partitioning – Chromatic polynomial and related theorems – Matching: Properties and theorems, Stable marriage problem – Covering: Properties – Theorems, Dimer covering – Four color problem – Five color theorem

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

TEXT BOOKS:

1. Narasing Deo, "Graph theory with application to Engineering and Computer Science", First Edition, Prentice Hall of India, 2016
2. West, D. B., "Introduction to Graph Theory", First Edition, Pearson Education, 2015

REFERENCES:

1. V.K.Balakrishnan, "Schaum's Outline of Graph Theory: Including Hundreds of Solved Problems", First Edition, Tata McGraw Hill, 2019
2. DL.R.Foulds, "Graph Theory Applications", Springer, 2016
3. Robin J. Wilson, "An Introduction to Graph Theory", First Edition, Pearson Education, 2010

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Integrate core theoretical knowledge of graph theory to solve problems	Apply
CO2	Apply the principles of tree and minimum spanning tree in problem solving	Apply
CO3	Apply the graph connectivity to address network design problems	Apply
CO4	Classify graphs into planar and non-planar	Analyze
CO5	Apply the knowledge of graph coloring, matching and covers in the field of computer science	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	1	-	-	-	2	-	2	-	1
CO2	3	2	1	2	-	1	-	-	-	2	-	3	-	2
CO3	3	2	2	2	-	2	-	-	-	2	-	2	-	2
CO4	3	3	1	1	-	1	-	-	-	2	-	2	-	2
CO5	3	2	3	2	-	2	-	-	-	2	-	3	-	2
CO	3	2.2	1.6	1.8	-	1.4	-	-	-	2	-	2.4	-	1.8

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP20	AGILE SOFTWARE DEVELOPMENT	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire the concepts of agile
- To understand agile scrum framework
- To understand agile development and testing with industry trends

UNIT I FUNDAMENTALS OF AGILE 9

The Genesis of Agile – Overview of Scrum – Extreme Programming – Feature Driven development – Lean Software Development – Agile project management – Design and development practices – Continuous Integration – Refactoring, Pair Programming – Simple Design – User Stories

UNIT II AGILE SCRUM FRAMEWORK 9

Scrum – Project phases – Agile Estimation – Planning game – Product and Sprint backlog – Iteration planning – User Stories definition and characteristics and verifying stories – Project velocity – Burn down chart – Sprint planning and retrospective – Daily scrum – Scrum roles – Product Owner – Scrum Master – Scrum Team – Scrum of Scrum – Kanban

UNIT III AGILE TESTING 9

Agile lifecycle and its impact on testing – Test-Driven Development (TDD) – Unit framework and tools for TDD – testing user stories – acceptance tests and scenarios – Planning and managing testing cycle – Exploratory, Risk based and Regression tests – Test Automation – Tools to support the Agile tester

UNIT IV AGILE SOFTWARE DESIGN AND DEVELOPMENT 9

Agile design practices – Open Closed Principle – Liskov Substitution Principle – Interface Segregation Principles – Dependency Inversion Principle in Agile Design – Need and significance of Refactoring – Refactoring Techniques – Continuous Integration – Automated build tools – Version control

UNIT V AGILE INDUSTRY TRENDS 9

Market scenario and adoption of Agile – Agile ALM –Roles in an Agile project – Agile applicability– Agile in Distributed teams – Business benefits – Challenges in Agile – Risks and Mitigation – Agile projects on Cloud – Balancing Agility with Discipline – Agile rapid development technologies

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Robert C. Martin, Jan M. Rabaey, Anantha P. Chandrakasan, Borivoje Nikolic, "Agile Software Development: Principles, Patterns, and Practices", Third Edition, Pearson Education, 2016
2. David J. Anderson and Eli Schragenheim, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Second Edition, Prentice Hall,2015

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. Paul Flewelling," The Agile Developer's Handbook: Get More Value from Your Software Development: Get the Best Out of the Agile Methodology", First Edition, Packet Publishing Ltd., 2018
2. Hazza and Dubinsky," Agile Software Engineering, Series: Undergraduate Topics in Computer Science", First Edition, Springer, 2009
3. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", First Edition, Butterworth-Heinemann, 2007.
4. Ken Schawber, Mike Beedle," Agile Software Development with Scrum", First Edition, Pearson Education, 2014

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Outline the importance of agile methodology in real time projects	Understand
CO2	Infer the different phases in scrum agile framework	Understand
CO3	Experiment with testing activities within an Agile project	Apply
CO4	Make use of different principles to design and develop software using agile	Apply
CO5	Interpret the recent trends and challenges of agile used in industry	Understand

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	2	2	-	1
CO2	2	1	1	2	1	-	-	-	2	-	2	2	-	1
CO3	3	2	2	2	1	-	-	-	-	-	3	3	-	2
CO4	3	2	2	2	1	-	-	-	3	2	3	3	-	2
CO5	2	1	1	1	2	-	-	-	3	2	2	2	-	3
CO	2.4	1.4	1.4	1.6	1.3	-	-	-	2.7	2	2.4	2.4	-	1.8

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP21	SERVICE ORIENTED ARCHITECTURE AND MICROSERVICES	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the basic principles of service orientation
- To learn service oriented analysis techniques and technology underlying the service design
- To acquire knowledge on basic concepts of SOAP, Registering and Discovering Services

UNIT I SOFTWARE ARCHITECTURE FOR APPLICATIONS 9

Software Architecture: Need for Software Architecture – Objectives of Software Architecture – Types of Information Technology (IT) Architecture – Architectural Patterns and Styles – Architecting Process for Software Applications: Architectural Considerations – Architecting Process for Software Applications – Level 0: High Level Architecture – Level 1: Solution Architecture Detailed Design

UNIT II SOA AND MSA BASICS 9

Service Orientation in Daily Life – Evolution of SOA and MSA Service oriented Architecture and Micro services architecture – Drivers for SOA – Dimensions of SOA – Conceptual Model of SOA – Standards and Guidelines for SOA – Emergence of MSA – Considerations for Enterprise wide SOA – Strawman Architecture for Enterprise wide SOA – Enterprise SOA Reference Architecture

UNIT III SERVICE ORIENTED APPLICATIONS 9

Considerations for Service oriented applications – Patterns for SOA – Pattern-based Architecture for Service oriented Applications – Composite Applications – Composite Application Programming Model – Service Oriented Analysis and Design

UNIT IV MICROSERVICES ARCHITECTURE 9

Trend in SOA – Micro Services Architecture (MSA) – Services Model for Cloud and Mobile Solutions – API Adoption on the Rise – Challenges and Take always from SOA Implementations Architecture Trend – Micro Services Architecture – Micro Services Architecture in Action

UNIT V RESONANCE AND COUPLED CIRCUITS 9

Cloud and MSA – Cloud Services – Hybrid Cloud Services – Considerations for Hybrid Cloud Services – Cloud Services and MSA – MSA for SMAC Solutions – Mobile and MSA – Mobile Technologies – Types of Mobile Applications – MSA for mobile solutions – Case Study – SOA – Loan Management System (LMS) PoC – MSA – APIary PoC

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1 Shankar Kambhampaty, "Service - Oriented Architecture & Micro services Architecture", Third Edition, Wiley, 2018

2 Thomas Erl, "Service Oriented Architecture – Analysis and Design for Services and Microservices", First Edition, Pearson Education, 2005

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. Sam Newman, "Building Microservices Designing Fine Grained Systems", First Edition, O'Reilly, 2015
2. James McGovern, Sameer Tyagi, Michael E Stevens, Sunil Mathew, "Java Web Services Architecture", First Edition, Elsevier, 2003
3. Frank P.Coyle, "XML, Web Services and the Data Revolution", First Edition, Pearson Education, 2002

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

Cos	Statements	K-Level
CO1	Describe the foundations and concepts of software architecture in applications	Understand
CO2	Summarize the importance and means of SOA and MSA	Understand
CO3	Examine the operations supports service-oriented architecture applications	Understand
CO4	Infer the knowledge of key technologies in the arena of MSA	Understand
CO5	Apply and practice the learning through a real or illustrative project/case study	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	-	1	-	2
CO2	2	1	1	1	-	-	-	-	-	-	-	1	-	2
CO3	2	1	1	1	-	-	-	-	-	-	-	1	-	2
CO4	2	1	2	1	1	-	-	-	-	-	-	1	-	2
CO5	3	2	3	2	2	2	-	-	-	-	2	2	-	3
CO	2.2	1.2	1.6	1.2	1.5	2	-	-	-	-	2	1.2	-	2.2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP22	SOFTWARE TESTING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the basics of testing and software testing lifecycle models.
- To learn about various levels of testing
- To learn about the issues, measurements and review of testing

UNIT I SOFTWARE TESTING FUNDAMENTALS 9

Testing as an Engineering Activity – Testing as a Process – Testing axioms – Basic definitions-software testing principles – Role of tester – testing as a process – Overview of Testing maturity model – Defects – Hypothesis and tests – Software Quality attributes – Software Testing life cycle – Software Specifications

UNIT II TEST DESIGN STRATEGIES 9

Introduction to Testing Design Strategies – The Smarter Tester – Test Case Design Strategies – Black Box testing – Random Testing – Equivalence Class Partitioning – Boundary Value Analysis – Cause and error graphing and state transition testing – Error Guessing – Black box testing and COTS – White Box testing – Test Adequacy Criteria – Coverage and Control Flow Graphs

UNIT III LEVELS OF TESTING 9

Unit testing – Need – Functions – Plan – Design – Considerations – Test Harness – Integration testing Goals – Strategies – Design – Plan – System testing – Function test – Performance test – Stress test – Configuration test – Security test – Recovery test – Regression testing – Alpha – beta – Acceptance test – Special role of Use cases – levels of testing and TMM

UNIT IV TEST MANAGEMENT 9

People and organizational issues in testing – organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results

UNIT V TEST MEASUREMENTS AND REVIEW 9

Defining Terms – Measurements and Milestones for Controlling and Monitoring – Status Meetings – Reports and Control Issues – Criteria for Test Completion – SCM – Types of reviews – developing a review program – Components of Review Plans – Reporting review results – Testing Tools – Case Selenium – Autoit

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Ilene Burnstein, "Practical Software Testing", First Edition, Springer, 2012
2. Ali Mili, Fairouz Tchier, "Software Testing Concepts and Operations", First Edition, Wiley, 2015

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. S Limaye, "Software Testing Principles, Techniques and Tools", Third Edition, McGraw Hill, 2009
2. Aditya P.Mathur, "Foundations of Software Testing", Second Edition, Pearson Education,2008
3. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing, Principles and Practices", First Edition, Pearson Education,2008

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Examine the role of tester, fundamentals and activities in software testing	Understand
CO2	Explore the design strategies for test cases	Apply
CO3	Elucidate the levels of testing and defect classes	Understand
CO4	Communicate effectively with developers and other stakeholders	Understand
CO5	Implement the testing and debugging policies with the types of review	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	2	1	-	-	-	-	-	1	2	-	1
CO2	3	2	2	3	2	-	-	-	-	-	2	3	-	2
CO3	2	1	2	2	2	-	-	-	-	-	1	2	-	1
CO4	2	1	3	2	2	-	-	-	2	3	1	2	-	1
CO5	3	2	3	3	3	-	-	-	-	2	2	3	-	2
CO	2.4	1.4	2.4	2.4	2	-	-	-	2	2.5	1.4	2.4	-	1.4
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP23	SOFTWARE QUALITY ASSURANCE	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the basic concepts of software quality and quality factors
- To study the SQA components can be integrated into the project life cycle
- To understand management components supports software quality and software quality infrastructure

UNIT I SOFTWARE QUALITY & ARCHITECTURE 9

Need for Software quality – Quality challenges – Software quality assurance SQA – Definition and objectives – Software quality factors – McCall's quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans

UNIT II SQA COMPONENTS AND PROJECT LIFE CYCLE 9

Software Development methodologies – Quality assurance activities in the development process – Verification & Validation – Reviews – Software Testing and its implementations – Quality of software maintenance – Pre maintenance of software quality components – CASE tools for software quality – Project Management

UNIT III SOFTWARE QUALITY INFRASTRUCTURE 9

Procedures and work instructions – Templates – Checklists – 3S development – Staff training and certification – Corrective and preventive actions – Configuration management – Software change control – Configuration management audit – Documentation control – Storage and retrieval

UNIT IV SOFTWARE QUALITY MANAGEMENT & METRICS 9

Project process control – Computerized tools – Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model

UNIT V STANDARDS, CERTIFICATIONS & ASSESSMENTS 9

Quality management standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies – Bootstrap methodology – SPICE Project – SQA project process standards – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 60 Periods

TEXT BOOKS:

1. Daniel Galin, "Software Quality Assurance", First Edition, Pearson Publication, 2015
2. Stephen Kan, "Metrics and Models in Software Quality Engineering" Second Edition, Addison Wesley, 2016

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. Alan C. Gillies, "Software Quality: Theory and Management", First Edition, International Thomson Computer Press, 2018
2. Mordechai Ben-Menachem "Software Quality: Producing Practical Consistent Software", First Edition, International Thompson Computer Press, 2015

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Examine the concepts in software development life cycle	Understand
CO2	Demonstrate their capability to adopt quality standards	Apply
CO3	Analyze the quality of software product	Analyze
CO4	Apply the concepts in preparing the quality plan & documents	Apply
CO5	Analyze the software quality infrastructure	Analyze

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	2	1	-	-	-	-	-	1	1	2	-	1
CO2	3	2	3	2	2	-	-	-	1	2	2	3	-	1
CO3	3	3	3	3	-	-	-	-	-	2	3	3	-	2
CO4	3	2	3	2	-	-	-	-	2	3	2	3	-	1
CO5	3	3	3	3	1	-	-	-	-	1	3	3	-	2
CO	2.8	2.2	2.8	2.2	1.5	-	-	-	1.5	1.8	2.2	2.8	-	1.4

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP24	UI AND UX DESIGN	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the principles of design and digital strategy for design.
- To acquire knowledge on the presentation techniques.
- To learn tools for futuristic technologies

UNIT I DESIGN PRINCIPLES AND EFFECTS 9

Introduction to design principles – Accessibility – Advance organization – Chunking – classical conditioning – exposure effect – Garbage In-Garbage Out – Hierarchy – Interference Effects – Layering – Operant Conditioning, Readability – von Restorff Effect – The Anatomy of Sketching

UNIT II APEAL IN DESIGN AND DIGITAL STRATEGY 9

Alignment – Archetypes – Attractiveness Bias – Cognitive Dissonance – Prospect – Refuge – Rule of Thirds – Savanna Preference – Similarity – Symmetry – Top-Down Lighting Bias – Waist-to-Hip Ratio – The Cycle of Innovation.

UNIT III PRESENTATION TECHNIQUES 9

Affordance – Alignment-Common Fate – Consistency – Face-ism Ratio – Figure-Ground Relationship – Gutenberg Diagram – Iconic Representation – Law of Pragnanz, Proximity – Three-Dimensional Projection – Uniform Connectedness

UNIT IV USABILITY OF DESIGN 9

User Experience design in ecommerce – incremental innovation – Stigler's Law-Hicks law – Fitts law – interference effect-visibility and way finding – Inverted Pyramid – Mental Model – Performance Load – Progressive Disclosure – Recognition Over Recall

UNIT V DESIGN DECISION 9

80/20 Rule – Cost-Benefit-Development Cycle – Expectation Effect – Feedback Loop – Prototyping – Structural Forms – Uncertainty Principle – Gathering information source and strategy – Skimming and scanning – Newsletters – feeds-groups Multimedia resources: video-audio-and courses – Conferences and local events

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. William Lidwell, Kritina Holden, Jill Butler, "Universal principles of Design", Second Edition Rockport publishers, 2017
2. Bill Buxton, "Sketching the User experiences", First Edition, Focal press, 2017

REFERENCES:

1. Susan Weins Chenk, "Hundred things every designer needs to know about people", First Edition, Pearson, 2015
2. Raman, Meenakshi and Sharma, "Technical Communication: Principles and Practice", First Edition, Oxford, 2015
3. Scott Sullivan, "Designing for wearable: Effective UX for current and Future Devices", First Edition, O'Reilly, 2016

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Apply the basic concepts of elements and principles of design issues	Apply
CO2	Develop digital strategy for appeal in design.	Apply
CO3	Create and present design innovatively	Apply
CO4	Design innovatively in web interface	Apply
CO5	Analyze the possibilities to take decision for better design.	Analyze

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	-	-	-	-	2	1	2	-	1
CO2	3	2	2	1	1	-	-	-	-	2	1	2	-	1
CO3	3	2	2	1	2	-	-	-	-	3	1	2	-	1
CO4	3	2	2	1	2	-	-	-	-	3	1	2	-	1
CO5	3	3	3	3	2	-	-	-	-	2	2	3	-	2
CO	3	2.2	2.2	1.6	1.6	-	-	-	-	2.4	1.2	2.2	-	1.2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP25	INFORMATION STORAGE MANAGEMENT	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- U19CS404 Database Management Systems

COURSE OBJECTIVES:

- To understand the challenges in information storage and management
- To study the core elements in a data center
- To understand RAID and its various levels for data backup

UNIT I STORAGE SYSTEM 9

Introduction to information storage – Virtualization and cloud computing – Key data center elements – Compute, application and storage virtualization – Disk dive & flash drive components and performance – RAID – Intelligent storage system and storage provisioning

UNIT II STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION 9

Fibre Channel SAN components – FC protocol and operations – Block level storage virtualization – iSCL and FCIP as an IP-SAN solutions – Converged networking option FcoE – Network Attached Storage (NAS) components – protocol and operations – File level storage virtualization

UNIT III BACKUP, ARCHIVE AND REPLICATION 9

Business continuity terminologies – planning and solutions – Clustering and multipathing to avoid single points of failure – Backup and recovery methods – targets and topologies – data deduplication and backup in virtualized environment – fixed content and data archive – Local replication in classic and virtual environments

UNIT IV CLOUD COMPUTING CHARACTERISTICS AND BENEFITS 9

Cloud Enabling Technologies – Characteristics of Cloud Computing – Benefits of Cloud Computing – Cloud Service Models Cloud deployment models – Cloud Computing Infrastructure – Cloud Challenges – Cloud migration considerations

UNIT V SECURING AND MANAGING STORAGE INFRASTRUCTURE 9

Security threats and countermeasures in various domains – Security solutions for FC-SAN – IP-SAN and NAS environments – Security in virtualized and cloud environments – Monitoring and managing various information infrastructure components in classic and virtual environments – Information lifecycle Management and storage tiering

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Somasundaram Gnanasundaram, Alok Shrivastava, "Information Storage and Management: Storing, Managing and Protecting Digital Information in classic, Virtualized and Cloud Environments", Second Edition, EMC Educations Services, Wiley, 2012

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. Ulf Troppens, Rainer Erkens, Wolfgang Mueller-Friedt, Rainer Wolafka, Nils Haustein,"Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE, 2nd Edition, Wiley, July 2009
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall, 2015.

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Examine the perspectives of the physical and logical components related to storage infrastructure including storage subsystems, RAID and intelligent storage systems	Apply
CO2	Analyze the network storage technologies correlated with virtualization such as FC-SAN, IP-SAN, FCoE, NAS and object- based, and unified storage	Apply
CO3	Categorize the business continuity solutions, backup and replications associated with archive for managing fixed content	Analyze
CO4	Analyze the key characteristics, services, deployment models, and infrastructure components for the cloud environment	Analyze
CO5	Apply the concept of security solutions for FC-SAN, IP-SAN and NAS environments with respect to storage infrastructure management	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	-	-	1	1	-	3
CO2	3	2	1	2	-	-	-	-	-	-	1	1	-	3
CO3	3	3	1	3	-	-	-	-	-	-	2	2	-	3
CO4	3	3	2	3	2	-	-	-	-	-	2	2	-	3
CO5	3	2	1	2	-	-	-	-	-	-	1	1	-	3
CO	3	2.4	1.2	2.4	2	-	-	-	-	-	1.4	1.4	-	3

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP26	DIGITAL IMAGE PROCESSING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the basic principles of digital image processing
- To understand simple image enhancement techniques in Spatial and Frequency domain
- To learn concepts of degradation function and restoration techniques

UNIT I DIGITAL IMAGE PROCESSING PRINCIPLES 9

Introduction – Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels – color models

UNIT II IMAGE ENHANCEMENT 9

Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering – Smoothing and Sharpening Spatial Filtering – Frequency Domain: Introduction to Fourier Transform – Smoothing and Sharpening frequency domain filters – Ideal – Butterworth and Gaussian filters

UNIT III IMAGE RESTORATION AND SEGMENTATION 9

Wavelets – Subband coding – Multiresolution expansions - Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards

UNIT IV WAVELETS AND IMAGE COMPRESSION 9

Wavelets – Subband coding – Multiresolution expansions - Compression: Fundamentals – Image Compression models – Error Free Compression – Variable Length Coding – Bit-Plane Coding – Lossless Predictive Coding – Lossy Compression – Lossy Predictive Coding – Compression Standards

UNIT V IMAGE REPRESENTATION AND RECOGNITION 9

Boundary representation – Chain Code – Polygonal approximation – signature – boundary segments – Boundary description – Shape number – Fourier Descriptor – moments – Regional Descriptors – Topological feature – Texture – Patterns and Pattern classes – Recognition based on matching

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Fourth Edition, Pearson Education, 2018

REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition, Tata McGraw Hill Pvt. Ltd., 2011
2. Anil Jain K. "Fundamentals of Digital Image Processing", Second Edition, PHI Learning Pvt. Ltd., 2011
3. Willliam K Pratt, "Digital Image Processing", Third Edition, John Willey, 2002

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Explain the basics of digital image Principles	Understand
CO2	Explore the concepts of image enhancement and restoration techniques	Understand
CO3	Apply and practice various image compression and segmentation Techniques	Apply
CO4	Analyze the wavelets Transformation and image compression Techniques	Analyze
CO5	Apply image representation and recognition based on its matching of patterns	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	-	1	2	-
CO2	2	1	1	1	-	-	-	-	-	-	-	1	2	-
CO3	3	2	2	2	1	-	-	-	-	-	-	2	3	-
CO4	3	3	2	3	1	-	-	-	-	-	-	2	3	-
CO5	3	2	3	2	2	-	-	-	-	-	-	2	3	-
CO	2.6	1.8	1.8	1.8	1.3	-	-	-	-	-	-	1.6	2.6	-
Correlation levels:		1: Slight (Low)		2: Moderate (Medium)				3: Substantial (High)						

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP27	PATTERN RECOGNITION	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the fundamental algorithms for pattern recognition
- To learn the various classification techniques
- To understand the feature extraction techniques in real time applications

UNIT I PATTERN RECOGNITION 9

Introduction and mathematical preliminaries – What is pattern recognition? – Clustering vs. Classification – Applications – Linear Algebra – vector spaces – probability theory, estimation techniques – parametric and non – parametric techniques of pattern recognition.

UNIT II CLASSIFICATION 9

Classification: Bayes decision rule – Error probability – Error rate – Minimum distance classifier – Mahalanobis distance – KNN Classifier – Linear discriminant functions and non – linear decision boundaries: Fisher's LDA – Single and Multilayer perceptron – training set and test sets – standardization and normalization.

UNIT III CLUSTERING 9

Clustering: Different distance functions and similarity measures – Minimum within cluster distance criterion – K-means clustering – single linkage and complete linkage clustering-MST, medoids, DBSCAN, Visualization of datasets, existence of unique clusters or no clusters.

UNIT IV FEATURE SELECTION 9

Feature selection: Problem statement and Uses – Probabilistic separability based criterion functions –interclass distance based criterion functions – Branch and bound algorithm – sequential forward/backward selection algorithms – (l,r) algorithm.

UNIT V FEATURE EXTRACTION AND RECENT ADVANCES 9

Feature Extraction: PCA-Kernel PCA. Recent advances in PR: Structural PR – SVMs – FCM – Soft Computing and Neuro-fuzzy – non-metric methods: Decision trees – CART methods

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification", Second Edition, John Wiley, 2019.
2. K. Fukunaga; "Statistical pattern Recognition", First Edition, Academic Press, 2015.

REFERENCES:

1. Tou and Gonzales, "Pattern Recognition Principles", First Edition, Wesley Publication Company, London, 2015
2. Morton Nadier and Eric Smith P., "Pattern Recognition Engineering", First Edition, John Wiley & Sons, New York, 2012
3. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", Fourth Edition, Academic Press, 2012

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Describe the fundamental concept of pattern recognition	Understand
CO2	Outline the various classification and clustering techniques	Understand
CO3	Apply the concept and techniques of clustering	Apply
CO4	Apply parametric & non-parametric techniques of pattern recognition	Apply
CO5	Apply the concept of pattern in feature extraction and its recent advancements	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	-	-	-	-	-	-	2	2	-
CO2	2	1	-	1	-	-	-	-	-	-	-	2	2	-
CO3	3	2	2	2	1	-	-	-	-	-	1	3	3	-
CO4	3	2	2	2	1	-	-	-	-	-	1	3	3	-
CO5	3	2	2	2	2	-	-	-	-	-	2	3	3	-
CO	2.6	1.6	2	1.6	1.3	-	-	-	-	-	1.3	2.6	2.6	-
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP28	HUMAN COMPUTER INTERACTION	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the foundations of Human Computer Interaction
- To understand the design technologies for individuals and persons with disabilities
- To study the guidelines for mobile HCI and user interface

UNIT I FOUNDATIONS OF HCI 9

The Human: I/O channels – Memory – Reasoning and problem solving – The Computer: Devices – Memory – processing and networks – Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity – Paradigms – Case Studies

UNIT II DESIGN & SOFTWARE PROCESS 9

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping – HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale – Design rules: principles – standards – guidelines – rules – Evaluation Techniques – Universal Design

UNIT III MODELS AND THEORIES 9

HCI Models: Cognitive models: Socio Organizational issues and stakeholder requirements – Communication and collaboration models Hypertext – Multimedia and WWW

UNIT IV MOBILE HCI 9

Mobile Ecosystem: Platforms – Application frameworks – Types of Mobile Applications: Widgets – Applications – Games – Mobile Information Architecture – Mobile 2.0 – Mobile Design: Elements of Mobile Design – Tools – Case Studies

UNIT V WEB INTERFACE DESIGN 9

Designing Web Interfaces – Drag & Drop – Direct Selection – Contextual Tools – Overlays – Inlays and Virtual Pages – Process Flow – Case Studies

Contact Periods:

Lecture: 45 Periods Tutorial: 0 Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", Third Edition, Pearson Education, 2017
2. Brian Fling, "Mobile Design and Development", First Edition, O'Reilly Media Inc., 2009

REFERENCES:

1. Andrew Sears Julie A.Jacko, "The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications", Second Edition, CRC Press, 2010
2. Martin Helander, "Handbook of Human Computer Interaction", First Edition, Elsevier Science Publisher, 2010

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Discuss the concepts of Interaction framework models and its paradigms	Understand
CO2	Summarize the effective HCI based on software process and design guidelines	Understand
CO3	Apply the HCI models and its principles for operative HCI	Apply
CO4	Design the competent and effective HCI for mobile based system	Apply
CO5	Analyze the web interfaces using appropriate tools and techniques	Analyze

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	1	1	-	-
CO2	2	1	1	1	-	-	-	-	-	-	1	1	-	-
CO3	3	2	2	2	2	-	-	-	-	-	2	2	-	1
CO4	3	2	2	2	2	-	-	-	-	-	2	2	-	2
CO5	3	3	2	2	2	-	-	-	-	-	1	1	-	2
CO	2.6	1.8	1.6	1.6	2	-	-	-	-	-	1.4	1.4	-	1.7

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP29	EXTENDED REALITY	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concept of 3D user interface and to promote design and technological foundations in VR
- To learn the basic concepts of AR and ER and the challenges.
- To study the production of highly integrative immersive applications

UNIT I 3D USER INTERFACE INPUT / OUTPUT HARDWARE 9

Input Hardware – Input device characteristics – Desktop input devices – Tracking Devices – 3D Mice – Special Purpose and Home Brewed Input Devices – Direct Human Input – Choosing Input Devices for 3D Interfaces – Output Hardware – Visual / Auditory Displays – Haptic Displays

UNIT II SOFTWARE TECHNOLOGIES 9

Database – World Space – World Environment – Objects – Geometry – Position – Hierarchy – Bounding Volume – Scripts and other attributes –VR Database –Tessellated Data – LODs – Cullers and Occluders – Lights and Cameras – Interaction – GUI – VR toolkits – Software in the market

UNIT III IMMERSIVE TECHNOLOGIES 9

History of Virtual Reality – Components off a VR System – Early VR Technology – VR becomes an Industry – Reality – Virtuality and Immersion – VR AR MR XR: Similarities and differences – Promising application fields – benefits of VR – Trends in VR

UNIT IV AUGMENTED REALITY 9

Augmented Reality Concepts – Challenges – Fundamentals: From Photons to Pixels – Hardware Software – Augmented Reality Displays – Head Attached Displays – Hand Held Displays – Spatial Displays

UNIT V EXTENDED REALITY 9

Augmented and Mixed Reality – Taxonomy – technology and features of augmented reality – Emerging Applications: Extended Reality in Product Development – Medical – Military – Environment – Designing Environment

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", First Edition, Addison Wesley, 2017
2. Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", First Edition, Morgan Kaufmann, 2013

REFERENCES:

1. Kelly S. Hale, Kay M. Stanney. Handbook of Virtual Environments: Design, Implementation, and Applications, Second Edition, CRC press, 2014
2. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Merging Real and Virtual Worlds", First Edition, A K Peters/CRC Press,2015
3. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", First Edition, Wiley Interscience, 2017

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Interpret the fundamentals of VR and to gain practical knowledge	Understand
CO2	Outline the software technologies used in VR environments	Understand
CO3	Analyze the techniques of VR, AR and MR	Analyze
CO4	Apply pivotal role in transforming teaching and learning in higher education	Apply
CO5	Demonstrate the applications of recent technologies in Mixed Reality	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	-	-	-	-	-	-	2	-	2
CO2	2	1	1	1	1	-	-	-	-	-	-	2	-	2
CO3	3	3	2	3	3	-	-	-	-	-	-	3	-	3
CO4	3	2	3	2	3	3	-	-	-	2	2	3	-	3
CO5	3	2	3	2	3	3	3	-	-	2	2	3	-	3
CO	2.6	1.8	2	1.8	2.2	3	3	-	-	2	2	2.6	-	2.6

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP30	NATURAL LANGUAGE PROCESSING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the fundamentals of natural language processing
- To understand the use of CFG and PCFG in NLP
- To understand the role of semantics of sentences and pragmatics and its applications

UNIT I FOUNDATIONS OF NLP 9

Origin and challenges of NLP – Language Modelling: 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

UNIT II WORD LEVEL ANALYSIS 9

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 9

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 9

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

UNIT V DISCOURSE ANALYSIS AND LEXICAL RESOURCES 9

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)

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin, "Speech and Language Processing", Second Edition, Pearson Publication, 2016
2. Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", Third Edition, O' Reilly Media, 2019

REFERENCES:

1. Breck Baldwin, "Language processing with Java and Ling Pipe Cookbook", First Edition, Atlantic Publisher, 2015
2. Richard M Reese, "Natural Language Processing with Java", Second Edition, O'Reilly Media, 2015
3. Nitin Indurkhya and Fred J. Damerau, "Handbook of Natural Language Processing", Second Edition, CRC Press, 2010

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Tag a given text with basic Language features	Apply
CO2	Design an innovative application using NLP components	Apply
CO3	Implement a rule-based system to tackle morphology/syntax of a language	Analyze
CO4	Design a tag set to be used for statistical processing for real-time applications	Apply
CO5	Compare and contrast the use of different statistical approaches for different types of NLP applications	Analyze

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	1	-	-	-	-	1	-	1	2	-
CO2	3	2	2	2	1	-	-	-	-	1	-	1	2	-
CO3	3	3	2	3	2	-	-	-	-	2	-	2	3	-
CO4	3	2	2	2	1	-	-	-	-	1	-	1	2	-
CO5	3	3	2	3	2	-	-	-	-	1	-	2	3	-
CO	3	2.4	1.8	2.4	1.4	-	-	-	-	1.2	-	1.4	2.4	-
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)		

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP31	INFORMATION RETRIEVAL	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire the knowledge of Web search, indexing and query processing
- To learn document text mining techniques.
- To understand web content mining for retrieving most relevant documents

UNIT I IR FRAMEWORKS 9

Introduction – History of IR – Components of IR – Issues – Open source Search Engine Frameworks – The impact of the web on IR – The role of artificial intelligence (AI) in IR – IR Versus Web Search – Components of a Search engine – Characterizing the web

UNIT II TEXT RETRIEVAL AND SEARCH ENGINES 9

Natural Language Content Analysis – Text Retrieval Problem – Overview of Text Retrieval Methods – Vector Space Retrieval Model – TF Transformation – Doc Length Normalization – Implementation of TR Systems – Evaluation of TR Systems

UNIT III WEB SECURITY AND CRAWLING 9

Web security overview and concepts – Web application security – Basic web security model – Web Hacking Basics – Basic Crawler Algorithm: Breadth First – Depth First Crawlers – Universal Crawlers – Preferential Crawlers – Focused Crawlers – Topical Crawlers

UNIT IV INDEXING 9

Static and Dynamic Inverted Index – Index Construction and Index Compression – Latent Semantic Indexing – Searching using an Inverted Index – sequential Search – Pattern Matching – Similarity search

UNIT V WEB STRUCTURE MINING 9

Link Analysis – Social Network Analysis – Co-Citation and Bibliographic Coupling – Page Rank Weighted Page Rank – HITS – Community Discovery – Web Graph Measurement and Modelling using Link Information for Web Page Classification

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, "Introduction to Information Retrieval", Second Edition, Cambridge University Press, 2017.
2. Kowalski Gerald, "Information Retrieval Architecture and Algorithms", First Edition, Springer, 2014.

REFERENCES:

1. W. Bruce Croft, Donald Metzler, Trevor Strohman," Search Engines Information Retrieval in Practice", Addison-Wesley,2010.

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Infer the components of an Information Retrieval and its issues	Understand
CO2	Analyze the problem, implementation and evaluation of various text retrieval method	Analyze
CO3	Apply the concept to Build the crawler algorithm over security system	Apply
CO4	Analyze various indexing technique to optimize search	Analyze
CO5	Analyze the performance on web structure and its content	Analyze

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	-	-	-	-	-	-	-	1	2	-
CO2	3	3	1	1	-	-	-	-	-	-	-	1	3	-
CO3	3	2	2	2	2	-	-	-	-	-	2	1	3	-
CO4	3	3	2	2	1	-	-	-	-	-	2	1	3	-
CO5	3	3	2	2	1	-	-	-	-	-	2	1	3	-
CO	2.8	2.4	1.6	1.6	1.33	-	-	-	-	-	2	1	2.8	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP32	MACHINE LEARNING –I	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn concepts of Machine Learning
- To understand Decision tree, Bayesian learning and Artificial Neural Networks concepts
- To perform statistical analysis of machine learning techniques

UNIT I MACHINE LEARNING FUNDAMENTALS 9

What is Machine Learning– Definitions – Theoretical & Applied Practice – AI vs. Machine Learning vs. Deep Learning –Types of Machine Learning (Supervised, Unsupervised, Reinforcement)– Introduction to Data Mining & Techniques – CRISP-DM Process

UNIT II DATA ENGINEERING 9

What is Data Vs Information – Data Preprocessing: Knowing data – Continuous – discrete – Linear & Non-Linear data – Data cleaning – Data reduction – Data transformation – Data discretization – Handle Missing value – Removing duplicates – Outlier Treatment – Normalizing and Scaling (Numerical Variables) – Encoding Categorical variables

UNIT III APPLIED SATISTICS 9

Permutation and Combination – Probability: Complement – Intersection – Union – Conditional Probability – Independent Events – Mutually Exclusive a Collectively Exhaustive Events – Bayes' Theorem – Central Tendency – Mean – Median – Mode – Skewness – Kurtosis – Distribution – Uniform – Normal – Poisson – Bionomial – Probability Exponential – Chi-Square

UNIT IV SUPERVISED LEARNING 9

Regression – Linear Regression – Support Vector Regression (SVR) Classification – Random Forest – Decision Trees – SVM – KNN – Naïve Bayes –Gradient boosting – Neural Networks – Multilayer Perception – Recommender systems – Market basket Analysis–Collaborative filtering & Content-based filtering – Boosting – Gradient and AdaBoosting – XGBoost

UNIT V UNSUPERVISED LEARNING 9

Clustering: K-Means – K Nearest Neighbours, Hierarchical clustering – Association Rule Learning – Dimensionality Reduction: Principle Component Analysis – Independent Component Analysis – Anomaly detection – Apriori algorithm – Singular value decomposition

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Tom M. Mitchell, "Machine Learning", Second Edition, McGraw Hill Education, India, 2016.
2. Ethem Alpaydin, "Introduction to Machine Learning", Fourth Edition, MIT press, 2020

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

REFERENCES:

1. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012.
2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
3. Gareth James,Daniela Witten,Trevor Hastie Robert Tibshirani," An Introduction To Statistical Learning With Applications In R",Seventh Edition,Springer,2017
4. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Second Edition, Springer series in statistics, 2015

COURSE OUTCOMES:

Upon completion of the course, the student will be able to:

Cos	Statements	K-Level
CO1	Interpret concepts and techniques of Machine Learning	Understand
CO2	Illustrate the different techniques on data engineering	Understand
CO3	Develop the statistical methods for the given problem	Apply
CO4	Design systems that use supervised learning algorithms	Apply
CO5	Develop model using unsupervised learning algorithms	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	-	-	-	-	-	1	1	2	2	-
CO2	2	1	1	2	2	-	-	-	-	1	2	2	2	-
CO3	3	2	2	3	3	2	1	-	-	2	2	3	3	-
CO4	3	2	3	3	3	3	2	-	-	2	2	3	3	-
CO5	3	2	3	3	3	3	2	-	-	2	2	3	3	-
CO	2.6	1.6	2	2.6	2.7	2.7	1.7	-	-	1.6	1.8	2.6	2.6	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP33	DEEP LEARNING	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand deep learning abstractions and Methodologies
- To learn deep forward and convolutional network models and their performance
- To acquire knowledge on real world deep learning applications

UNIT I DEEP LEARNING BASICS 9

Biological Neuron, Idea of computational units, McCulloch – Pitts unit and Thresholding logic- Single Computational Layer: The Perceptron – Learning Algorithms – Capacity – Overfitting and Under fitting – Hyperparameters and Validation Sets – Estimators – Bias and Variance – Maximum Likelihood Estimation – Supervised Learning Algorithms – Unsupervised Learning Algorithms

UNIT II ARCHITECTURE OF NEURAL NETWORKS 9

Perceptron Optimization – Relationship with Support Vector Machines – Choice of Activation and Loss Functions – Choice and Number of Output Nodes – Choice of Loss Function – Derivatives of Activation Functions

UNIT III DEEP FEEDFORWARD NETWORKS 9

Building a Machine Learning Algorithm – Challenges Motivating Deep Learning – Example: Learning XOR – Gradient Based Learning – Hidden Units – Back Propagation and Other Differentiation Algorithms – Practical Issues in Neural Network Training – The Vanishing and Exploding Gradient Problems

UNIT IV CONVOLUTIONAL NEURAL NETWORKS 9

The Basic Structure of a Convolutional Network: Padding – Strides – Typical Settings – Polling – The ReLU Layer – Fully Connected Layers – The Interleaving Between Layers – Local Response Normalization – Training a Convolutional Network using Tensor Flow – Recurrent Neural Networks

UNIT V CASE STUDIES 9

Vision, NLP, Speech – Case Studies of Convolutional Architectures: AlexNet – ZFNet – VGG – GoogleLeNet – ResNet – Pretrained Models – Applications of Convolutional Networks: Content Based Image Retrieval using Tensor Flow – Object Localization – Object Detection

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Charu C.Aggarwal, "Neural Networks and Deep learning", First Edition, Springer International Publishing, 2018
2. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", First Edition, The MIT Press, 2016

REFERENCES:

1. Habibi Aghdam, Hamed, Jahani Heravi, Elnaz, "Guide to Convolutional Neural Networks", First Edition, Springer International Publishing, 2017
2. Skansi, Sandro, "Introduction to Deep Learning", First Edition, Springer International Publishing, 2018

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

3. François Chollet," Deep Learning with Python", Second Edition, Manning Shelter,2018

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Explain the deep learning abstractions	Understand
CO2	Analyse optimization and generalization in deep learning	Analyze
CO3	Outline the various deep learning models	Understand
CO4	Explore the architecture of CNN models	Understand
CO5	Develop Deep learning applications with appropriate models	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	-	-	-	-	1	-	2	2	-
CO2	3	2	-	2	2	-	-	-	-	1	-	3	3	-
CO3	2	1	-	1	1	-	-	-	-	2	-	2	2	-
CO4	2	1	2	1	1	-	-	-	-	2	-	2	3	-
CO5	3	2	3	2	3	2	2	-	-	2	2	3	3	-
CO	2.4	1.4	2.5	1.4	1.8	2	2	-	-	1.6	2	2.4	2.6	-
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)				

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP34	DATA VISUALIZATION	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand how accurately represent voluminous complex data set in web and from other data sources
- To understand the methodologies used to visualize large data sets
- To understand the process involved in data visualization and security aspects involved in data visualization

UNIT I INTRODUCTION 9

Context of data visualization – Definition – Methodology – Visualization design objectives – Key Factors – Purpose – visualization function and tone – visualization design options – Data representation – Data Presentation – Seven stages of data visualization – widgets – Data visualization tools

UNIT II VISUALIZING DATA METHODS 9

Mapping – Time series – Connections and correlations – Scatterplot maps – Trees, Hierarchies and Recursion – Networks and Graphs – Info graphics

UNIT III VISUALIZING DATA PROCESS 9

Acquiring data – Tools for Acquiring Data from the Internet – Locating Files for Use with Processing – Loading Text Data – Dealing with Files and Folders – Listing Files in a Folder – Asynchronous Image Downloads – Advanced Web Techniques – Using a Database – Dealing with a Large Number of Files

UNIT IV INTERACTIVE DATA VISUALIZATION 9

Drawing with data – Scales – Axes – Updates, Transition and Motion – Interactivity - Layouts – Geomapping – Exporting, Framework – T3 – .js – tablo

UNIT V SECURITY DATA VISUALIZATION 9

Port scan visualization – Vulnerability assessment and exploitation – Firewall log visualization – Intrusion detection log visualization – Attacking and defending visualization systems – Creating security visualization system

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Ben Fry, "Visualizing Data", Second Edition, O"Reilly Media, Inc., 2017.

2. Andy Kirk, "Data Visualization A Handbook for Data Driven Design", First Edition Sage Publications, 2016

REFERENCES:

1. Scott Murray, "Interactive data visualization for the web", First Edition, O'Reilly Media, Inc., 2015.
2. Greg Conti, "Security Data Visualization: Graphical Techniques for Network Analysis", First Edition No Starch Press Inc, 2016.
3. Philipp K. Janert, Gnuplot in Action, "Understanding Data with Graphs", First Edition, Manning Publications", 2010

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Explain the various methodologies present in data visualization	Understand
CO2	Develop skills for designing and critique visualizations	Apply
CO3	Discuss the process involved in data visualization	Understand
CO4	Explore interactive data visualization techniques.	Apply
CO5	Describe the security issues in data visualization	Understand

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	2	-	-	-	-	2	-	2	2	-
CO2	3	2	2	2	3	-	-	-	-	3	-	3	3	-
CO3	2	1	1	1	2	-	-	-	-	2	-	2	2	-
CO4	3	2	2	2	3	-	-	-	-	3	-	3	3	-
CO5	2	1	1	1	2	2	-	-	-	2	-	2	2	-
CO	2.4	1.4	1.4	1.4	2.4	2	-	-	-	2.4	-	2.4	2.4	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP35	MACHINE LEARNING -II	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the core concepts of data science and data collection methods
- To understand the statistical analysis of data and its visualization
- To learn real time applications of Data Science

UNIT I DATA SCIENCE 9

Introduction to core concepts and technologies – Introduction–Terminology – Data science process–Data Science Toolkit – Types of data – Big Data Analytics in Industry Verticals – Example applications

UNIT II DATA COLLECTION AND MANAGEMENT 9

Introduction – Sources of data – Data collection and APIs – Data collection Methods – Exploring and Fixing data – Data storage and Management – Data Management Techniques – Using Multiple Data Sources – Case study Data Collection

UNIT III DATA ANALYSIS 9

Data Analysis: Introduction – Terminology and Concepts – Introduction to Statistics–Central Tendencies and Distributions – Variance – Distribution properties and Arithmetic – Samples/CLT–Basic Machine Learning Algorithms – Linear Regression – SVM – Naive Bayes

UNIT IV DATA VISUALISATION 9

Data Visualization: Introduction –Types of Data Visualization – Data for Visualization: Data Types–Data Encodings – Retinal Variables – Mapping Variables to Encodings – Visual Encodings–Data retrieval – Data Visualization tools

UNIT V APPLICATION OF DATASCIENCE 9

Applications of Data Science – Technologies for Visualization – Bokeh (Python) – Recent trends in various Data Collection and Analysis Techniques – Various Visualization Techniques (Matplotlib, Seaborn) – Application
Development methods used in data science

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Cathy O'Neil, Rachel Schutt, "Doing Data Science, Straight Talk from The Frontline", First Edition, O,Riley, 2014.

REFERENCES:

1. Jure Leskovek, Anand Rajaraman, Jeffrey Ullman, "Mining of Massive Datasets", First Edition, Cambridge University Press, 2014

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Describe the process of data science and its real time applications	Understand
CO2	Outline the techniques of data collection and Management	Understand
CO3	Examine the mathematical techniques to analyses the data.	Understand
CO4	Develop the different visualization of data using tools	Apply
CO5	Apply data science concepts and methods to solve real time problems	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	-	-	-	-	1	-	2	2	-
CO2	2	1	-	1	-	-	-	-	-	1	-	2	2	-
CO3	2	1	2	1	-	-	-	-	-	1	-	2	2	-
CO4	3	2	3	2	3	-	-	-	-	2	-	3	3	-
CO5	3	2	3	2	3	-	-	-	-	3	-	3	3	-
CO	2.4	1.4	1.6	1.4	3	-	-	-	-	1.6	-	2.4	2.4	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP36	COGNITIVE SCIENCE AND ANALYTICS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the nature of Cognitive Science and Artificial Intelligence
- To learn basic cognitive science research methods
- To understand the neuroscience models of cognitive science and applications

UNIT I INTRODUCTION 9

Introduction to cognitive science – The Cognitive view – Some Fundamental Concepts – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science – Artificial Intelligence – Knowledge representation – The Nature of Artificial Intelligence – Search – Control – and Learning – Cognitive psychology

UNIT II COGNITIVE SCIENCE METHODOLOGIES 9

The Architecture of the Mind – The Nature of Cognitive Psychology – A Global View of The Cognitive Architecture – Propositional Representation – Schematic Representation – Cognitive Processes – Working Memory – and Attention – The Acquisition of Skill – Cognitive Architecture – Cognitive neuroscience – Brain and Cognition – Neuropsychology – Computational Neuroscience

UNIT III COGNITIVE NEUROSCIENCE AND MODELS 9

Language Acquisition – Milestones in Acquisition – Theoretical Perspectives Semantics and Cognitive Science – Meaning and Entailment – Reference – Sense Cognitive and Computational Models of Semantic Processing – Information Processing Models of the Mind – Physical symbol systems and language of thought – Applying the Symbolic Paradigm

UNIT IV COMPUTATIONAL MODELS 9

Neural networks and distributed information processing – Neural network models of Cognitive Processes – Higher level cognition – Reasoning – Decision Making

UNIT V FUTURE TRENDS AND APPLICATIONS 9

Computer Science and AI – Foundations & Robotics – New Horizons – Dynamical systems and situated cognition – Challenges – Emotions and Consciousness – Physical and Social Environments – Applications

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Jay Friedenberg, Gordon Silverman, "Cognitive Science: An Introduction to the Study of Mind", Third Edition, SAGE Publications, 2015
2. José Luis Bermúdez, "Cognitive Science: An Introduction to the Science of the Mind", Second Edition, Cambridge University Press, 2010

REFERENCES:

1. Bowerman, Melissa and Stephen C. Levinson, "Language Acquisition and Conceptual Development", First Edition, Cambridge University Press 2001

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Infer the major concepts, philosophical and theoretical perspectives in cognitive science	Understand
CO2	Interpret the methodologies and theories used by psychologists and cognitive neuroscientists	Analyze
CO3	Discover the various domains of Cognitive Neuroscience and Nervous system.	Understand
CO4	Analyze the various computational models of semantic processing and language acquisition.	Analyze
CO5	Apply the cognitive science research methods to dynamic and real time applications	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	2	-	-	-	-	-	2	2	-
CO2	3	3	1	3	1	3	-	-	-	-	-	3	3	-
CO3	2	1	1	1	1	2	-	-	-	-	-	2	2	-
CO4	3	3	1	3	1	3	-	-	-	-	-	3	3	-
CO5	3	2	2	2	2	3	-	-	-	-	-	3	3	-
CO	2.6	2	1.2	2	1.2	2.6	-	-	-	-	-	2.6	2.6	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP37	VIDEO PROCESSING AND ANALYTICS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the basics of video analytics and its features.
- To understand the various tracking and Segmentation methods to analyze video.
- To analyze the recognition techniques and data inference from various case studies.

UNIT I INTRODUCTION TO VIDEO ANALYSIS 9

Analog Video – Digital Video – Time Varying Image Formation models – Three-Dimensional Motion Analog Video – Digital Video – Computer Vision: Challenges – Spatial Domain Processing – Frequency Domain Processing–Background Modeling – shadow detection – Eigen Faces – Object Detection – Local Features – Mean Shift: Clustering, Tracking

UNIT II TRACKING AND VIDEO ANALYSIS 9

Tracking and Motion Understanding – Object tracking using Contours – Kalman filters–Condensation – Particle – Bayesian filters – Hidden Markov Model – Change Detection and model-based tracking – Block Matching Method – Mesh Based Method – Optical Flow Method – Hierarchical Block Matching Motion Estimation – Motion estimation and Compensation–Overlapped Block Motion and compensation – PelRecursive Motion Estimation

UNIT III SEGMENTATION 9

Motion Segmentation – Optical Flow Segmentation – Modified Hough Transform Method – Bayesian Segmentation – Simultaneous Estimation and Segmentation – Action Segmentation – Segmentation for Layered Video Representation – Model Field Parameters – Estimation of Model Field Parameters

UNIT IV ACTION RECOGNITION 9

Action Recognition – Low Level Image Processing for Action Recognition – Segmentation and Extraction – Local Binary Pattern – Structure from Motion – Action Representation Approaches: Classification of Various Dimension of Representation – View Invariant Methods – Gesture Recognition and Analysis

UNIT V CASE STUDIES 9

Face Detection and Recognition – Natural Scene Videos – Crowd Analysis – Video Surveillance – Traffic Monitoring System – Intelligent Transport System.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. A.Murat Tekalp, "Digital Video Processing", Second Edition, Prentice Hall, 2015
2. Richard Szeliski, "Computer Vision: Algorithms and Applications", First Edition, Springer, 2016.

REFERENCES:

1. Yao Wang, Jorn Ostermann and Ya-Qin Zhang, "Video Processing and Communications", Prentice Hall, First Edition, 2005
2. Thierry Bouwmans, FatihPorikli, Benjamin Höferlin and Antoine Vacavant, "Background Modeling and Foreground Detection for Video Surveillance: Traditional and Recent Approaches, Implementations, Benchmarking and Evaluation", CRC Press, Taylor and Francis Group, 2014

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Interpret the algorithms available for performing analysis on video data and address the challenges based algorithms.	Understand
CO2	Describe the approaches for identifying and tracking objects and person with motion	Understand
CO3	Interpret the algorithms available for searching and matching in video content	Understand
CO4	Analyze approaches for action representation and recognition	Analyze
CO5	Analyze and apply algorithms for developing solutions for real world problems.	Analyze

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	1	-	-	-	-	-	-	2	2	-
CO2	2	1	1	2	1	-	-	-	-	-	-	2	2	-
CO3	2	1	1	2	1	-	-	-	-	-	-	2	2	-
CO4	3	2	2	3	2	-	-	-	-	-	-	3	3	-
CO5	3	2	2	3	2	3	-	-	-	-	-	3	3	-
CO	2.4	1.4	1.4	2.4	1.4	3	-	-	-	-	-	2.4	2.4	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP38	SOCIAL NETWORK ANALYSIS	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire the concepts of social network analysis
- To understand the graph based and statistics based social network measures
- To study the concepts of social network visualization and related research goals

UNIT I BASIC CONCEPTS 9

Introduction – Goals of analysis – Network variables – Mathematical Foundations – Data Collection – Data management – Data import – Cleaning – Data transformation – Normalization – Cognitive social structure data – Matching and Converting attributes – Data export

UNIT II WORKING WITH DATA 9

Graph based network visualization – Visualize Networks in class – Whole network characterization – Cohesion – Reciprocity – Transitivity and the clustering coefficient – Centralization – Core periphery – Undirected and Directed non valued networks – Valued networks

UNIT III STATISTICAL MEASURES, SUBGROUPS, PERSONAL NETWORKS 9

Multivariate Techniques Used in Network Analysis – Creating subgroups – Cliques – Girvan – Newman – Factions – Components – Performing a cohesive subgraph analysis – Ego network overview – Analyzing ego network data

UNIT IV VISUALIZATION IN INTERVIEWS, BUILDING MODELS 9

Interpreting and personal network visualization – Equivalence – Structural equivalence – Regular equivalence – The REGE algorithm – Testing Hypotheses – Statistical models to use in SNA – like QAP and ERGM

UNIT V RESEARCH DESIGN 9

Research Design – Whole network and personal – Network research designs – Sources – Actor attributes – Sampling and bounding – Reliability and validity issues – Ethical considerations – challenges of operationalizing a cultural anthropology research project as a network project

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

TEXT BOOKS:

1. Stephen P Borgatti, Martin G Everett and Jeffrey C Johnson, "Analyzing Social Networks", Second Edition, SAGE Publications, 2020
2. Charles Kadushin, "Understanding Social Networks: Theories, Concepts and Findings", First Edition, Oxford University Press, 2011

REFERENCES:

1. Tom Valente, Social Networks and Health: Models, Methods and Applications, First Edition, Oxford University Press, 2010
2. John Scott, "Network Analysis: A Handbook", Second Edition, SAGE Publishing, 2000
3. David Knoke, Song Yang, "Social Network Analysis", Third Edition, SAGE Publishing, 2019

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Collect whole and personal network data and input it into social network analysis	Understand
CO2	Transform data for analysis using graph-based social network measures	Apply
CO3	Transform data for analysis using statistics-based social network measures and apply node and group level social network measures	Apply
CO4	Visualize network data using different methods and packages, to build and test network models at the nodal, dyadic and network levels	Analyze
CO5	Choose among social network designs based on research goals	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	-	-	-	-	-	1	-	2	2	-
CO2	3	2	1	3	2	-	-	-	-	2	-	2	3	-
CO3	3	2	1	3	-	-	-	-	-	2	-	2	3	-
CO4	3	3	2	3	2	-	-	-	-	3	-	2	3	-
CO5	3	2	1	3	-	-	-	-	-	2	-	2	3	-
CO	2.8	2	1.2	2.8	2	-	-	-	-	2	-	2	2.8	-

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP39	COMPREHENSION - I	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire the knowledge of Engineering Mathematics
- To learn deep knowledge about modern computing technology through hardware and software interface by exploring how machines are designed, built, and operate
- To understand the importance of data structures and algorithms

UNIT I ENGINEERING MATHEMATICS 9

Discrete Mathematics – Propositional and first order logic – Sets – relations – functions – partial orders and lattices – Monoids – Groups – Graphs: connectivity – matching – coloring – Combinatorics: counting – recurrence relations – generating functions

Linear Algebra: Matrices – determinants – system of linear equations – eigenvalues and eigenvectors – LU decomposition

Calculus: Limits – continuity and differentiability – Maxima and minima – Mean value theorem – Integration – Probability and Statistics: Random variables – Uniform – normal – exponential – Poisson and binomial distributions – Mean – median – mode and standard deviation – Conditional probability and Bayes theorem

UNIT II DIGITAL LOGIC 9

Boolean algebra – Combinational and sequential circuits – Minimization – Number representations and computer arithmetic (fixed and floating point)

UNIT III COMPUTER ORGANIZATION AND ARCHITECTURE 9

Machine instructions and addressing modes – ALU – Data path and control unit – Instruction pipelining – pipeline hazards – Memory hierarchy: cache – main memory and secondary storage – I/O interface interrupt and DMA mode

UNIT IV PROGRAMMING AND DATA STRUCTURES 9

Programming in C: Recursion – Arrays – stacks – queues – linked lists – trees – binary search trees – binary heaps – graphs

UNIT V ALGORITHMS 9

Searching – sorting – hashing – Asymptotic worst-case time and space complexity – Algorithm design techniques: greedy – dynamic programming and divide-and-conquer – Graph traversals – minimum spanning trees – shortest paths

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

REFERENCES:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Tenth Edition, Wiley India Pvt Ltd, 2018
2. Oliver C. Ibe, Fundamentals of Applied probability and Random processes, Second Edition, Elsevier, 2014
3. M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2017
4. David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface", Fifth Edition, Morgan Kaufmann / Elsevier, 2014

Dr. P. Thangaraj M.E., Ph.D
Professor and Head
Department of Computer Science and Engineering
KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

5. M.A.Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Pearson Education, 2013
6. Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, Prentice Hall, 2010

COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Apply mathematical foundations to real world problems	Apply
CO2	Design and analyze combinational and sequential logic circuits	Analyze
CO3	Manipulate data using arithmetic instructions in computers, analyze memory management techniques and pipelining concepts and select appropriate interface standards for I/O devices	Analyze
CO4	Demonstrate the application of linear and non-linear data structures on various problems	Apply
CO5	Examine algorithm design techniques for a given application	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	2	1	-
CO2	3	3	3	2	2	-	-	-	-	2	-	2	1	-
CO3	3	2	2	2	2	-	-	-	-	2	-	2	3	-
CO4	3	2	3	2	-	-	-	-	-	2	-	2	3	-
CO5	3	2	3	2	-	-	-	-	-	2	-	2	3	-
CO	3	2.2	2.6	1.8	2	-	-	-	-	2	-	2	2.2	-
Correlation levels:	1: Slight (Low)				2: Moderate (Medium)					3: Substantial (High)				

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KPR Institute of Engineering and Technology
Arasur, Coimbatore- 641 407

U19CSP40	COMPREHENSION - II	Category: PE			
		L	T	P	C
		3	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of theory of computations, Compilers Principles and Techniques
- To learn Operating Systems Concepts and Database Systems Concepts
- To understand knowledge on Data Communications and Networking

UNIT I THEORY OF COMPUTATION 9

Regular expressions and finite automata – Context-free grammars and push-down automata – Regular and context-free languages – pumping lemma – Turing machines and decidability

UNIT II COMPILER DESIGN 9

Lexical analysis – parsing – syntax-directed translation – Runtime environments – Intermediate code generation – Local optimization – Data flow analyses: constant propagation – liveness analysis – common sub expression elimination

UNIT III OPERATING SYSTEMS 9

System calls – processes – threads – inter-process communication – concurrency and synchronization – Deadlock – CPU and I/O scheduling – Memory management and virtual memory – File systems

UNIT IV DATABASES 9

ER-model – Relational model: relational algebra – tuple calculus – SQL – Integrity constraints – normal forms – File organization – indexing (example B and B+ trees) – Transactions and concurrency

UNIT V COMPUTER NETWORKS 9

Concept of layering: OSI and TCP/IP Protocol Stacks – Basics of packet – circuit and virtual circuit – switching – Data link layer – framing – error detection – Medium Access Control – Ethernet ridging – Routing protocols – shortest path – flooding – distance vector and link state routing – Fragmentation and IP addressing – IPv4 – CIDR notation – Basics of IP support protocols ARP – DHCP – ICMP – Network Address Translation – Transport layer – flow control and congestion control – UDP – TCP – sockets – Application layer protocols: DNS – SMTP – HTTP – FTP – Email

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Total: 45 Periods

REFERENCES:

1. J.E.Hopcroft, R.Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", Third Edition, Pearson Education, 2014
2. Alfred Aho, Ravi Sethi, Jeffrey D Ullman, Monica S. Lam, "Compilers Principles, Techniques and Tools", Second Edition, Pearson Education, 2014
3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", Ninth Edition, John Wiley & Sons (Asia) Pvt. Ltd, 2016
4. Abraham Silberschatz, Henry Korth, and S. Sudarshan, "Database System Concepts", Sixth Edition, McGraw-Hill, 2011
5. Behrouz A Forouzan, "Data Communications and Networking", Fifth edition, Tata McGraw–Hill, New Delhi, 2013

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COURSE OUTCOMES:

Upon completion of the course, the student will be able to

COs	Statements	K-Level
CO1	Examine Automata Theory, Languages and Computations	Apply
CO2	Construct and examine different phases of compilers	Apply
CO3	Examine the features of various operating systems	Apply
CO4	Apply Database System Concepts to real world applications	Apply
CO5	Examine the functions of different network layers	Apply

COURSE ARTICULATION MATRIX:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	2	-	-	-	-	-	-	-	2	2	-
CO2	3	2	1	2	2	-	-	-	-	-	-	2	2	-
CO3	3	2	1	2	-	-	-	-	-	-	-	2	-	2
CO4	3	2	2	2	2	-	-	-	-	-	-	2	3	-
CO5	3	2	2	2	-	-	-	-	-	-	-	2	-	3
CO	3	2	1.5	2	2	-	-	-	-	-	-	2	2.3	2.5

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

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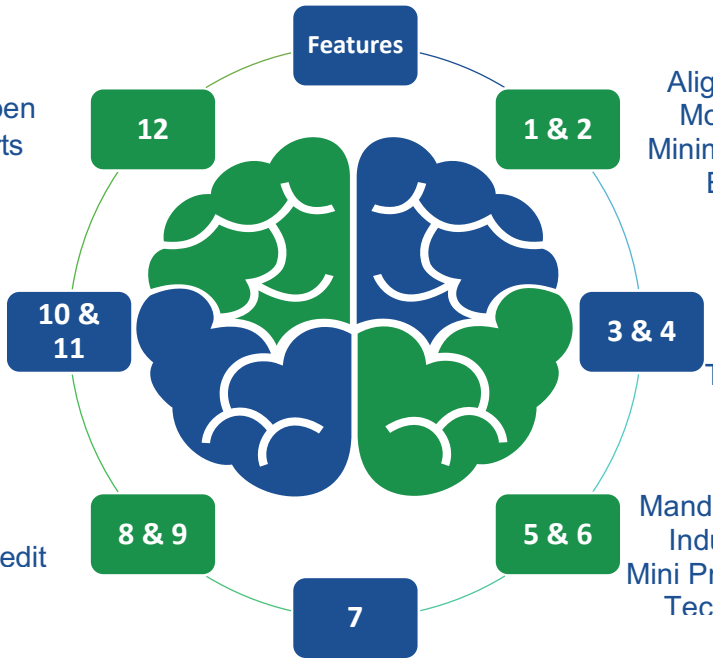
Curriculum Features



Aligned with AICTE Model Curriculum Minimum Credits to be Earned – 165

Theory Courses Integrated with Laboratory Track Based Professional

Mandatory Internship / Industrial Training Mini Project, Project and Technical Seminar

Design Thinking Course

Fast Track System Industry Based One Credit

MOOC and Value-Added Courses Hindi and Foreign Language Courses

Interdisciplinary / Open Elective / Liberal Arts

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NBA Accredited (CSE, ECE, EEE, MECH, CIVIL)