Sri Krishna College of Engineering and Technology

An Autonomous Institution, Affiliated to Anna University

Coimbatore – 641 008

CURRICULUM AND SYLLABI

M.Tech. COMPUTER SCIENCE AND ENGINEERING

(5 Year Integrated)

REGULATION 2020

ABOUT THE DEPARTMENT

VISION

To produce technologically adept, innovative professionals with human values who will serve as a valuable resource for industry and society.

MISSION

1. To empower the students with excellence in cutting edge technology for a challenging professional career.
2. To impart moral, ethical values and interpersonal skills to the students.
3. To facilitate the academic industry collaborations and societal out reach programmes.

PROGRAMME OUTCOMES (POs)

Computer Science Engineering Graduates will be able to:

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

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

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

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

PO5 - **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.

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

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

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

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

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

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

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 Successful career in academia or industries associated with Computer Science and Engineering.

PEO2 Exhibit analytical, decision making and problem solving skills for handling real life problems and to create novel products.

PEO3 Ability to communicate the findings or express innovative ideas in an effective manner with an awareness of professional, social and ethical responsibilities.to broader social context.

PEO4 Possess leadership qualities and emerge in a range of professions.

PROGRAMME SPECIFIC OUTCOMES (PSO)

Upon completion of the programme, graduates will have ability to:

PSO1 Apply the fundamental knowledge for problem solving and analysis as well as conduct investigations in computer science and engineering for sustainable development.

PSO2 Design and develop the solutions for real time problems and implement them by using modern software tools in lieu of deploying them in the society for its growth.

PSO3 Communicate effectively, adopt ethics and engage in life-long learning.

Mapping of PO's toPEO's

Programme Educational Objectives (PEO)	Programme Outcomes (PO)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
PEO1	2	2	2	2	2	2	2	2	2	2	2	2
PEO 2	3	3	3	3	3	3	2	2	2	2	2	2
PEO3	2	2	2	2	2	2	3	3	3	3	2	1
PEO4	1	1	1	1	1	2	2	2	3	2	2	2

Mapping of PO's to PSO's

Programme Specific Outcomes (PSO)	Programme Outcomes (PO)											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
PSO1	2	3	2	1	2	1	1	1	2	1	2	1
PSO2	2	2	3	1	2	1	2	1	1	1	2	1
PSO3	1	1	1	1	1	1	1	1	3	3	1	3

Mapping of PEO's & PSO's

Programme Specific Outcomes (PSO)	Programme Educational Objectives (PEO)			
	PEO1	**PEO2**	**PEO3**	**PEO4**
PSO1	3	2	2	2
PSO2	3	3	3	2
PSO3	2	2	2	2

1	Reasonably agreed	**2**	Moderately agreed	**3**	Strongly agreed

Sem	Course Title	Programme Outcome (PO)											
		1	2	3	4	5	6	7	8	9	10	11	12
Semester I	Linear Algebra and Differential Calculus	2	2	2						2			
	Problem Solving using C	3	3	3						3		3	2
	Business English Communication								2	2	1		1
	Engineering Physics	2	2	1						2			
	C Programming Laboratory	3	3	2		1			3	3	1	3	1
	Engineering Graphics	2	2	1		2			3				
	Induction Programme						3	3	3	3	3	3	3
Semester II	Integral Calculus and Complex Variables	2	2	2						2			
	Python Programming	3	3	2						3		3	3
	Data Structures	3	3	2									3
	Basics of Electrical and Electronics Engineering	2	2	2					2	2			3
	Digital Principles and System Design	3	3	2		2							
	Python Programming Laboratory	3	3	2		2			2	2	2	2	3
	Data Structures Laboratory	3	3	2					2	2	2	2	3
	Environmental Sciences						2	2					
Semester III	Discrete Structures	2	2	2						2			
	Operating Systems	3	3	2									3
	Design and Analysis of Algorithms	3	3	2									3
	Computer Architecture	2	2	2				2					
	Object Oriented Programming Using Java And UML	3	3	3		2			3	3	3		3
	Operating Systems Laboratory	3	3	2					3	3	3		3
	Analysis of Algorithms Laboratory	3	3	2					2	2	2		3

Semester IV	Applied Statistics	2	2	2						2			2
	Database Management Systems	3	3	2									
	Core Java Programming	3	3	2						3		3	3
	Microprocessors and Microcontrollers	2	2	1		1			2	2	1		2
	Enterprise Design Patterns	3	3	3	3		3	3					3
	Database Management Systems Laboratory	3	3	2		2			3	3	2		3
	Java Laboratory	3	3	2		2			3	3	2		3
Semester V	Data Warehousing and Mining	3	3	3		2							3
	Artificial Intelligence	3	3	3									3
	JEE Framework	2	3	3						2		2	3
	PHP and JS framework	2	3	3						2		2	3
	Computer Networks	3	3	3						2			3
	Agile Technology	2	3	3		3	2			2	2	2	3
Semester VI	Compiler Design	3	3	3	3	2							2
	Cryptography, Network Security and Application Security	3	3	3			2			2			2
	Software Validation and Testing	2	3	3		2	2	2	2	3	2		3
	Big Data Analytics	3	3	2		2				2	2		3
	Mobile Application Development	3	3	3	3	3				3			3
	Mini Project I	2	2	2	2	3	3	3	3	3	3	2	3
Sem VII	BlockChain Technology	3	3	2	2	2	2	2	3	3	2		3
	Internet of Things	3	3	3	3	3	3	3	3	2	2		3
	Cloud Computing	3	3	3	3	3	3	3	3		2		2
Semester VIII	Microservices and Distributed Computing Architecture	3	3	2	2	2			3			3	2
	Banking and Insurance	3	3	2	2	2	2		3			3	3
	Machine Learning	3	3	3	2	2	1			3		2	
	Mini Project II	2	3	3	2	3	3	3	3	3	3	2	3

Sem IX	Front end Frameworks Engineering	3	3	3	2		2		2	3			3
	Project Phase I	2	3	3	2	3	3	3	3	3	3	2	3
Sem X	Project Phase II	3	3	3	3	3	3	3	3	3	3	3	3
PROFESSIONAL ELECTIVE – Stream1 Computer and Network Security	Mobile Ad Hoc Networks	3	3	3	3	3	3	3	2		3		2
	Mobile Computing	2	2	3	2	3	2	2	2	2	2	2	3
	Distributed Systems	3	3	3			2						2
	Wireless Sensor Networks	3	3	3		3	2	2			3		3
	Cyber Security and Ethical Hacking	3	3	3	3	3	3	2	3	2	2	2	3
	Advanced Databases	3	3	3	3	2	2						3
	Advanced Algorithms	3	3	3	3	3	3	3	2		3		2
	Software Product Management	3	3	3		2	2	2	2				3
	Information Ethics and Cyber Laws	1	2				2	2	3	2	2		3
PROFESSIONAL ELECTIVE – Stream2 Intelligent Systems	Soft Computing	3	3	3	3	2	2	2	2	2	2		2
	Deep Learning	3	3	3	3	3	3	3	2	3	2	2	3
	Human Computer Interaction	3	3	3	2	2	2	2	2	2	2		3
	Image Processing and Pattern Recognition	3	3	3	3	3	3	3	2	2	2		2
	Speech and Natural Language Processing	3	3		2	3			3	2	3		3
	Social Network Analysis	3	3	3	3	3	3	3	3	3	3		3
	Optimization Techniques	3	3		3	3			3	3	3		3
	Data Visualization	3	3	3	3	2	2	2	2	2	2		2
	Computer Vision	3	3	3	3	3	3	3	2	3	2	2	3
PROFESSIONAL ELECTIVE – Stream3 Thriving Electives	Game Theory and its Applications	3	3	3	2		2		2				2
	Cognitive Science and Decision Making	3	3	3	3		2						2
	Business Intelligence	3	3	3	2		2	2				2	2
	Quantum Computing	3	3	3	2		2	2					2
	Robotics and its Applications	3	3	3	2	2	2			2			3
	Virtual Reality	3	3	3	3		2						2
	High Performance Computing	3	3	3	3	2							2
	DevOps	3	3	3	2	2							2

OPEN ELECTIVE COURSES	Multimedia Applications	3	3	3	3	3	3	3	1	1	1	2	3
	.NET Framework for Application Development	3	3	3	3	3	3		2	3	3		3
	Dependable Computing	3	3	3	3	2	2	2	2	2	2		2
	Business Information Systems	3	3	3	3	3	2	2	2	2	2	2	3

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SEMESTER I							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credits**	**Ext/Int**	**Category**
THEORY							
1	20MAI101	Linear Algebra and Differential Calculus	3/1/0	4	4	50/50	BS
2	20CSI101	Problem Solving using C	3/0/0	3	3	50/50	PC
THEORY CUM PRACTICAL							
3	20ENI101	Business English Communication	2/0/2	4	3	40/60	HM
4	20PHI101	Engineering Physics	3/0/2	5	4	40/60	BS
PRACTICAL							
5	20CSI102	C Programming Laboratory	0/0/3	3	1.5	40/60	PC
6	20MEI101	Engineering Graphics	2/0/2	4	3	40/60	ES
MANDATORY COURSE							
7	20MCI101	Mandatory Course I (Induction Programme)	Three weeks		0	0/100	MC
			Total	**23**	**18.5**	**700**	

SEMESTER II							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1	20MAI201	Integral Calculus and Complex Variables	3/1/0	4	4	50/50	BS
2	20CSI201	Python Programming	3/0/0	3	3	50/50	PC
3	20CSI202	Data Structures	3/1/0	4	4	50/50	PC
THEORY CUM PRACTICAL							
4	20EEI201	Basics of Electrical and Electronics Engineering	3/0/2	5	4	40/60	ES
5	20ECI201	Digital Principles and System Design	3/0/2	5	4	40/60	ES
PRACTICAL							
6	20CSI203	Python Programming Laboratory	0/0/3	3	1.5	40/60	PC
7	20CSI204	Data Structures Laboratory	0/0/3	3	1.5	40/60	PC
MANDATORY COURSE							
8	20MCI201	Mandatory Course II (Environmental Sciences)	2/0/0	2	0	0/100	MC
			Total	**29**	**22**	**800**	

SEMESTER III							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1	20MAI301	Discrete Structures	3/1/0	4	4	50/50	BS
2	20CSI301	Operating Systems	3/0/0	3	3	50/50	PC
3	20CSI302	Design and Analysis of Algorithms	3/0/0	3	3	50/50	PC
4	20CSI303	Computer Architecture	3/0/0	3	3	50/50	PC
THEORY CUM PRACTICAL							
5	20CSI304	Object Oriented Programming using Java and UML	3/0/2	5	4	40/60	PC
PRACTICAL							
6	20CSI305	Operating Systems Laboratory	0/0/3	3	1.5	40/60	PC
7	20CSI306	Analysis of Algorithms Laboratory	0/0/3	3	1.5	40/60	PC
AUDIT COURSE							
8	20ACIXXX	Audit Course I	2/0/0	2	0	0/100	AC
			Total	**26**	**20**	**800**	

SEMESTER IV							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1	20MAI401	Applied Probability	3/1/0	4	4	50/50	BS
2	20CSI401	Database Management Systems	3/0/0	3	3	50/50	PC
3	20CSI402	Core Java Programming	3/0/0	3	3	50/50	PC
4	20CSI403	Enterprise Design Patterns	3/0/0	3	3	50/50	PC
THEORY CUM PRACTICAL							
5	20ECI401	Microprocessors and Microcontrollers	3/0/2	5	4	40/60	ES
PRACTICAL							
6	20CSI404	Database Management Systems Laboratory	0/0/3	3	1.5	40/60	PC
7	20CSI405	Java Laboratory	0/0/3	3	1.5	40/60	PC
AUDIT COURSE							
8	20ACIXXX	Audit Course II	2/0/0	2	0	0/100	AC
			Total	**26**	**20**	**800**	

SEMESTER V							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1	20CSI501	Data Warehousing and Mining	3/0/0	3	3	50/50	PC
2	20CSI502	Artificial Intelligence	3/0/0	3	3	50/50	PC
THEORY CUM PRACTICAL							
3	20CSI503	JEE Framework	3/0/2	5	4	40/60	PC
4	20CSI504	PHP and JS framework	3/0/2	5	4	40/60	PC
5	20CSI505	Computer Networks	3/0/2	5	4	40/60	PC
6	20CSI506	Agile Technology	3/0/2	5	4	40/60	PC
			Total	**26**	**22**	**600**	

SEMESTER VI							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1	20CSI601	Compiler Design	3/0/0	3	3	50/50	PC
2	20CSI9XX	Professional Elective I	3/0/0	3	3	50/50	PE
THEORY CUM PRACTICAL							
3	20CSI602	Cryptography, Network Security and Application Security	3/0/2	5	4	40/60	PC
4	20CSI603	Software Validation and Testing	3/0/2	5	4	40/60	PC
5	20CSI604	Big Data Analytics	3/0/2	5	4	40/60	PC
6	20CSI605	Mobile Application Development	2/0/4	6	4	40/60	PC
PROJECT WORK							
7	20CSI606	Mini Project I	0/0/3	3	1.5	40/60	PW
			Total	**30**	**23.5**	**700**	

SEMESTER VII							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1	20XXXXX	Open Elective I	3/0/0	3	3	50/50	OE
2	20CSI9XX	Professional Elective II	3/0/0	3	3	50/50	PE
3	20CSI9XX	Professional Elective III	3/0/0	3	3	50/50	PE
THEORY CUM PRACTICAL							
4	20CSI701	Block Chain Technology	3/0/2	5	4	40/60	PC
5	20CSI702	Internet of Things	3/0/2	5	4	40/60	PC
6	20CSI703	Cloud Computing	3/0/2	5	4	40/60	PC
			Total	**24**	**21**	**600**	

SEMESTER VIII							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1	20CSI801	Microservices and Distributed Computing Architecture	3/0/0	3	3	50/50	PC
2	20XXXXX	Open Elective II	3/0/0	3	3	50/50	OE
3	20MGI801	Banking and Insurance	3/0/0	3	3	50/50	HM
4	20CSI9XX	Professional Elective IV	3/0/0	3	3	50/50	PE
5	20CSI9XX	Professional Elective V	3/0/0	3	3	50/50	PE
THEORY CUM PRACTICAL							
6	20CSI802	Machine Learning	3/0/2	5	4	40/60	PC
PROJECT WORK							
7	20CSI803	Mini Project II	0/0/3	3	1.5	40/60	PW
			Total	**23**	**20.5**	**700**	

SEMESTER IX							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
THEORY							
1	20CSI9XX	Professional Elective VI	3/0/0	3	3	50/50	PE
THEORY CUM PRACTICAL							
2	20CSI901	Front end Frameworks Engineering	3/0/2	5	4	40/60	PC
PROJECT WORK							
3	20CSI902	Project Phase I	0/0/16	16	8	40/60	PW
EMPLOYABILITY ENHANCEMENT SKILLS							
4	20EES001	Employability Enhancement Skills			1.5	0/100	EES
			Total	**24**	**16.5**	**400**	

SEMESTER X							
S No.	**Course Code**	**Course**	**L/T/P**	**Contact hrs/week**	**Credit**	**Ext/Int**	**Category**
PROJECT WORK							
1	20CSI903	Project Phase II	0/0/32	32	16	40/60	PW
			Total	**32**	**16**	**100**	

HUMANITIES AND MANAGEMENT (HM) – 6 credits

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	20ENI101	Business English Communication	2/0/2	4	3	40/60	HM
2	20MGI801	Banking and Insurance	3/0/0	3	3	50/50	HM

BASIC SCIENCES (BS) – 20 credits

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	20MAI101	Linear Algebra and Differential Calculus	3/1/0	4	4	50/50	BS
2	20PHI101	Engineering Physics	3/0/2	5	4	40/60	BS
3	20MAI201	Integral Calculus and Complex Variables	3/1/0	4	4	50/50	BS
4	20MAI301	Discrete Structures	3/1/0	4	4	50/50	BS
5	20MAI401	Applied Probability	3/1/0	4	4	50/50	BS

ENGINEERING SCIENCES (ES) – 15 credits

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	20MEI101	Engineering Graphics	2/0/2	4	3	40/60	ES
2	20EEI201	Basics of Electrical and Electronics Engineering	3/0/2	5	4	40/60	ES
3	20ECI201	Digital Principles and System Design	3/0/2	5	4	40/60	ES
4	20ECI401	Microprocessors and Microcontrollers	3/0/2	5	4	40/60	ES

PROFESSIONAL CORE (PC) – 106.5 credits

S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
1	20CSI101	Problem Solving using C	3/0/0	3	3	50/50	PC
2	20CSI102	C Programming Laboratory	0/0/3	3	1.5	40/60	PC
3	20CSI201	Python Programming	3/0/0	3	3	50/50	PC
4	20CSI202	Data Structures	3/1/0	4	4	50/50	PC
5	20CSI203	Python Programming Laboratory	0/0/3	3	1.5	40/60	PC
6	20CSI204	Data Structures Laboratory	0/0/3	3	1.5	40/60	PC
7	20CSI301	Operating Systems	3/0/0	3	3	50/50	PC
8	20CSI302	Design and Analysis of Algorithms	3/0/0	3	3	50/50	PC
9	20CSI303	Computer Architecture	3/0/0	3	3	50/50	PC
10	20CSI304	Object Oriented Programming using Java and UML	3/0/2	5	4	40/60	PC
11	20CSI305	Operating Systems Laboratory	0/0/3	3	1.5	40/60	PC
12	20CSI306	Analysis of Algorithms Laboratory	0/0/3	3	1.5	40/60	PC

13	20CSI401	Database Management Systems	3/0/0	3	3	50/50	PC
14	20CSI402	Core Java Programming	3/0/0	3	3	50/50	PC
15	20CSI403	Enterprise Design Patterns	3/0/0	3	3	50/50	PC
16	20CSI404	Database Management Systems Laboratory	0/0/3	3	1.5	40/60	PC
17	20CSI405	Java Laboratory	0/0/3	3	1.5	40/60	PC
18	20CSI501	Data Warehousing and Mining	3/0/0	3	3	50/50	PC
19	20CSI502	Artificial Intelligence	3/0/0	3	3	50/50	PC
20	20CSI503	JEE Framework	3/0/2	5	4	40/60	PC
21	20CSI504	PHP and JS framework	3/0/2	5	4	40/60	PC
22	20CSI505	Computer Networks	3/0/2	5	4	40/60	PC
23	20CSI506	Agile Technology	3/0/2	5	4	40/60	PC
24	20CSI601	Compiler Design	3/0/0	3	3	50/50	PC
25	20CSI602	Cryptography, Network Security and Application Security	3/0/2	5	4	40/60	PC
26	20CSI603	Software Validation and Testing	3/0/2	5	4	40/60	PC
27	20CSI604	Big Data Analytics	3/0/2	5	4	40/60	PC
28	20CSI605	Mobile Application Development	2/0/4	6	4	40/60	PC
29	20CSI701	Block Chain Technology	3/0/2	5	4	40/60	PC
30	20CSI702	Internet of Things	3/0/2	5	4	40/60	PC
31	20CSI703	Cloud Computing	3/0/2	5	4	40/60	PC
32	20CSI801	Microservices and Distributed Computing Architecture	3/0/0	3	3	50/50	PC
33	20CSI802	Machine Learning	3/0/2	5	4	40/60	PC
34	20CSI901	Front end Frameworks Engineering	3/0/2	5	4	40/60	PC

AUDIT COURSES (AC)

S.No.	Course Code	Course Title	Category
1	20ACI090	English for Research Paper Writing	AC
2	20ACI091	Disaster Management	AC
3	20ACI092	Sanskrit for Technical Knowledge	AC
4	20ACI093	Value Education	AC
5	20ACI094	Constitution of India	AC
6	20ACI095	Pedagogy Studies	AC
7	20ACI096	Stress Management by Yoga	AC
8	20ACI097	Personality Development through Life Enlightenment Skills	AC
9	20ACI098	Essence of Indian Traditional Knowledge	AC

PROFESSIONAL ELECTIVE COURSES

S. No	Course Code	Course Title	L/T/P	Contact Hrs/Wk	Credits	Category
Computer and Network Security						
1.	20CSI911	Mobile Ad Hoc networks	3/0/0	3	3	PE
2.	20CSI912	Mobile Computing	3/0/0	3	3	PE
3.	20CSI913	Distributed Systems	3/0/0	3	3	PE
4.	20CSI914	Wireless Sensor Networks	3/0/0	3	3	PE
5.	20CSI915	Cyber Security and Ethical Hacking	3/0/0	3	3	PE
6.	20CSI916	Advanced Databases	3/0/0	3	3	PE
7.	20CSI917	Advanced Algorithms	3/0/0	3	3	PE
8.	20CSI918	Software Product Management	3/0/0	3	3	PE
9.	20CSI919	Information Ethics and Cyber Laws	3/0/0	3	3	PE
Intelligent Systems						
10.	20CSI921	Soft Computing	3/0/0	3	3	PE
11.	20CSI922	Deep Learning	3/0/0	3	3	PE
12.	20CSI923	Human Computer Interaction	3/0/0	3	3	PE
13.	20CSI924	Image Processing and Pattern Recognition	3/0/0	3	3	PE
14.	20CSI925	Speech and Natural Language Processing	3/0/0	3	3	PE
15.	20CSI926	Social Network Analysis	3/0/0	3	3	PE
16.	20CSI927	Optimization Techniques	3/0/0	3	3	PE
17.	20CSI928	Data Visualization	3/0/0	3	3	PE
18.	20CSI929	Computer Vision	3/0/0	3	3	PE
Thriving Electives						
19.	20CSI931	Game Theory and its Applications	3/0/0	3	3	PE
20.	20CSI932	Cognitive Science and Decision Making	3/0/0	3	3	PE
21.	20CSI933	Business Intelligence	3/0/0	3	3	PE
22.	20CSI934	Quantum Computing	3/0/0	3	3	PE
23.	20CSI935	Robotics and its Applications	3/0/0	3	3	PE
24.	20CSI936	Virtual Reality	3/0/0	3	3	PE
25.	20CSI937	Parallel Computing	3/0/0	3	3	PE
26.	20CSI938	DevOps	3/0/0	3	3	PE

Open Elective Courses offered to other departments

S.No.	Course Code	Course Title	L	T	P	Credit	Ext/Int
1	20CSI001	Multimedia Applications	3	0	0	3	50/50
2	20CSI002	.NET Framework for Application Development	3	0	0	3	50/50
3	20CSI003	Dependable Computing	3	0	0	3	50/50
4	20CSI004	Business Information Systems	3	0	0	3	50/50

ONE CREDIT COURSES

S.No	Course	Course Title
1.	20CSI811	SciKit
2.	20CSI812	Scrum
3.	20CSI813	Tensorflow
4.	20CSI814	MATLAB Programming
5.	20CSI815	SPSS
6.	20CSI816	SAP
7.	20CSI817	Laravel
9.	20CSI818	Foreign language / Spoken Hindi
10.	20CSI819	Patent Publications
11.	20CSI820	Metaverse
12.	20CSI821	Serverless Stack
13.	20CSI822	Salesforce
14.	20CSI823	Octave PL
15.	20CSI824	Gradle Build Tool
16.	20CSI825	Bean Stalk
17.	20CSI826	Spoken English
18.	20CSI827	Universal Human Values

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

S. No	Stream	Credits/Semester										Credits
		I	II	III	IV	V	VI	VII	VIII	IX	X	
1.	Humanities and Management (HM)	3							3			6
2.	Basic Sciences (BS)	8	4	4	4							20
3.	Engineering Sciences (ES)	3	8		4							15
4.	Professional Core (PC)	4.5	10	16	12	22	19	12	7	4		106.5
5.	Professional Electives (PE)						3	6	6	3		18
6.	Open Electives (OE)							3	3			6
7.	Project Work (PW)						1.5		1.5	8	16	27
8.	Employability Enhancement Skills (EES)									1.5		1.5
9.	Mandatory Course (MC)											**Non credit**
10.	Audit courses (AC)											**Extra Credit**
	Total	**18.5**	**22**	**20**	**20**	**22**	**23.5**	**21**	**20.5**	**16.5**	**16**	**200**

20MAI101 LINEAR ALGEBRA AND DIFFERENTIAL CALCULUS 3/1/0/4

Nature of Course J (Problem Analytical)

Pre requisites -

Course Objectives:

1 To develop the skill to use matrix algebra techniques that is needed by engineers for practical applications.

2 To gain knowledge in using infinite series of approximations for solutions arising in mathematical modelling.

3 To familiarize with functions of several variables applicable in many branches of engineering.

4 To find the solution of ordinary differential equations as most of the engineering problems are characterized in this form.

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Recall the concepts of matrices, ordinary and partial derivatives	[K]
C101.2	Express square matrix in the diagonal form and infinite series approximations	[U]
C101.3	Apply the knowledge of differential equation and extreme values of the given functions to solve the engineering problems	[AP]

Course Contents:

Module 1: Linear Algebra 20 Hours

Symmetric, Skew – symmetric and orthogonal matrices - Characteristic equation – Eigen values and eigenvectors of real matrices and their properties (statement only).Cayley-Hamilton theorem (statement only): Verification and application to find inverse and powers of real matrices. Orthogonal transformation of a real symmetric matrix to diagonal form – Reduction of Quadratic form to canonical form by orthogonal reduction.

Module 2: Sequences and Series 20 Hours

Convergence of sequences and series – Tests of convergence of positive term series: Comparison test, D'Alembert's ratio test- Cauchy root test -Alternating Series- Leibnitz's test- Series of positive and negative terms-Absolute and conditional convergence.

Module 3: Calculus 20 Hours

Functions of several variables: Total derivatives – Differentiation of implicit functions – Jacobians – Taylor series expansion – Maxima and Minima – Method of Lagrangian multipliers. Ordinary differential equations-Second and Higher order linear differential equations with constant coefficients –Cauchy's and Legendre's linear differential equations-Method of variation of parameters. Application of ODE: Diffferential equations connected with electric circuits and Simple Harmonic motion (Differential equations and associated conditions need to be given)

Total Hours: 60

Text Books:

1 G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 13th Edition,Pearson,Reprint,2014

2 Kreyszig. E, "Advanced Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, Singapore 2014.

3 Grewal. B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2014.

Reference Books:

1 Veerarajan. T, “Engineering Mathematics I”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.

2 Glyn James, “Advanced Modern Engineering Mathematics”, Pearson Education, 4th Edition,2012.

3 N.P.Bali and Dr.Manish Goyal, “A Text book of Engineering Mathematics” 9th Edition, Laxmi publications Ltd, 2014.

Web References:

1 http://www.nptel.ac.in/courses/111105035

2 http://www.nptel.ac.in/courses/122104017

3 http://nptel.ac.in/courses/122102009

4 http://nptel.ac.in/courses/111107063

Online Resources:

1 https://www.coursera.org/learn/linearalgebra2

2 https://www.coursera.org/learn/differentiation-calculus

3 https://www.coursera.org/learn/single-variable-calculus

4 https://alison.com/courses/Algebra-Functions-Expressions-and-Equations

Assessment Methods & Levels (based on Blooms Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C101.1	Remember	Classroom or Online Quiz	4
C101 .2	Understand	Class Presentation/Power point presentation	6
C101.1,2,3	Apply	Group Assignment & Tutorial	10

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1	1	1	1						1				1	2	1
C101.2	2	2	2						2				2	2	2
C101.3	3	3	3						3				3	2	3

20CSI101 **PROBLEM SOLVING USING C** **3/0/0/3**

Nature of Course F (Theory Programming)
Pre requisites -

Course Objectives:

1. To describe problem solving concept and basics of C programming.
2. To discuss the control structures in C.
3. To solve real world problems using arrays, strings, pointers and functions.
4. To explain Structure, Union and File concepts.

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1:	Apply problems solving techniques to solve real world problems.	[AP]
C101.2:	Calculate programs using C constructs, arrays and strings.	[AP]
C101.3:	Use the concepts of pointers, structures and files in programs.	[AP]
C101.4:	Discuss modular programming with functions.	[U]

Course Contents:

Module 1: Problem Solving Techniques **15 Hours**

General problem Solving concepts - Algorithm, Pseudo-code and Flowchart - Problem Solving with Sequential Logic Structure - Problem Solving with Decisions - Problem Solving with Loops **Case Study:** Raptor and Scratch Tools

Module 2: C Basics **15 Hours**

Fundamentals – Structure of a 'C' program – compilation and linking process **Constructs of C:** Lexical elements – Operators – Constants, Variables - data types – I/O statements – format specifications – control statements – decision making and looping. **Arrays:** Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. **Strings**: Character array – string handling functions – manipulation on strings.

Module 3: Functions and Pointers **15 Hours**

Function – definition of function – Declaration of function – arguments (formal and actual) – return types - Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Arrays using Pointers, Pointers to structures. **Structures and Unions:** Introduction – need for structure data type – structure definition – Structure declaration –Structure within a structure – Union – File Handling**.**

Total Hours: 45

Text Books:

1. Herbert Schildt, "The Complete Reference C", 4th Edition, McGraw Hill, 2015.
2. M. Sprankle, Jim Hubbard, "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011.
3. Byron,S. Gottfreid, "Programming with C", McGraw Hill, Schaum'soutlines,3rd Edition, 2014.

Reference Books:

1 S.Thamarai Selvi and R.Murugesan, "Programming in ANSI C",6th Edition, McGraw Hill, 2012.

2 K.R.Venugopal and Sudeep R. Prasad, "Mastering C", McGrawHill, 2nd Edition,2015.

Web References:

1. http://nptel.ac.in/courses/106105085/
2. https://onlinecourses.nptel.ac.in/noc17_cs43/
3. http://raptor.martincarlisle.com/
4. https://scratch.mit.edu/

Online resources:

1. www.leetcode.com
2. https://nptel.ac.in/courses/106104128/

Assessment Methods & Levels (based on Blooms Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C101.1,2	Understand	Assignment	5
C101 .1,2	Apply	Online Quiz	5
C101.1,3,4	Apply	Mini Project	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	30	30	20	20
Understand	40	30	30	30
Apply	30	40	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1	3	3	3						3		3	1	3	2	3
C101.2	3	3	3						3		3	2	3	2	3
C101.3	3	3	3						3		3	1	3	2	3
C101.4	2	2	1						2		2	2	2	2	2

20ENI101 BUSINESS ENGLISH COMMUNICATION 2/0/2/3

Nature of Course D (Theory Application)

Pre requisites -

Course Objectives:

1. To develop the listening skills and reading practices using authentic business vocabulary.
2. To instill analytical thinking and logical reasoning to enhance LSRW skills in business related situations.
3. To make the students to communicate effectively in corporate sector using business English.
4. To prepare students for competitive exams like BEC, IELTS, TOEFL.

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Remember LSRW skills and employ cross-cultural communication in business related situations.	[R]
C101.2	Understand and gain proficiency with business vocabulary.	[U]
C101.3	Apply Task- based activity to enhance an effective communication.	[AP]
C101.4	Apply Business English in working environment.	[AP]
C101.5	Understand and analyse a variety of reading strategies to foster comprehension and to construct meaningful and relevant connections to the text.	[AN]

Course Contents:

Module 1: Listening and Speaking 15 Hours

Taking and Leaving Voice mail messages –Identifying the information before listening- Inferring ideas- Listening to short monologues -Longer listening tasks -Recognise functions. Expressing hypothetical Situations – Expressing obligation -Aspects of business – Giving examples- Giving reasons- Giving extra information- Presentation at a business meeting-Connecting ideas- Collaborative task – Short talk on a business topics- Film Reviews.

Module 2: Reading and Writing 15 Hours

Science texts - Terms related about science and scientists - Scanning for specific information- Understanding cohesive features - Skimming the reading comprehensions - Interpret opinions and ideas expressed – Collocations - Identifying dependent preposition - Identifying the extra words. Definitions, Extended Definitions -Letter writing (accepting and declining invitations)- Internal communication (notes/memo/E-mail writing to the head of the department, colleague, assistant , staff in the department etc) Report writing- Business proposal- circular- agenda and minutes- Appropriate linking words- Report Phrases - Asking for Information and Making Suggestions- Transcoding (Bar Chart, Flow Chart)- Letter - calling for quotations, Replying for quotations- Placing an order and complaint letter.

Module 3: Parts of Speech 15 Hours

Tenses - Adjectives - Adverbs - Articles- Modal verbs, Active and Passive Voice, Impersonal Passive voice, Homophones Homonyms- Acronyms- Abbreviations- British and American words- Comparatives and Superlatives- Gerunds- infinitives – Participles- Modal Verbs - Relative Pronouns- Reported Speech - Indirect Questions- Spotting errors- Job Application Letter- Sales Letter.

Lab Components

1 Mini Presentation	[E]
2 Logical reasoning and Ethics in a given situation	[E]
3 Technical Presentation	[E]
4 Group Discussion	[E]
5 Extempore	[E]

Total Hours: 60 Hours.

Text Books:

1. Whitby, Norman, “Business Benchmark Pre-Intermediate to Intermediate Student's Book”, Cambridge University Press, 2013.
2. Rizvi Ashraf M, “Effective Technical Communication”, McGraw Hill Education (India) Private Limited, 2nd Edition, 2018.
3. Sumant S, “English for Engineers, Tata Mcgraw Hill Education Private Limited 2017.

Reference Books:

1. Wood, Ian, Paul Sanderson, Anne Williams, Marjorie Rosenberg, “Pass Cambridge BEC Vantage”, Cengage learning. 2nd Edition. 2014.
2. Dr.Gunasekaran S, ‘A Workbook of Technical English ”, Vishnu Prints Media, Fourth Edition,2017
3. Lewis, Norman, “Word Power Made Easy”, Pocket Books, New York, 1979.

Web References:

1. http://www.cambridgeindia.org
2. http://www.cambridgeenglish.org/exams/business-certificates/business-vantage
3. https://steptest.in

Online Resources:

1. https://www.coursera.org/specializations/business-english
2. http://www.academiccourses.com/Courses/English/Business-English

Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)
Formative assessment based on Capstone Model (Max. Marks:30)

Course Outcome	Revised Bloom’s Level	Assessment Component	Marks
C101.1	Remember	Extempore	5
C101.2	Understand	Mini Presentation	5
C101.3	Apply	Group Discussion	5
C101.4	Apply	Technical Presentation	10
C101.5	Understand	Reading Comprehension	5

Summative assessment based on Continuous and End Semester Examination

Revised Bloom's Level	Continuous Assessment			End Semester Examination (Theory) [40 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	30	20	20	20
Understand	30	30	30	30
Apply	40	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1								1	1	1		1	1	1	1
C101.2								1	1	1		1	1	1	1
C101.3								3	3	1		2	3	2	3
C101.4								3	3	2		1	3	2	3
C101.5								3	3	2		1	3	2	3

20PHI101 **ENGINEERING PHYSICS** **3/0/2/4**

Nature of Course : E (Theory skill based)
Pre requisites : Nil

Course Objectives:

1 To learn the basic concepts of physics needed for computing engineering
2 To apply the physics concepts in solving real time engineering problem
3 To implement and visualize theoretical aspects in the laboratory
4 To familiarize the students to handle various instruments and equipment

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Recognize the fundamental concepts of interference, diffraction and polarization	[K]
C101.2	Explain the basics in magnetic and superconducting materials	[U]
C101.3	Extend knowledge about semiconductors and fibre optic communication.	[U]
C101.4	Apply the gained knowledge to solve the problems related to their field of study	[AP]

Course Contents:

Module 1: Wave optics **15 Hours**

Huygen's theory (An introduction to Wavefront and its types), Interference-Principle of superposition-Young's experiment-Theory of interference fringes-Types of interference – Conditions for interference pattern- Michelson interferometer. Diffraction-Two kinds of diffraction-Difference between interference and diffraction - Fraunhoffer diffraction at single slit-Plane diffraction grating. Polarization-Introduction- Brewster's law, Malus law, Double refraction-Nicol's prism-construction and working.

Module 2: Magnetic and Superconducting materials **15 Hours**

Basic Definitions: Permeability (absolute and relative), magnetic field intensity, magnetic moment of bar magnet, intensity of magnetisation, Magnetic line of force, magnetic field and magnetic induction, magnetic flux–Types of magnetism: para, dia, ferro and antiferro magnetic material – Domain theory – Magnetic hysterisis – Soft and hard magnetic materials – Ferrites – Properties, applications-Magnetic recording and readout-Magnetic disc drives. Superconductivity – Properties – Temperature dependence of resistivity in superconducting materials – Temperature dependence of critical field – Critical currents- Meissner effect-, Types of super conductors – BCS theory - High Tcsuper conductors– Application: Josephson effect - SQUID, magnetic levitation.

Module 3: Semiconductor devices and Fibre Optic Communication **15 Hours**

Introduction to semiconductors – Basic of Intrinsic and extrinsic semiconductors – PN Junction diode – formation and operation – IV characteristics, Applications - Light Emitting Diode(LED)- Transistor – Bi-polar Junction Transistor (BJT)- Common base configuration - VI characteristics Fibre Optics - Principle and propagation–Numerical aperture and acceptance angle – Classification of optical fibres – Splicing - Fibre optic communication system (Block diagram) - Fibre optic sensors: temperature and displacement.

Lab Component

1	Laser and optical fiber parameters	[U]
2	Wavelength measurement of mercury spectrum- Spectrometer Grating	[U]
3	Young's modulus - Non- Uniform bending method	[U]
4	Rigidity modulus – Torsional Pendulum	[U]
5	Coefficient of viscosity for a liquid –Poiseuille's method	[U]

6	Magnetic field along the axis of current carrying coil- Stewart and Gee method.	[U]
7	LCR circuits.	[U]
8	Newton's ring- wavelength of sodium vapour lamp / Airwedge – Thickness of thin sample	[U]
9	Time constant of RC circuits.	[U]
10	Transverse and longitudinal wave modes- Melde's experiment.	[U]
	Total Hours:	**75**

Text Books:

1. Beiser A, "Concepts of Modern Physics", 5th Edition, McGraw Hill International, 2010.
2. David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics", Wileyplus, 2010
3. S.L.Gupta, Sanjeev Gupta, "Modern Engineering Physics", Dhanpat Rai Publications, 2011

Reference Books:

1. Ajoy Ghatak, "Optics" , 5thEdition, Tata McGraw Hill, 2012
2. Sears, Zemansky, "University Physics', Addison-Wesley, 1999
3. Francis.A.Jenkins and Harvey.E.White, "Fundamentals of Optics", 4th Edition, McGraw Hill Education, 2017

Web References:

1. https://www.drdo.gov.in/drdo/data/Laser%20and%20its%20Applications.pdf
2. https://www3.nd.edu/~powers/ame.20231/planckdover.pdf
3. https://www.corning.com/in/en/products/communication-networks/.../fiber.html
4. https://physics.info/
5. http://www.feynmanlectures.caltech.edu/info/
6. http://nptel.ac.in/courses/113106032/4%20-%20Crystal%20structure.pdf
7. http://www.phys.ufl.edu/courses/phy2054/s09/lectures/2054_ch21A.pdf
8. https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2013/
9. https://swayam.gov.in/course/4537-fundamentals-of-electronic-materials-and-devices
10. https://www2.physics.ox.ac.uk/sites/default/files/2011-06-08/optics_2016_week_1_notes_and_slides_pdf_19526.pdf

Online Resources:

1. https://www.patana.ac.th/secondary/science/anrophysics/ntopic4/commentary.htm
2. http://www.indiaeducation.net/
3. https://www.jic.ac.uk/microscopy/links.html
4. http://esiksha.com/home.asp
5. www.fiberopticsonline.com/
6. https://ocw.mit.edu/courses/#physics
7. https://physics.stanford.edu/people/susmita-adhikari

Assessment Methods & Levels (based on Blooms' Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 marks]
	Theory			Practical	
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	Rubric based CIA [30 Marks]	
Remember	30	20	30	20	30
Understand	60	60	60	40	60
Apply	10	20	10	30	10
Analyse	-	-	-	10	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1	1	1	1						1				1	1	1
C101.2	2	2	1						2				2	2	2
C101.3	2	2	1						2				2	2	2
C101.4	3	3	2						3				3	2	3

20CSI102 **C PROGRAMMING LABORATORY** **0/0/3/1.5**

Nature of Course M (Practical application)
Pre requisites -

Course Objectives:

1 To describe problem solving concept and basics of C programming.
2 To discuss the control structures in C.
3 To solve real world problems using arrays, strings, pointers and functions.
4 To explain Structure, Union and File concepts.

Course Outcomes:

Upon completion of the course, students shall have ability to

C102.1	Apply problems solving techniques to solve real world problems.	[AP]
C102.2	Calculate programs using C constructs, arrays and strings.	[AP]
C102.3	Use the concepts of pointers, structures and functions in programs.	[AP]
C102.4	Read and write data from/to files.	[K]

List of Experiments:

1. Draw a Flowchart using Raptor Tool
    - Simple Flow Chart
    - Decision Making
    - Looping [Pre test & Post test]
2. Create Animation / Gaming /Application using Scratch Tool
3. Program to process data types and evaluate an expression.
4. Program using decision making statements
5. Program using looping statements
6. Program using single and two dimensional arrays
7. Program to manipulate strings
8. Program using structures and unions
9. Program using functions
10. Program using files

Total Hours: 45

Assessment Methods & Levels (based on Blooms Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Rubric based Continuous Assessment[60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	10	10
Understand	40	40
Apply	50	50
Analyse	-	-
Evaluate	-	-
Create	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C102.1	3	3	2		1			3	3	1	3	1	3	2	3
C102.2	3	3	2		1			3	3	1	3	1	3	2	3
C102.3	3	3	2		1			3	3	1	3	1	3	2	3
C102.4	1	1	1		1			1	1	1	1	1	1	1	1

20MEI101 **ENGINEERING GRAPHICS** **2/0/2/3**

Nature of Course M (Practical application)

Pre requisites -

Course Objectives:

1. To know the method to construct the conic curves used in Engineering Applications.
2. To develop an understanding of Isometric to Orthographic Views and vice versa.
3. To learn the basic projection of straight lines and plane surfaces.
4. To develop the imagination of solids inclined to one reference plane.
5. To know the development of surfaces used in various fields

Course Outcomes

C101.1	Explain the basic concepts of Engineering Graphics.	[U]
C101.2	Sketch isometric, orthographic projections and projection of lines and planes	[AP]
C101.3	Develop lateral surfaces of solids including prisms and pyramids	[C]
C101.4	Construct projections of lines, planes, solids and isometric views using modeling software.	[C]

Course Contents

Conic curves and Special curves-Isometric to Orthographic projection-Orthographic to Isometric projection-Projection of Lines and Plane surfaces-Projection of Solids-Development of Surfaces-Introduction to Perspective projection.

S.No	List of Experiments	CO Mapping	RBT
1	Introduction to Drafting Software.	C101.1	[U]
2	Construction of Conic Curves (Ellipse, Parabola and Hyperbola)	C101.1	[U]
3	Construction of Special Curves (Cycloid and Involutes)	C101.1	[U]
4	Isometric to Orthographic projections – Manual sketches	C101.2	[AP]
5	Isometric to Orthographic projections – Software sketches	C101.4	[A]
6	Projection of lines - Inclined to HP, VP and Both HP & VP	C101.4	[A]
7	Projection of Plane surfaces (Hexagon, Pentagon and circle) – inclined to any one of the principle planes	C101.4	[A]
8	Projection of Solids (Prism and Pyramid) – Inclined to HP	C101.3	[AP]
9	Projection of Solids (Cone and Cylinder) – Inclined to VP	C101.3	[AP]

10	Development of Surfaces (Prism, Pyramid, Cone and Cylinder)	C101.4	[A]
11	Introduction to Perspective projection	C101.2	[U]

Total Hours : 60

Reference Books:

1. Bhatt N.D. and PanchalV.M., “Engineering Drawing”, Charotar Publishing House, 50th Edition,2014.
2. K. V. Natarajan, “A Text Book of Engineering Graphics", Dhanalakshmi Publishers, 2018.
3. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2011.
4. Venugopal K. and Prabhu Raja V., “Engineering Graphics”, New Age International (P) Limited, 2013.

Web References:

1. http://nptel.ac.in/courses/112102101/
2. www.solidworks.com

Assessment Methods & Levels (based on Blooms Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	30	30
Understand	30	30
Apply	20	20
Analyse	20	20
Evaluate	0	0
Create	0	0

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1	1	1	1		1			1					1	1	1
C101.2	3	3	2		1			3					3	2	3
C101.3	1	1	1		3			3					3	3	3
C101.4	1	1	1		3			3					3	3	3

20MCI101 **INDUCTION PROGRAMME** **1/0/0/0**

Nature of Course Induction Programme

Pre requisites Nil

Course Objectives:

1. To have broad understanding of society and relationships
2. To nurture the character and fulfil one's responsibility as an engineer, a citizen and a human being
3. To incorporate meta skills and values

Course Outcomes:

Upon completion of the course, students shall have ability to

C101.1	Explore academic interest and activities	[AP]
C101.2	Work for excellence	[AP]
C101.3	Promote bonding and give a broader view of life and character	[AP]

Course Contents:

PHYSICAL ACTIVITY: Research over the past years has shown Yoga to have stress-relieving powers on students, paving the way for improved academic performance with the practice of asanas, meditation and breathing exercises. To prove these words Yoga classes has been planned in this module.(CO mapping: C101.1, C101.2, C101.3)

CREATIVE ARTS (students can select any one of their choice): Cultural development supports students to understand, feel comfortable with, value and appreciate the potential enrichment of cultural diversity. They should challenge discrimination, whether based on cultural or racial difference. Students should experience cultural traditions embedded in arts, crafts, language, literature, theatre, song, music, dance, sport, Science, technology and travel. Students should develop an appreciation of beauty both in experiencing artistic expression and by exploring their own creative powers. To inculcate those skills they are given a chance to exhibit their talents through painting, sculpture, pottery, music, dance, craft making and so on. .(CO mapping: C101.1, C101.2, C101.3)

UNIVERSAL HUMAN VALUES: Moral development involves supporting students to make considered choices around their behaviour and the values that provide a framework for how they choose to live. Moral development is also learning about society's values, understanding the reasons for them, how they are derived and change; and how disagreements are resolved. Students must consider the consequences of personal and societal decisions on the wider community – local and global- and on the environment and future generations. To acquire this the students are exposed to training to enhance their soft skills. .(CO mapping: C101.1, C101.2, C101.3)

LITERARY AND PROFICIENCY MODULES: Social development helps students to work effectively together, developing the inter-personal skills required to relate positively with their peers and people of all ages. Students must also understand how to participate productively in a diverse and plural society and learn about, and how to effectively engage with societal institutions and processes. They should understand that a person may have different roles and responsibilities within society. To reach this the following aspects are given in the form of Reading, writing, speaking – debate, role play etc.Communication and computer skills. (CO mapping: C101.1, C101.2, C101.3)

LECTURES BY EMINENT PEOPLE: Teaching with Lectures. ... It is essential to see lectures as a means of helping students learn to think about the key concepts of a particular subject, rather than primarily as a means of transferring knowledge from instructor to student. During the induction period students will attend to Guest lectures by subject experts.(CO mapping: C101.1, C101.2, C101.3)

VISIT TO LOCAL AREAS: Traveling is in fact a way of learning to learn. You are out of your comfort zone and so you must learn to be able to adapt to a new learning environment in a very short time. It also helps in your overall learning as well. In the induction period students will be taken to different places near college to learn new things. Eg. Meditation centre/orphanage/Hospital.(CO mapping: C101.1, C101.2, C101.3)

FAMILIARIZATION TO DEPARTMENT/BRANCH INNOVATION: Hod's of different branches will present about their department followed by department visit to view various facilities available at their department, new innovations from students and faculties etc.(CO mapping: C101.1, C101.2, C101.3)

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C101.1						3	3	3	3	3	3	3			1
C101.2						3	3	3	3	3	3	3			1
C101.3						3	3	3	3	3	3	3			1

20MAI201 INTEGRAL CALCULUS AND COMPLEX VARIABLES 3/1/0/4

Nature of Course J (Problem analytical)
Prerequisites -

Course Objectives:

1 To gain knowledge in improper integrals, Gamma and Beta functions which are needed in engineering applications
2 To develop logical thinking and analytical skills in evaluating multiple integrals
3 To acquaint with the concepts of vector calculus needed for problems in all engineering disciplines
4 To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence.

Course Outcomes:

Upon completion of the course, students shall have ability to

C201.1 Recall basic integration formulae, scalar and vector point function concepts [R]
C201.2 Identify the concepts of integrals in computing Beta and Gamma functions [U]
C201.3 Apply the concepts of the integration in evaluating engineering problems related to area, volume and vector point functions. [AP]
C201.4 Find the derivatives of the complex valued functions and to evaluate complex valued integrals. [AP]

Course Contents:

Module 1: Integral Calculus 20 Hours

Definite integrals - Evaluation of definite integrals using Bernoulli's formula. Beta and Gamma functions: Relation between Beta and Gamma Functions - Evaluation of Integrals using Beta and Gamma Functions. Multiple integrals : Double integration in Cartesian coordinates –Area as double integral – Change the order of integration-Triple integration in Cartesian co-ordinates –Volume as triple integral

Module 2: Vector Calculus 20 Hours

Vector differential operator- Gradient of a scalar point function - Directional derivatives – Divergence and Curl of a vector point function – Irrotational and solenoidal vector fields – Simple problems– Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem(theorem statements only)– Simple applications involving cubes and rectangular parallelopipeds.

Module 3: Complex Variable 20 Hours

Complex differentiation: Analytic Functions - Cauchy-Riemann equations (excluding proof) – Harmonic functions- Conjugate harmonic functions – Construction of analytic functions – Conformal mapping. Transformation: w = c+z,cz,1/z and Bilinear transformation. Complex integration: Cauchy's Integral theorem (statement)- Cauchy's Integral formula - Laurent's series-Zeros and singularities – Residues – Cauchy's Residue theorem (statement). Contour integration: Evaluation of real integrals of the form $\int_0^{2\pi} f(\cos\theta, \sin\theta)\, d\theta$ and $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)}\, dx$

Total Hours: 60

Text Books:

1 G.B.Thomas and R.L.Finney, Calculus and Analytic Geometry, 13th Edition, Pearson, Reprint, 2014.

2 Kreyszig. E, "Advanced Engineering Mathematics" Tenth Edition, John Wiley and Sons (Asia) Limited, Singapore, 2014.

3 Grewal. B.S, "Higher Engineering Mathematics", 43rd Edition, Khanna Publications, Delhi, 2014.

Reference Books:

1 Veerarajan. T, "Engineering Mathematics II", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2018.

2 Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edition, 2012.

3 N.P.Bali and Dr.Manish Goyal, "A Text book of Engineering Mathematics", 9th Edition, Laxmi publications Ltd, 2014.

Web References:

1 http://nptel.ac.in/video.php?subjectId=122107037
2 http://nptel.ac.in/courses/122107036/
3 http://nptel.ac.in/video.php?subjectId=117102060

Online Resources:

1 https://www.coursera.org/learn/pre-calculus
2 https://www.coursera.org/learn/linearalgebra1
3 https://alison.com/courses/Advanced-Mathematics-1
4 https://www.edx.org/course/algebra-lineal-mexicox-acf-0903-1x.

Assessment Methods & Levels (based on Blooms Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C201.1	Remember	Classroom or Online Quiz	4
C201.2	Understand	Class Presentation/Power point presentation	6
C201.1,2,3 &C201.4	Apply	Group Assignment & Tutorial	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1	1	1	1						1				1	2	1
C201.2	2	2	1						2				2	3	2
C201.3	3	3	2						3				3	3	3
C201.4	3	3	2						3				3	3	3

20CSI201 PYTHON PROGRAMMING 3/0/0/3

Nature of Course :F (Theory Programming)
Prerequisites : -

Course Objectives:

1	To describe and execute Python script using types and expressions
2	To discuss the difference between expressions & statements and to understand the concept of assignment semantics.
3	To utilize high level data types such as lists and dictionaries.
4	To import and utilize a module and to perform read & write operations on files.

Course Outcomes:

Upon completion of the course, students shall have ability to

C201.1	Read, write, execute by hand simple Python programs.	[U]
C201.2	Structure simple Python programs for solving problems.	[U]
C201.3	Decompose a Python program into functions.	[AP]
C201.4	Represent compound data using Python lists, tuples and dictionaries.	[AP]
C201.5	Read and write data from / to files in Python Programs.	[AP]

Course Contents:

Module 1: Introduction, Data, Expressions, Statements 15 Hours

Introduction-Python Interpreter And Interactive Mode; Values and Data Types: Variables, Expressions, Statements, Tuple Assignment, Precedence of Operators, Comments; Modules and Functions, Function Definition and Use, Flow of Execution, Parameters and Arguments; Illustrative Programs: Exchange the Values of Two Variables, Circulate the Values of N Variables, Distance Between Two Points.

Module 2: Control Flow, Functions 15 Hours

Conditionals: Boolean Values and Operators, Conditional (If), Alternative (If-Else), Chained Conditional (If-Elif-Else); Iteration: While, For, Break, Continue, Pass; Fruitful Functions: Return Values, Parameters, Local and Global Scope, Function Composition, Recursion; Strings: String Slices, Immutability, String Functions and Methods, String Module; Lists as Arrays. Illustrative Programs: Square Root, Gcd, Exponentiation, Sum an Array of Numbers, LinearSearch, Binary Search.

Module 3: Lists, Files, Modules, Packages 15 Hours

Lists: List Operations, List Slices, List Methods, List Loop, Mutability, Aliasing, Cloning Lists, List Parameters; Tuples: Tuple Assignment, Tuple as Return Value; Dictionaries: Operations and Methods; Advanced List Processing - List Comprehension; Set in Python, Illustrative Programs: Selection Sort, Insertion Sort, Merge Sort, Histogram - Classes, Inheritance in python, Files And Exception: Text Files, Reading and Writing Files, Format Operator; Command Line Arguments, Errors and Exceptions, Handling Exceptions, Modules, Packages; Illustrative Programs: Word Count, Copy File.

Total Hours: 45

Text Books:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" – Revised And updated for Python 3.2, Network Theory Ltd., 2011.

Reference Books:

1. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
2. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) PrivateLtd.,, 2015.
3. John V Guttag, "Introduction to Computation and Programming Using Python'', Revised and expanded Edition, MIT Press , 2013

Web References:

1. https://www.wileyindia.com/introduction-to-computer-science-using-python.html
2. https://www.programiz.com/python-programming
3. https://www.fullstackpython.com/best-python-resources
4. https://www.tutorialspoint.com/python/
5. https://www.geeksforgeeks.org/python-programming-language/

Online Resources:

1. http://nptel.ac.in/courses/106106145/
2. https://www.codecademy.com/learn/learn-python

Assessment Methods & Levels (based on Blooms Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C201.1&C201.2	Understand	Assignment	5
C201.3	Apply	Online Quiz	5
C201.4&C201.5	Apply	Mini Project	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [50 Marks]
	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	
Remember	20	20	20	20
Understand	50	40	30	30
Apply	30	40	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes(PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C201.1	2	2	1						2		2	3	2	3	2
C201.2	2	2	1						2		2	3	2	2	2
C201.3	3	3	2						3		3	3	3	3	3
C201.4	3	3	2						3		3	3	3	3	3
C201.5	3	3	2						3		3	3	3	3	3

20CSI202 **DATASTRUCTURES** **3/1/0/4**

Nature of Course : F (Theory Programming)

Prerequisites : C Programming

Course Objectives:

1. To demonstrate the comprehensive view of ADT and their significance in problem solving.
2. To construct the linear data structures – lists, stacks, and queues in real world applications.
3. To describe the non linear data structures such as tree and graph
4. To explain the sorting, searching and hashing algorithms.

Course Outcomes:

Upon completion of the course, students shall have ability to

C202.1	Choose appropriate data structures like linked list, stack and queue to the specified problem definition.	[AP]
C202.2	Examine and manipulate data using trees and graphs and choose data structure to suit application requirement.	[AP]
C202.3	Practice various searching and sorting techniques.	[AP]
C202.4	Discuss the various hashing techniques.	[U]
C202.5	Apply the fundamental knowledge of various data structures to implement algorithm for any real time problem.	[AP]

Course Contents:

Module 1: Linear Data Structures – List, Stack, Queues **20 Hours**

Abstract Data Types (ADTs) – List ADT – Array implementation – Linked list implementation –Singly linked lists- Circularly linked lists- Doubly-linked lists – Applications of lists –Polynomial Manipulation. Stack ADT – Operations – Applications – Evaluating arithmetic expressions - Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – Applications of queues.

Module 2: Non Linear Data Structures – Trees, Graphs **20 Hours**

Tree ADT – Tree traversals – Binary Tree ADT –Expression trees – Applications of trees – Binary search tree ADT –Threaded Binary Trees- AVL Trees – Red Black Tree, Splay Tree, B-Tree – B+ Tree – Heap – Applications of heap. Graph - Definition – Representation of Graph – Types of graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Bi-connectivity– Euler circuits – Applications of graphs.

Module 3: Searching, Sorting and Hashing Techniques **20 Hours**

Searching- Linear Search – Binary Search - Trie–Tree Map – Hash map. Sorting – Bubble sort – Selection sort – Insertion sort – Shell sort– Radix sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing. Case Study: Using appropriate data structures for Contact book application, Dictionary, Navigation map, Compiler design.

Total Hours: 60

Text Books:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education India, 3rd Edition, 2013.
2. Debasis Samanta, "Classic data structures", Prentice Hall, 2nd Edition, 2014.
3. Peter Brass, "Advanced Data Structures", Cambridge University Press, 2008.

Reference Books:

1. Seymour Lipschutz "Data Structures by Schaum Series" 2nd Edition, McGraw Hill, 2013.
2. Narasimha Karumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", 5th Edition, Career Monk, 2016.
3. Reema Thareja, "Data Structures Using C", 2nd Edition, Oxford University Press, 2011.

Web References:

1. http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures
2. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms
3. https://www.geeksforgeeks.org/data-structures/

Online Resources:

1. https://www.edx.org/course/foundations-of-data-structures.
2. https://www.udemy.com/topic/data-structures/.
3. https://nptel.ac.in/courses/106102064/.
4. https://www.coursera.org/specializations/data-structures-algorithms.

Assessment Methods & Levels (based on Blooms Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C202.1,2	Understand	Assignment	5
C202.1,2	Apply	Online Quiz	5
C202.3,4,5	Apply	Tutorial	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	30	30	20	20
Understand	40	30	30	30
Apply	30	40	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes(PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C202.1	3	3	2									3	3	3	3
C202.2	3	3	2									3	3	3	3
C202.3	3	3	2									3	3	3	3
C202.4	2	2	1									2	2	3	2
C202.5	3	3	2									3	3	3	3

20EEI201 **BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING** **3/0/2/4**

Nature of Course G (Theory analytical)
Prerequisites -

Course Objectives:

1. To equip students with a basic understanding of Electrical circuits
2. To learn the working principle of transformers
3. To understand the DC and AC Machine working principles and to have a knowledge on selection of machine for specific types of applications.
4. To give a comprehensive exposure to electrical installations.
5. To equip students with an ability to understand basics of analog and digital electronics.

Course Outcomes:

Upon completion of the course, students shall have ability to

C201.1	Analyze the concepts in ac circuit and dc circuits.	[A]
C201.2	Understand the working principle of single phase and three phase transformers.	[U]
C201.3	Understand the working principle of DC and AC machines.	[U]
C201.4	Illustrate the basic components used for electrical installations.	[AP]
C201.5	Understand the basic concepts of analog and digital electronics.	[U]

Course Contents:

Module 1: DC Circuits and AC Circuits **15 Hours**

DC Circuits-Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, Star Delta Transformation, analysis of simple circuits with dc excitation, Mesh, Nodal Analysis Superposition, Thevenin, Norton and Maximum Power Transfer theorem. AC Circuits- Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor.

Module 2: Electrical Machines and Installations **15 Hours**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections (Qualitative only). Construction and working principle of DC motor. Construction and working principle of Synchronous motor and three phase Induction motor. Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption.

Module 3: Basics of Analog and Digital Electronics **15 Hours**

Semiconductor, PN junction diode, Zener diode, rectifier- Half wave, full wave and Bridge rectifier, Introduction to Number system, basic Boolean laws, reduction of Boolean expressions and implementation with logic gates.

Lab Component

1	Familiarization of Electrical Elements, Sources, Measuring Devices and Verification of ohm's law	[R]
2	Estimation of voltage and current by KVL and KCL in Electric Circuits	[U]
3	Determination of mesh current and node voltage by Mesh and Nodal Analysis	[AP]
4	Application of Superposition theorem in electrical circuits	[AP]
5	Application of the venin's and maximum power transfer theorem in electrical circuits.	[U]
6	Demonstration of cut-out sections of machines: dc machine (Commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine	[AP]
7	Load test on dc shunt motor.	[AP]
8	Demonstration of components of LT Switch Gears	[U]
9	Construction of bridge rectifier	[U]
10	Verification of logic gates.	[U]

Total Hours: 75

Text Books:

1. Fitzgerald. A.E., Charles Kingsely Jr, Stephen D.Umans, "Electric Machinery", Tata McGraw Hill, 6th Edition2015.
2. Vincent. Del. Toro, "Electrical Engineering Fundamentals", Prentice Hal India, 2nd Edition, 2015.
3. E. Hughes, "Electrical and Electronics Technology", Pearson, 10th Edition, 2011
4. Sudhakar. A and Shyam Mohan. SP "Circuits and Network Analysis & Synthesis" 5th edition, Tata McGraw Hill, 2015.
5. Salivhanan, "Electron Devices and Circuits", 4th edition, McGraw Hill Education India Private Ltd., 2016
6. M. Morris Mano, "Digital Logic and Computer Design", Prentice Hall of India, 5th Edition, 2007

Reference Books:

1. Charles A.Gross, Thaddeus A.Roppel, "Fundamentals of Electrical Engineering", CRC press,2012.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 5th Edition 2011.
3. Schaum's Series, "Basic Circuit Analysis ",2nd Edition, McGraw Hill India Private Ltd., 2011(Reprint)

Web References:

1. http://nptel.ac.in/course.php?disciplineId=108
2. https://ocw.mit.edu/courses/find-bytopic/#cat=engineering&subcat=electricalengineering&spec=electricpower
3. https://nptel.ac.in/video.php?subjectId=117103063
4. https://onionesquereality.wordpress.com/.../more-video- lectures-iit-open
5. https://nptel.iitg.ernet.in/Elec_Comm_Engg/.../Video-ECE.pdf

Online Resources:

1. Electrical Knowhow@lifeneverask
2. Electricity &Magnetism, Part 1- PHYS 102.1x(edx.in)
3. Fundamentals of Electrical Engineering@coursera
4. Circuits and Electronics@edxonline
5. https://www.coursera.org/learn/electronics
6. NPTEL e learning courses

Summative assessment based on Continuous and End Semester Examination

Continuous Assessment

Bloom's Level	Theory			Practical Rubric based CIA [30 Marks]	End Semester Examination (Theory) [40 marks]
	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]		
Remember	50	50	40	40	40
Understand	50	50	40	40	40
Apply		-	20	20	20
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1	3	3	3					2	3			3	3	3	3
C201.2	2	2	1					1	2			2	2	2	2
C201.3	2	2	2					2	2			3	2	2	2
C201.4	3	3	2					3	3			3	3	3	3
C201.5	2	2	1					2	2			2	2	2	2

20ECI201 DIGITAL PRINCIPLES AND SYSTEM DESIGN 3/0/2/4

Nature of Course : G (Theory Analytical)

Prerequisites : Nil

Course Objectives:

1. To understand how computers operate at the most basic level.
2. To gain familiarity of the principles of combinational logic and the design of combinational circuits.
3. To understand the basics of sequential logic devices and the design of sequential circuits.
4. To understand the concepts of Programmable logic devices.

Course Outcomes:

Upon completion of the course, students shall have ability to

C201.1	Interpret information in binary and to manipulate Boolean functions using Boolean algebra, minimize Boolean Functions and implement using Logic gates.	[AP]
C201.2	Analyze and design different combinational logic circuits.	[A]
C201.3	Analyze and design various sequential logic circuits.	[A]
C201.4	Illustrate digital logic circuits using programmable logic devices.	[AP]

Course Contents:

Module 1: Introduction **15 Hours**

Number Systems- Binary codes – Binary Arithmetic - Boolean algebra - Boolean functions – Minimization of Boolean Functions using Karnaugh Maps and Tabulation Methods –Implementation of Logic Circuits using Gates (Two Level/Multilevel Implementation) – NAND, NOR Implementation.

Module 2: Combinational Logic **15 Hours**

Analysis and Design Procedures - Circuits for Arithmetic Operations-Code conversion-Parity Checker and Generator-Multiplexer- Boolean function implementation using multiplexer- Demultiplexer - Decoder – Encoders-Combinational Logic Implementation using decoder.

Module 3: Sequential Logic &Programmable Logic devices **15 Hours**

Latches-Flip flops-Analysis and Synthesis of Clocked Sequential Circuits – Shift Registers –— Ripple Counters – Synchronous Counters-Special Counters – Analysis and Design of Asynchronous Sequential Circuits- Memory and Programmable Logic Devices–RAM-Memorydecoding-PROM,ProgrammableLogicArray,ProgrammableArrayLogic.

Lab Component:

1. Realization of Boolean Functions using Logic Gates and Verification of Boolean Laws.
2. Analysis and Synthesis of Combinational Logic Circuits.
3. Code Converter
4. Parity Generator and Checker
5. Two bit magnitude comparator
6. Arithmetic Circuits
7. Multiplexer and Demultiplexer
8. Decoder &Encoder
9. Design and Implementation of Shift Registers.
10. Design and Implementation of Counters.

Total Hours : 75

Text Books:

1 M. Morris R. Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson, 2018.

2 C. H. Roth Jr., Larry L. Kinney "Fundamentals of Logic Design", 7th Edition, Cengage Learning, 2014.

Reference Books:

1 John F. Wakerly, "Digital Design: Principles and Practices", 5th Edition, Pearson,2018.

2 Donald P leach, Albert Paul Malvino, Goutam Saha, "Digital Principles and Application", 8th Edition, McGraw Hill education Private Limited, 2015.

3 Clive Woods, Brian Holdsworth, "Digital Logic Design", 4th Edition, O'Reilly Media,2002

4 Donald D.Givone, "Digital Principles and Design", 7th Edition, McGraw Hill, 2010.

Web References:

1 http://www.ee.ncu.edu.tw/~jimmy/courses/DSD06/02_async.pdf
2 https://www.cse.iitb.ac.in/~supratik/courses/cs226/slides/
3 https://books.google.co.in/books/about/Digital_Principles_System_Design.html?id=wlT3-7wA-t8C

Online Resources:

1 https://www.coursera.org/learn/digital-systems#syllabus
2 https://www.edx.org/course/computation-structures-part-1-digital-mitx-6-004-1x-0

Assessment Methods & Levels (based on Blooms Taxonomy)
Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment				End Semester Examination
	Theory			Practical	
	CIA-1 [10 marks]	CIA-2 [10marks]	CIA-3 [10marks]	Rubric based CIA [30 Marks]	(Theory) [40 marks]
Remember	10	20	20	30	20
Understand	40	20	20	20	20
Apply	50	40	40	20	40
Analyse	-	20	20	30	20
Evaluate	-	-	-		-
Create	-	-	-		-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1	3	3	3		2								3	3	3
C201.2	2	2	1		1								2	2	2
C201.3	2	2	2		1								2	2	2
C201.4	3	3	2		2								3	3	3

20CSI203 PYTHON PROGRAMMING LABORATORY 0/0/3/1.5

Nature of Course M (Practical application)
Prerequisites -

Course Objectives:

1 To write, test, and debug simple Python programs.

2 To build Python programs with conditionals and loops.

3 To use functions for structuring Python programs.

4 To represent compound data using Python lists, tuples, and dictionaries.

5 To read and write data from/to files in Python.

Course Outcomes:

Upon completion of the course, students shall have ability to

C203.1	Build simple Python programs	[AP]
C203.2	Implement Python programs using control flow structures.	[AP]
C203.3	Develop Python programs step-wise by defining functions and calling them.	[AP]
C203.4	Construct Python lists, tuples, dictionaries for representing compound data	[AP]
C203.5	Read and write data from/to files in Python.	[AP]

List of Experiments:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Mergesort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

Total Hours: **45**

Text Books:

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

2 Guido van Rossum and Fred L. Drake Jr, "An Introduction to Python" – Revised and updated for Python 3.2, Network Theory Ltd.,2011.

Reference Books:

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

2 Timothy A. Budd, “Exploring Python”, McGraw Hill Education (India) Private Ltd., 2015.

3 John V Guttag, “Introduction to Computation and Programming Using Python’’, Revised and expanded Edition, MIT Press , 2013

Web References:

1 https://www.programiz.com/python-programming

2 https://www.fullstackpython.com/best-python-resources

3 https://www.tutorialspoint.com/python/

4 https://www.geeksforgeeks.org/python-programming-language/

Online Resources:

1 http://nptel.ac.in/courses/106106145/

2 https://www.codecademy.com/learn/learn-python

Assessment Methods & Levels (based on Blooms Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	-	-
Understand	20	20
Apply	30	30
Analyse	50	50
Evaluate	-	-
Create	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C203.1	3	3	3		2			2	3	2	3	3	3	3	3
C203.2	2	2	1		1			1	2	1	2	2	2	2	2
C203.3	2	2	2		2			2	2	2	2	3	2	2	2
C203.4	3	3	2		2			3	3	1	3	3	3	3	3
C203.5	3	3	1		2			2	2	2	2	2	2	2	2

20CSI204 **DATA STRUCTURES LABORATORY** **0/0/3/1.5**

Nature of Course M (Practical application)
Prerequisites C Programming

Course Objectives:

1 To demonstrate the comprehensive view of ADT and their significance in problem solving.
2 To construct the linear data structures – lists, stacks, and queues in real world applications.
3 To describe the non linear data structures such as tree and graph
4 To explain the sorting, searching and hashing algorithms.

Course Outcomes:

Upon completion of the course, students shall have ability to

C204.1	Choose appropriate data structures like linked list, stack and queue to the specified problem definition.	[AP]
C204.2	Examine and manipulate data using trees and graphs and choose data structure to suit application requirement.	[AP]
C204.3	Implement various techniques for searching and sorting.	[AP]
C204.4	Discuss the various hashing techniques.	[U]
C204.5	Apply the fundamental knowledge of various data structures to implement algorithm for any real time problem.	[AP]

List of Experiments:

1. Students of a Programming class arrive to submit assignments. Their register numbers are stored in a LIFO list in the order in which the assignments are submitted. Write a program using array to display the register number of the ten students who submitted first. Register number of the ten students who submitted first will be at the bottom of the LIFO list. Hence pop out the required number of elements from the top so as to retrieve and display the first 10students.

2. To facilitate a thorough net surfing, any web browser has back and forward buttons that allow the user to move backward and forward through a series of web pages. To allow the user to move both forward and backward two stacks are employed. When the user presses the back button, the link to the current web page is stored on a separate stack for the forward button. As the user moves backward through a series of previous pages, the link to each page is moved in turn from the back to the forward stack. When the user presses the forward button, the action is the reverse of the back button. Now the item from the forward stack is popped, and becomes the current web page. The previous web page is pushed on the back stack. Simulate the functioning of these buttons using array implementation of Stack. Also provide options for displaying the contents of both the stacks when ever required.

3. Design a program to employ a stack for balancing symbols such as parentheses, flower braces and square brackets, in the code snippet given below.

```
for(i=0;i<n;i++)

{
```

```
if(i<5)
{
z[i]=x[i]+y[i];
p=(((a+b)*c)+(d/(e+f)*g);
}
```

Ensure that your program works for any arbitrary expression.

4. Most of the bugs in scientific and engineering applications are due to improper usage of precedence order in arithmetic expressions. Thus it is necessary to use an appropriate notation that would evaluate the expression without taking into account the precedence order and parenthesis.

5. a) Write a program to convert the given arithmetic expression into

   i) Reverse Polish notation

   ii) Polish notation

   b) Evaluate the above notations with necessary input.

6. Some priests are given three poles and a stack of 4 gold disks, each disk a little smaller than the one beneath it. Their assignment is to transfer all 4 disks from one of the 3 pole to another with 2 important constraints. They can move only one disk at a time, and they can never place a larger disk on top of a smaller one. Design a recursive program for the above Towers of Hanoi puzzle using stack.

7. In a theme park, the Roller-Coaster ride is started only when a good number of riders line up in the counter (say 20 members). When the ride proceeds with these 20 members, a new set of riders will line up in the counter. This keeps continuing. Implement the above scenario of lining up and processing using arrays with Queue ADT.

8. When burning a DVD it is essential that the laser beam burning pits onto the surface is constantly fed with data, otherwise the DVD fails. Most leading DVD burn applications make use of a circular buffer to stream data from the hard disk onto the DVD. The first part, the ‘writing process’ fills up a circular buffer with data, then the ‘burning process’ begins to read from the buffer as the laser beam burns pits onto the surface of the DVD. If the buffer starts to become empty, the application should continue filling up the emptied space in the buffer with new data from the disk. Implement this scenario using CircularQueue.

9. a) There is a garage where the access road can accommodate any number of trucks at one time. The garage is built in such a way that only the last truck entered can be moved out. Each of the trucks is identified by a positive integer (a truck_id). Implement dynamically to handle truck moves, allowing for the following

commands:

i) On_road (truck_id); ii) Enter_garage (truck_ id);

iii) Exit_garage (truck_id); iv) Show_trucks (garage or road);

If an attempt is made to get a truck out which is not the closest to the garage entry, the error message “Truck x cannot be moved” should be displayed.

b) For the aforementioned scenario, assume now a circular road and two entries: one for entry, another for exit. Trucks can get out only in the order they got in. Write a program dynamically to handle truck moves allowing for the following commands

i) Enter garage (truck name)

ii) Exit garage (truck name)

iii) Show trucks

10. Imagine an effective dynamic structure for storing polynomials. Write operations for addition, subtraction, and multiplication of polynomials.

    Input:

    p1=3x7+5x6+22.5x5+0.35x2

    p2=0.25x3+0.33x2 -0.01

11. Given two sorted lists L1 and L2 write a program to merge the two lists in sorted order after eliminating duplicates.

12. Write a program to implement Bubble sort, Heap sort and Quick sort techniques to arrange the following sequence of elements in descending order.

    9,-4, 5, 8,-3, 7, 0, 4, 1, 2.

    best, true, hill, dove, van, good, egg, lap

    Display the count of number of comparisons and swaps made in each method. Apply the same sorting techniques for sorting a large dataset [Randomly generate 5000 integers within the range -50000 to 50000 to build the data set]. From your observation and analysis, determine the best sorting technique for working with large numbers.

13. Mini projects – File Archive, Tetris Game Player, Simulation of Buffer pool in Virtual Memory, Document retrieval from health care records, Implement a city database using suitable data structure.

Total Hours: 45

Text Books:

1 Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, Pearson Education India, 3rd Edition,2013.

2 Debasis Samanta, “Classic data structures”, Prentice Hall, 2nd Edition, 2014.

3 Peter Brass, “Advanced Data Structures”, Cambridge University Press, 2008.

Reference Books:

1 Seymour Lipschutz “Data Structures by Schaum Series” 2nd Edition, McGraw Hill, 2013.

2 Narasimha Karumanchi, “Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles”, 5th Edition, CareerMonk,2016.

3 Reema Thareja, “Data Structures Using C”, 2nd Edition, Oxford University Press, 2011

Web References:

1 http://freevideolectures.com/Course/2519/C-Programming-and-Data-Structures.

2 http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms.

3 https://www.geeksforgeeks.org/data-structures/

Online Resources:

1 https://www.edx.org/course/foundations-of-data-structures.

2 https://www.udemy.com/topic/data-structures/.

3 https://nptel.ac.in/courses/106102064/.

4 https://www.coursera.org/specializations/data-structures-algorithms.

Assessment Methods & Levels (based on Blooms Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	10	10
Understand	20	20
Apply	30	30
Analyse	40	40
Evaluate	-	-
Create	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C204.1	3	3	2					3	3	2	2	3	3	3	3
C204.2	3	3	3					3	3	3	2	3	3	2	3
C204.3	3	3	2					3	3	2	2	3	3	3	3
C204.4	2	2	1					2	2	1	2	2	2	3	2
C204.5	3	3	3					3	3	3	2	3	3	3	3

20MCI201 **ENVIRONMENTAL SCIENCES** **2 /0 /0 /0**

Nature of Course :C (Theory Concept)
Pre requisites :Basics in Environmental Studies

Course Objectives:

1 To learn the integrated themes on various natural resources.
2 To gain knowledge on the type of pollution and its control methods.
3 To have an awareness about the current environmental issues and the social problems.

Course Outcomes:

Upon completion of the course, students shall have ability to

C201.1	Recall and play an important role in transferring a healthy environment for future generation.	[R]
C201.2	Understand the importance of natural resources and conservation of biodiversity.	[U]
C201.3	Understand and analyze the impact of engineering solutions in a global and societal context.	[U]
C201.4	Apply the gained knowledge to overcome pollution problems.	[AP]
C201.5	Apply the gained knowledge in various environmental issues and sustainable development.	[AP]

Course Contents:

Module 1: Natural Resources **10 Hours**

Introduction-Forest resources: Use and abuse, case study-Major activities in forest-Water resources-over utilization of water, dams-benefits and problems. Mineral resources-Use and exploitation, environmental effects of mining- case study–Food resources- World food problems, case study. Energy resources -Renewable and non-renewable energy sources Land resources-Soil erosion and desertification – Role of an individual in conservation of natural resources.

Module 2: Environmental Pollutions **10 Hours**

Definition – causes, effects and control measures of: a. Air pollution-Acid rain - Green house effect-Global warming- Ozone layer depletion – case study- Bhopal gas tragedyb. Water pollution c. Solid waste management-Recycling of plastics-Pyrolysis method- causes, effects and control measures of municipal solid wastes d. Noise pollution. e. Nuclear hazards-case study-Chernobyl nuclear disaster-Role of an individual in prevention of pollution.

Module 3: Social issues and the Environment **10 Hours**

Sustainable development-water conservation, rain water harvesting, E-Waste Management – Environmental ethics: 12 Principles of green chemistry-Scheme of labelling of environmental friendly products (Eco mark) – Emission standards – ISO 14001 standard. HIV AIDS.

Total Hours: 30

Text Books:

1 Anubha Kaushik and C P Kaushik “Perspectives in Environmental Studies”4th Edition, Newage International (P) Limited, Publisher Reprint 2014. New Delhi
2 Rajagopalan, R, “Environmental Studies-From Crisis to Cure”, Oxford University Press 2015.

Reference Books:

1 Tyler Miller, Jr., "Environmental Science", Brooks/Cole a part of Cengage Learning, 2014.
2 William Cunningham and Mary Cunningham, "Environmental Science", 13th Edition, McGraw Hill, 2015.
3 Gilbert M. Masters, "Introduction to Environmental Engineering and Science", Third Edition, Pearson Education, 2014.

Web References:

1 http://nptel.ac.in/courses/104103020/20
2 http://nptel.ac.in/courses/120108002
3 http://nptel.ac.in/courses/122106030
4 http://nptel.ac.in/courses/120108004/
5 http://nptel.ac.in/courses/122102006/20

Online Resources:

1 https://www.edx.org/course/subject/environmental-studies
2 www.environmentalscience.org

Assessment Methods & Levels (based on Bloom's Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:40)

Course Outcome	Bloom's Level	Assessment Component	Marks
C201.1	Remember	Quiz	**5**
C201.2	Understand	Mini project based on environmental aspect	**15**
C201.3	Understand	Class Presentation	**10**
C201.4	Apply	Group Assignment	**10**

Summative assessment based on Continuous Assessment

Bloom's Level	Continuous Assessment		Term End Assessment
	CIA-1 [0 marks]	CIA-2 [0 marks]	[60 marks]
Remember	-	-	30
Understand	-	-	40
Apply	-	-	30
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C201.1						2	2						2		
C201.2						2	2						2		
C201.3						2	2							2	
C201.4						3	3						2		
C201.5						3	3						2		

20MAI301 **DISCRETE STRUCTURES** **3/1/0/4**

Nature of Course J(Problem analytical)
Prerequisites -

Course Objectives:

1 To study the concepts needed to test the logic of a program.

2 To learn the working on class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.

3 To know the fundamental concepts of Group theory.

4 To use number theory in computer networks and security.

Course Outcomes :

Upon completion of the course, students shall have ability to

C301.1	Recall the basic concepts of sets, groups and truth table	[R]
C301.2	Find the validity of arguments.	[U]
C301.3	Use the concepts of Discrete Mathematics in software development and hardware design.	[AP]
C301.4	Demonstrate and understand the fundamental Concepts of a mathematical function and all of its properties.	[AP]
C301.5	Apply operator-algebraic techniques to reformulate and solve group theoretic problems	[AP]

Course Contents

Module 1: Propositional and Predicate calculus **20 Hours**

Basic concepts – propositions - connectives– Truth tables – Tautologies and contradictions - Contrapositive – Logical equivalences and implications –Normal forms – Principal conjunctive and disjunctive normal forms– Rules of inference – Validity of arguments - Predicates – Statement function – Variables – Free and bound variables – Quantifiers– Universe of discourse – Theory of inference – The rules of universal specification and generalization – Validity of arguments

Module 2: Sets **20 Hours**

Sets- Operations on Sets – Law on Sets - Cartesian product of sets – Relations on sets Types of relations and their properties– Relational matrix and the graph of a relation – Equivalence relations – Partial ordering

Functions: Definitions of functions – Classification of functions–Composition of functions– Inverse function-Characteristic function of a set – Hashing functions – Recursive functions – Permutation functions.

Module 3: Group Theory and Number Theory **20 Hours**

Binary operation-Semi group – Monoid – Group – Subgroup-Abelian group-Group homomorphism and isomorphism-Normal subgroup-Quotient group-Lagrangian theorem. Division algorithm-Base-b representations- Number patterns-Prime and composite numbers - GCD-Euclidean algorithm-Fundamental theorem of arithmetic – LCM-Wilson's Theorem-Fermat's Theorem-Tau and Sigma Function.

Total Hours **60**

Text Books:

1. Tremblay J.P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011
2. Kenneth H.Rosen, "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill, New Delhi, 2012
3. Koshy .T, "Elementary Number Theory with Applications", Elsevier Publications, New Delhi, 2002.

Reference Books:

1. Ralph.P.Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", 5th Edition, Pearson Education Asia, New Delhi,2014
2. Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, "Discrete Mathematical Structures", 6th Edition , Pearson Education Pvt Ltd., New Delhi, 2014
3. Thomas Koshy, "Discrete Mathematics with Applications", Elsevier Publications, 2004.

Web References:

1 http://www.nptel.ac.in/courses/111105035
2 http://www.nptel.ac.in/courses/122104017
3 http://nptel.ac.in/courses/122102009
4 http://freevideolectures.com/Course/2267/Mathematics-I/22

Online Resources:

1 www.edx.org/Probability
2 https://ocw.mit.edu/courses/.../18-440-probability-and-random-variables-spring-2014/
3 https://onlinecourses.nptel.ac.in/noc15_ec07/

Assessment Methods & Levels (based on Blooms Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C301.1	Remember	Class room or online Quiz	2
C301.2	Understand	Class presentation/Powerpoint	4
C301.3	Apply	Presentation	
C301.4	Apply	Group Assignment	6
C301.5	Apply	Group Activities	8

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C301.1	1	1	1						1				1	2	1
C301.2	2	2	1						2				2	3	2
C301.3	3	3	2						3				3	3	3
C301.4	3	3	2						3				3	2	3
C301.5	3	3	2						3				3	3	3

20CSI301 OPERATINGSYSTEMS 3/0/0/3

Nature of Course: G (Theory analytical)

Prerequisites -

Course Objectives:

1. To describe the structure and functions of Operating System.
2. To explain about Processes, Threads and Scheduling algorithms.
3. To identify the principles of Concurrency and Deadlocks.
4. To list various Memory Management schemes.
5. To discuss I/O management and File systems.

Course Outcomes

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

C301.1	Review the basic concepts and operations of Operating Systems.	[U]
C301.2	Illustrate the Process management concepts including scheduling, synchronization deadlocks and multithreading.	[AP]
C301.3	Relate concepts of memory management including virtual Memory and Page replacement to the issues that occur in Real time applications – Traffic control System.	[AP]
C301.4	Identify issues related to file system interface, implementation, disk management and protection and security mechanisms.	[AP]
C301.5	Practice administrative tasks on Linux Servers.	[AP]

Course Contents

Module 1: Introduction 15 Hours

Review of computer organization - Introduction to popular operating systems- OS structure - System calls - System Programs – POST - System Boot - Functions of OS - Evolution of Operating Systems**:** Multitasking, Multiuser, parallel, distributed & Real–time OS – GUI - Types of servers - Computer organization interface: Interrupt handler mechanism.

Module 2: Process and memory Management 15 Hours

Process Concept - Process Scheduling - Operations on Processes – Inter process Communication; Threads-Overview - Multicore Programming - Multithreading Models - CPU Scheduling - Process Synchronization-Critical Section Problem - Mutex Locks – Semaphores – Monitors - Deadlocks; Main Memory- Contiguous Memory Allocation – Segmentation – Paging - 32 and 64 bit architecture examples; Virtual Memory - Demand Paging- Page Replacement – Allocation of frames – Thrashing- Allocating Kernel Memory.

Module 3: Files and I/O Systems 15 Hours

File-System Interface : File concept - Access methods - Directory Structure - Directory organization- File system mounting - File Sharing and Protection; File System Implementation: File System Structure- Directory implementation- Allocation Methods- Free Space Management; Mass Storage Structure: disk space management - disk scheduling– NFS – RAID; Protection and Security; **CASE STUDY** - Linux System- Basic Concepts; System Administration-Requirements for Linux System Administrator, Setting up a LINUX Multifunction Server , Setting Up Local Network Services; Virtualization- Basic Concepts, Setting Up Xen, VMware on Linux Host and Adding Guest OS, UNIX Shell.

TotalHours 45

Text Books:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, “Operating System Concepts” 10th Editon, Wiley,2018.
2. D.M.Dhamdhere, “Operating systems- A Concept based Approach” 3rd Edition, McGraw Hill, 2017.

Reference Books:

1. Andrew S. Tanenbaum, “Modern Operating Systems”, 5th Edition, Pearson Education, 2016.
2. Gary Nutt, “Operating Systems”, 3rd Edition, Pearson Education, 2004.
3. Harvey M. Deital, “Operating Systems”, 3rd Edition, Pearson Education, 2004.

Web References:

1. http://geeksforgeeks.org/OperatingSystems/
2. https://www.tutorialspoint.com/operating_system/

Online Resources:

1. https://nptel.ac.in/courses/106108101/
2. https://www.coursera.org/learn/os-power-user

Assessment Methods & Levels (based on Blooms Taxonomy)
Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C301.1,2,3	Apply	Tutorial	**10**
C301.1,2,3	Apply	Assignment	**5**
C301.4,5	Apply	Case Study	**5**

Summative assessment based on Continuous and End Semester Examination

Bloom’s Category	Continuous Assessment			End Semester Examination [50 Marks]
	CIA-1 [10Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	
Remember	20	20	20	20
Understand	40	30	30	30
Apply	40	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes(PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C301.1	1	1	1									2	1	2	1
C301.2	3	3	2									3	2	3	2
C301.3	3	3	2									2	3	3	3
C301.4	3	3	2									3	3	2	3
C301.5	3	3	1									3	3	3	3

20CSI302 DESIGN AND ANALYSIS OF ALGORITHMS 3/0/0/3

Nature of Course : G (Theory analytical)

Prerequisites : Data Structures

Course Objectives:

1. To explain asymptotic analysis for computer algorithms.
2. To discuss the different algorithm design techniques.
3. To examine the efficiency of various algorithm design techniques.
4. To identify the limitations of Algorithm's power.

Course Outcomes:

Upon completion of the course, students shall have ability to

C302.1	Recognize the general principles and algorithm design techniques for developing efficient algorithms.	[R]
C302.2	Compute the time and space complexities of algorithms.	[AP]
C302.3	Choose appropriate design techniques for solving problems.	[AP]
C302.4	Interpret the limitations of algorithm's power and to choose suitable approximation algorithms.	[AP]

Course Contents:

Module 1: Fundamentals of Algorithm Analysis 15 Hours

Notion of an Algorithm – Importance & role of algorithms in computing – General steps in Algorithmic problem solving – Analysis of Algorithm efficiency: Analysis Framework or Parameters, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis for Non - Recursive and Recursive Algorithms, Empirical Analysis of Algorithm. Brute Force Approach: Selection Sort - Bubble Sort - Sequential Search - String Matching.

Module 2: Advanced Design Paradigms 15 Hours

Decrease and Conquer Technique: Insertion sort - Topological sort. Divide and Conquer Technique: Merge sort - Quick sort - Binary search - Strassen's Matrix Multiplication. Dynamic Programming: Knapsack Problem and Memory functions - Optimal Binary Search Trees - Warshall's and Floyd's Algorithms. Greedy Technique: Prims Algorithms - Kruskal's Algorithm - Dijkstra's Algorithm - Huffman Trees and Codes. Iterative Improvement: Maximum Flow Problem– Maximum matching in Bipartite graph – Stable Marriage Problem.

Module 3: Limitations and Coping with the Limitations of Algorithm Power 15 Hours

Lower Bound Arguments - P, NP and NP-Complete Problems. Backtracking: n-Queen Problem - Hamiltonian Circuit Problem - Subset Sum Problem. Branch and Bound Technique: Assignment Problem - Knapsack Problem - Travelling Salesman Problem. Approximation Algorithms: Vertex-cover problem - Travelling Salesman Problem. Case Study – Bloom Filter.

Total Hours: 45

Text Books:

1. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Pearson Publications, 3rd Edition,2012.
2. Thomas H. Cormen, Charles E. Leiserson, R.L. Rivest, “Introduction to Algorithms”, Prentice Hall of India Publications, 3rd Edition, 2009.

Reference Books:

1. Harsh Bhasin, “Algorithms Design and Analysis”, Oxford university press, 2015.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, “Computer Algorithms/ C++”, 2nd Edition, Universities Press, 2008.
3. Sara Baase and Allen Van Gelder, **“**Computer Algorithms: Introduction to Design and Analysis”, Pearson Publications, 3rd Edition, 2008.

Web References:

1. https://www.tutorialspoint.com/design_and_analysis_of_algorithms/
2. https://www.geeksforgeeks.org/fundamentals-of-algorithms/
3. https://www.cs.usfca.edu/~galles/visualization/Algorithms.html

Online Resources

1. https://www.edx.org/course/algorithmic-design-techniques-uc-san-diegox-algs200x
2. http://nptel.ac.in/courses/106106131/
3. https://www.edx.org/course/algorithm-design-analysis-pennx-sd3x

Assessment Methods & Levels (based on Blooms Taxonomy)
Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C302.1	Remember	Online Quiz	**5**
C302.2	Apply	Technical Presentation	**5**
C302.3	Apply	Assignment	**5**
C302.4	Apply	Surprise Test	**5**

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment			End Semester Examination [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	20	20	20	20
Understand	20	20	20	20
Apply	60	60	60	60
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes(PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C302.1	1	1	1									2	1	2	1
C302.2	3	3	2									3	2	3	2
C302.3	3	3	2									2	3	3	3
C302.4	3	3	2									3	3	2	3

20CSI303 **COMPUTER ARCHITECTURE** **3/0/0/3**

Nature of Course C (Theory Concept)
Prerequisites -

Course Objectives:

1 To explain the basic structure and operational concepts of a computer.
2 To demonstrate the logic design of control unit.
3 To examine the concept of pipelining and multi-core architectures.
4 To describe the components and organization of memory.
5 To identify different ways of communication with I/O devices.

Course Outcomes:

Upon completion of the course, students shall have ability to

C303.1	Describe the functionalities of various units of a computer.	[R]
C303.2	Illustrate the logic design of Control Unit.	[AP]
C303.3	Illustrate various memory components and memory mapping techniques	[AP]
C303.4	Choose different ways of communication with I/O devices using various interconnection networks	[AP]
C303.5	Infer the processor concepts by introducing multi-core, cluster, shared and distributed architecture concepts.	[U]

Course Contents:

Module 1: Architecture Fundamentals and Memory Organization **15 Hours**

Organization of the Von Neumann Machine - Basic operational concepts of a machine - Memory locations and addresses – Instruction format - Instruction Sets, Addressing modes and Assembly language. Memory Organization: Basic concepts, Semiconductor RAMs, ROMs, Cache memories, Performance consideration, Virtual memory and Memory Management requirements - Secondary storages.

Module 2: Control Unit **15 Hours**

Execution of a Complete Instruction - Hardwired Control, Micro Programmed and Nano programmed Control. **Pipelining:** Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets, Data Path and Control Consideration and Superscalar Operation. Case study: Intel Pentium.

Module 3: I/O Interfacing and Concepts in ILP **15 Hours**

I/O fundamentals: Handshaking, Buffering, I/O techniques: programmed I/O, interrupt-driven I/O, vectored and prioritized Interrupts and DMA. Buses: bus protocols, local and geographic arbitration. **Multicore Architecture:** Multicore Processors, Centralized and Distributed shared memory architecture, Cluster computers. Instruction Level Parallelism: Basic concepts of ILP – Hardware and Software Approaches – Dynamic Scheduling. Case Study: HP Moonshot, Architecture of Quad core 7thGeneration Processors.

Total Hours: 45

Text Books:

1 Carl Hamachar, Zvonco Vranesic and Safwat Zaky, "Computer Organization", McGraw Hill, 6th Edition2018.

2 John P. Hayes, "Computer Architecture and Organization", McGraw Hill, 3rd Edition, 2013

3 David A. Patterson and John L. Hennessy, "Computer Organization and Design: The Hardware/Software Interface, Elsevier", 5th Edition, 2013.

Reference Books:

1 John L. Hennessy and David A. Patterson, "Computer Architecture: A Quantitative Approach", Morgan Kaufmann, 5th Edition 2011.

2 John Paul Shen and Mikko H. Lipasti, "Modern Processor Design: Fundamentals of Superscalar Processors", Tata McGraw Hill, 1st Edition 2013.

3 M. J. Flynn, Computer Architecture: Pipelined and Parallel Processor Design, Narosa Publishing House.

4 Kai Hwang, "Advanced Computer Architecture: Parallelism, Scalability, Programmability", McGraw Hill,2011

Web References:

1 http://www.hp.com/hpinfo/newsroom/press_kits/2013/hpmoonshot2013/DS_Moonshot_System.pdf

2. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/

3. https://www.studytonight.com/computer-architecture/

Online Resources:

1. https://www.coursera.org/learn/comparch
2. http://nptel.ac.in/courses/

Assessment Methods & Levels (based on Blooms Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C303.1,2	Apply	Technical Quiz	**5**
C303.3,4	Apply	Assignment	**10**
C303.5	Apply	Case Study	**5**

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [50 marks]
	CIA-1 [10marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	20	20	20	20
Understand	80	40	40	40
Apply	-	40	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C303.1	1	1	1				2						1	2	1
C303.2	3	3	2				3						2	3	2
C303.3	3	3	2				2						3	3	3
C303.4	3	3	2				3						3	2	3
C303.5	2	2	1				2						2	3	2

20CSI304 OBJECT ORIENTED PROGRAMMING USING JAVA AND UML 3/0/2/4

Nature of Course F (Theory Programming)
Pre requisites C Programming

Course Objectives:

1. To understand the object-oriented approach to analyzing and designing systems and software solutions.
2. To employ the UML notation and symbols to create effective and efficient system designs.
3. To understand Object Oriented programming concepts like Data Abstraction, Encapsulation and basics of Java.
4. To analyze different types of constructor and inheritance.
5. To understand and apply package, Interface.

Course Outcomes:

Upon completion of the course, students shall have ability to

CS304.1	Interpret the contemporary issues and discuss about analysis and coding standards.	[AP]
CS304.2	Use UML diagrams for real time problems.	[AP]
CS304.3	Identify and reproduce the features of Object Oriented programming paradigm.	[U]
CS304.4	Analyze the usage of different kinds of constructor in real world scenario, handling arrays and strings, Inheritance, packages, interface concepts.	[A]

Course Contents:

Module 1: Introduction to Object Oriented Technologies and the UML 15 Hours

Description of the real world using the Objects Model - Classes, inheritance and multiple configurations - Quality software characteristics - Description of the Object Oriented Analysis process vs. the Structure Analysis Model - Introduction to the UML Language. Analysis of system requirements - Actor definitions - Writing a case goal. Use Case Diagram - Use Case Relationships - Requirements Analysis Using Case Modeling Analysis of system requirements -Actor definitions - Writing a case goal - Use Case Diagrams - Use Case Relationships.

Module 2: Introduction to Object Oriented Programming 15 Hours

Object Oriented Programming Features - Benefits of Object Oriented Methodology – Overview of Object oriented programming Languages - JAVA: Introduction to Java Programming –Features of Java- Classes and Objects - Arrays – Methods -Constructor-Access Specifier – Package, Inheritance. Method Overloading - Method Overriding - Nested Classes-Inner Classes - Inheritance Types- Interfaces

Module 3: Analysis to Design in the Characterization Stage 15 Hours

Interaction Diagrams: Description of goal-Defining UML Method, Operation, Object Interface, Class-Sequence Diagram - Finding objects from Flow of Events - Describing the process of finding objects using a Sequence Diagram.

Total Hours: 45

Lab Exercises:

1. Programs using classes and methods.
2. Sort the strings in ascending order using constructors.
3. Design a package to perform bank accounting transactions.
4. Payroll processing using Inheritance for employees.
5. To develop a mini-project by following the 4 exercises listed below.
    a. To develop a problem statement.
    b. Identify Use Cases and develop the Use Case model.
    c. Identify the conceptual classes and develop a domain model with UML Class diagram.
    d. Using the identified scenarios find the interaction between objects and represent them using UML Sequence diagrams.

Suggested domains for Mini-Project:

1. Passport automation system.
2. Book bank
3. Exam Registration
4. Stock maintenance system.
5. Online course reservation system
6. E-ticketing
7. Software personnel management system
8. Credit card processing
9. e-book management system
10. Recruitment system

Total hours: 75

Text Books:

1. BerndBrueggeandAllenH.Dutoit,"Object-OrientedSoftwareEngineering:usingUML,Patterns, and Java", Pearson, 3rd Edition,2013
2. Herbert Schildt, "Java : The Complete Reference", 9th edition, Tata McGraw Hill,2014.

Reference Books:

1. Craig Larman, "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development", Pearson Education, 3rd Edition, 2005.
2. Martin Fowler ,Kendall Scott, "UML Distilled: A Brief Guide to the Standard Object Modeling Language", Addison Wesley, 3rd Edition,2003.
3. Paul Deitel, Harvey Deitel, "Java How To Program", 10th Edition, Prentice Hall Publications, 2014.
4. Y. Daniel Liang ,"Introduction to Java Programming",9th Edition , Prentice Hall Publications, 2015.

Web References:

1. http://www.uml.org/
2. http://modeling-languages.com/uml-tutorial-online
3. http://www.javaworld.com
4. http://www.nptel.ac.in

Online Resources:

1. https://www.coursera.org/umlapproach
2. https://www.coursera.org/learn/object-oriented-java

Assessment Methods & Levels (based on Blooms' Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Continuous Assessment

Bloom's Level	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	Practical Rubrics based CIA [30 marks]	End Semester Examination (Theory) [40 Marks]
Remember	20	20	20	20	20
Understand	20	20	20	20	20
Apply	60	40	30	30	40
Analyse	-	20	30	30	20
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C304.1	3	3	2		2			3	3	3		2	3	3	3
C304.2	3	3	3		2			3	3	3		3	3	3	3
C304.3	2	2	2		1			2	2	2		3	2	2	2
C304.4	3	3	3		2			3	3	3		3	3	3	3

20CSI305 OPERATING SYSTEMS LABORATORY 0/0/3/1.5

Nature of Course M (Practical Application)
Prerequisites -
Course Objectives:

1. To construct and debug various functionalities of operating System such as system calls, Process Synchronization Process Scheduling.
2. To examine the deadlock, memory management and disk scheduling techniques for real world problems.
3. To categorize the behaviour of simulation models using GDB debugger.

Course Outcomes

Upon completion of the course, students shall have ability to

C305.1	Demonstrate the use of basic unix commands and shell programming	[AP]
C305.2	Compute synchronization techniques to processes.	[AP]
C305.3	Write programs for disk scheduling, Memory management and File organization Techniques.	[AP]
C305.4	Practice simple applications using operating system functionalities and debug using GDB debugger.	[AP]
C305.5	Calculate the efficiency of CPU Scheduling algorithms.	[A]
C305.6	Examine the efficiency of Deadlock Prevention and avoidance mechanisms.	[A]

List of Experiments

1. Analysis and Synthesis of Basic Linux Commands.
2. Programs using Shell Programming.
3. Implementation of Unix System Calls.
4. Simulation and Analysis of Non Preemptive and Preemptive CPU Scheduling Algorithms.
5. i. Simulation of Producer – Consumer Problem using Semaphores
   ii. Implementation of Dining Philosopher's Problem to demonstrate Process Synchronization.
6. Simulation of Banker's Algorithm for Deadlock Avoidance.
7. Analysis and Simulation of Memory Allocation and Management Techniques.
8. Implementation of Page Replacement Techniques.
9. Simulation of Disk Scheduling Algorithms.
10. Implementation of File organization Techniques.
11. Simulate Shared memory and IPC.
12. Design an efficient Traffic Control System to avoid traffic congestion in Metrocities. Use Process Synchronization, Scheduling, Deadlock and Memory Management concepts to implement the system. Use GDB tool to debug the system designed.

Total Hours: 45

Text Books:

1. Abraham Silberschatz, Peter B.Galvin, Greg Gagne, "Operating System Concepts", 10th Edition, Wiley, 2018.
2. D.M.Dhamdhere, "Operating systems A Concept based Approach", 3rd Edition, McGraw Hill, 2017.

Reference Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", 5th Edition, Pearson Education, 2016.
2. Gary Nutt, "Operating Systems", 3rd Edition, Pearson Education, 2004.
3. Harvey M. Deitel, Paul J Deitel, David R Choffnes, "Operating Systems", 3rd Edition, Pearson Education, 2004.

Assessment Methods & Levels (based on Blooms Taxonomy)
Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	-	-
Understand	20	20
Apply	60	60
Analyse	20	20
Evaluate	-	-
Create	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C305.1	3	3	2					3	3	3		3	3	3	3
C305.2	3	3	2					3	2	3		3	3	2	3
C305.3	3	3	2					3	3	3		3	3	3	3
C305.4	3	3	2					3	3	3		3	3	3	3
C305.5	2	3	1					2	3	2		3	3	3	2
C305.6	3	2	2					3	2	3		3	2	3	3

20CSI306 ANALYSIS OF ALGORITHMS LABORATORY 0/0/3/1.5

Nature of Course L (Problem experimental)

Pre requisites Data Structures

Course Objectives:

1. To experiment the various design techniques of algorithms.
2. To construct the time efficiency of algorithms.

Course Outcomes:

Upon completion of the course, students shall have ability to

C306.1	Identify the suitable algorithm design techniques to suit efficiency requirements.	[U]
C306.2	Test the code with best, worst and average case inputs.	[A]
C306.3	Illustrate empirical analysis of algorithms.	[AP]
C306.4	Interpret the order of growth of running time, for different sets of inputs using GNU plot.	[AP]

Course Contents:

1. Implement recursive and non-recursive algorithms for an application and analyze the same.
2. Implement and analyze Sorting, Searching and String-matching algorithms using Brute Force approach.
3. Design algorithms using Divide and Conquer technique for different real -world scenarios.
4. Use different algorithm techniques to find the valuable set of items in a Knapsack. Analyze the same.
5. Implement and analyze an algorithm to find the shortest path between every pair of cities using Dynamic Programming.
6. Using different algorithms based on Greedy technique, implement and analyze a real-world application.

Scenarios:

1. An array has exactly ‘n’ nodes. They are filled from the set {0, 1, 2, …..,n-1, n}. There are no duplicates in the list. Design an O(n) worst case time algorithm to find which one of the elements from the above set is missing in the array.
2. Write a C program to solve given recursive function:
   $x(n) = x(n - 1) + 5$ for $n > 1$,
   $x(1) = 0$
   Further, analyze the time complexity of the algorithm.
3. Implement a suitable Brute Force algorithm for given scenario:
   Consider a multi-national organization having a list of employee IDs and we want to look up an employee ID ‘X’ suppose the list has ‘n’ IDs. Further, analyze the time complexity of the algorithm and plot a graph of the time taken versus ‘n’ for Empirical Analysis.
4. For a large local area network with a lot of switches, implement an algorithm to find the minimum number of packets that need to be relayed across the network and avoid multiple copies of the same packet from arriving via different paths.
5. Use suitable algorithms to deal with the following Scenario and analyze the same:

A vendor car has capacity 'K' kg. There are some bundles having respective weights cl,c2,…,cn kg which are to be transported by that vendor car. The problem is to pick up those bundles and load them in the car so that the car capacity is maximum utilized, if not fully.

6. Implement an algorithm for the Huffman-tree construction. Analyze the time efficiency class of the algorithm for constructing a Huffman tree as a function of the alphabet's size.
7. Implement a suitable Backtracking algorithm to find a tour:
   A person has to travel from island 'A' to another island 'B' crossing 'n' bridges and return to 'A'. A person can plan a walk in such a way that he will cross each of these bridges once but not more than once.
8. Implement a suitable Branch and Bound algorithm to find the shortest tour:
   A robot is involved in cutting the metal surface with laser. The sequence of movements for the robot arm should be minimal.
9. Implement a suitable Dynamic Programming algorithm for given scenario: A thief enters a house for robbing it. He can carry a maximal weight of 'W' kg into his bag. There are 'N' items in the house with the respective weights (w_i) and values (v_i). What items should thief take? He either takes or leaves the item.

Total Hours: 45

Text Books:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Publications, 3rd Edition, 2012.
2. Thomas H. Cormen, Charles E. Leiserson, R.L. Rivest, "Introduction to Algorithms", Prentice Hall of India Publications, 3rd Edition, 2009.

Reference Books:

1. Harsh Bhasin, "Algorithms Design and Analysis", Oxford university press, 2015.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, "Computer Algorithms/ C++", 2nd Edition, Universities Press, 2008.
3. Sara Baase and Allen Van Gelder, **"**Computer Algorithms: Introduction to Design and Analysis", Pearson Publications, 3rd Edition, 2008.

Assessment Methods & Levels (based on Blooms Taxonomy)
Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 Marks] (in %)
Remember	-	-
Understand	20	20
Apply	50	50
Analyse	30	30
Evaluate	-	-
Create	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C306.1	2	2	1					1	2	1		2	2	2	2
C306.2	3	3	2					3	2	3		3	3	3	3
C306.3	3	3	2					2	2	2		3	2	3	3
C306.4	3	3	2					3	3	3		2	3	3	2

20MAI401 **APPLIED PROBABILITY** **3/1/0/4**

Nature of Course J (Problem analytical)

Pre requisites -

Course Objectives:

1 To study the basic probability concepts.

2 To understand and have a well – founded knowledge of standard distributions which can be used to describe real life phenomena.

3 To acquire skills in handling situations involving more than one random variable.

4 To learn the concept of testing hypothesis using statistical analysis.

Course Outcomes :

Upon completion of the course, students shall have ability to

C401.1	Recall the concepts of basic probability	[R]
C401.2	Understand how to handle situations involving random variable	[U]
C401.3	Apply the probability concepts in transition from real problem to a probability model	[AP]
C401.4	Use distribution in cluster analysis of similar binary variables	[AP]
C401.5	Derive the logic and attain the knowledge of hypothesis testing.	[AP]

Course Contents

Module 1: Probability and Random Variables **20 Hours**

Introduction-Addition and Multiplication law of probability – Conditional probability - Total probability theorem - Bayes theorem – One dimensional random variable-Discrete and Continuous Random Variables-Probability mass function - Probability density function – Moment Generating Function

Module 2: Two dimensional random variables and Standard distributions **20 Hours**

Two dimensional random variables- Joint distributions - Marginal and conditional distributions – Covariance – Correlation- Regression. Discrete distributions – Binomial, Poisson and Geometric distribution – Continuous distributions: Uniform, Exponential and Normal distributions

Module 3: Statistics **20 Hours**

Introduction to Statistics-Measures of central tendency-Testing of hypothesis-Types of errors, critical region, rejection of region-Test statistics for small samples: Student's t-test-F-test- □2 - test-goodness of fit-independence of attributes-Test statistics for large samples: Z test for single proportion, Difference of proportion, Mean and Difference of Means.

Total Hours: 60

Text Books:

1. Gupta, S.C., & Kapoor, V.K., “Fundamentals of Mathematical Statistics”, Sultan Chand & sons, 2000, Reprint 2014.
2. Peebles Jr. P.Z., “Probability Random Variables and Random Signal Principles”, Tata McGraw-Hill Publishers, 4th Edition, New Delhi, 2016.
3. Palaniammal, S., “Probability and Random Processes”, Prentice hall of India, New Delhi, 2014.

Reference Books:

1. Ross, S., “A First Course in Probability”, 9th Edition, Pearson Education, Delhi, 2014.
2. Henry Stark and John W. Woods, “Probability and Random Processes with Applications to Signal Processing”
3. Richard A. Johnson , Irwin Miller, John Freund, “Miller & Freund's Probability and Statistics for Engineers”, 9th Edition,2016.

Web References:

1 http://nptel.ac.in/courses/111104079/

2 http://nptel.ac.in/video.php/subjectId=117105085

3 http://nptel.ac.in/syllabus/111105041/

4 http://freevideolectures.com/Course/3028/Econometric-Modelling/22#

Online Resources:

1 www.edx.org/Probability

2 https://ocw.mit.edu/courses/.../18-440-probability-and-random-variables-spring-2014/

3 https://onlinecourses.nptel.ac.in/noc15_ec07/

Assessment Methods & Levels (based on Blooms’ Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C401.1	Remember	Class room or online Quiz	2
C401.2	Understand	Class presentation	4
C401.3& C401.4	Apply	Power point Presentation / Group Activities	6
C401.5	Apply	Group Assignment	8

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [50 Marks]
	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 marks]	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C401.1	1	1	1						1			1	1	2	1
C401.2	2	2	1						2			2	2	2	2
C401.3	3	3	2						3			3	3	3	2
C401.4	3	3	2						2			3	2	3	3
C401.5	2	3	2						3			2	3	3	3

20CSI401 **DATABASE MANAGEMENT SYSTEMS** **3/0/0/3**

Nature of Course G (Theory Analytical)

Pre requisites -

Course Objectives:

1 To understand the basic concepts of Database.

2 To apply effective relational database design concepts.

3 To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.

4 To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

5 To implement efficient computing trends in databases.

Course Outcomes:

Upon completion of the course, students shall have ability to

C401.1	Differentiate database systems from file systems by enumerating the features of database system.	[U]
C401.2	Apply transaction processing and concurrency control techniques.	[AP]
C401.3	Illustrate SQL Programming language and Normalization.	[AP]
C401.4	Employ database management system for a real database application.	[AP]
C401.5	Interpret a data base model expressed in the form of an entity relation diagram and transform into relational Schema.	[AP]

Course Contents:

Module 1: Introduction & Data Modelling **20 Hours**

Concept of Database & Overview of DBMS - Characteristics of databases, Database Language, Types of DBMS architecture–3 Schema Architecture -Introductions to data models –types- ER Model- ER Diagrams – Extended ER Diagram –reducing ER to table Applications: ER model of University Database Application. Design a DB for Car Insurance Company - Draw ER diagram and convert ER model to relational schema. Evaluating data model quality - The relational Model– Schema – Keys- Relational Algebra – Domain Relational Calculus- Tuple Relational Calculus - Fundamental operations. Relational Database Design And Querying– Undesirable Properties of Relations – Functional Dependency: Closures- Single Valued Dependency Single valued Normalization (1NF, 2NF 3NF & BCNF)- Desirable properties of Decompositions – 4NF - 5NF- De-normalization- Client Server database Implementation.

Module 2: Storage Techniques and Query Processing **15 Hours**

SQL fundamentals – Views - Integrity Procedures, Functions, Cursor and Triggers–Embedded SQL – Dynamic SQL –Plan statement execution - Transaction Concepts – Transaction model – ACID Properties –serial and concurrent schedules, conflict serializability, Two-phase locking. Overview of physical storage structure- stable storage, failure classification -log based recovery, deferred database modification, check-pointing-File Structures:- Index structures- Primary, Secondary and clustering indices. Single and multilevel indexing -Introduction to

Query Processing – Issues in query optimization – Steps in query processing – heuristics based query optimization.

Module 3: Database Implementation and Recent trends **10 Hours**

Distributed database Implementation- Concurrent transactions - Concurrency control – Lock based –Time stamping-Validation based. NoSQL, NoSQL Categories - Designing an enterprise database system.

Total Hours: 45

Text Books:

1 Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.

2 Gupta G K, "Database Management Systems", Tata McGraw Hill Education Private Limited, New Delhi, 2011.

3 Abraham Silberschatz, Henry F.Korth, S.Sudharshan, "Database System Concepts",6th Edition, Tata McGraw Hill,2011.

Reference Books:

1 Raghu Ramakrishnan, Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill,2006.

2 Maqsood Alam, Aalok Muley, Chaitanya Kadaru, Ashok Joshi "Oracle NoSQL Database", McGraw Hill Professional,2013

3 Plunkett T., B. Macdonald, et al., Oracle Big Data Hand Book, Oracle Press, 2013.

Web References:

1 http://nptel.ac.in/video.php?subjectId=106106093

2 http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-830-database-systems-fall-2010/

3 www.tutorialspoint.com/dbms/

Online Resources:

1 https://www.udemy.com/database-management-system/

2 http://www.nptelvideos.in/2012/11/database-management-system.html

3 http://nptel.ac.in/courses/106106093/

4 https://alison.com/courses/IT-Management-Software-and-Databases

5 https://mva.microsoft.com/en-us/training-courses/database-fundamentals-8243?l=TEBiexJy_5904984

6 http://www.sqlcourse.com/

7 https://www.coursera.org/learn/database-management

8 http://www.joyofdata.de/blog/free-and-certified-mongodb-online-courses-mooc/

9 https://www.lynda.com/NoSQL-training-tutorials/1473-0.html

10 https://www.udemy.com/learn-nosql-database-design-from-scratch/

11 https://www.class-central.com/tag/nosql

Assessment Methods & Levels (based on Blooms Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C401.1,2	Apply	Online Quiz	5
C401.3	Apply	Case study	5
C401.4,5	Apply	Assignment	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination[50 marks]
	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	50	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C401.1	2	2	1										2	3	2
C401.2	3	3	2										3	3	2
C401.3	3	2	2										2	3	3
C401.4	2	3	2										3	3	2
C401.5	3	3	2										2	3	3

20CSI402 **CORE JAVA PROGRAMMING** **3/0/0/3**

Nature of Course K (Problem Programming)

Pre requisites -

Course Objectives:

1	To explain the features of java programming.
2	To illustrate the use of file system, JDBC.
3	To demonstrate inheritance, exception handling and multithreading for real time applications.
4	To use the concepts of generic structures, hash, connectivity for solving real world problems.

Course Outcomes:

Upon completion of the course, students shall have ability to

C402.1	Illustrate the features of java programming language and function overloading	[AP]
C402.2	Demonstrate JDBC, file system and command line arguments	[AP]
C402.3	Apply the concepts of inheritance, exception handling and multithreading in real world scenario	[AP]
C402.4	Illustrate I/O streams, packages, interfaces, Generic, Collection framework	[AP]
C402.5	Employ the power of new features in java	[AP]

Course Contents:

Module1: Fundamentals of Java Technology and Programming **15 Hours**

JVM Internals – JVM Architecture, JDK, JRE, JIT, JVM Memory. Class fundamentals: Declaring objects, Assigning object reference variable, Methods & Method Signatures, Method retuning Values, Method with parameters, Variable argument, - I/O Basics: Byte stream& Character Stream, Getting user input: Reading console input & Writing console output, Reading and Writing files-new file system API NIO2. Access control, static and final keyword, - Nested and Inner classes , Command Line argument - String and String Buffer class, Java Bean standards, Naming conventions, Interface, JDBC connection.

Module 2: Exception, Concurrency, Enumeration and Annotations **15 Hours**

Exception handling mechanism. New look try/catch mechanism. Thread class & Runnable Interface. Inter Thread Communication, Synchronization of threads using Synchronized keyword and lock method. Thread pool and Executors framework, Futures and callable, Fork-Join in Java. Deadlock conditions. Enumeration - usage. Annotations: basics of annotation. The Annotated element Interface. Using Default Values, Marker Annotations. Single-Member Annotations. The Built- In Annotations-Some Restrictions.

Module 3: Generics **15 Hours**

Basics , Generics and type safety Collections Interfaces –Collection, Set, List, Queue, Collections Classes – Array List, Hash Set, Tree Set. Accessing a Collection via Iterators. MapInterfaces. MapClasses– AbstractMap, HashMap, TreeMap. New Java Features: Enhancement for

switch expression, lambda expressions, functional interface, Garbage Collection, Compact Number formatting, Java Strings New Methods – indent(), transform(), describeConstable(), and resolveConstantDesc(), Optional Class.

Total Hours: 45

Text Books:

1. Herbert Schildt, “Java The Complete Reference”, 8th Edition, McGraw-Hill Osborne Media, 2018.
2. Kathy Sierra, “SCJP/OCJP Sun Certified Programmer for Java 6 Study Guide”, Dream tech press, Kogent Learning Solutions Inc., 2011.
3. Paul Deitel, Harvey Deitel, “Java How To Program”,10th Edition, Prentice Hall Publications,2014
4. Cay S. Horstmann and Gary Cornell, “Core Java, Vol.2: Advanced Features”, 9th Edition, Prentice Hall, 2013.

Reference Books:

1. Cay S.Horstmann and Gary Cornell, “Core Java, Volume I Fundamentals”, 9th Edition, PrenticeHall,2012
2. Y. Daniel Liang, "Introduction to Java Programming”,9thEdition, Prentice Hall Publications,2015

Web References:

1. https://www.geeksforgeeks.org/java/
2. https://www.tutorialspoint.com/java/
3. https://www.javatpoint.com/java-tutorial
4. https://www.w3schools.com/java/
5. http://www.javaworld.com

Online Resources:

1. https://www.coursera.org/specializations/object-oriented-programming
2. https://www.udemy.com/topic/java-certification/
3. https://www.edx.org/learn/java

Assessment Methods & Levels (based on Blooms Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C402.1,2	Apply	Technical Quiz	5
C402.3	Apply	Assignment	5
C402.1- C402.5	Apply	Project	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [50marks]
	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	40	30	30	30
Analyse	-	-	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C402.1	3	3	2						2		3	3	2	3	3
C402.2	2	3	2						3		3	3	3	3	2
C402.3	3	2	2						2		3	3	2	3	3
C402.4	2	3	2						3		3	3	3	3	2
C402.5	3	2	2						3		3	3	2	3	3

20ECI401 MICROPROCESSORS AND MICROCONTROLLERS 3/0/2/4

Nature of Course G(Theory Concept)
Pre requisites Digital Principles and System Design

Course Objectives:

1. To understand the architecture and Instruction set of 8086 and8051
2. To develop the programming abilities to work on 8086 microprocessor and microcontrollers
3. To know about different peripheral devices and their interfacing to 8051 &ARM Processor
4. To understand the architecture and programming of ARM Processor
5. To apply and understand the principles and working of Arduino Processor.

Course Outcomes:

Upon completion of the course, students shall have ability to

C401.1	Understand the operations of microprocessor architecture 8086 and write the assembly language programming	[U]
C401.2	Understand the concepts of microcontroller 8051 and apply the programming concepts in microcontroller.	[AP]
C401.3	Design 8051 microcontroller and to interface the controller with the external circuits.	[AP]
C401.4	Understand the concepts of ARM architecture and interfacing with external circuit.	[U]
C401.5	Study of IoT application Arduino processor and its architecture	[U]

Course Contents:

Module 1: Organization and Architectural Features of 8086 Microprocessor 10 Hours

The instruction set, Addressing modes; Interrupts, Assembly language programming of 8086.

Module 2: Microcontroller 15 Hours

Architecture of 8051, Special Function Registers (SFRs), I/O Pins Ports and Circuits, Instruction set, Interrupts, Assembly language programming**.** 8051 interfacing - LCD & Keyboard Interfacing, ADC, DAC &Sensor Interfacing- Temperature, pressure, gas sensor , External Memory Interface and Stepper Motor

Module 3: ARM Processor 20 Hours

The ARM architecture, ARM Bus architecture ARM7TDMI, Processor Fundamentals, ARM Instruction Set, Memory Mapping, The Thumb Instruction Set, Interfacing of sensors, Transducers, actuators, Interfacing of sensors- Temperature, pressure, Seven segment display, A/D and D/A Converters with ARM**.** IOT Processors - Arduino Architecture, Basic programming- LED blinking, Fading, Traffic Light, LCD Display

List of Exercises

S.No.	List of Experiments:	BT
1.	Assembly Language programsusing8086.	[AP]
2.	Assembly Language programsusing8051.	[AP]
3.	Stepper motor control using8086Microprocessor.	[AP]
4.	Interfacing 8051withADC.	[AP]
5.	Basic Programming with Arduino Kit	[AP]
6.	Design of a Traffic light controller with Arduino.	[AP]
7.	Design a Simple chat Server using Arduino.	[AP]
8.	Basic programming using ARM Processor.	[AP]

Total Hours:75

Text Books:

1. A.K.Ray & K.M.Bhurchandi, "Advanced Microprocessors and peripherals- Architectures, Programming and Interfacing", 3rd Edition, McGraw Hill, 2012.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, "The 8051 microcontroller and embedded systems", PearsonEducation,2006
3. Andrew N.Sloss, Dominic Symes and Chris Wright "ARM System Developer's Guide: Designing and Optimizing System Software", 1st Edition, Morgan Kaufmann Publishers, 2004.
4. Simon Monk "Programming Arduino getting started with sketches", McGraw-Hill, 2012.

Reference Books:

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design", PHI,2003
2. Steve Furber, "ARM System –On –Chip architecture", Addision Wesley, 2000.
3. Massiomi Banzi and Michael Shiloh, "Make: Getting Started with Arduino", 3rd Edition.

Web References:

1. http://nptel.ac.in/courses/108107029/
2. http://www.eeherald.com/section/design-guide/esmod.html
3. https://www.edx.org/course/embedded-systems-shape-world-utaustinx-ut-6-03x
4. https://www.udemy.com/mcu_msp430/

Online Resources:

1. https://www.coursera.org/learn/raspberry-pi-interface/home/welcome
2. http://www.multisoftvirtualacademy.com/8051-microcontroller-online-training.php

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			Rubric Based CIA [30 Marks]	End Semester Examination [40 Marks]
	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]		
Remember	25	20	30	-	20
Understand	25	30	30	20	30
Apply	50	50	40	80	50
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C401.1	2	2	1		1			2	2	1		2	2	3	2
C401.2	3	3	2		2			3	3	2		3	3	3	3
C401.3	3	3	2		2			3	3	2		2	3	3	3
C401.4	2	2	1		1			2	2	1		3	2	2	2
C401.5	2	2	1		1			2	2	1		2	2	3	2

20CSI403 **ENTERPRISE DESIGN PATTERNS** **3/0/0/3**

Nature of Course: G (Theory Analytical)

Pre requisites: -

Course Objectives:

1. To identify the importance of design patterns
2. To categorize and analyse the different aspects of how the objects interact with each other and with physical components of the design solutions.
3. To interpret the insight into design thinking with graphical interfaces to provide dynamism in transformations of a design product or a solution.

Course Outcomes:

Upon completion of the course, students shall have ability to

C403.1	Summarize the various design patterns and its purpose	[U]
C403.2	Analyse the various behavioral aspects of design pattern to be solved	[A]
C403.3	Discriminate the importance of dynamic responsibility in evaluating the standard design patterns by invoking object oriented concepts.	[U]
C403.4	Evaluate the different pattern interactions between various physical components and the user, managing a design solution through visual representations and simulation models.	[AP]
C403.5	Illustrate different transformations of a product or a service through brainstorming and incremental approach.	[AP]

Course Contents:

Module 1: Introduction to Design patterns **15 Hours**

Describing design pattern, Design problems, Design problems solved by design patterns, Selection of a design pattern, Usage of design patterns. **The catalog of design pattern:** Creational pattern, Structural pattern, Behavioural pattern, Class & object communication. **Case Study:** Designing a document editor.

Module 2: Design Thinking **15 Hours**

Defining design thinking, needs, requirements. **Stages in design thinking**: Preliminary immersion, Reframing, Exploratory Research, Desk Research In-depth immersion. Interviews, Cultural Probes, Generative Sessions, A day in the Life, Shadowing. Analysis and Synthesis: Insight Cards, Affinity diagram, Conceptual Map, Guiding criteria, Personas, Empathy Map, User's journey, Blueprint.

Module 3: Ideation **15 Hours**

Brainstorming, Co-creation workshop, Idea menu, Decision matrix. **Prototyping:** Paper prototyping, Volumetric model, Staging, Storyboard, Service prototyping. **Case Study:** Andorinha project.

Total Hours: 45

Text Books:

1. Enrich Gamma, Richard Helm, Ralp Johnson and John Vissides, "Design Patterns: Elements of reusable object oriented software", Pearson, 1st Edition, 2015.
2. Maurício Vianna, Ysmar Vianna, Brenda Lucena and Beatriz Russo," Design thinking : Business innovation", MJV Technologies and innovation press, 2011.

Reference Books:

1. Alan Shalloway and James R. Trott," Design Pattern Explained: A new perspective on object oriented design", Addison Wesley publication, 2011
2. Tim Brown, "Change by Design: Design Thinking Transforms organizations and inspires innovations", Harper Collins publication, 2009
3. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
4. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve –Apply", Springer, 2011.

Web References:

1. https://sourcemaking.com/design_patterns
2. https://www.coursera.org/learn/uva-darden-design-thinking-innovation.

Online Resources:

1 https://www.tutorialspoint.com/design_pattern/design_pattern_overview.htm

2 http://www.oodesign.com/

3 https://code.tutsplus.com/articles/a-beginners-guide-to-design-patterns--net-12752

4 https://dzone.com/refcardz/design-patterns

5 http://dschool.stanford.edu/dgift/

6 http://www.creativityatwork.com/design-thinking-strategy-for-innovation/

7 http://www.designthinkingforeducators.com/design-thinking/

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C403.1	Understand	Quiz	5
C403.2	Analyse	Class Presentation	5
C403.3	Evaluate	Problem solving	5
C403.4	Evaluate		
C403.5	Apply	Case Study	5

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	End Semester Examination [50 Marks]
Remember	30	20	20	20
Understand	30	30	30	30
Apply	20	50	50	40
Analyse	20	-	-	10
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
C403.1	2	2	2	2		2	2					2			2
C403.2	3	3	3	3		3	3					3			3
C403.3	3	3	3	3		3	3					3			3
C403.4	3	3	3	3		3	3					3			3
C403.5	3	3	3	3		3	3					3			3

20CSI404 **DATABASE MANAGEMENT SYSTEMS LABORATORY** **0/0/3/1.5**

Nature of Course M (Practical Application)

Pre requisites -

Course Objectives:

1. To learn the fundamentals of data models to conceptualize and depict a database system using ER diagram.
2. To introduce the concepts of basic SQL as a universal Database language
3. To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.
4. To understand the internal storage structures using different file and indexing techniques which will help in physical DB design along with Query optimization techniques

Course Outcomes:

Upon completion of the course, students shall have ability to

C404.1	Demonstrate and implement a database schema for a given problem-domain	[AP]
C404.2	Identify user needs and take them into account in the selection, creation, evaluation and administration of computer-based systems.	[AP]
C404.3	Apply stored programming Concepts (PL-SQL)	[AP]
C404.4	Use graphical user interface, Event Handling and Database connectivity to Implement and deploy applications.	[AP]
C404.5	Demonstrate Database model to solve a given problem.	[AP]

Course Contents:

1. Implementation of SQL commands DDL, DML, DCL and TCL
2. Queries to demonstrate implementation of Integrity Constraints, Reports Normalization.
3. Practice of Inbuilt functions
4. Implementation of Join and Nested Queries AND Set operators.
5. Implementation of Aggregate functions in SQL.
6. Implementation of Order By, Group By & Having clause.
7. Implementation of virtual tables using Views
8. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers)
9. Application Development using front end tools
10. Mini project (Application Development)
    a. Inventory Control System.
    b. Material Requirement Processing.
    c. Hospital Management System.
    d. Railway Reservation System.
    e. Personal Information System.
    f. Web Based User Identification System.
    g. Timetable Management System.
    h. Hotel Management System.

Total Hours: 45

Text Books:

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.
2. Gupta G K, "Database Management Systems", Tata McGraw Hill Education Private Limited, New Delhi, 2011.
3. Abraham Silberschatz, Henry F.Korth, S. Sudharshan, "Database System Concepts", 6th Edition, Tata McGraw Hill, 2011.

Reference Books:

1. Carlos Coronel and Steven Morris, Database System Design and Implementation, Cennage learning, 11thEdition, 2013
2. Gupta G K, "Database Management Systems", McGraw Hill Education Private Limited, New Delhi,2011.
3. Ramez Elmasri and Shamkant B.Navathe, Fundamentals of Database Systems, Pearson Education, 7th Edition, 2013.

Web References:

1. www.tutorialspoint.com/dbms/

2. http://www.sqlcourse.com/

Assessment Methods & Levels (based on Blooms Taxonomy)
Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	10	10
Understand	30	30
Apply	60	60
Analyse	-	-
Evaluate	-	-
Create	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C404.1	3	3	2		2			3	3	2		3	3	3	3
C404.2	2	3	2		2			3	2	2		3	2	3	3
C404.3	3	3	2		2			3	3	2		3	3	3	2
C404.4	3	2	2		2			2	3	2		3	3	3	3
C404.5	3	3	2		2			3	3	2		3	2	3	3

20CSl405 **JAVA LABORATORY** **0/0/3/1.5**

Nature of Course K (Problem Programming)

Pre requisites -

Course Objectives:

1 To Analyse different kinds of constructor, Inheritance and polymorphism

2 To Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem

3 To Implement Object Oriented programming concepts using basic syntaxes of control Structures, strings and function for developing skills of logic building activity.

Course Outcomes:

Upon completion of the course, students shall have ability to

C405.1	Demonstrate the use of object oriented concepts in real world problems	[AP]
C405.2	Construct java programs to solve the given problems usingbasic programming Constructs	[AP]
C405.3	Apply the concepts of inheritance, constructor, exception handling	[AP]
C405.4	Develop and debug java programs using Package, multithreading, Exceptions and interface concepts	[AP]
C405.5	Illustrate and establish JDBC connectivity with different SQL packages	[AP]

List Of Experiments

1. Simple Java programs
2. Implementation of Election Contest using class and object.
3. Implementation of Bank Loan Processing using Constructors.
4. Implementation of Single and Multilevel Inheritance for library management systems.
5. Develop Oil Wells sales details for demonstrating the concept of Hierarchial Inheritance.
6. Implementation of String Operations.
7. Implementation of exception handling mechanism using tries and catch block.
8. Implementation of Multi-threading for generation of Prime numbers and Fibonacci Series.
9. Design Java Package for numbers. Develop two different classes that belongs to two package, one to check whether the given string is palindrome or not and the other to check whether the given number is odd or even and access these package using one main file
10. Implement a java program to include all types of annotations.
11. Implement function interface using Lambd a expressions.
12. Implementation of tourism information system using JDBC.

Total Hours: 45

Text Books:

1. Herbert Schildt, “Java The Complete Reference”, 8th Edition, McGraw-Hill Osborne Media, 2018.
2. Kathy Sierra, “SCJP/OCJP Sun Certified Programmer for Java6 Study Guide”, Dreamtech press, Kogent Learning Solutions Inc., 2011.
3. Paul Deitel, Harvey Deitel,“Java How To Program”, 10th Edition, Prentice Hall Publications,2014
4. CayS.Horstmann and GaryCornell, “Core Java, Vol.2: Advanced Features”, 9th Edition, Prentice Hall,2013.

Reference Books:

1. Cay. S. Horstmann and Gary Cornell, “Core Java, Volume I Fundamentals”, 9th Edition, PrenticeHall,2012
2. Y. Daniel Liang, "Introduction to Java Programming”, 9th Edition, Prentice Hall Publications,2015

Web References:

1. https://www.w3schools.com/java/
2. https://www.geeksforgeeks.org/java/

Online Resources:

1. https://www.udemy.com/topic/java-certification/
2. https://www.edx.org/learn/java

Assessment Methods & Levels (based on Blooms Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Rubric based Continuous Assessment [60 marks] (in %)	End Semester Examination [40 marks] (in %)
Remember	10	10
Understand	20	20
Apply	70	70
Analyse	-	-
Evaluate	-	-
Create	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C405.1	3	3	2		2			3	3	2		3	3	3	3
C405.2	2	3	2		2			3	2	2		3	2	3	3
C405.3	3	3	2		2			3	3	2		3	3	3	2
C405.4	3	2	2		2			2	3	2		3	3	3	3
C405.5	3	3	2		2			3	3	2		3	2	3	3

20CSI501 DATA WAREHOUSING AND MINING 3/0/0/3

Nature of Course G (Theory analytical)
Pre requisites -

Course Objectives:

1 To learn the fundamentals of data warehouse and OLAP

2 To acquire knowledge in data pre-processing and association rule mining

3 To perform data classification and clustering

4 To gain knowledge about the emerging trends in data mining

Course Outcomes:

Upon completion of the course, students shall have ability to

C501.1	Describe data warehousing design process and OLAP operations	[U]
C501.2	Illustrate data pre-processing techniques	[AP]
C501.3	Practice association, classification and clustering methods	[AP]
C501.4	Apply data mining techniques for real world problems	[AP]

Course Contents:

Module 1: Data Warehousing 15 Hours

Basic Concepts – Architecture – Data warehouse modeling – Data cube and OLAP – Data warehouse design and usage – Framework for data warehouse design – Data warehouse design process - Data warehouse implementation – Efficient data cube computation – Indexing OLAP data – Efficient processing of OLAP queries – OLAP server architectures. **Data Mining -** Data Preprocessing – Data Cleaning – Data Integration and Transformation – Data Reduction – Data transformation and discretization – Mining frequent patterns, associations and correlations – Basic concepts - Frequent Item set mining methods – Pattern evaluation methods – Pattern mining in multilevel, multidimensional space
- Constraint-based frequent pattern mining.

Module 2: Classification 20 Hours

Classification - Basic concepts - Decision Tree Induction – Bayesian Classification – Rule Based Classification – Model evaluation and selection – Techniques to improve classification accuracy – Bayesian belief networks - Classification by Back propagation – Support Vector Machines – Classification using frequent patterns – Lazy Learners – Other classification methods – Genetic algorithms – Rough set approach – fuzzy set approach. **Cluster Analysis** -Overview of basic clustering methods - Partitioning Methods
– k-Means – k-Medoids- Hierarchical methods- Agglomerative & Divisive Clustering – Density-Based Methods – DBSCAN – OPTICS – DENCLUE - Grid-Based Methods – STING – CLIQUE – Evaluation of clustering – Clustering High-Dimensional Data – Constraint-Based Cluster Analysis – Outlier Analysis – Outlier detection methods – Statistical, proximity and clustering based approaches.

Module 3: Current Trends 10 Hours

Graph mining – Temporal data mining – Spatial data mining – Distributed data mining – Web Mining - Privacy, security and legal aspects of data mining – Data mining applications – Financial data analysis – Telecommunication industry – Retail industry – Health care and biomedical research.

Total Hours: 45

Text Books:

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012.
2. M. Kantardzic, "Data Mining: Concepts, Models, Methods, and Algorithms", 2nd Edition, Wiley-IEEE Press, 2011.

Reference Books:

1. Alex Berson and Stephen J. Smith "Data Warehousing, Data Mining & OLAP", McGraw Hill, 2012.
2. Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2012.

Web References:

1. www.cs.purdue.edu/homes/clifton/cs490d/
2. www.tutorialspoint.com/data_mining/dm_cluster_analysis.htm
3. www.cs.waikato.ac.nz/ml/weka/

Online Resources:

1. http://www.mhssce.ac.in/ACADEMIC/syllabus/comp/sem6.pdf

Assessment Methods & Levels (based on Blooms Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C501.1	Understand	Online Quiz	5
C501.2	Understand	Technical Presentation	5
C501.3	Apply	Group AssignmenT	5
C501.4	Analyse	Surprise Test	5

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	20	20	20	20
Understand	60	30	30	30
Apply	20	50	50	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C501.1	3	3	3		2							3	2	3	2
C501.2	3	3	3		2							3	3	3	2
C501.3	3	3	3		2							3	2	3	3
C501.4	3	3	3		2							3	3	3	2

20CSI502 **ARTIFICIAL INTELLIGENCE** **3/0/0/3**

Nature of Course G (Theory analytical)
Pre requisites -

Course Objectives:

1. Understand the concepts of AI and Intelligent Agents.
2. Explore Problem solving using search techniques in AI.
3. Understand Logical Agents and First-Order logic.
4. Explore knowledge Representation issues.
5. Understand concepts of learning from examples.

Course Outcomes:

Upon completion of the course, students shall have ability to

C502.1	Understand the basic concepts of AI and Intelligent Agents.	[U]
C502.2	Identify Searching techniques for problem solving in AI.	[U]
C502.3	Apply First-order Logic and chaining techniques for problem solving.	[AP]
C502.4	Demonstrate knowledge representation techniques for problem solving	[AP]
C502.5	Apply supervised learning and Neural Networks for solving problems in AI.	[AP]

Course Contents:

Module 1: Introduction **15 Hours**

What Is AI, the Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art. Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, And The Structure of Agents. Solving Problems by Searching: Problem-Solving Agents, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions. Beyond Classical Search: Local Search Algorithms and Optimization Problems, Searching with Nondeterministic Actions and Partial Observations, Online Search Agents and Unknown Environments. Constraint Satisfaction Problems: Definition, Constraint Propagation, Backtracking Search, Local Search, The Structure of Problems.

Module 2: Logical Agents **15 Hours**

Knowledge-Based Agents, Propositional Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic. First- Order Logic: Syntax and Semantics, Knowledge Engineering in FOL, Inference in First-Order Logic, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution. Planning: Definition, Algorithms, Planning Graphs, Hierarchical Planning, Multi-agent Planning. Knowledge Representation: Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning Systems for Categories, Reasoning with Default Information, The Internet Shopping World.

Module 3: Learning from Examples **15 Hours**

Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks. Applications: Human computer interaction (HCI), Knowledge management technologies, AI for customer relationship management, Expert systems, Data mining, text mining, and Web mining, Other current topics.

Total Hours: 45

Text Books:

1 Russel S, Norvig P, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson Education, 2010.

2 Margaret H. Dunham, Data Mining: Introductory and Advanced Topics, Prentice Hall, 2003.

Reference Books:

1. Rich E, Knight K, Nair S B, Artificial Intelligence, 3rd Edition, Tata McGraw-Hill, 2009.
2. Luger George F, Artificial Intelligence: Structures and Strategies for Complex problem solving, 6th Edition, Pearson Education, 2009
3. S.Balakrishnan, J.Janet, Artificial Intelligence and Expert Systems, LAP LAMBERT Academic Publishing, 2017.

Web References:

1. https://www.tutorialspoint.com/artificial_intelligence/
2. https://developer.ibm.com/articles/cc-beginner-guide-machine-learning-ai-cognitive/

Online Resources:

1. https://nptel.ac.in/courses/106105077/
2. https://swayam.gov.in/course/4193-artificial-intelligence-i
3. https://swayam.gov.in/course/3827-ai-search-methods-for-problem-solving
4. https://www.class-central.com/course/edx-cs188-1x-artificial-intelligence-445

Assessment Methods & Levels (based on Blooms Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C502.1, 2	Understand	Online Quiz	**5**
C502.3	Apply	Technical presentation	**5**
C502.4,5	Apply	Assignment	**10**

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	20	20	20	20
Understand	60	50	40	40
Apply	20	30	40	40
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C502.1	3	3	3									3	2	2	2
C502.2	3	3	3									3	2	2	2
C502.3	3	3	3									3	3	3	3
C502.4	3	3	3									3	3	3	3
C502.5	3	3	3									3	3	3	3

20CSI503 **JEE FRAMEWORK** **3/0/2/4**

Nature of Course F (Theory Programming)
Pre requisites Java Programming

Course Objectives:

1. To learn the fundamentals of JEE concepts and usage of build tools like Maven.
2. To acquire knowledge on core technologies like IOC, DI and AOP.
3. To develop and deploy application in frameworks like Spring, Spring MVC and Building REST Services with spring MVC
4. To understand Logging process, ORM framework and build secure applications using JWT and OAUTH

Course Outcomes:

Upon completion of the course, students shall have ability to

C503.1	Understand the concepts of JEE and build tools like maven.	[U]
C503.2	Apply core Technologies in real world application	[AP]
C503.3	Demonstrate real world application in different frameworks like spring and spring MVC	[AP]
C503.4	Apply logging process and spring security in real world applications	[AP]

Course Contents:

Module 1: Introduction to Jakarta Enterprise Edition (formerly called as Java EE) 15 Hours

Java EE 8 Platform Overview- Distributed Multi tiered Applications- Web & Business Components- Java EE Containers – services & types- Java EE Application Assembly & Deployment – Packaging Applications, Java EE modules- Getting Started with Web applications- Model View Controller (MVC)2 Architecture & Packaging – Web application deployment descriptor (web.xml file)- Web Application Archive (*.WAR file), Java ARchive (*.JAR), Enterprise Application aRchive(*.EAR). **Build Tools:** Maven, Configuration, Archetype, Local Maven Repository and Mvn Repository, Dependency Plugins.

Module 2: Core Technologies and Frameworks 15 Hours

Introduction to Spring Core, Spring Architecture, Bean Container, Inversion of Control, IOC Container, Bean Definition, Bean Scope, Bean Life Cycle, Dependency Injection- Constructor Injection & property Injection, Auto-wiring, Aspect Object Programming(AOP), Spring MVC, Building a REST services with spring, using http calls (GET, POST, PUT, etc) with annotations: Controller, Rest Controller, Get Mapping, Post Mapping, Put Mapping and Delete Mapping, Error handling for REST, Logging with Log4J. Case Study: Performing CURD operation using spring MVC and RESTFUL services. **Introduction to Tools**: Postman and SoapUI.

Module 3: Data Persistence 15 Hours

Object/Relation Mapping using Simple JDBC Integration with native sql commands, JNDI(Java Naming and Directory Interface), JNDI Datasource Configuration, Application Deployment in Tomcat with JNDI, Hibernate: Introduction, Integrating and configuring Hibernate, understanding connection pool, ORM Architecture, Spring Data, JPA vs Hibernate, JPA annotations, Entity Manager, Entity Relationships – ManyToOne Relation, OneToMany Relation, OneToOne Relation

and ManyToMany Relation. Building a sample application using JPA. **Web Security Framework**: JSON Web Token (JWT), JWT structure and configuration. OAUTH2, Architecture, Authentication grant, Obtaining Access Token, Accessing a protected resource, OAuth Registry, Extensibility. Case Study: Develop a Spring based application with JWT-OAUTH2

Lab Exercises

1. Developing simple application in Maven.
2. Implement Spring IOC.
3. Implement Spring JDBC.
4. Create a web application using Spring MVC.
5. Implement Data Persistence using JPA and Hibernate.
6. Creating RESTFUL services and Test using Postman or SoapUI
7. Usage of Java Naming and Directory Interface
8. Implement Logging using Log4j.
9. Implement Spring Security using JWT and OAUTH2.

Total Hours : 75

Text Books:

1 Kogent Learning Solutions Inc., "Java Server Programming Java EE7 (J2EE 1.7): Black Book", Dream Tech Press, 2014.

2 Jim Keogh, “J2EE: The Complete Reference”, McGraw Hill, 2002

3 Geoffroy Warin, “Mastering Spring MVC 4”, Packet Publishing, 2015

4 Christian Bauer, Gavin King, and Gary Gregory, “Java Persistence with Hibernate”, Second Edition, Manning publication, 2015

5 Joseph B.Ottinger, Jeff Lin Wood, Dave Minter, “ Beginning Hibernate: for Hibernate 5”, 4th Edition, A press, 2016

6 Laurentiu Spilca, “Spring Security in Action, Manning Publication, 2020

Reference Books:

1 Elder Moraes, “Java EE 8 Cookbook”, Packt Publishing, 2018.

2 Jon Brisbin, Oliver Gierke, Thomas Risberg, Mark Pollack, Michael Hunger,” Spring Data: Modern Data Access for Enterprise Java”, O 'Reilly Media, November, 2012,

Web References:

1 https://www.baeldung.com/rest-with-spring-series
2 https://www.coursera.org/courses?query=spring%20framework
3 https://www.gangboard.com/spring-and-hibernate-courses
4 https://www.progress.com/tutorials/jdbc/understanding-jta
5 https://www.ibm.com/developerworks/library/j-jndi/index.html

Online Resources:

1 https://jeemainonline.in/
2 https://www.udemy.com/share/101Wc4/
3 https://www.udemy.com/topic/java-ee/

Assessment Methods & Levels (Based on Blooms Taxonomy)
Summative Assessment based on Continuous and End Semester Examinations

Bloom's Level	Continuous Assessment Theory			Practical Rubric Based CIA [30 Marks]	End Semester Examination [40 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]		
Remember	20	20	20	-	20
Understand	40	50	40	40	40
Apply	40	30	40	60	40
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C503.1	2	3	3						2		2	3	2	2	2
C503.2	2	3	3						2		2	3	2	2	2
C503.3	2	3	3						2		2	3	3	3	3
C503.4	2	3	3						2		2	3	3	3	3

20CSI504 **PHP AND JS FRAMEWORK** **3/0/2/4**

Nature of Course F (Theory Programming)

Prerequisites -

Course Objectives:

1 To understand PHP Scripting Language for web development

2 To acquire knowledge in JS

3 To learn the features of React

4 To illustrate session management and chat application using Node.js

Course Outcomes:

Upon completion of the course, students shall have ability to

C504.1	Develop PHP programs for web based applications	[AP]
C504.2	Apply the structure of Java Script for real time examples	[AP]
C504.3	Illustrate the features of React	[AP]
C504.4	Use Node.js for connectivity and session management	[AP]

Course Contents:

Module 1: PHP **15 Hours**

Installing PHP(WAMP SERVER),Lexical Structure, Data Types, Variables, Expressions and Operators, Flow Control Statements, Including Code, Embedding PHP in Web Pages, Functions, Strings, Arrays, Classes, Introspection and Serialization, JSON

Module 2: JavaScript fundamentals **15 Hours**

An introduction to JavaScript – Data Types – Conditionals and Loops –Functions – Classes and Objects – Inbuilt Methods – Arrays – Regular Expressions – Arrow Functions – Debugging in browsers – JS HTML DOM – JS Browser BOM – Introduction to AJAX and JSON – JS vs JQuery – Why JS Frameworks – Scope & Function Context - Closures - JavaScript Design Pattern.

Module 3: React **15 Hours**

React features – JSX – Component Life Cycle – Working with Forms – Event Handling in React – Introduction to Flux and Redux – State Management – Hooks and Context – Axios - Unit Testing. **Node.js:** Node.js Generators - Serving Static files Using Node.js - Session Management in Node.js - Connecting Node.js to Angular.js using Web sockets. **Project:** Responsive application - MyReads: A Book Lending App.

Lab Exercises

1. Programs using functions and arrays in PHP
2. Write a PHP script to decode a JSON string
3. Working with JS forms and filters
4. Building Single Page Application using JS
5. Form and event handling using React
6. Simple animations using React
7. Serving Static files Using Node.js
8. Session Management in Node.js
9. Chat application using Node.js
10. Developing responsive application

Total Hours : 75

Text Books:

1 Steven Holzner, “PHP:The Complete Reference”, McGraw Hill Education, 2017

2 Artemij Fedosejev, “React.js Essentials”, Packet publishing, 2015, 3Basarat Ali Syed, “Beginning Node.js”, Apress, 2014

Reference Books:

1 Rasmus Lerdorf, Kevin Tatroe, Peter MacIntyre, “Programming PHP”, O'Reilly Publications, 3rd Edition, 2002.

2 Anthony Accomazzo, Ari Lerner, Nate Murray, Clay All sopp, David Gutman, and Tyler McGinnis , “Fullstack React: The Complete Guide to ReactJS and Friends”, Fullstack.io, 2017.

3 Valentin Bojinov, David Herron, Diogo Resende, “Node.js Complete Reference Guide”, Packt Publishing, 2018.

Web References:

1 https://www.w3schools.com/nodejs/

2 https://www.w3schools.com/angular/

3 https://reactjs.org/tutorial/

4 https://hackr.io/tutorials/learn-php

Online Resources:

1 https://www.edx.org/course/angularjs-framework-fundamentals

2 https://www.udemy.com/introduction-to-php-programming-training-course/

Assessment Methods & Levels(Based on Bloom's Taxonomy)
Summative Assessment based on Continuous and End Semester Examinations

Bloom's Level	Continuous Assessment Theory			Practical Rubric Based CIA [30 Marks]	End Semester Examination [40 marks]
	CIA-1 [10 marks]	CIA-2 [10marks]	CIA-3 [10marks]		
Remember	20	20	20	-	20
Understand	50	40	40	40	40
Apply	30	40	40	60	40
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C504.1	2	3	3						2		2	3	2	2	2
C504.2	2	3	3						2		2	3	2	2	2
C504.3	2	3	3						2		2	3	3	3	3
C504.4	2	3	3						2		2	3	3	3	3

20CSI505 **COMPUTER NETWORKS** **3/0/2/4**

Nature of Course: F (Theory programming)
Pre requisites -

Course Objectives:

1. To explain networks, topologies and the key concepts.
2. To discuss the layered communication architectures and its functionalities.
3. To demonstrate the concepts of error control, addressing and routing mechanisms.
4. To identify the functions, protocols and communication between layers.
5. To describe user-oriented services and advanced networking technologies.

Course Outcomes:

Upon completion of the course, students shall have ability to

C505.1	Describe the fundamentals of data communications, topologies and functions of layered model.	[U]
C505.2	Practice the error detection and correction methods and explain data link layer functionalities.	[AP]
C505.3	Examine the logical addressing schemes and routing strategies.	[A]
C505.4	Discuss the process-to-process delivery models and congestion control principles.	[U]
C505.5	Describe the services of application layer and emerging networking technologies.	[U]

Course Contents:

Module 1: Overview of data communication, Networking and physical layer **15 Hours**

Introduction - Networks topologies, Protocols and standards, Reference models: OSI reference model, TCP/IP reference model, Overview of data (analog& digital), Overview of signal (analog& digital), Transmission Impairment, Performance, Transmission (analog& digital),Transmission media, Switching

Module 2: Data link layer **15 Hours**

Error detection (Parity, CRC, Hamming code), Sliding Window, Stop and Wait protocols, Multiple access protocols. Traditional Ethernet, Gigabit Ethernet, FDDI, Wi-Fi; Wi-Max, Bluetooth. **Network layer:** Logical Addressing, Internet Protocol(IPV4, IPV6), subnetting, Protocols: Address Mapping, ICMP; Routing algorithms: shortest path algorithm, flooding, distance vector routing, link state routing; Unicast and Multicast routing protocols.

Module 3: Transport layer **15 Hours**

Process to process delivery, UDP, TCP, Congestion control algorithms, Quality of service - Socket Programming. **Application layer:** DNS, E-Mail, SNMP, FTP, HTTP &WWW. Modern topics: ISDN services, DSL technology, VLAN.

Lab Component:

1. Study of system administration and network administration commands
2. Study of socket programming and client server model using TCP and UDP
3. Implementation bit stuffing and hamming code algorithms
4. Implementation of sliding window protocols
5. Implementation of Subnetting
6. Implementation of Remote Command Execution

7. Implementation of Domain name system
8. Implementation of file Transfer Protocol
9. Study of Network Simulator -2

Total Hours: 75

Text Books:

1. Behrouz A. Forouzan, “Data communication and Networking”, 5th Edition, Tata McGraw-Hill, 2016.
2. AS Tanenbaum, DJ Wetherall, “Computer Networks”, 5th Edition, Prentice-Hall, 2016.
3. Thomas D. Nadeau and Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, Inc., 2013

Reference Books:

1. Peterson & Davie, "Computer Networks, A Systems Approach", 3rd Edition, Harcourt, 2013
2. William Stallings, “Data and Computer Communications”, 8th Edition, PHI, 2006
3. Bertsekas and Gallagher “Data Networks, PHI, 2000
4. JF Kurose, KW Ross, “Computer Networking: A Top-Down Approach”, 5th Edition, Addison-Wesley, 2009.

Web References:

1. https://www.howtoforge.com/tutorial/software-defined-networking-sdn-architecture-and-role-of-openflow/
2. https://www.sdxcentral.com/sdn/network-virtualization/definitions/data-center-networking-explained/

Online Resources:

1. http://nptel.ac.in/courses/106105082/
2. https://nptel.ac.in/courses/106105183/
3. https://www.udacity.com/course/computer-networking--ud436
4. https://www.free-online-training-courses.com/networking/

Assessment Methods &Levels(Based on Blooms Taxonomy)
Summative Assessment based on Continuous and End Semester Examinations

Bloom's Level	Continuous Assessment Theory			Practical Rubric Based CIA [30 Marks]	End Semester Examination [40 marks]
	CIA-1 [10 marks]	CIA-2 [10marks]	CIA-3 [10marks]		
Remember	20	20	20	-	20
Understand	50	40	40	40	40
Apply	30	30	30	60	30
Analyse	-	10	10	-	10
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C505.1	3	3	3						2			3	2	2	2
C505.2	3	3	3						2			3	2	2	2
C505.3	3	3	3						2			3	3	3	3
C505.4	3	3	3						2			3	3	3	3
C505.5	3	3	3						2			3	3	3	3

20CSI506 **AGILE TECHNOLOGY** **3/0/2/4**

Nature of Course D (Theory application)
Pre requisites -

Course Objectives:

1 To introduce the basic concepts of Agile Software Process.
2 To provide an insight to different areas of Agile Methodologies.
3 To explore the roles of prototyping in the software process
4 To perform a detailed examination and demonstration of Agile development and testing techniques.

Course Outcomes:

Upon completion of the course, students shall have ability to

C506.1 Understand the background and driving forces for taking an Agile approach to software development [U]
C506.2 Apply design principles, refactoring, version control and continuous integration to achieve Agility [AP]
C506.3 Demonstrate how an iterative, incremental development process leads to faster delivery of more useful software [AP]
C506.4 Recognize the importance of interacting with business stakeholders in determining the requirements for a software system [U]
C506.5 Interpret Software process improvement as an ongoing task for development teams thereby showing how agile approaches can be scaled up to the enterprise level. [AP]

Course Contents:

Module 1: Agile and its Significance **20 Hours**

Agile development – Classification of methods – The agile manifesto and principles – Agile project management – Embrace communication and feedback - Simple practices and project tools – Empirical vs defined and prescriptive process – Principle-based versus Rule-Based – Sustainable discipline. The human touch – Team as a complex adaptive system – Agile hype – Specific agile methods. The facts of change on software projects – Key motivations for iterative development – Meeting the requirements challenge iteratively – Problems with the waterfall. Research evidence – Early historical project evidence – Standards-Body evidence – Expert and thought leader evidence – A Business case for iterative development – The historical accident of waterfall validity.

Module 2: Agile Methodology **10 Hours**

Method overview – Lifecycle – Work products, Roles and Practices values – Common mistakes and misunderstandings – Sample projects – Process mixtures – Adoption strategies – Fact versus fantasy – Strengths versus “Other” history.

Module 3: Agile Practicing and Testing **15 Hours**

Project management – Environment – Requirements – Test – The agile alliances – The manifesto – Supporting the values – Agile testing – Nine principles and six concrete practices for testing on agile teams. **Case Study:** Agile – Motivation – Evidence – Scrum – Extreme Programming – Unified Process – Practice Tips.

List of Experiments:

1. Understand the background and driving forces for taking an Agile Approach to Software Development.
2. Understand the business value of adopting agile approach.
3. Understand agile development practices
4. Drive Development with Unit Test using Test Driven Development
5. Apply Design principle and Refactoring to achieve agility
6. Implement automated build tool
7. Implement version control tool
8. Implement Continuous Integration tool
9. Perform Testing activities within an agile project.
10. Case Studies on Software development using Scrum

Total Hours : 75

Text Books:

1 Mark C. Layton, Steven J. Ostermiller, Dean J. Kynaston, “Agile Project Management”, Wiley, 2020
2 Elisabeth Hendrickson, “Agile Testing” Quality Tree Software Inc 2008.
3 Angel Medinilla, “Agile Management: Leadership in an Agile Environment”, Springer, 2012

Reference Books:

1 Craig Larman “Agile and Iterative Development – A Manager’s Guide” Pearson Education – 2004
2 James shore, Shane Warden, “The Art of Agile Development (Pragmatic guide to agile software development)” , O'Reilly Media, 2008
3 Neil Perkin, Peter Abraham, Building the Agile Business Through Digital Transformation, Kogan Page, 2020

Web References:

1 www.agileintro.wordpress.com/2008
2 http://www.serena.com/docs/repository/solutions/intro-to-agile-devel.pdf
3 www.qualitytree.com

Online Resources:

1 https://www.edx.org/course/agile-software-development
2 https://itacademy.harvard.edu/agile
3 https://www.coursera.org/specializations/agile-development

Assessment Methods & Levels (Based on Blooms Taxonomy)
Summative Assessment based on Continuous and End Semester Examinations

Bloom's Level	**Continuous Assessment Theory**			**Practical Rubric Based CIA [30 Marks]**	**End Semester Examination [40 marks]**
	CIA-1 [10 marks]	**CIA-2 [10marks]**	**CIA-3 [10marks]**		
Remember	20	20	20	-	20
Understand	50	40	40	40	40
Apply	30	40	40	60	40
Analyse	-	-	-	-	-
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C506.1	2	3	3		3	2			2	2	2	3	2	2	2
C506.2	2	3	3		3	2			2	2	2	3	2	2	2
C506.3	2	3	3		3	2			2	2	2	3	3	3	3
C506.4	2	3	3		3	2			2	2	2	3	3	3	3
C506.5	2	3	3		3	2			2	2	2	3	3	3	3

20CSI601 **COMPILER DESIGN** **3/0/0/3**

Nature of Course D (Theory Design)
Pre requisites -
Course Objectives:

1. To introduce the major concept areas of language translation and compiler design
2. To predict, design and construct a lexical analyzer and parser.
3. To employ code generation schemes
4. To perform optimization of codes and gain knowledge about runtime environments
5. To provide practical programming skills necessary for constructing a compiler using LEX and YACC tools

Course Outcomes:
Upon completion of the course, students shall have ability to

C601.1	Construct a lexical analyzer to identify the tokens in a program.	[AP]
C601.2	Deduce a parser through the application of grammar.	[A]
C601.3	Demonstrate intermediate code generation and symbol table organization techniques.	[AP]
C601.4	Illustrate the code generation techniques with a simple program.	[AP]
C601.5	Estimate the code optimization strategies.	[A]

Course Contents:

Module 1: Introduction to Compilers and Syntax Analysis **15 Hours**

The Structure of Compiler – Evolution of Programming Languages – Application of Compiler Technology – Programming Languages Basics - Phases of a compiler; Cousins of the Compiler - Grouping of Phases - Compiler Construction Tools - role of assemblers - macroprocessors – loaders - linkers **Lexical Analysis:** Role of Lexical Analyzer - Input Buffering - Specification of Tokens - Recognition of Tokens - Lexical Analyzer Generators -A language for Specifying Lexical Analyzer - Finite Automata - From a regular expression to an NFA and **DFA.Syntax Analysis:** Role of the parser; Writing Grammars; Context-Free Grammars - Derivation Trees – Ambiguity in Grammars and Languages - Top Down parsing - Recursive Descent Parsing - Predictive Parsing - Bottom-up parsing - Shift Reduce Parsing - LR Parsers - SLR Parser - Canonical LR Parser - LALR Parser - YACC-Parser Generators - Design of a parser generator.

Module 2: Intermediate Code Generation and Code Generation **15 Hours**

Intermediate languages: Three address code – Types of Three address code – Declarations - Assignment Statements - Boolean Expressions - Case Statements – Quadruples – Triples - Arrays – Loops - Back patching - Syntax directed Definitions – Inherited and Synthesized Attributes - Syntax Directed Translation - Construction of Syntax Tree - Applications of Syntax Directed Translation - Type Checking - Type system - Type checker; Type expression - Type conversion. The Target Machine – Runtime Storage Management – Basic Blocks and Flow Graphs - Next-use Information - Register allocation - Issues in the design of code generator – A simple Code generator – Data Structures for simple code generator, Labelling algorithm - Code generator using DAG – Dynamic programming based code generation - Loop Optimization - Peephole Optimization. **Case Study:** Bootstrapping a Compiler.

Module 3: Code Optimization and Run Time Environments **15 Hours**

Introduction - Principal Sources of Optimization - Optimization of Basic Blocks – DAG representation of Basic Blocks - Structure Preserving transformation – functional transformation - Introduction to Global Data Flow Analysis – Runtime Environments – Source Language Issues – Symbol Tables - Storage Organization – Storage Allocation strategies – Access to non-local names – Heap Management - Parameter Passing; Error handling - Error Detection and Recovery - Lexical phase error management – Syntax phase error management - Error recovery routines. **Case Study**: Just-in-time compilation with adaptive optimization for dynamic languages.

Total Hours:45

Text Books:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, “Compilers: Principles, Techniques and Tools”, Second Edition, Pearson Education Limited, 2014.

Reference Books:

1. Allen I. Holub, “Compiler Design in C”, Prentice Hall of India, 2016.
2. C.N.Fischer and R.J.Le Blanc, “Crafting a compiler with C”, Benjamin Cummings, 2010.
3. Henk Alblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”, PHI, 2001.
4. Kenneth C.Louden, “Compiler Construction: Principles and Practice”, Thompson Learning, 2003.
5. Dhamdhere, D.M., "Compiler Construction Principles and Practice", 2nd edition, Macmillan India Ltd., New Delhi, 2008.

Web References:

1. gatecse.in/category/compiler-design/
2. www.tutorialspoint.com/compiler_design

Online Resources:

1. http://nptel.ac.in/syllabus/syllabus.php?subjectId=106108113
2. nptel.ac.in/courses/106104123/
3. https://online.stanford.edu/courses/soe-ycscs1-compilers

Assessment Methods & Levels (based on Blooms’ Taxonomy)
Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C601.1	Apply	Assignment	5
C601.2, C601.3	Analyse	Tutorial	10
C601.4, C601.5	Analyse	Case Study	5

Assessment Methods & Levels (based on Blooms’ Taxonomy)
Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment Theory			End Semester Examination Theory [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	20	20	20	20
Understand	30	40	30	30
Apply	30	40	20	30
Analyse	20	-	30	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment Total		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C601.1	2	3	3	2	2							2	2	2	2
C601.2	2	2	3	3	2							2	2	2	2
C601.3	2	2	2	2								2	2		2
C601.4	2	3	3	3								3	2	3	3
C601.5	3	3	3	2								3	2		3

20CSI602 **CRYPTOGRAPHY, NETWORK SECURITY AND APPLICATION SECURITY** **3/0/2/4**

Nature of Course G (Theory Analytical)

Pre requisites Computer Networks

Course Objectives

1 To identify the different types of modern cryptographic techniques.

2 To identify the concepts of public key encryption and number theory.

3 To apply public key encryption and hash functions.

4 To understand various protocols for network security to protect against the threats in the networks.

5 To apply various network security and application security to analyze major security threats.

Course Outcomes:

Upon completion of the course, students shall have ability to

C602.1	Identify network security threats and the associated attacks.	[R]
C602.2	Identify classical encryption techniques for secure data transit across data networks	[U]
C602.3	Understand security protocols for protecting data on networks	[U]
C602.4	Apply various public key encryption and hash functions.	[AP]
C602.5	Analyze the various types of security in applications and network security.	[A]

Course Contents

Module 1: Introduction **15 Hours**

Security goals-OSI Security Architecture(attacks, services, mechanisms)- Symmetric ciphers: Classical Encryption techniques- Block Ciphers and Data Encryption Standard – Finite fields- Advanced Encryption Standard – Multiple Encryption and Triple DES - Block cipher modes of operations – Confidentiality using Symmetric Encryption.

Module 2: Public-Key Encryption and Hash Functions **15 Hours**

Fermat's and Euler's theorem-Testing of primality- The Chinese remainder theorem – Public Key Cryptography and RSA – Key Management and other Public Key Cryptosystems – Message Authentication and Hash Functions – Hash and Mac Algorithms - MAC - HMAC,CMAC,SHA-3– Digital Signatures and Authentication Protocols. **Authentication Applications:** Kerberos – X.509 Authentication Service – Public key Infrastructure.

Module 3: Network Security and Application Security **15 Hours**

Electronic Mail Security: PGP – S/MIME IP Security: Architecture-Authentication header - Encapsulating security payloads. Web Security: SSL, TLS, SET. **System Security:** Intrusion – Malicious Software – Firewalls. Application Security: Basics of Bitcoin and Blockchain: Bitcoins – Ecosystem – Ethereum – Forks – Digital Tokens – Blockchain Technology – Initial Coin Offerings (ICOs) – Investing. E-Commerce Security.

Lab Exercises

1. Implement the following Substitution & Transposition Techniques concepts: [U]

a. Caesar Cipher

b. Playfair Cipher

c. Hill Cipher

d. Vigenere Cipher
e. Rail fence – row & column transformation
2. Implement the following algorithms
a. DES
b. RSA Algorithm [U]
c. Diffiee-Hellman
d. MD5
e. SHA3
3. Configure a mail agent to support Digital Certificates, send a mail and verify the correctness of this system using the configured parameters. [AP]
4. Configure SSH (Secure Shell) and send/receive a file on this connection to verify the correctness of this system using the configured parameters. [AP]
5. Demonstrate intrusion detection system (ids) using snort. [AP]

Total Hours: 75

Text Books:

1. William Stallings, “Cryptography and Network Security – Principles and Practices”, 7th edition, Prentice Hall of India,2017
2. Antony Lewis, “The Basics of Bitcoins and Block chains”, Mango Publishing Coral Gables, 2018.

Reference Books:

1 Behrouz A.Forouzon, ”Cryptography and network security”, 3rd edition, Tata McGraw-Hill, 2015.

2 Atul Kahate, “Cryptography and Network Security”, 3rd edition, Tata McGraw-Hill, 2013.

Web References:

1 https://crypto.stanford.edu/~dabo/cs255/syllabus.html

2 http://www.iitg.ac.in/icdcn2006/isg.pdf

3 http://www.tutorialspoint.com/cryptography/

4 https://blockgeeks.com/guides/what-is-blockchain-technology/

5 https://www.youtube.com/playlist?list=PL96A74njP_C8arW6NeU1o0e1NKjAWj0HA

Online Resources:

1 https://onlinecourses.nptel.ac.in/noc18_cs07/preview

2 http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html

3 http://freevideolectures.com/Course/3027/Cryptography-and-Network-Security

4 https://www.coursera.org/learn/crypto

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment				End Semester Examination (Theory) (40 Marks)
	CIA- 1 (10 Marks)	CIA-2 (10 Marks)	CIA-3 (10 Marks)	Rubrics based CIA (30 marks)	
Remember	20	10	10	20	30
Understand	40	40	30	20	30
Apply	40	50	20	30	20
Analyse	-	-	40	30	20
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C602.1	3	3	3		2			2				2		1	3
C602.2	3	3	3		2			2				3		2	2
C602.3	3	2	3		2			3				3		2	2
C602.4	3	3	3		3			3				2		3	3
C602.5	3	2	2		2			2				2		2	2

20CSI603 SOFTWARE VALIDATION AND TESTING 3/0/2/4

Nature of Course F (Theory Programming)
Pre requisites Agile Technology
Course Objectives:

1. To learn fundamental concepts in software testing
2. To identify various software testing issues and solutions in software unit test; integration, regression, system, performance, system and vulnerability testing.
3. Test project, design test cases and data.
4. To plan and execute a testing project for use modern software testing tools to support software testing projects
5. Analyse test management and test automation techniques

Course Outcomes:
Upon completion of the course, students shall have ability to

C603.1	Apply software testing knowledge and engineering methods.	[AP]
C603.2	Examine and solve various functionality problems by designing and selecting testing models and methods	[A]
C603.3	Develop construct the complementary techniques to dynamic testing for improving the software quality	[AP]
C603.4	Design and experiment a software test process for a software project	[A]
C603.5	Apply debugging process and techniques for software engineering problems	[AP]

Course Contents:

Module 1: Introduction 15 Hours

Software Testing- Evolution of Software testing–Software Testing Models- -Software testing Life cycle – Testing methodology- Behavior Driven Development(BDD)- Software testing principles - The Tester's Role in a Software Development Organization-Origin of defects - Cost of defects-Defect classes - the defect Repository and Test Design- Defect Examples.

Module 2: Verification and Validation Testing, Object Oriented Testing 15 Hours

Black box and white box testing techniques- Inspection-Structured walkthrough- technical reviews-Unit Testing (Junit and Mockito Framework) – Integration Testing –System Testing–Acceptance testing-Performance Testing-Security and vulnerability testing-Object Oriented Testing: OO Testing Basic- OO testing methods- Class level testing - Interclass test case design.

Module 3: Debugging and Test Maturity models, Test Automation 15 Hours

Debugging- Process – Techniques-Correction of Bugs – debuggers.-Need for process maturity – Measurement and Improvement of test process-Test process maturity models- Software test automation - skills needed for automation - design and architecture for automation - requirements for a test tool.

List of Experiments:

1. A program for written in C language for Matrix Multiplication fails‖ introspect the causes for its failure and write down the possible reasons for its failure
2. Take ATM system and study its system specifications and report various bugs.
3. Write the test cases for banking application
4. Create test plan document for library management system
5. Perform unit testing using Junit / Mockito.
6. Study of test automation tool (selenium, Jest /Cypress)
7. Study of BDD using Jasmine
8. Study of Angular JS testing tool (Karma and Protractor)

9. Study of bug tracking tool (bugzilla)

10. Study of any test management tool (test director)

11. Study of any open source testing tool (test link)

12. Take a mini project and execute it during SDLC create all testing documents like test plan, TCD etc.,

Total Hours: 75

Text Books:

1. Naresh Chauhan, “Software Testing Principles and Practices”, Oxford University Press, 2010
2. Srinivasan Desikan, Gopalaswamy Ramesh, “Software Testing – Principles and Practices”, Pearson Education, 2006.
3. Ilene Burnstein, “Practical Software Testing”, Springer Verlag International Edition, Springer (India) Pvt Ltd - (Indian reprint edition 2013)

Reference Books:

1. William E- Perry, “Effective methods for software testing”, Wiley publications, 2006.
2. Ali Behforooz, Frederick J Hudson, “Software Engineering Fundamentals”, Oxford University Press, New York, 2003.
3. Aditya P. Mathur, “Foundations of Software Testing Fundamental Algorithms and Techniques”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.
4. Boris Beizer, “Software Testing Techniques”, Second Edition, Van Nostrand Reinhold, New York, 1990
5. Georgia Weidman**”** Penetration Testing: A Hands-On Introduction to Hacking”, 1st Edition (June 8, 2014), nostartch press
6. John Ferguson Smart, ”BDD in Action: Behavior-driven development for the whole software lifecycle”, 2014, Manning publications

Web References:

1. https://www.ibm.com/topics/software-testing
2. https://www.utest.com/academy
3. https://docs.angularjs.org/guide/unit-testing
4. https://site.mockito.org/

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105150/
2. https://www.coursera.org/specializations/software-testing-automation
3. https://alison.com/courses/software-testing

Assessment Methods & Levels (based on Blooms' Taxonomy)
Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment Theory			Practical Rubric based CIA [30 Marks]	End Semester Examination Theory [40 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]		
Remember	30	20	20	20	20
Understand	30	40	40	20	20
Apply	20	20	20	30	30
Analyse	20	20	20	30	30
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C603.1	2	3	3		2	2	2	2	3	2		2	3	2	2
C603.2	2	3	3		2	2	3	2	3	2		3	3	2	2
C603.3	2	3	3		2	2	2	2	3	2		3	3	3	2
C603.4	2	3	3		2	2	3	2	3	2		3	3	3	2
C603.5	2	3	3		2	2	2	2	3	2		3	3	3	2

20CSI604 **BIG DATA ANALYTICS** **3/0/2/4**

Nature of Course G (Theory analytical)
Pre requisites Database Management Systems, Probability

Course Objectives:

1 To explore the fundamental concepts of data analytics
2 To learn the principles and methods of statistical analysis.
3 Discover interesting patterns, analyze supervised and unsupervised models and Estimate the accuracy of the algorithms.
4 To understand the various search methods and visualization techniques
5. To learn Data analytics using Hadoop framework.

Course Outcomes:

Upon completion of the course, students shall have ability to

C604.1 Identify the real world business problems and model with analytical solutions. [U]
C604.2 Solve analytical problem with relevant mathematics background knowledge. [AP]
C604.3 Convert any real world decision making problem to hypothesis and apply suitable statistical testing. [A]
C604.4 Explain and Analyse the Big Data using Map-reduce programming in Hadoop and Spark framework. [AP]
C604.5 Use open source frameworks for modelling and storing data. [A]

Course Contents:

Module 1: Introduction to Big Data **15 Hours**

Data Science – Fundamentals and Components –Types of Digital Data – Classification of Digital Data – Introduction to Big Data – Characteristics of Data – Evolution of Big Data – Big Data Analytics – Classification of Analytics – Top Challenges Facing Big Data – Importance of Big Data Analytics **DESCRIPTIVE ANALYTICS USING STATISTICS:** Mean, Median and Mode – Standard Deviation and Variance – Probability – Probability Density Function – Percentiles and Moments – Correlation and Covariance – Conditional Probability – Bayes' Theorem – Introduction to Univariate, Bivariate and Multivariate Analysis – Dimensionality Reduction using Principal Component Analysis(PCA) and LDA.

Module 2: Predictive Modeling and Machine Learning **15 Hours**

Linear Regression – Polynomial Regression – Multivariate Regression –Bias/Variance Trade Off – K Fold Cross Validation – Data Cleaning and Normalization – Cleaning Web Log Data – Normalizing Numerical Data – Detecting Outliers – Introduction to Supervised And Unsupervised Learning – Reinforcement Learning – Dealing with Real World Data – Machine Learning Algorithms –Clustering.

Module 3: Big Data Hadoop Framework **15 Hours**

Introducing Hadoop –Hadoop Overview – RDBMS versus Hadoop – HDFS (Hadoop Distributed File System): Components and Block Replication – Processing Data with Hadoop – Introduction to MapReduce – Features of MapReduce – Introduction to NoSQL: CAP theorem – MongoDB: RDBMS Vs MongoDB – Mongo DB Database Model – Data Types and Sharding – Introduction to Hive – Hive Architecture – Hive Query Language (HQL). **Case study:** Using R – Python – Hadoop - Spark and Reporting tools to understand and Analyze the Real world Data sources in the following domain-financial – Insurance - Healthcare in Iris - UCI datasets.

Lab Exercises:

1. R Data Types and R Matrix Tutorial , Arithmetic & Logical Operators with Example
2. R Data Frame: Create, Append, Select, Subset and Data Frames
3. R Exporting Data to Excel, CSV, SAS, STATA, Text File
4. R Aggregate Function: Summarise & Group_by() Example
5. Using Python Read data from text file, Excel and web. and explore various commands for doing descriptive analysis in Iris dataset
6. Use the data sets from UCI and Perform the following
   (i) Univariate analysis:Frequence, Mean, Median, Mode, Variance, Standard devation,
   (ii) Bivariate analysis :Linear and logistics regression.
   (iii) Multiple Regression.
7. HDFS Commends Map Reduce Program to show the need of Combiner
8. Map Reduce I/O Formats-Text, key-value Map Reduce I/O Formats –Nline, Multiline.
9. Sequence file Input /Output Formats Secondary sorting
10. Distributed Cache & Map Side Join, Reduce side Join Building and Running a Spark Application Word count in Hadoop and Spark Manipulating RDD

Total Hours: 75

Text Books:

1 EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data”, Wiley publishers, 2015.

2 Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, Second Edition, 2014.

3 An Introduction to Statistical Learning: with Applications in R (Springer Texts in Statistics) Hardcover – 2017

Reference Books:

1 Bart Baesens , “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications“, Wiley Publishers, 2014

2 Bill Franks, “Taming the Big Data Tidal Wave: Finding opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012

3. Probability And Statistics For Engineers And Scientists 9th Edition by Walpole and R E and Myers and R H , Pearson India

Web References:

1 https://bigdatauniversity.com/
2 http://www.statistics.com/data-analytics- courses
3 www.ibm.com/Data Analytics/
4 https://www.youtube.com/watch?v=bAyrObl7TYE
5 https://www.youtube.com/watch?v=k7zu3NXEiGY
6 https://www.youtube.com/watch?v=1vbXmCrkT3Y
7 https://www.youtube.com/watch?v=XnNzck5-HdQ

Online Resources:

1 https://www.edx.org/course/subject/data-analysis- statistics
2 https://www.coursera.org/browse/data-science/data- analysis?languages=en
3 http://online-learning.harvard.edu/course/big- data-analytics
4 https://www.cse.iitm.ac.in/~ravi/courses/Introduction%20to%20Data%20Analytics.html

Assessment Methods & Levels (based on Blooms' Taxonomy)
Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment Theory			Practical Rubric based CIA [30 Marks]	End Semester Examination Theory [40 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]		
Remember	20	20	20	20	20
Understand	30	20	20	30	20
Apply	50	40	40	50	40
Analyse	-	20	20		20
Evaluate	-	-	-		-
Create	-	-	-		-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C604.1	3	3	2		2				2	2		3	3	3	2
C604.2	3	3	2		2				2	2		3	3	3	2
C604.3	3	3	2		2				2	2		3	3	3	2
C604.4	3	3	2		3				2	2		3	3	3	2
C604.5	3	3	2		3				2	2		3	3	3	2

20CSI605 **MOBILE APPLICATION DEVELOPMENT** **2/0/4/4**

Nature of Course F (Theory Programming)

Pre requisites -

Course Objectives:

1. To understand the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
2. To understand how to work with various mobile application development frameworks.
3. To learn the basic and important design concepts and issues of development of mobile applications.
4. To model and manage mobile application development.
5. To explore the techniques for deploying and analyzing mobile applications to enhance the performance and security.

Course Outcomes

Upon completion of the course, students shall have ability to

C605.1	Design and Develop Android application by setting up Android development environment	[R]
C605.2	Implement adaptive, responsive user interfaces that work across a wide range of devices.	[AP]
C605.3	Explain long running tasks and background work in Android applications.	[U]
C605.4	Demonstrate and analyze the methods in storing, sharing and retrieving data in Android applications.	[A]
C605.5	Discuss the performance of android applications and understand the role of permissions and security.	[A]

Course Contents:

Module 1: Introduction to Android Development Environment **10 Hours**

Get started –Introduction to Mobile Computing–Frameworks and Tools–Generic UI Development–Android User–Characteristics of Mobile Applications–Build your first app – Activities, Testing, debugging and using support libraries.

Module 2: Graphics and UI Performance **10 Hours**

User Interaction – Delightful user experience – Testing your UI – Background Tasks –Triggering, scheduling and optimizing background tasks – Responsive layout – Integration with Hardware Components – Cross Platform Development – PhoneGap – Crash analytics – Offline and Online Mode – Native Apps / Hybrid Model / Web Based Apps using Container – Mobile Architecture.

Module 3: Android Storing and Retrieving Data **10 Hours**

All about data–Preferences and Settings–Storing data using SQLite–Sharing data with content providers–Loading data using Loaders–Permissions, Performance and Security–Firebase and AdMob–Publish.

Total Hours 30 hours

Laboratory Component:

S. No	List of Experiments
1.	Develop an application that uses GUI components, Font and Colours
2.	Develop an application that uses Layout Managers and event listeners.
3.	Write an application that draws basic graphical primitives on the screen.
4.	Develop an application that makes use of databases.
5.	Develop an application that makes use of Notification Manager.
6.	Implement an application that uses Multi-threading.
7.	Develop a native application that uses GPS location information using PhoneGap.
8.	Implement an application that creates an alert upon receiving a message.
9.	Develop a mobile application to send an email.
10.	Develop a Mobile application for simple needs using Android Studio and Angular FireBase (Mini Project).

Total Hours 60 Hours

Text Books:

1. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference, Google Developer Training Team, 2017. https://www.gitbook.com/book/google-developer-training/android-developer-fundamentals-course-concepts/details
2. Erik Hellman, Android Programming – Pushing the Limits, 1st Edition, Wiley India Pvt Ltd, 2014.
3. Bintu Harwani, PhoneGap Build - Developing Cross Platform Mobile Applications in the Cloud, 1st Edition, Auerbach Publications, 2014.
4. Dawn Griffiths and David Griffiths, Head First Android Development, 1st Edition, O'Reilly SPD Publishers, 2015.
5. Michel Gregg, "BUILD YOUR OWN SECURITY LAB: A FIELD GUIDE FOR NETWORK TESTING", John Wiley & Sons, 2008.

Reference Books:

1. J F DiMarzio, Beginning Android Programming with Android Studio, 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580
2. Anubhav Pradhan, Anil V Deshpande, Composing Mobile Apps using Android, Wiley 2014, ISBN: 978-81-265-4660-2

Web References:

1. https://developer.android.com/training/basics/firstapp
2. https://www.ibm.com/cloud/learn/mobile-application-development-explained
3. https://buildfire.com/mobile-app-development-tools/

Online Resources:

1. https://www.tutorialspoint.com/mobile_development_tutorials.htm
2. https://www.udemy.com/course/learn-android-application-development-y/

Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy
Summative assessment based on Continuous and End Semester Examination

Revised Bloom's Level	Continuous Assessment Theory			Practical Rubric based CIA [30 Marks]	End Semester Examination (Theory) [40 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]		
Remember	30	10	10	10	10
Understand	20	20	20	20	20
Apply	20	30	30	30	30
Analyse	30	40	40	40	40
Evaluate					
Create					

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C605.1	3	3	3	3	3				3			2	3	3	2
C605.2	3	3	2	2	3				2			3	3	3	2
C605.3	3	3	3	3	3				3			2	3	2	2
C605.4	3	3	2	3	2				3			3	3	3	2
C605.5	3	3	3	3	2				2			3	3	3	2

20CSI701 **BLOCKCHAIN TECHNOLOGY** **3/0/2/4**

Nature of Course D (Theory Applications)

Pre requisites Cryptography and Network Security, Web Application, Java Knowledge

Course Objectives:

1. To provide the basic concepts of Blockchain Technology and its properties.
2. To discuss the Cryptography techniques.
3. To describe the Cryptocurrency algorithms.
4. To explore Ethereum and Hyperledger platforms to build applications.

Course Outcomes:

Upon completion of the course, students shall have ability to

C701.1	Describe the fundamental concepts of Blockchain Technology.	[U]
C701.2	Interpret the challenges in Cryptocurrency and Bitcoin.	[AP]
C701.3	Illustrate Bitcoin consensus algorithms.	[A]
C701.4	Analyze Hyperledger and Ethereum platform.	[A]
C701.5	Design Blockchain applications to solve real time business issues.	[AP]

Course Contents:

Module 1: Introduction to Blockchain and Cryptography **15 Hours**

Introduction –Digitalization–Blockchain types– Centralized ledger system–- Distributed ledger system– Decentralization in Real Time- Advantages and disadvantages - Blockchain versions. **Cryptography:** Concepts–Types–Digital signature –Hash value– Hash function–Properties –Hash pointer– Merkle tree.

Module 2: Cryptocurrency and Bitcoin **15 Hours**

Basic Concept–Working principle – Token– Double spending–Security risks. Bitcoin Consensus: Proof of Work (PoW)–Proof of Stake– Proof of Burn –Delegated Proof of Stake–Proof of Elapsed Time. Bitcoin Miner–Byzantine Generals Problem –Mining Pool– Permissioned and Permissionless Blockchain– Characteristics– Consensus model for permissioned Blockchain–Distributed consensus –Paxos.

Module 3: Hyperledger and Ethereum **15 Hours**

Introduction to Blockchain platform-Hyperledger: Frameworks–Architecture of Hyperledger fabric– Chaincode–Channels–Hyperledger fabric network creation – Report generation using Caliper.**Ethereum:** EVM– Transaction - Remix IDE – Meta mask – Ganache – Truffle – Mist browser–Ether–Gas–Smart contracts–Ethereum network. Programming language for Ethereum–Solidity–Truffle framework–DApps– DAO - ABI. **Case Study:** Logistics and Supply Chain –Rental – Financial – HR Functions –Electronic Health Record – Smart Grid.

Total Hours: 45 hours

Laboratory Component:

Implementation of Following Applications using Blockchain Platform.

1. Basic programs using Solidity.
2. Pollution Monitoring System.
3. E-Commerce System for Remote Purchasing.
4. E-Voting system.
5. Stock Market Maintenance System.
6. Documentation Storage System.
7. Secured Medical Records Sharing System.
8. Cross Border Payment System.
9. Land Registry System.
10. E-Governance System.

Total Hours 30 Hours

Text Books:

1. Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, Beginning Blockchain, A Beginner's Guide to Building Blockchain Solutions, Apress,First Edition, 2018.
2. Bashir, Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, Kindle Edition, second Edition,2018.
3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder, Bitcoin and cryptocurrency technologies: a comprehensive introduction, Princeton University Press,First Edition, 2016.

Reference Books:

1. Daniel Drescher, Block Chain Basics, Apress, First Edition, 2017.
2. Andreas M. Antonopoulas, "Mastering Bitcoin: Programming the Open Blockchain", O'Reilly,First Edition, 2016
3. Ritesh Modi, Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Block Chain, Packt Publishing, First Edition,2018.

Web References:

1. https://www.tutorialandexample.com/blockchain/
2. https://www.tutorialspoint.com/solidity/index.htm
3. https://www.geeksforgeeks.org/consensus-algorithms-in-blockchain/?ref=lbp
4. https://www.javatpoint.com/blockchain-tutorial
5. https://www.investopedia.com/news/how-bitcoin-works/

Online Resources:

1. https://www.coursera.org/learn/blockchain-basics
2. https://www.coursera.org/learn/smarter-contracts
3. https://nptel.ac.in/courses/106/104/106104220/
4. https://www.edx.org/course/introduction-to-hyperledger-blockchain-technologies

Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Revised Bloom's Level	Continuous Assessment Theory			Practical	End Semester Examination (Theory)
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	Rubric based CIA) Marks]	[40 marks]
Remember	30	20	20	20	20
Understand	30	30	20	20	30
Apply	20	30	30	30	30
Analyse	20	20	30	30	20
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C701.1	3	3	2	2	2	2	2	2	2	2		2	2	2	2
C701.2	3	3	2	2	2	1	2	3	3	2		2	3	2	2
C701.3	3	3	2	2	2	1	2	2	3	2		2	2	2	2
C701.4	3	3	2	2	2	2	2	2	2	2		3	2	2	2
C701.5	3	3	2	2	2	2	2	2	3	2		3	3	2	2

20CSI702 **INTERNET OF THINGS** **3/0/2/4**

Nature of Course D (Theory Application)
Pre requisites Microprocessors & Microcontrollers

Course Objectives:

1. To discuss the fundamentals and design methodology of Internet of Things.
2. To describe the design constraints of real world IoT applications.
3. To build simple and low cost IoT applications using Arduino / Raspberry Pi / Node MCU.
4. To apply the concept of Internet of Things in real world scenarios.

Course Outcomes

Upon completion of the course, students shall have ability to

C702.1	Describe the fundamental concepts of Internet of Things.	[U]
C702.2	Interpret the applications of IoT and identify the Real-World Design Constraints.	[U]
C702.3	Build IoT systems using Arduino, Node MCU and Raspberry Pi.	[AP]
C702.4	Design IoT applications in different domains and analyze their performance.	[AP]
C702.5	Focus on integration of next generation technologies with IoT	[A]
C702.6	Analyze the difficulties of IoT with Cloud computing and identify the imminent technologies to alleviate it.	[A]

Course Contents:

Module 1: Fundamentals and Design Methodology of IoT **15 Hours**

Introduction to IoT – Definition & Characteristics of IoT – Physical Design of IoT – Networks - Cloud Connectors - LAN & WAN- Logical Design of IoT - IoT Enabling Technologies - IoT Levels & Deployment Templates - Domain Specific IoTs – IoT vs M2M – IoT Challenges – IoT systems management with NETCONF-YANG – IoT Design Methodology.

Module 2: System Hardware for IoT **15 Hours**

Sensors & Actuators – Proximity Sensors - Hardware Kits: Arduino, Node MCU, Raspberry Pi. Arduino UNO: Physical Design – Interfaces – Arduino IDE – Arduino Programming with examples - Digital IO – Analog Input – Analog Output – Serial Communication – Condition and Looping statements – Programming using ESP8266 Node MCU. Raspberry Pi: Physical Design – Interfaces – Python programming with Raspberry Pi – Python Packages for IoT.

Module 3: Data Analytics and Cloud for IoT **15 Hours**

Data Analytics for IoT - Tools for IoT- Cloud Basics - loT with Cloud challenges - Fog computing for loT - Edge computing for loT - Cloud security aspects for loT applications. **Case Study:** AWS for IoT - ThingSpeak - AZURE IoT Hub - IBM Watson for IoT - Cyber Physical Systems.

Total Hours **45 hours**

Laboratory Component:

S. No.	List of Experiments
1.	Study and Configuration of Arduino, Node MCU and Raspberry PI.
2.	Basic Programming using Arduino/Raspberry Pi a. LED and Switch Interface b. Analog & Digital Sensor Interface c. Serial Communication d. Local display of sensor data using LCD e. Display of Sensor values in Mobile handset using Bluetooth.
3.	Basic Programming using NodeMCU. a. List all WiFi access-points in surroundings b. Connecting ESP8266 to WiFi Service
4.	Design and development of Weather Monitoring System.
5.	Design and development of Air Pollution Identification System.
6.	Design and development of Automatic Irrigation System.
7.	Design and development of Theft Identification Alert System.
8.	Design and development of Health Abnormality Alert System.
9.	Study of Nano Developer Kit for Edge Computing.

Total Hours 30 Hours

Text Books:

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things: A Hands-on Approach, Universities Press, 2015.
2. Dr. Simon Monk, “Programming the Raspberry Pi: Getting Started with Python”, Second Edition, McGraw-Hill Education, 2016.
3. Dr. Simon Monk, “Programming Arduino: Getting Started With Sketches”, second edition “McGraw-Hill Education, 2016.
4. Rajkumar Buyya, Satish Narayana Srirama, “Fog and Edge computing: Principles and Paradigms”, John Wiley & Sons, 2019.

Reference Books:

1. Gaston C. Hillar “Internet of Things with Python”, Packt Publishing, 2016.
2. Adrian McEwen, “Designing the internet of things”, Wiley Publishers, 2013.

Web References:

1. https://ict.iitk.ac.in/courses/introduction-to-internet-of-things/
2. https://www.ibm.com/in-en/cloud/internet-of-things
3. https://devopedia.org/iot-cloud-platforms

Online Resources:

1. https://www.coursera.org/specializations/iot
2. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
3. https://nptel.ac.in/courses/108/108/108108098/

Tentative Assessment Methods & Levels (based on Revised Bloom’s Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Revised Bloom’s Level	Continuous Assessment Theory			Practical Rubric based CIA [30 Marks]	End Semester Examination (Theory) [40 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]		
Remember	30	30	10	10	10
Understand	30	30	30	30	30
Apply	30	20	30	30	40
Analyse	10	20	30	30	20
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C702.1	3	3	3	2	2	2	2					2	3	2	2
C702.2	3	3	3	2	2	2	2					2	3	2	2
C702.3	3	3	3	2	2	2	2	2	2	2		2	3	2	2
C702.4	3	3	3	3	2	2	2	2	2	2		2	3	2	2
C702.5	3	3	3	3	3	3	3	3	2	2		3	3	2	2
C702.6	3	3	3	2	2	2	2					2	3	2	2

20CSI703 **CLOUD COMPUTING** **3/0/2/4**

Nature of Course H (Theory Technology)

Pre requisites Operating Systems

Course Objectives:

1. To provide the basic concepts of cloud infrastructure.
2. To describe the procedures of virtual data center environment.
3. To discuss resource management, fault tolerance and security aspects of Cloud.
4. To explore Next generation Data center technologies and Cloud API.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C703.1	Describe the characteristics of cloud infrastructure and virtualization	[U]
C703.2	Illustrate the virtual data center's functionalities and cloud computing.	[A]
C703.3	Examine resource management and load balancing techniques of cloud systems.	[AP]
C703.4	Interpret cloud infrastructure management services, storage and security policies.	[AP]
C703.5	Discover the popular cloud services AWS, GCP, AZURE.	[A]

Course Contents:

Module 1: Introduction to cloud Computing **15 Hours**

Evolution of Cloud Computing – Cloud Characteristics and Benefits – Elasticity in Cloud – On-demand Provisioning. **NIST Cloud Computing Reference Model**: Architectural Design Challenges. **Cloud Deployment Models:** Public - Private and Hybrid Clouds. **Service Models:** IaaS – PaaS – SaaS. **Classic Data Center:** Compute-Network-Storage-DBMS-Applications - Intelligent Storage Systems - RAID Techniques-Storage Networking Technologies.

Module 2: Virtualization **15 Hours**

Introduction to Web Service and Service Oriented Architecture – SOAP – REST - A Phased Approach from Classic Data center to Virtual Data center - Basics of virtualization - Para Virtualization - Full virtualization - Hardware Assisted Virtualization – Implementation levels of Virtualization – Benefits of Virtualization Tools and Mechanisms – Virtualization of CPU – Memory – I/O Devices – Virtualized Data Center - Compute-Storage – Networking – Desktop Virtualization – Server virtualization and its Applications.

Module 3: Cloud Management, Storage and Security **15 Hours**

Network – Subnet – Firewall – Network Address Translation – Application Load Balancer - Resource Provisioning and Methods – Cloud Management Products – Cloud Storage – Provisioning Cloud Storage – Managed and Unmanaged Cloud Storage – Cloud Security-Overview-Challenges–Architecture Design – Virtual Machine Security – Application Security – Data Security – Introduction to Hosting Application - Faas - DaaS. **Google App Engine:** Programming Environment for GAE – Architecture of GFS.**Cloud Platforms:** Openstack – Well Architected Framework - AWS - Microsoft Azure – GCP – IBM Cloud - Eucalyptus.

Total Hours 45 hours

Laboratory Component:

S. No.	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, which is 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.	Installation of Openstack.
5.	Installation and configuration of Hadoop.
6.	Implement the following file management tasks in Hadoop: Adding files and directories, retrieving files and deleting files.
7.	Install HIVE and perform CURD operations.
8.	Creating a warehouse application in a website.
9.	Creating a new GCP Console Project.
10.	Implementation of Virtual Data Center in AWS.
11.	Deployment and configuration of Microsoft Azure.

Total Hours 30 Hours

Text Books:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing Principles and Paradigms”,1st edition, Wiley Publishers, 2013.
2. Barrie Sosinsky, “Cloud Computing Bible”, 1st edition, Wiley Publishers, 2011.
3. James Edward Smith, Jim Smith, Ravi Nair, Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier, 17-Jun-2005.

Reference Books:

1. Rittinghouse, John W., and James F. Ransome, Cloud Computing: Implementation, Management and Security‖, CRC Press, 2017.
2. Rajkumar Buyya, Christian Vacchiola, S Thamarai Selvi, “Mastering Cloud Computing”, 1st edition, McGraw Hill, 2013.
3. Toby Velte, Antohy T Velte, Robert Elsenpeter, “Cloud Computing: A Practical Approach”, 1st edition, McGraw Hill, 2009.
4. Tim Mather, Subra Kumaraswamy, Shahed Latif, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance”, 1st edition, O’Reilly, 2010.

Web References:

1. https://www.tutorialspoint.com/cloud_computing/index.htm
2. https://www.w3schools.in/cloud-security-challenges/
3. https://www.ibm.com/security/digital-assets/hybrid-multicloud-ebook/
4. https://d1.awsstatic.com/whitepapers/aws-overview.pdf
5. https://www.javatpoint.com/azure-portal-overview
6. https://docker-curriculum.com/#docker-run

Online Resources:

1. https://www.coursera.org/learn/cloud-computing
2. https://nptel.ac.in/courses/106/105/106105167/

3. https://www.edureka.co/aws-certification-training
4. https://aws.amazon.com/training/learn-about/cloud-practitioner
5. https://www.eduonix.com/courses/Software-Development/Learn-Cloud-Computing-from-Scratch-for-Beginners
6. https://nptel.ac.in/courses/106/104/106104182/

Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy)
Summative assessment based on Continuous and End Semester Examination

Revised Bloom's Level	Continuous Assessment Theory			Practical	End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	Rubric based CIA [30 Marks]	(Theory) [40 marks]
Remember	30	20	20	10	20
Understand	30	30	30	30	20
Apply	20	30	30	40	40
Analyse	20	20	20	20	20
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C703.1	3	3	3	2	2	2	2	2		2		2	3	2	2
C703.2	3	3	3	2	2	2	2	2		2		2	3	2	2
C703.3	3	3	3	3	3	3	3	2		2		2	3	3	3
C703.4	3	3	3	2	2	2	2	2		2		2	3	2	2
C703.5	3	3	3	3	3	3	3	3		2		2	3	3	3

20CSI801 MICROSERVICES AND DISTRIBUTED COMPUTING ARCHITECTURE **3/0/0/3**

Nature of Course G (Theory Analytical)
Pre requisites JEE Framework, Distributed Systems

Course Objectives:

1 To learn service-oriented and micro-services concepts.
2 To understand the technology underlying in micro-services patterns.
3 To represent the Microservice design and operations.
4 To recognize the concepts in Spring Boot Cloud.
5 To produce a Docker package container.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C801.1	Appraise Microservice approaches.	[A]
C801.2	Deploy the Microservice design patterns.	[AP]
C801.3	Compute MicroServices design principles and services.	[A]
C801.4	Practice the basic Spring Boot Cloud.	[A]
C801.5	Develop the Docker container and deploy it.	[AP]

Course Contents:

Module 1: Introduction of Microservices **15 Hours**

Microservices: Introduction of Microservices - Adopting Microservices - Microservices Way. **Microservices Value Proposition:** Microservice Architecture Benefits-Deriving Business Value-Defining a Goal-Oriented Layered Approach-Applying the Goal-Oriented Layered Approach. **Patterns:** Decomposition- Refactoring to microservice- Deployment Patterns-Data Management- Transactional Management - Transactional Messaging – Testing –SAGA- CQRS- Cross Cutting Concerns.

Module 2: Microservice Design and Operations **15 Hours**

Microservice Design Principles: Designing Microservice system- Systems Approach to Microservices- Microservices Design Process. **Microservice Design Foundation:** Goals for Microservices- Operating Principles- Platforms- Shared and Local Capabilities. **Service Design**: Microservice Boundaries - API Design for Microservices- Data and Microservice - Distributed Transactions - Asynchronous Message Passing and Microservices - Dealing with Dependencies. **System Design and Operations:** Independent Deployability -The Role of Service Discovery-The Need for an API Gateway-Monitoring and Alerting

Module 3: Spring Boot Cloud and Docker Platform **15 Hours**

Spring Boot Cloud - Eureka – Resillence4j – Cloud Gateway – Cloud Config – RestController – Data JPA – Feign Client – Slueth – ZipKin – Junit5 - Maven – Visual Studio Code. Docker: Image - Line - Build - Port Mapping - Network - Label - Volume - Process Listing. Image Management and Kubernetes – Pods - Service – Deployments – Secrets - Persistent Volume. Apache Kafka: Introduction - Intra Component Communication - Loose Coupling - EAI Patterns - Stream Processing

Total Hours: 45

Text Books:

1 Microservice Architecture, Aligning Principles, Practices, and Culture, Irakli Nadareishvili, Ronnie Mitra, Matt McLarty, and Mike Amundsen, O'Reilly, 2016

2 Microservices — A Practical Guide, Eberhard Wolff , Createspace Independent Publishing Platform, 2018

Reference Books:

1 Microservices Patterns: With examples in Java, Chris Richardson, Manning; 1st edition, 2018
2 Building Microservices, Sam Newman, O'Reilly, 2015.

3 Designing Data-Intensive applications, The Big Ideas Behind Reliable, Scalable and Maintainable Systems, Martin Kleppmann, O'Reilly, 2017

Web References:

1 https://www.coursera.org/courses?query=microservices
2 https://www.udemy.com/join/signup-popup/?next=%2Fcourse%2Fsubscribe%2F%3FcourseId%3D2005816
3 https://www.udemy.com/join/signup-popup/?next=%2Fcart%2Fcheckout%2Fexpress%2Fcourse%2F3989588%2F%3FdiscountCode%3DIND21PM

Online Resources:

1 https://onlinecourses.nptel.ac.in/noc21_cs14/preview
2 https://www.educative.io/courses/introduction-microservice-principles-concepts?affiliate_id=5073518643380224

Assessment Methods & Levels (based on Blooms'Taxonomy)
Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C801.1,	Analyse	Quiz, Assignment	5
C801.2 & C801.5	Apply	Assignment	10
C801.4 & C801.3	Apply	Case study	5

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment(30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	20	20	10	10
Understand	20	20	20	20
Apply	30	40	40	40
Analyse	30	20	30	30
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C801.1	3	3	2	2	2								3	3	3
C801.2	3	3	3	2	2								3	3	3
C801.3	3	3	3	3	3						3	3	3	3	3
C801.4	3	3	2	2	2			3			3	3	3	3	3
C801.5	3	3	2	2	2			3			3	2	3	2	2

20MGI801 BANKING AND INSURANCE 3/0/0/3

Nature of Course C (Theory Concept)
Pre requisites -

Course Objectives:

1 To enable the students to understand the Banking system in India and to familiarize them with the different banking products
2 To familiarize the students with different aspects of Bank Management
3 To familiarize the students with basics of Insurance business and Insurance products
4 To enable the students understand operations of Insurance companies

Course Outcomes:

Upon completion of the course, students shall have ability to:

C801.1	Understand the role of banks in an economy	[U]
C801.2	Know the different financial products offered by banks	[R]
C801.3	Become familiar with the IT enabled modern banking operations	[AP]
C801.4	Understand the nuances of Insurance business	[U]

Course Contents:

Module 1: Banking Principles and Practices 15 Hours

Indian Financial System - Central Banking Authority - Roles and Functions - Commercial Banks and Financial Intermediaries - Role and functions of SEBI - Deposits types – Concept of CASA - KYC Guidelines - Opening of Accounts for Various Types of Customers: Minors - Joint Account Holders – HUF – Firms – Companies – Trusts - Societies - Approach to Lending - Credit distribution - Principles of good Lending - Credit Products & Facilities – Documentation Procedures – Working Capital Assessment - Priority Sector Lending- Agriculture/SMEs/SHGs/SSI/Tiny Sector –Consortium Financing - Credit Appraisal Techniques – CIBIL Procedures, Important Provisions of RBI Act, 1934 – Salient Features of Banking Regulations Act 1949 and Negotiable Instrument Act 1881 – Overview of Bankers Book of Evidence Act 1879

Module 2: Insurance and Risk Management 15 Hours

Definition of insurance - Characteristics of insurance – Principles of contract of insurance – Fundamental principles of General insurance – Fire insurance – Marine insurance – Motor insurance – Personal accident insurance – Liability insurance –Miscellaneous insurances – Claims settlements, Fundamental principles of Life insurance- Life insurance products – Traditional and unit linked policies – Individual and group policies - With and without profit policies – Types of life insurance policies – Term insurance – Whole life insurance and its variants – Endowment insurance and its variants- Summary provisions of Insurance Act, 1938, Risk Management in Insurance: Risk – Uncertainty – Loss – Perils - Hazards – Insurable risk - Risk retention – Risk Transfer - Underwriting :Meaning and types of Underwriting

Module 3: Fintech in Banking and Insurance 15 Hours

Fintech: An introduction, Regulatory framework in India – Regtech – Mobile Money: MMT, SFM, RTGS, NEFT, NDS – Crypto Currencies: Legal and Regulatory implications - Payment Stacks - Payment Gateways - Anti-Money laundering: KYC to KYD - Regulatory Sandboxes, The future of data-driven finance, Insurtech: Introduction to Insurance Technology, IOT in Insurance, Telematics, Health Informatics, Cryptography and Block-chain, Block-chain applications in records keeping and Insurance claims management– IRDA: Introduction - Purpose – Duties - Powers and Functions – Insurance policyholders' protection under IRDA – Exposure/Prudential norms.

Total Hours: 45

Text Books:

1 SusanneChishtiandJanosBarberis,"TheFINTECHBook:TheFinancialTechnology Handbook for Investors, Entrepreneurs and Visionaries", John Wiley, 1st Edition,2016
2 Gupta, P. K, Insurance and Risk Management, Himalaya Publishing House

3 IIBF, Principles and Practices of Banking, 3 rd Edition, MacMillan Education. 2015
4 IIBF, Legal and Regulatory Aspects of Banking, 3 rd Edition, MacMillan Education. 2015.
5 M.Y.Khan, Indian Financial System, McGraw Hill Education Pvt. Ltd, 9 th Edition, 2015.
6 Preethi Singh, Dynamics of the Indian Financial system: Markets, Institutions and Services, Ane Books Private Ltd. 2015.
7 V.Nitynanada Sharma, Banking and Financial System, Cambridge University Press-New Delhi, 2011.
8 George Rejda, Principles of Risk Management and Insurance, Pearson Education.

Reference Books:

1 M. Y. Khan, Indian Financial System, Tata McGraw-Hill.
2 C. Arthur, William Jr., Michael Smith, Peter Young, Risk Management and Insurance, McGraw-Hill
3 S. Balachandran, General Insurance, Insurance Institute of India.
4 S. Balachandran, Karve, Palav, Life Insurance, Insurance Institute of India
5 Bharti Pathak, Indian Financial System, Pearson Education.
6 Trieschmann, Gustavson, Hoyt, Risk Management and Insurance, South Western College Publishing.
7 Insurance Theory and Pratice , Nalini Prava Tripathy & Prabir Pal, Prentice – Hall of India , Pvt Ltd, New Delhi
8 Agustin Rubini,“ Fintech in a Flash: Financial Technology MadeEasy”,Zaccheus,3rdEdition,2018
9 Theo Lynn, John G. Mooney, Pierangelo Rosati, Mark Cummins, “Disrupting Finance: FinTech and Strategy in the21stCentury”,Palgrave,1stedition, 2018
10 Abdul Rafay, “FinTech as a Disruptive Technology for Financial Institutions”,IGIGlobal,January,2019
11 Bernardo Nicoletti , The Future of Fin Tech: Integrating Finance and Technology in Financial Services, Palgrave Macmillan, August, 2018

Web References:

1 https://bits-pilani-wilp.ac.in/programmes-for-organisation/banking-finance-insurance.php?gclid=Cj0KCQjwkruVBhCHARIsACVIiOyBptIgEvU20VSJvwP72JJxZt46BMHgEen3H1pGtY2SZBcpLbAYYEYaAoUKEALw_wcB
2 https://www.coursera.org/courses?query=banking
3 https://onlinecourses.swayam2.ac.in/cec20_mg08/preview

Online Resources:

1 https://www.youtube.com/watch?v=VLXWRrBkSgk
2 https://www.youtube.com/watch?v=vqmMxbHufQk

Assessment Methods & Levels (based on Blooms' Taxonomy)
Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C801.2	Remember	Quiz	5
C801.1, C801.4	Understand	Assignment	10
C801.3	Apply	Case study	5

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment(30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	30	40	40	40
Understand	40	40	40	40
Apply	30	20	20	20
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C801.1	3	3	2	2	2			3					3	2	2
C801.2	3	3	3	2	2								3	3	3
C801.3	3	3	3	3	3	2		3			3	3	3	3	3
C801.4	3	3	2	2	2	2		3			3	3	3	3	3

20CSI802	MACHINE LEARNING	3/0/2/3

Nature of Course	F (Theory Programming)
Pre requisites	Data Warehousing and Mining

Course Objectives:

1. To learn the concepts of Machine Learning.
2. To apply the concepts and algorithms of Supervised and unsupervised learning.
3. To understand the theoretical aspects of Graphical Models.
4. To analyze machine learning algorithms in advanced learning.
5. To develop skills of using machine learning algorithms for solving practical problems.

Course Outcomes

Upon completion of the course, students shall have ability to

C802.1	Design a learning model appropriate to the application	[A]
C802.2	Deploy a Neural Network for an application of your choice	[AP]
C802.3	Implement Probabilistic Discriminative and Generative algorithms for an application of your choice and analyze the results.	[AP]
C802.4	Implement Clustering algorithms for different types of applications.	[AP]
C802.5	Analyse the suitable perceptron model for learning.	[A]
C802.6	Devise deep learning algorithms for various types of learning models.	[AP]

Course Contents:

Module 1: Introduction to Machine Learning and Supervised Learning 15 Hours

Machine Learning – Types of Machine Learning – Machine Learning process - Preliminaries - Probability theory – Probability Distributions – Decision Theory - Linear Models for Regression. **Supervised Learning:** Linear Models for Classification - Discriminant Functions - Probabilistic Generative Models - Probabilistic Discriminative Models – Decision Tree Learning – Bayesian Learning - Ensemble Methods - Multi-layer Perceptron - Feed- forward Network - Error Back propagation - Support Vector Machines.

Module 2: Unsupervised and Probabilistic Graphical Models 15 Hours

Un-Supervised Learning: Clustering- K-means – EM Algorithm- Mixtures of Gaussians – Dimensionality Reduction - Linear Discriminant Analysis - Factor Analysis - Principal Components Analysis - Independent Components Analysis. **Probabilistic Graphical Models**: Undirected Graphical Models – Markov Random Fields – Directed Graphical Models –Bayesian Networks – Conditional Independence properties – Markov Random Fields Hidden Markov Models – Conditional Random Fields(CRFs).

Module 3: Deep Learning 15 Hours

Introduction to Biological Neuron - Idea of computational units - McCulloch-Pitts unit and Thresholding logic - Linear Perceptron - Perceptron Learning Algorithm - Linear separability - Convergence theorem - Perceptron Learning Algorithm - Regularization - Deep Learning- Optimization for Training Deep Models.

Total Hours 45 Hours

Laboratory Component:

S. No	List of Experiments
1.	Solving Regression & Classification using Decision Trees
2.	Root Node Attribute Selection for Decision Trees using Information Gain
3.	Bayesian Inference in Gene Expression Analysis
4.	Pattern Recognition Application using Bayesian Inference
5.	Bagging in Classification
6.	Bagging, Boosting applications using Regression Trees
7.	Data & Text Classification using Neural Networks
8.	Using Weka tool for SVM classification for chosen domain application
9.	Data & Text Clustering using K-means algorithm
10.	Data & Text Clustering using Gaussian Mixture Models

Total Hours 30 Hours

Text Books:

1. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer, 2007.
2. Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, Chapman and Hall, CRC Press, Second Edition, 2014.
3. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
4. Goodfellow, I., Bengio,Y., and Courville, A, “Deep Learning”, MIT Press, 2016.

Reference Books:

1. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.
2. Tom Mitchell, “Machine Learning”, McGraw-Hill, 1997.

Web References:

1. https://www.coursera.org/learn/machine-learning
2. https://www.edx.org/learn/machine-learning
3. https://onlinecourses.nptel.ac.in/noc21_cs24/preview

Online Resources:

1. https://www.youtube.com/playlist?list=PLOU2XLYxmsIIuiBfYad6rFYQU_jL2ryal
2. https://www.youtube.com/playlist?list=PLD0F06AA0D2E8FFBA

Tentative Assessment Methods & Levels (based on Revised Bloom's Taxonomy
Summative assessment based on Continuous and End Semester Examination

Revised Bloom's Level	Continuous Assessment Theory			Practical Rubric based CIA [30 Marks]	End Semester Examination (Theory) [40 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]		
Remember	40	20	10	10	20
Understand	30	20	20	30	20
Apply	20	40	40	40	30
Analyse	10	20	30	20	30
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C802.1	3	3	3	2	2	1			3		2		3	3	2
C802.2	3	3	3	2	2	1			3		2		3	3	3
C802.3	3	3	3	2	2	1			3		2		3	3	3
C802.4	3	3	3	2	2	1			2		3		3	3	2
C802.5	3	3	3	2	2	1			2		2		3	3	2
C802.6	3	3	3	2	2	1			3		2		3	3	2

20CSI901 FRONT END FRAMEWORKS ENGINEERING 3/0/2/4

Nature of Course D (Theory Application)
Prerequisites JEE Frameworks, PHP & JS Frameworks

Course Objectives:

1. To understand the fundamentals of HTML5 and CSS3.
2. To provide the basic concept of ES6 and its functions.
3. To build simple application using React JS.
4. To explore the techniques of Reactive extension of JS and React Testing.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C901.1	Analyze the fundamentals of HTML5 and CSS3.	[A]
C901.2	Articulate the concept of ES6 and its functions.	[AP]
C901.3	Design applications using the various React Components.	[AP]
C901.4	Demonstrate the form validations in various applications.	[AP]
C901.5	Focus on integration of React Hooks and unit testing library.	[A]

Course Contents:

Module 1: Basics of Web and Front End Framework 15 Hours

HTML5 and CSS3: Introduction - Media Queries - Bootstrap - Layouts – **JavaScript:** Call back, Promise, Async & Await - Var vs Let, IIFE - DOM - HTTP Cookies & Sessions - Authentication - Responsive Design - Ajax Web Application - **ES6:** Variables - Loops - Operators Scope - Hoisting - Arrays - Spread - DeStructuring - Class - Inheritance - Functions and Methods - Extended Class - Map, Filter and Reduce Functions - Arrow Functions - Lambda Expressions - Map/Weak Map - **NodeJS:** Introduction - Package.json – Node Package Manager.

Module 2: Front End Framework-I 15 Hours

ReactJS: Introduction - JSX – Modular Project Structure - State and Props - PropTypes - Class Components - Class vs Functional Components - Auxillary Components - Controlled and Uncontrolled Components - Component Interaction - Iteration & Conditional Response - Event Bubbling - Component Wrapper - Integration of CSS Modules - YUP and Formik Forms Validations - Events Handling - Data Binding.

Module 3: Front End Framework-II 15 Hours

Reactive extension for JavaScript (RxJS): React Hooks - Custom Hooks - FromFetch – Axios – Services - BehaviorSubjects - StateLess, StateFull and Container Components - Error Handling – Env - CORS - React Unit Testing Library - Deployment to Cloud based Server - Introduction to i18N - Routes & Navigation - LazyCache - IDE Setup - Debugging using Browser or IDE.

Lab Exercises:

1. **HTML LAYOUTS AND LINKS**
   a. Develop a web application to control over different layouts.
   b. Create a webpage with HTML describing your department use paragraph and list tags.
   c. Apply various colors to suitable distinguish key words, also apply font styling like italics, underline and two other fonts to words you find appropriate, also use header tags.
   d. Create links on the words e.g. “Wi-Fi” and “LAN” to link them to Wikipedia pages.
2. **WEB APPLICATION DESIGN FORMATTING**
   a. Develop a web application with background banner image and navigation menus.
   b. Develop a web application with responsive images.
   c. Develop a web application using left menu.
   d. Develop setting to change the theme of entire web Application
3. **INTRODUCTION TO INTERACTIVE FORMS AND AJAX DATA BINDING**
   a. Developing Web Page Styles using JavaScript and CSS.
   b. Develop Script interactive forms.
   c. Data binding using Ajax.
4. **REACT ENVIRONMENT SETUP**
   a. Setting up development environment.
   b. Integration with Existing Apps.
   c. Running on Device.
   d. Debugging.
   e. Testing.
   f. Write source code using Typescript.
5. **PROGRAMMING WITH REACT**
   a. Basics Interactive examples.
   b. Function Components and Class Components.
   c. React Native Fundamental, Handling Text Input.
   d. Using a scroll View, using List View.
   e. Platform Specific Code.
6. **BUILD A DRUNKEN SNAKE GAME USING HOOKS**
   a. Introduction and scaffolding the project.
   b. Components, Props and Styles.
   c. State and Lifecycle Events.
   d. Extended Game Functionality.
   e. Finishing up and Deployment.

Total Hours: 75

Text Books:

1. David Durocher, HTML / CSS Quick Start Guide: The Simplified Beginners Guide to Developing a Strong Coding Foundation, Building Responsive Websites, and Mastering the Fundamentals of Modern Web Design, 2021.
2. Juha Hinkula, Full Stack Development with Spring Boot and React: Build Modern and Scalable Full Stack Applications Using the Power of Spring Boot and React, 3rd Edition, 2022.
3. Lamis Chebbi, Reactive Patterns with RxJS for Angular: A Practical Guide to Managing Your Angular Application's Data Reactively and Efficiently Using RxJS 7, 2022.

Reference Books:

1. Chris Minnick, JavaScript All-in-One For Dummies, 2023.
2. Thomas Findlay, React - The Road To Enterprise, 2022.
2. Brijen Makwana, React Hooks 101, 2022.

Web References:

1. https://www.w3schools.in/html5tutorials/
2. https://www.freecodecamp.org/news/write-less-do-more-with-javascript-es6-5fd4a8e50ee2/
3. https://reactjs.org/
4. https://www.sleeplessyogi.com/posts/html-to-react-the-ultimate-guide-free-lessons

Online Resources:

1. https://www.theknowledgeacademy.com/in/offers/reactjs-programming-certification-training-course/?utm_term=reactjs%20course&utm_campaign=%5BReact%5D%5BIN%5D&utm_source=adwords&utm_medium=ppc&hsa_acc=9865744776&hsa_cam=15982693323&hsa_grp=1308419199541468&hsa_ad=&hsa_src=o&hsa_tgt=kwd-81776387944495:loc-90&hsa_kw=reactjs%20course&hsa_mt=p&hsa_net=adwords&hsa_ver=3&utm_content=%5BReactjs%5D%5BCourses%5D
2. https://www.koenig-solutions.com/reactjs-training-course?keyword=%2BReact%20%2Bcourses&device=c&utm_device=c&msclkid=86abf5b22dd21f7f204d962a3536167e&utm_source=bing&utm_medium=cpc&utm_campaign=Rest%20of%20India&utm_term=%2BReact%20%2Bcourses&utm_content=Reactjs%20Training%20-%20India
3. https://reactjs.org/community/courses.html
4. https://www.coursera.org/courses?query=react

Assessment Methods & Levels (based on Blooms' Taxonomy)					
Summative assessment based on Continuous and End Semester Examination					
Bloom's Level	**Continuous Assessment**				**End Semester Examination Theory [40 marks]**
	Theory			**Practical**	
	CIA-1 [10 marks]	**CIA-2 [10 marks]**	**CIA-3 [10 marks]**	**Rubric based CIA [30 Marks]**	
Remember	30	20	20	20	30
Understand	30	30	20	30	30
Apply	20	30	30	50	20
Analyse	20	20	30	-	20
Evaluate	-	-	-	-	-
Create	-	-	-	-	-

Course Outcome (CO)	**Programme Outcomes (PO)**												**Programme Specific Outcomes (PSO)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C901.1	3	3	3	2		2		2	3			3	3	3	2
C901.2	3	3	3	2		2		2	3			3	3	3	2
C901.3	3	3	3	2		2		2	3			3	3	3	2
C901.4	3	3	3	2		2		2	3			3	3	3	2
C901.5	3	3	3	2		2		2	3			3	3	3	2

20CSI911 **MOBILE AD HOC NETWORKS** **3/0/0/3**

Nature of Course H(Theory Technology)
Pre requisites Computer Networks

Course Objectives:

1	To understand the principles of sensor networks and mobile ad hoc networks, and their impact on protocol design
2	To develop MAC and routing protocols for sensor and mobile networks
3	To develop efficient protocols for sensor and mobile networks
4	To understand and develop information dissemination protocols for sensor and mobile network

Course Outcomes:

Upon completion of the course, students shall have ability to

C911.1	Demonstrate the Knowledge of routing mechanisms and the three classes of approaches: proactive, on-demand, and hybrid	[AP]
C911.2	Identify the issues and challenges in providing QoS.	[AP]
C911.3	Interpret the energy management techniques in adhoc networks.	[A]
C911.4	Demonstrate various types of mesh networks.	[AP]
C911.5	Discuss about sensor networks.	[U]

Course Contents:

Module 1: Introduction **15 Hours**

Cellular and Ad hoc wireless networks – Issues of MAC layer and Routing – Proactive - Reactive and Hybrid Routing protocols – Multicast Routing – Tree based and Mesh based protocols – Multicast with Quality of Service Provision. **QUALITY OF SERVICE:** Real-time traffic support – Issues and challenges in providing QoS – Classification of QoS Solutions – MAC layer classifications – QoS Aware Routing Protocols – Ticket based and Predictive location based QoS Routing Protocols

Module 2 : Energy Management Ad Hoc Networks **15 Hours**

Need for Energy Management – Classification of Energy Management Schemes – Battery Management and Transmission Power Management Schemes – Network Layer and Data Link Layer Solutions – System power Management schemes.

Module 3: Mesh Networks **15 Hours**

Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture – Opportunistic Routing – Self Configuration and Auto Configuration - Capacity Models – Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks. **SENSOR NETWORKS:** Introduction – Sensor Network architecture – Data Dissemination – Data Gathering –MAC Protocols for sensor Networks – Location discovery – Quality of Sensor Networks –Evolving Standards – Other Issues – Recent trends in Infrastructure less Networks

Total Hours: 45

Text Books:

1. C. Siva Ram Murthy, and B. S. Manoj, "AdHoc Wireless networks ", Pearson Education - 2008.
2. Amitabh Mishra “Security and Qualityof Service in Adhoc Wireless Networks”, Cambridge University Press, 2008.
3. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2008.

Reference Books:

1. Feng Zhao and Leonidas Guibas, “Wireless Sensor Networks”, Morgan Kaufman Publishers, 2004.
2. C.K. Toh, “Adhoc Mobile Wireless Networks”, Pearson Education, 2002.
3. Thomas Krag and Sebastin Buettrich, ‘Wireless Mesh Networking’, O’ Reilly Publishers

Web References:

1. https://tutorialspoint.dev/computer-science/computer-network-tutorials/manet-mobile-ad-hoc-network
2. https://www.geeksforgeeks.org/introduction-of-mobile-ad-hoc-network-manet/

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105160/
2. https://www.coursera.org/lecture/iot/lecture-3-2-manets-ED6nz
3. https://ict.iitk.ac.in/courses/wireless-ad-hoc-and-sensor-networks/

Assessment Methods & Levels (based on Blooms’ Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C911.1	Apply	Case Study	5
C911.2	Apply	Case Study	5
C911.3& C911.5	Understand	Quiz	5
C911.4	Apply	Group Assignment	5

	Continuous Assessment			End Semester
Bloom’s Level	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	Examination [50 Marks]
Remember	20	20	20	20
Understand	30	20	20	20
Apply	50	30	30	30
Analyse	-	30	30	30
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C911.1	3		3	2		3	3	2		3		2	3	2	
C911.2		3			3									3	2
C911.3	3	3	3	3		3	2			2				2	
C911.4		2			3								3	3	2
C911.5		2	2	2	2	2	2			2		2	3	3	2

20CSI912 **MOBILE COMPUTING** **3/0/0/3**

Nature of Course H (Theory Technology)
Pre requisites Computer Networks

Course Objectives:

1 To learn the fundamental concepts of mobile computing.
2 To understand the technologies and architecture of mobile telecommunication system
3 To be familiar with the network layer protocols and ad hoc networks.
4 To know the basis of transport and application layer protocols.
5 To gain knowledge about different mobile platforms and application development.

Course Outcomes:

Upon completion of the course, students shall have ability to

C912.1	Describe the basics of mobile computing and mobile communications technologies.	[U]
C912.2	Determine mobility support architecture, mobility management and location management.	[U]
C912.3	Interpret the functionalities of network, application and transport layers and identify routing protocols for adhoc networks	[AP]
C912.4	Focus and apply working knowledge on mobile computing platforms, technologies and mobile application protocols	[A]
C912.5	Illustrate use of mobile transaction models and mobile commerce to develop mobile content applications. .	[AP]

Course Contents:

Module 1: Introduction **15 Hours**

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies- Multiplexing – Spread spectrum -MAC Protocols – SDMA- TDMA- FDMA- CDMA. Mobile Telecommunication System: Introduction to Cellular Systems – GSM – Services & Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security – GPRS- UMTS – Architecture – Handover – handoff - types of handoffs - Location management - HLR-VLR scheme - hierarchical scheme - predictive location management schemes -Security.

Module 2: Mobile Network Layer: **15 Hours**

Mobile Computing, Mobile IP, Cellular 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. **Mobile Transport And Application Layer :**Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML.

Module 3: Mobile Platforms, Applications, Mobile Transaction Models **15 Hours**

Mobile Device Operating Systems – Special Constraints & Requirements – Commercial Mobile Operating Systems – Software Development Kit. Mobile Computing-technological prospective: 1G, 2G and 3G,4G,5G Communications network and services - the Internet - mobile computing and cellular telephony - voice and data services on 3G networks - battery problem and power dissipation, low energy processors. Mobile Transaction and Commerce:-Models for mobile transaction-Kangaroo and joey transactions - team transaction. Recovery model for mobile transactions. Electronic payment and protocols for mobile commerce- MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues**. Case study:** Evolution of 5G and 6G Technologies**.**

Total Hours: 45

Text Books:

1. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals Of Mobile Computing”, Second Edition, PHI Learning, 2015.
2. Jochen Schiller, “Mobile Communications”, Pearson Education, 2008.
3. Raj Kamal,” Mobile Computing”, Third Edition, Oxford University Press, 2018.
4. William Stallings, “Wireless Communications and Networks”, Pearson Education, 2013.

Reference Books:

1. Frank Adelstein, S.K.S. Gupta, Golden G. Richard III and Loren Schwiebert, “Fundamentals of Mobile and Pervasive Computing”, McGraw-Hill Professional, 2005.
2. Asoke K Telukder, Roopa R Yavagal, “Mobile Computing”, TMH, 2011.
3. Kumkum Garg, “Mobile Computing Theory and Practice”, Pearson Education, 2010.

Web References:

1. http://www.mi.fu-berlin.de/inf/groups/ag-tech/teaching/resources/Course-Material.html#MC
2. https://www.mi.fu-berlin.de/inf/groups/ag-tech/teaching/resources/Mobile_Communications/course_Material/C01-Introduction.pdf

Online Resources:

1. https://www.coursera.org/learn/smart-device-mobile-emerging-technologies
2. https://www.cse.iitb.ac.in/~mythili/teaching/cs653_spring2014/index.html
3. https://www.tutorialspoint.com/mobile_computing/index.htm
4. https://www.coursera.org/lecture/iot-wireless-cloud-computing/5-12-mec-mobile-edge-computing-gVIbr

Assessment Methods & Levels (based on Blooms’ Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C912.1-2	Understand	Quiz	5
C912.3	Apply	Assignment	5
C912.4	Analyse	Case Study	5
C912.5	Apply	Group Assignment	5

Assessment Methods & Levels (based on Blooms’ Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment Theory			End Semester Examination Theory [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	30	30	30	30
Analyse	20	20	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment Total		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C912.1	3	2	3				2	2				3	3	2	2
C912.2	2	2	3		2	2	2					3	2	2	2
C912.3	2	2	3	2	3		2			2		3	2	3	2
C912.4	2	2	3	2		2	2		2				2	2	2
C912.5	2	2		2	3	3	2		2	2	2	3	2	3	2

20CSI913 **DISTRIBUTED SYSTEMS** **3/0/0/3**

Nature of Course G (Theory Analytical)
Pre requisites -

Course Objectives:

1 To understand the foundations of distributed systems
2 To discuss the various communications in distributed systems
3 To learn issues related to clock synchronization and the need for global state in distributed systems
4 To explore the fault tolerance and deadlock handling mechanisms.
5 To learn the characteristics of distributed shared memory and distributed file systems

Course Outcomes:

Upon completion of the course, students shall have ability to:

C913.1	Understand the representation, challenges and system models for distributed systems	[U]
C913.2	Illustrate the communication in distributed systems.	[AP]
C913.3	Understand the significance of synchronization, consistency and replication.	[U]
C913.4	Analyze fault tolerance and recovery in distributed systems	[A]
C913.5	Apply distributed algorithms for deadlock prevention and detection.	[AP]
C913.6	Analyze the design and functioning of distributed shared memory and distributed file systems	[A]

Course Contents:

Module 1: Introduction and Communication **15 Hours**

Definition, Examples - Resource sharing and the Web – Challenges - System models - External data representation and marshaling. **Communication:** Message Passing - Message format - Message Buffering- Remote Procedure Call - Remote Object Invocation - Message Oriented Communication - Stream oriented communication and Multicast Communication

Module 2: Synchronization and Fault tolerance **15 Hours**

Clock synchronization - Logical clocks - Mutual exclusion - Global positioning of nodes - Election algorithms. **Consistency and Replication:** Consistency models - Replica management - Consistency protocols. **Fault tolerance**: Introduction - process resilience - reliable client server communication - reliable group communication - distributed commit - recovery.

Module 3: Deadlocks, DSM, DFS **15 Hours**

System model - Handling deadlocks - Deadlock avoidance - Deadlock prevention - Centralized deadlock detection - Distributed deadlock detection. **Distributed Shared Memory**: Introduction - General architecture - Design issues - Design and implementation of DSM. **Distributed File Systems:** Requirements - File service architecture - Scalable performance -Load balancing and availability. **Case Studies:** Dropbox - Google FS (GFS) - Resilient Distributed Datasets (RDDs)

Total Hours: 45

Text Books:

1 George Coulouris, Jean Dollimore, Tim Kindberg and Gordon Blair, “Distributed Systems: Concepts & Design”, Pearson Education, 5th Edition, 2017
2 Andrew Tanenbaum, Maarten Van Steen, "Distributed Systems: Principles and Paradigms", Prentice Hall, 3rd Edition, 2017
3 Singhal and Shivratri, "Advanced Concept in Operating Systems", McGraw Hill, 2015.

Reference Books:

1 Sunita Mahajan, Seema Shah, “ Distributed Computing”, Oxford, second edition, 2013
2 Pradeep K. Sinha, “Distributed Operating Systems”, Prentice Hall of India Private, 2012.
3 Fokkink W., “Distributed algorithms: an intuitive approach”, MIT Press, 2nd Edition, 2018

Web References:

1 https://nptel.ac.in/courses/106106168/
2 https://www.udemy.com/share/102lB2/
3 https://www.classcentral.com/course/distributed-database-11170

Online Resources:

1 https://www.wiziq.com/tutorials/distributed-computing
2 https://www.tutorialspoint.com/apache_spark/apache_spark_rdd.htm
3 https://www.tutorialspoint.com/hadoop/hadoop_introduction.htm

Assessment Methods & Levels (based on Blooms’Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C913.2-5	Apply	Assignment	10
C913.6	Analyse	Case Study	5
C913.1-6	Understand	Online Quiz	5

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment(30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	20	20	20	20
Understand	40	30	30	30
Apply	40	30	30	40
Analyse	-	20	20	10
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C913.1	3	3	3			2						2	3		2
C913.2	2	2	2			2						2	2		2
C913.3	2	2	2			2						2	2		2
C913.4	2	2	2			2						2	2		2
C913.5	3	3	3			2						2	3		2
C913.6	3	3	3			2						2	3		2

20CSI914 WIRELESS SENSOR NETWORKS 3/0/0/3

Nature of Course G (Theory Analytical)
Pre requisites Computer Networks

Course Objectives:

1. To obtain a broad understanding of the technologies and applications for the emerging and exciting domain of wireless sensor networks
2. To study the challenges and latest research results related to the design and
3. To focus on network architectures and energy efficiency
4. To study the concept of Time Synchronization and Localization
5. To focus on Routing Protocols and Operating Systems

Course Outcomes

Upon completion of the course, students shall have ability to

C914.1	Learn the basics of wireless sensor networks and its applications in enabling technologies.	[R]
C914.2	Understand the architecture and elements of wireless sensor networks	[U]
C914.3	Analyzing the idea on MAC protocols for wireless sensor networks.	[A]
C914.4	Apply the concept of Topologies, Synchronization and Localization for sensor networks	[AP]
C914.5	To be able to understand the various routing protocols and tools needed to establish sensor networks	[U]

Course Contents:

Module 1: Overview of Wireless Sensor Networks 15 Hours

Challenges for Wireless Sensor Networks - Enabling Technologies for Wireless Sensor Networks – WSN Standards-EEE 802.15.4 -Zigbee.Single-Node Architecture: Hardware Components - Energy Consumption of Sensor Nodes - Operating Systems and Execution Environments -Network Architecture: Sensor Network Scenarios - Optimization Goals and Figures of Merit -Gateway Concepts

Module 2: Time Synchronization and Localization 15 Hours

MAC Protocols for Wireless Sensor Networks - S-MAC –B-MAC- Wakeup radio concepts -Introduction to the time synchronization problem - Protocols based on sender/receiver synchronization - Single-hop localization - Positioning in multi-hop environments - Topology-control: Aspects of topology-control algorithms

Module 3: Routing Protocols and Operating Systems 15 Hours

Energy-Efficient unicast - Broadcast and multicast - Geographic Routing- Mobile nodes -Operating Systems for Wireless Sensor Networks: Operating System Design Issue - Examples of Operating Systems: Tiny OS, Mate, Magnet OS and OSPM - Application specific support: Target detection and tracking, Sensor Node Hardware –Tmote - Micaz.

Total Hours: 45 Hours

Text Books:

1 Holger Karl and Andreas Willig, Protocols And Architectures for Wireless Sensor Networks, John Wiley,2007.
2 Kazem Sohraby, Daniel Minoli and Taieb Znati, Wireless Sensor Network- Technology, Protocols and Applications, John Wiley, 2007

Reference Books:

1 Feng Zhao and Leonidas J. Guibas, Wireless Sensor Networks - An Information Processing Approach", Elsevier, 2007.
2 Anna Hac, Wireless Sensor Network Designs, John Wiley, 2004.
3 Bhaskar Krishnamachari, Networking Wireless Sensors, Cambridge Press, 2009.

Web References:

1 http://www.tfb.edu.mk/amarkoski/WSN/Kniga-w02
2 http://profsite.um.ac.ir/~hyaghmae/ACN/WSNbook.pdf

3 https://www.semanticscholar.org/paper/Protocols-and-Architectures-for-Wireless-Sensor-Karl-Willig/d223f7f7b11c10a7e3fd84bad731acda5277378d
4 http://ijcttjournal.org/Volume4/issue-8/IJCTT-V4I8P194.pdf
5 https://cse.iitkgp.ac.in/~smisra/course/wasn.html
6 https://www.iith.ac.in/~ubdesai/WSN_Roadmap_Final_%20Report.pdf

Online Resources:

1 https://www.coursera.org/lecture/internet-of-things-history/sensor-networks
2 https://nptel.ac.in/courses/108/108/108108147/
3 https://nptel.ac.in/courses/106/105/106105160/
4 https://www.coursera.org/learn/wireless-communications
5 https://www.coursera.org/lecture/computer-networking/introduction-to-wireless-networking-technologies-RgXEN
6 https://www.youtube.com/watch?v=PVH1K1Eocz0

Assessment Methods & Levels (based on Bloom's Taxonomy)
Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C914.1	Remember	Quiz	3
C914.2	Understand	Quiz	3
C914.3	Analyse	Group Assignment	5
C914.4	Apply	Group Assignment	5
C914.5	Understand	Class Presentation	4

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination [50 marks]
	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	
Remember	50	20	30	30
Understand	50	20	30	30
Apply	-	30	20	20
Analyse	-	30	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C914.1	3	3			2	1	1			2		1	3	1	1
C914.2	3	3	2		2	2	1			2		2	3	2	1
C914.3	3	2	2		2	2	2			2		2	3	2	3
C914.4	3	3	3		2	2	2			3		3	2	3	1
C914.5	3	3	3		3	2	2			2		3	2	2	2

20CSI915 **CYBER SECURITY AND ETHICAL HACKING** **3/0/0/3**

Nature of Course D (Theory Application)
Pre requisites Computer Networks, Operating systems

Course Objectives:

1 To provide the knowledge on foundations and vulnerabilities of Cyber Security
2 To introduce symmetric and Asymmetric Cryptography and message authentication techniques
3 To create awareness on cyber laws and forensics.
4 To deliver insights on Ethical Hacking and various attacks.

Course Outcomes:

Upon completion of the course, students shall have ability to

C915.1	Discuss the foundations of Cyber Security Concepts.	[U]
C915.2	Identify the vulnerabilities in the given Information system.	[AP]
C915.3	Demonstrate the cryptography techniques.	[AP]
C915.4	Interpret Cyber law and Forensics	[U]
C915.5	Discriminate ethical hacking techniques	[A]

Course Contents:

Module 1: Foundations of Cyber Security Concepts **15 Hours**

Essential Terminologies: CIA – Risks – Breaches – Threats – Attacks - Exploits. **Cyber Security Vulnerabilities:** Internet Security - Cloud Computing & Security - Social Network sites security - Cyber Security Vulnerabilities-Overview - vulnerabilities in software - System administration - Complex Network Architectures - Open Access to Organizational Data - Weak Authentication – Authorization - Unprotected Broadband communications - Poor Cyber Security Awareness. OWASP & application vulnerabilities.

Module 2: Cyber Laws and Forensics **15 Hours**

Introduction - Cyber Security Regulations - Roles of International Law - the state and Private Sector in Cyberspace - Cyber Security Standards. The INDIAN Cyberspace - National Cyber Security Policy 2013. Introduction to Cyber Forensics - Need of Cyber Forensics - Cyber Evidence - Documentation and Management of Crime Sense - Image Capturing and its importance - Partial Volume Image - Web Attack Investigations - Denial of Service Investigations - Internet Crime Investigations - Internet Forensics - Steps for Investigating Internet Crime, Email Crime Investigations.

Module 3: Introduction to Ethical Hacking **15 Hours**

LINUX and Networking, Doxing - Website/ IP information Gathering - Network Mapping o Google Hacking - d Discovering IP Range and Open Port - Identifying Target Operating System and Services - Secure Bypassing Firewalls while Scanning - Understanding Wireless Networks - Deauthentication attack - Fragmentation Attacks - Chop Chop attack - Fake authentication - Evil Twin Attack - Cafe-latte attack - Reveal Hidden SSID's - WPA and WPA2 wireless password - hacking techniques - Cracking Wireless Passwords using Rainbow tables - Brute force techniques

Total Hours: 45

Text Books:

1. William Stallings, Cryptography and Network Security, 7th Edition, Pearson Education, March 2017.
2. Bothra Harsh, "Hacking", Khanna Publishing House, Delhi, 2017.
3. V.K. Pachghare, "Cryptography and Information Security", PHI Learning, 2019.
4. Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi.

Reference Books:

1. Atul Kahate, “Cryptography and Network Security”, Tata McGraw Hill, 2011.
2. Nina Godbole, “Information System Security”, Wiley, 2008
3. The basic of Hacking and Penetration testing : Ethical hacking and penetration by Patrick Engebretson, 2013
4. The Art of service, “OWASP A Complete Guide”, OWASP publishing- 2021 edition

Web References:

1. https://www.eckovation.com/course/ethical-hacking-and-cyber-security
2. https://nptel.ac.in/courses/106105217/
3. https://owasp.org/www-project-web-security-testing guide/assets/archive/OWASP_Testing_Guide_v4.pdf

Online Resources:

1. https://swayam.gov.in/nd2_nou19_cs08
2. https://swayam.gov.in/nd1_noc19_cs68

Assessment Methods & Levels (based on Blooms’ Taxonomy)
Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C915.1-2	Apply	Quiz	5
C915.3	Apply	Assignment	5
C915.4	Understand	Case Study (Indian Cyberspace)	5
C915.5	Analyse	Mini Project	5

Assessment Methods & Levels (based on Blooms’ Taxonomy)
Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment Theory			End Semester Examination Theory [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	30	30	30	30
Analyse	20	20	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment Total		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C915.1	3	3	3				2	3				3	3	2	2
C915.2	3	3	3		2	2	2	2				3	2	2	3
C915.3	3		3	3	3		2			2		3	2	3	3
C915.4	3		3	2		2	2	3	2				2	2	3
C915.5	3	3		3	3	3	2	2	2	2	2	3		3	3

20CSI916 **ADVANCED DATABASE** **3/0/0/3**

Nature of Course D (Theory Application)
Pre requisites Database Management Systems

Course Objectives:

1	To distinguish the parallel and distributed database
2	To classify the different types of NoSQL database
3	To understand the usage and applications of object relational database
4	To explain the importance of temporal and spatial database

Course Outcomes:

Upon completion of the course, students shall have ability to

C916.1	Distinguish parallel and distributed database and Identify the database based on the application	[U]
C916.2	Define, compare and use the four types of NoSQL Databases	[U]
C916.3	Design the model to represent the real world data using object oriented database	[AP]
C916.4	Design a semantic based database to meaningful data access	[AP]
C916.5	Test the rule set in the database to implement intelligent databases	[A]

Course Contents:

Module 1: Parallel and Distributed Databases **15 Hours**

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures –Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts –Distributed Data Storage –Transaction management in distributed data storage- Transaction compensation mechanism – Commit Protocols – Concurrency control in Distributed Query Processing-In memory database-Data as Service- Basic Properties of NoSQL- Eventual Consistency-CAP theorem- Types of NoSQL.

Module 2: Object Relational Database **15 Hours**

Concepts for Object Databases: Object Identity – Object structure – Type Constructors – Encapsulation of Operations – Methods – Persistence – Type and Class Hierarchies – Inheritance – Complex Objects – Object Database Standards, Languages and Design: ODMG Model – ODL – OQL – Object Relational and Extended – Relational Systems: Object Relational features in SQL/Oracle

Module 3: Intelligent Databases **15 Hours**

Active Databases: Syntax and Semantics (Starburst, Oracle, DB2)- Taxonomy- Applications- Design Principles for Active Rules- Temporal Databases: Overview of Temporal Databases- TSQL2- Deductive Databases: Logic of Query Languages – Datalog- Recursive Rules- Syntax and Semantics of Datalog Languages- Implementation of Rules and Recursion- Recursive Queries in SQL- Spatial Databases- Spatial Data Types- Spatial Relationships- Spatial Data Structures-Spatial Access Methods- Spatial DB Implementation.

Total Hours: 45

Text Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, “Database System Concepts”, Seventh Edition, McGraw-Hill, 2020
2. Ramez Elmasri and Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2016.
3. Gaurav Vaish, “Getting Started with NoSQL”, Packt Publishing, March 2013
4. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, ”Advanced Database Systems”, Morgan Kaufmann publishers,2006.

Reference Books:

1. Peter Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, McGraw Hill, Third Edition 2014
2. Peter Morris,Rob, Carlos Coronel, “Database Systems – Design, Implementation and Management”, 9th Edition, Thomson Learning, 2009.

Web References:

1. https://link.springer.com/chapter/10.1007%2F0-387-27544-4_6
2. https://www.comp.nus.edu.sg/~lingtw/cs4221/oodbms.concepts.pdf
3. https://www.youtube.com/playlist?list=PLwZJjHGjgrZqJ9yQZ-WJb5gBJcKMr9iXP
4. https://docs.microsoft.com/en-us/sql/relational-databases/in-memory-database?view=sql-server-ver15

Online Resources:

1. https://www.udemy.com/database-management-system
2. https://www.coursera.org/learn/database-management
3. https://www.coursera.org/learn/introduction-mongodb

Assessment Methods & Levels (based on Blooms’ Taxonomy)
Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C916.1	Understand	Quiz	2
C916.2	Understand	Quiz	3
C916.3	Apply	Assignment	5
C916.4	Apply	Case Study	5
C916.5	Analyse	Assignment	5

Assessment Methods & Levels (based on Blooms’ Taxonomy)
Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment Theory			End Semester Examination Theory [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	30	30	30	30
Analyse	20	20	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment Total		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C916.1	3	3	3	2	2	2						3	3	3	1
C916.2	3	3	3	3	2	2						3	3	3	1
C916.3	3	3	3	3	2	2						3	3	3	1
C916.4	3	3	3	3	2	2						3	3	3	1
C916.5	3	3	3	2	2	2						3	3	2	1

20CSI917 **ADVANCED ALGORITHMS** **3/0/0/3**

Nature of Course J (Problem Analytical)
Pre requisites Design and Analysis of Algorithm , Probability

Course Objectives:

1 Analyze the asymptotic performance of algorithms.
2 Write rigorous correctness proofs for algorithms.
3 Demonstrate a familiarity with major algorithms analysis.
4 Apply important algorithmic design paradigms and methods of analysis.

Course Outcomes:

Upon completion of the course, students shall have ability to

C917.1	Analyze efficient algorithms for a range of computational problems, along with the analysis of probabilistic randomized techniques	[A]
C917.2	Apply the algorithms and design techniques to solve problems, and mathematically evaluate the quality of the solutions using multithreaded and parallel algorithmic techniques	[AP]
C917.3	Interpret various problems and solutions to online algorithmic strategy	[AP]
C917.4	Illustrate the knowledge of string matching algorithms and their design paradigm	[A]
C917.5	Interpret the understanding on a wide range of advanced algorithmic problems, their relations and variants, and application to real-world problems.	[AP]

Course Contents:

Module 1: Probabilistic Analysis and Advanced Randomization **15 Hours**

Hiring Problem - Indicator Random Variables - Randomization - Probabilistic Analysis. Algorithm for Bipartite Matching - Constructing Perfect Matching - Randomized Markov Chains - Ergodicity - Time Reversal.

Module 2: Multithreaded and Parallel Algorithms **15 Hours**

Dynamic Multithreaded Algorithms - Performance Measures and Scheduling - Analyzing Multithreaded Algorithms - Parallel Loops and Race Conditions - Multithreaded Matrix Multiplication - Merge Sort. Parallel Algorithms- PRAM, Pointer Jumping and Parallel Prefix.

Module 3: Online Algorithms and String Matching **15 Hours**

Streaming and Dynamic Algorithms - River Search Problem – Paging- The k-Server Problem - List Ordering and Move-to-Front. String Matching: Notations - Naive String Matching Algorithm - Rabin-Karp Algorithm - String Matching with Finite Automata - Knuth-Morris-Pratt Algorithm.

Total Hours:45

Text Books:

1 Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, Pearson Publications, 3rdEdition, 2012.
2 Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms‖, MIT Press, England, 2009.

Reference Books:

1 Mark Allen Weiss, Data structures and Algorithm Analysis in C‖, Pearson Education, New Delhi, 2006.
2 Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures‖, Galgotia Publications, New Delhi, 2000.
3 Allan Borodin and Ran El-Yaniv, Online Computation and Competitive Analysis‖,

Cambridge-UK, Cambridge University Press, 1998

Web References:

1 http://www.cs.yorku.ca/~andy/courses/4101/lecture-notes/Goemans-MIT-94.pdf
2 http://www.cs.bu.edu/~gacs/papers/cs530-09-notes.pdf

Online Resources:

1 https://nptel.ac.in/courses/106101060/
2 https://nptel.ac.in/courses/106104019/
3 https://www.coursera.org/learn/advanced-algorithms-and-complexity

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C917.1 & C917.4	Analyse	Online Quiz	5
C917.2	Apply	Assignment	5
C917.3	Apply	Assignment	5
C917.5	Apply	Tutorial	5

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	End Semester Examination [50 Marks]
Remember	20	20	20	20
Understand	30	20	20	20
Apply	40	30	30	30
Analyse	10	30	30	30
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C917.1	3		3	3		3	3	2		3		2	3	2	
C917.2		3			3									3	2
C917.3	3	3	3	3		3	2			2				2	
C917.4		2			3								3	3	2
C917.5	3	2	2	2	2	2	2			2		2	3	3	2

20CSI918 **SOFTWARE PRODUCT MANAGEMENT** **3/0/0/3**

Nature of Course G (Theory Analytical)
Pre requisites -

Course Objectives:

1. To understand the fundamentals of product design, practical management concepts like leadership and motivation.
2. To induce entrepreneurial intent as well as understand the practical issues faced by entrepreneurs.
3. To practice software product management techniques in software development process.
4. To induce the qualities of software product manager in the software management process.
5. To discuss the notion of risks and the risk management process

Course Outcomes:
Upon completion of the course, students shall have ability to

C918.1	Relate software product management to better software products.	[U]
C918.2	Recognize the role of a software product manager.	[U]
C918.3	Reflect on how the management principles will improve software projects.	[AP]
C918.4	Devise various software design techniques in software and measure the applicability of process models.	[A]
C918.5	Apply techniques to measure and visualize project progress	[AP]

Course Contents:

Module 1: Software Product **15 Hours**

Terms and Characteristics - External and Internal views – Software Product as type - Attributes of software products - Elements of Software Product Management - Role of software product manager - Framework - Market analysis - Product analysis - Product Strategy - Product planning – development

Module 2: Software Pricing **15 Hours**

- Elements of product pricing - The Role of the Software Pricing Manager - The Software Pricing Framework - Pricing Strategy - Price Structure, Policy and Level - Pricing in Distribution Channels - Pricing for Large Customer Accounts - Negotiation - Pricing in the Global Market - Business-to-Consumer (B2C) Software - Software as a Service - Pricing for Corporate IT Organizations

Module 3: Software Product Management and Pricing in the Corporate Structure **15 Hours**

Product Design - Importance - Objectives - Factors influencing product design - Characteristics of a good product design -Software Product Management in the Internal Environment - Software Pricing in the Internal Environment - Organizational Alternatives - Scenarios

Total Hours: 45

Text Books:

1. Software Product Management and Pricing: Key Success Factors for Software Organization, Hans-Bernd Kittlaus, Peter N. Clough, 2011, Springer Science & Business Media.
2. Software Product Management: The ISPMA-Compliant Study Guide and Handbook, Hans-Bernd Kittlaus, Samuel A. Fricker, 2017, Springer Science & Business Media.

Reference Books:

1. Software Project Management, K. Sutha & T. Jebeula, 2nd Edition, Margham Publications, 2018.
2. Software Product Management Essentials, Alyssa S. Dver, Meghan Kiffer Pr, 2003.
3. Entrepreneurship, Robert D. Hisrich, 6th Edition, Tata McGraw Hill Publications, 2014.
4. Entrepreneurial Development, Jayshree Suresh, 5th Edition, Margham Publications, 2010.

Web References:

1. https://cs.stanford.edu/people/eroberts/cs181/projects/201011/Licensure/indexba53.html?page_id=2
2. https://www.uvic.ca/engineering/assets/docs/professional-behaviour.pdf

Online Resources:

1. http://nptel.ac.in/courses/106101061/29
2. http://nptel.ac.in/courses/106105087/
3. http://www.acm.org/about/se-code

Assessment Methods & Levels (based on Blooms' Taxonomy)
Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C918.1	Understand	Online Quiz	5
C918.2	Understand	Assignment	5
C918.3	Analyse	Group Assignment	2.5
C918.4	Apply	Case Study	2.5
C918.5	Apply	Class Presentation	5

Assessment Methods & Levels (based on Blooms' Taxonomy)
Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment Theory			End Semester Examination Theory [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	30	20	20	20
Understand	30	40	30	30
Apply	20	30	30	30
Analyse	20	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment Total		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C918.1	3	3	3		2	2	2					2	3	2	2
C918.2	3	3	3		2	2	3	2				3	3	2	3
C918.3	3	3	3		2	2	2	2				3	3	3	2
C918.4	3	3	3		2	2	3					3	3	3	3
C918.5	3	3	3		2	2	2					3	3	3	3

20CSI919 **INFORMATION ETHICS AND CYBER LAWS** **3/0/0/3**

Nature of Course D (Theory Application)
Pre requisites -

Course Objectives:

1 To provide the knowledge on ethics in IT sector
2 To explain the basic information on standards.
3 To have knowledge on copy right issues of software's.
4 To understand the issues those are specific to amendment rights.

Course Outcomes:

Upon completion of the course, students shall have ability to

C919.1	Discuss the foundations of ethics in IT sector.	[U]
C919.2	Demonstrate the Deontological Theory	[AP]
C919.3	Interpret Intellectual Property Rights and Cyber laws	[U]
C919.4	Discriminate computer Attacks and Risk Analysis	[A]
C919.5	Survey the cybercrimes happenings in a region	[A]

Course Contents:

Module 1: Ethics in IT **15 Hours**

Definition - Ethics in the business world: Corporate social responsibility – Improving corporate ethics – Ethical work environment - Ethics in Information Technology domain -Ethical considerations in decision making - Software engineering code of ethics and practices: IEEE-CS –ACM Joint task force.

Module 2: Ethical Theories **15 Hours**

Utilitarianism, Intrinsic and instrumental value, Acts Vs. rules, Critique of utilitarianism, Deontological theory, Rights, Rights and social contract theory, Virtue ethics, Analogical reasoning in computer ethics

Module 3: Intellectual Property and Cyber Laws **15 Hours**

Copyrights, Patents, Trade secrets - Ethics of IT organizations: Key ethical issues for organization - Contingent workers – Outsourcing – Whistle blowing – Green computing - Types of Professional relationships - Conflicting responsibilities. **CYBER LAWS**: Information privacy – Privacy laws, applications and court rulings, Key privacy and anonymity issues: Data breaches – Electronic discovery – Consumer profiling – Workplace monitoring – Advanced surveillance technology - Licensing – Selling software – Piracy - Federal laws for prosecuting computer attacks - Risk assessment.

Total Hours: 45

Text Books:

1. George Reynolds, "Ethics in Information Technology" 6th Edition, Thomson Asia Pvt. Ltd., Chennai, 2019.
2. Deborah G Johnson, "Computer Ethics", Pearson Education, New Delhi, 2009.
3. Akash Kamal Mishra, "Cyber Laws in India- Fathoming your Lawful Perplex", Xpress Publishing., Chennai, 2020.
4. Richard A. Spinello, "Cyber Ethics, Morality and Law in Cyber Space", 5th Edition, Jones & Bartlett Learning., MA, 2020.
5. William Stallings, Cryptography and Network Security, 7th Edition, Pearson Education, March 2017.

Gupta Sarika, "Information and Cyber Security", Khanna Publishing House, Delhi.

Reference Books:

1. Caroline Whitback, “Ethics in Engineering Practice and Research”, Cambridge University Press, UK,2011.
2. Penny Duquenoy, Simon Jones and Barry G Blundell, “Ethical, legal and professional issues in computing”, Middlesex University Press,UK, 2008.

Web References:

1. https://www.eckovation.com/course/ethical-hacking-and-cyber-security
2. https://nptel.ac.in/courses/106105217/

Online Resources:

1. https://swayam.gov.in/nd2_nou19_cs08
2. https://swayam.gov.in/nd1_noc19_cs68

Assessment Methods & Levels (based on Blooms’ Taxonomy)
Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C919.1	Apply	Quiz	5
C919.2	Apply	Assignment	5
C919.3	Understand	Quiz	5
C919.4 & C919.5	Analyse	Case Study (Indian Cybercrime)	5

Assessment Methods & Levels (based on Blooms’ Taxonomy)
Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment Theory CIA-1 [10 marks]	Continuous Assessment Theory CIA-2 [10 marks]	Continuous Assessment Theory CIA-3 [10 marks]	End Semester Examination Theory [50 marks]
Remember	20	20	20	20
Understand	30	30	30	30
Apply	30	30	30	30
Analyse	20	20	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment Total		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C919.1	1	3					2	3				3	1	2	3
C919.2	1	2				2	2	2				3	1	2	3
C919.3	1						2	3		2		3	1	3	3
C919.4	1					2	2	3	2				1	2	3
C919.5	1					2	2	3	2				1	2	3

20CSI921 **SOFT COMPUTING** **3/0/0/3**

Nature of Course D (Theory Application)
Pre requisites Probability and statistics
Course Objectives:

1. To illustrate the fundamentals of Artificial Neural Networks architecture.
2. To apply the Neural Networks techniques in problem solving.
3. To interpret the fuzzy logic membership functions and the operations of fuzzy logic controller.
4. To explore the concepts of Genetic Algorithm and its applications in optimization problems.
5. To realize the advanced optimization techniques and algorithms.

Course Outcomes:
Upon completion of the course, students shall have ability to:

C921.1	Describe soft computing techniques and their roles in building intelligent machines.	[U]
C921.2	Deduce the real-world problems using Artificial Neural Network models.	[AP]
C921.3	Design Fuzzy controller and carry out operations on Fuzzy sets.	[AP]
C921.4	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems	[AP]
C921.5	Examine the conventional optimization problems with Genetic Algorithms.	[A]
C921.6	Simulate advanced Multi-objective optimization Problems.	[AP]

Course Contents:

Module 1: Artificial Neural Networks **15 Hours**

Introduction to Soft Computing -Basic concepts of artificial neural networks - Single layer feedforward network - Multi-layer feedforward network - Recurrent network. **Supervised Learning Network:** Perceptron network - Back propagation network - Radial basis function network. **Unsupervised Learning Network:** Fixed weight competitive nets - Korhonen self-organizing feature maps - Counter propagation network - Adaptive reasoning theory-Associative memory.

Module 2: Fuzzy Logic Design **15 Hours Fuzzy**

Logic: Basic concepts of fuzzy sets - Crisp set and Fuzzy set - Fuzzy set operations - Fuzzy Arithmetic-Fuzzy numbers - Fuzzy ordering - Fuzzy vectors-Fuzzy measures. **Membership functions:** Features of membership function - Fuzzification. **Fuzzy Rule Based Systems:** Fuzzy proposition - Formation and decomposition of rules - Fuzzy reasoning - Fuzzy Inference systems - Fuzzy expert system - Fuzzy logic controller design - Applications of Fuzzy logic.

Module 3: Genetic Algorithms and Optimization Techniques **15 Hours**

Traditional optimization and search techniques - Genetic algorithms. **Operators:** Encoding – Selection-Crossover – Mutation - Applications. **Hybrid Systems:** Neuro fuzzy hybrid systems - Adaptive Neuro-Fuzzy Inference Systems - Genetic algorithm based back propagation network – **Optimization Techniques:** Memetic Algorithms - Particle Swarm Optimization - Ant Colony Optimization - Multi Objective Optimization Problems. **CASE STUDY:** Data Curation - Pattern recognition problems.

Total Hours 45 Hours

Text Books:

1. Fuzzy Logic: A Practical approach, F. Martin, Mc Neil, and Ellen Thro, Academic Press, 2014.
2. Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K. Kasabov, MIT Press, 1998.
3. Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002.
4. Saroj Kaushik and Sunita Tiwari, "Soft Computing", Tata McGraw-Hill, 2018
5. Simon O. Haykin, "Neural Networks and Learning Machines", 3rd edition, Pearson Education, 2009

Reference Books:

1. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis, and Applications, S. Rajasekaran, and G. A. VijayalakshmiPai, Prentice Hall of India, 2007.
2. Soft Computing, D. K. Pratihar, Narosa, 2008.
3. Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.
4. Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning, 2009.
5. S. N. Sivanandam & S. N. Deepa, "Principles of Soft Computing", 2nd Edition, Wiley, 2011.

Web References:

1. http://www.support-vector.ws/
2. https://mitpress.mit.edu/books/learning-and-soft-computing
3. https://www.tutorialspoint.com/fuzzy_logic/
4. https://www.tutorialspoint.com/artificial_neural_network/

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105173 - Introduction to Soft Computing
2. https://www.coursera.org/learn/neural-networks-deep-learning
3. https://nptel.ac.in/courses/106/106/106106126/ - Search methods for problem solving

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C921.1 – 5	Understand	Quiz	5
C921.5	Analyse	Assignment	5
C921.4 & 6	Apply	Case Study	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment (30)			End Semester Examination [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	20	20	20	20
Understand	30	30	30	30
Apply	40	30	30	30
Analyse	10	20	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
C921.1	3	3	3	2	2							2	3		2
C921.2	3	3	3	2	2							2	3		2
C921.3	3	3	3	3	2							2	2		2
C921.4	3	3	3	3	2	2	2	2	2	2		2	2	2	2
C921.5	3	3	3	3	2	2	2	2	2	2		2	2	2	2
C921.6	3	3	3	3	2	2	2	2	2	2		2	2	2	2

20CSI922 **DEEP LEARNING** **3/0/0/3**

Nature of Course H (Theory Technology)

Pre requisites Machine learning

Course Objectives:

1. To explain the basic concepts of neural networks and deep networks.
2. To discuss the major architectures of deep networks.
3. To examine the core concepts in deep architecture tuning.
4. To demonstrate the applications of deeplearning.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C922.1	Distinguish neural and deep networks.	[U]
C922.2	Demonstrate various deep supervised learning architectures	[U]
C922.3	Identify the appropriate deep network architecture for an application	[AP]
C922.4	Apply various deep learning techniques to design efficient algorithms for real-world applications.	[AP]
C922.5	Analyze the performance of a deep learning network.	[A]

Course Contents:

Module 1: Foundations of Neural Networks **15 Hours**

Neural Networks –Training Neural Networks–Activation Functions – Loss Functions–Hyper parameters. **Fundamentals of Deep Networks:** Introduction to Deep learning – Common Architectural Principles of Deep Networks–Building Blocks of Deep Networks. **Introduction to Deep Learning Tools:** Google Colab – Tensor Flow- Keras.

Module 2: Major Architectures of Deep Networks **15 Hours**

Unsupervised Pre-Trained Networks- Convolutional Neural Networks - Transfer learning Techniques - Recurrent Neural Networks - Stochastic Gradient Descent – Recursive Neural Networks, Long Short Term Memory (LSTM) Networks.**Tuning Deep Networks**: Basic Concepts in Tuning Deep Networks - Matching Input Data and Network Architectures - Relating Model Goal and Output Layers - Working with Layer Count, Parameter Count, and Memory - Weight Initialization Strategies-Using Activation Functions.

Module 3: Applications **15 Hours**

Object Detection – Automatic Image Captioning – Image generation with Generative adversarial networks – Video to Text with LSTM models – Attention models for Computer Vision –Named Entity Recognition. Case Study: Opinion Mining using Recurrent Neural Networks – Parsing and Sentiment Analysis using Recursive Neural Networks – Sentence Classification using Convolutional Neural Networks – Dialogue Generation with LSTMs.

Total Hours: 45 Hours

Text Books:

1. Adam Gibson, Josh Patterson, Deep Learning, A Practitioner's Approach, O' Reilly Media, 2017.
2. Ian Good fellow, Yoshua Bengio and Aaron Courville, DeepLearning, MITPress,2017.
3. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018
4. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" Apress, 2018.

Reference Books:

1. Daniel Graupe, Deep Learning Neural Networks: Design and Case Studies, World Scientific Publishing, 2016.
2. Yu and Li Deng, Deep Learning: Methods and Applications, Now Publishers Inc,2014.

3. ZuradaJ.M. “Introduction to Artificial Neural systems”, Jaico Publishing House,2012.
4. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy, ”Deep Learning with tensorflow: Explore neural networks and build intelligent systems with Python", Packt Publisher, 2020.
5. Antonio Gulli, Sujit Pal "Deep Learning with Keras", Packt Publishers, 2017.

Web References:

1. http://deeplearning.cs.cmu.edu/
2. http://deeplearning.net/
3. https://machinelearningmastery.com/introduction-python-deep-learning-library-keras/
4. https://github.com/googlecreativelab/teachable-machine-v1

Online Resources:

1. http://nptel.ac.in/courses/
2. https://www.udacity.com/course/deep-learning--ud730
3. https://bigdatauniversity.com/courses/introduction-deep-learning/

Assessment Methods & Levels (based on Blooms’ Taxonomy)

Formative assessment based on Capstone Model(Max.Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C922.1&2	Understand	Online Quiz	5
C922.3&4	Apply	Mini Project	10
C922.5	Analyse	Case Study	5

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment			End Semester Examination
	CIA-1 [10marks]	CIA-2 [10marks]	CIA-3 [10marks]	(50marks)
Remember	20	20	10	10
Understand	30	40	40	40
Apply	40	10	30	30
Analyse	10	30	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C922.1	3	3	3	2	2	2	2		2			2	2	2	2
C922.2	3	3	3	3	3	2	2		2			2	3	3	2
C922.3	3	3	3	3	3	3	3		3			3	3	3	3
C922.4	3	3	3	3	3	3	3		3	2		3	3	3	3
C922.5	3	3	3	3	3	3	3	2	3	2	2	3	3	3	3

20CSI923 HUMAN COMPUTER INTERACTION 3/0/0/3

Nature of Course C (Theory Concept)
Pre requisites Design Patterns

Course Objectives:

1. To explain the design of Human Computer Interaction systems.
2. To provide knowledge on prototyping, testing, and evaluating HCI systems.
3. To analyze usability design issues and evaluation.
4. To visualize various interface methodologies from technical, cognitive, and functional perspective.
5. To Carry out usability case studies in real world applications

Course Outcomes:

Upon completion of the course, students shall have the ability to:

C923.1	Describe the capabilities of both humans and computers from human information processing perspective..	[R]
C923.2	Discuss HCI design principles, standards, and guidelines.	[U]
C923.3	Apply evaluation methods and techniques for data analysis.	[AP]
C923.4	Illustrate the research frontiers of HCI, including universal design, responsive design, and pervasive computing.	[AP]
C923.5	Interpret the HCI implications for designing multimedia/ e-commerce/ e-learning Web sites.	[A]

Course Contents:

Module 1: Introduction to Interactive system 15 Hours

Introduction to Human-computer Interaction - Methodology for Designing User-computer Interfaces – Ergonomics - Importance and Benefits of Good Design – Cognitive Model/ Mental Models - Design of an Interactive System - Interaction Styles - Direct Manipulation -Virtual Reality - Augmented Reality.

Module 2: Evaluation and Task Modeling 15 Hours

Prototyping -Testing and Evaluating Interface Designs - Guidelines and Criteria for Designing UI - UI Software and Specifications - Languages and Tools for Specifying and Building Interfaces - Dialogue Independence – UIMS Languages and Software Abstractions - Programming Support Tools - Basic Interaction Tasks - Techniques - Devices.

Module 3: Design of an Interactive system 15 Hours

Human Performance - Scientific Foundations for Designing User Interfaces - Visual Presentation of Information - Graphical Design - Designing Experiments - Research in Human-Computer Interaction – **Case Studies:** HCI and Global Sustainability - HCI in Health Care - Social Networks and Social Media - Enterprise Social Computing - Role of Creativity and Cognition in HCI.

Total Hours 45 Hours

Text Books:

1. Alan Dix, Janet Fincay, GreGoryd, Abowd, and Russell Bealg, “Human – Computer Interaction”, 3rd edition, Pearson, 2004
2. Julie A. Jacko (2012). Human-Computer Interaction Handbook (3rd Edition). CRC Press. ISBN 1-4398-2943-8
3. Ben Shneidermann, “Designing The User Interface - Strategies for Effective Human-Computer Interaction”, 6th Edition, Pearson Education Asia, 2017
4. Wilbert O Galitz, “The Essential Guide To User Interface Design”, Wiley Dreamatech, 3rd edition, 2007.

Reference Books:

1. Gavin Allanwood, Peter Beare, “User Experience Design – Creating designs users really love”, 1st Edition, Bloomsbury Publishers, 2014.
2. About Face 3: The Essentials of Interaction Design, Alan Cooper, Robert Reimann, David Cronin, Wiley, 4th Edition, 2014.

3. Andrew Sears, Julie A. Jacko, “The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, New York: John Wiley & Sons, 2002
4. Jeff Johnson, “Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Rules”, Second Edition, Morgan Kaufmann, 2014.
5. Yvonne Rogers , Helen Sharp, and Jennifer Preece, “Interaction Design: Beyond Human
6. Jonathan Lazar Jinjuan Heidi Feng, Harry Hochheiser, “Research Methods in Human-Computer Interaction”, Wiley, 2010

Web References:

1. https://www.oswego.edu/human-computer-interaction/human-computer-interaction-useful-links
2. https://www.interaction-design.org/courses/ui-design-patterns-for-successful-software

Online Resources:

1. https://www.coursera.org/specializations/interaction-design
2. https://in.udacity.com/course/human-computer-interaction--ud400
3. https://onlinecourses.nptel.ac.in/noc18_de03
4. https://www.coursera.org/learn/human-computer-interaction

Assessment Methods & Levels (based on Blooms’ Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C923.1 & 2	Understand	Quiz	5
C923.3 & 4	Apply	Assignment	5
C923.5	Analyse	Case Study	10

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment(30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	80	40	30	30
Understand	20	40	40	40
Apply	-	20	20	20
Analyse	-		10	10
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C923.1	3	3	3	2	2	2		2	2	2		2	3	3	2
C923.2	3	3	3	2	2	2		2	2	2		2	3	3	2
C923.3	3	3	3	2	2	2		2	2	2		2		3	2
C923.4	3	3	3	2	2	2	2	2	2	2		2	3	3	
C923.5	3	3	3	2	2	2	2	2	2	2		3	3	3	2

20CSI924 IMAGE PROCESSING AND PATTERN RECOGNITION 3/0/0/3

Nature of Course D (Theory Application)
Pre requisites -

Course Objectives:

1. To discuss the basic and advanced concepts of digital image processing
2. To apply wavelets, compression and segmentation concepts in real-time projects
3. To illustrate the pattern recognition algorithms and tools.
4. To explore the insights of digital image processing tools and techniques.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C924.1	Describe the basics of Image formation and transformation using sampling and quantization.	[U]
C924.2	Explore wavelets transforms and compression methods on digital images.	[AP]
C924.3	Examine the edge detection and segmentation techniques.	[AP]
C924.4	Interpret pattern recognition using classification algorithms	[U]
C924.5	Analyse the clustering algorithms.	[A]

Course Contents:

Module 1: Digital Image Processing Basics 15 Hours

Fundamentals - Image acquisition – Sampling and Quantization - Mathematical tools - Intensity transformations and spatial filtering - Histogram processing - Low pass and High pass spatial filters - Frequency domain Preliminary concepts – DFT–DCT - Low pass and High pass frequency domain filters - Image restoration and reconstruction.

Module 2: Image Processing Methodologies 15 Hours

Wavelet transforms - Matrix based transforms – Correlation – Walsh - Hadamard transform - Slant transform - Haar transform - Color image processing -Color models. **Image compression**: Fundamentals - Huffman coding - Golomb coding - Arithmetic coding - LZW coding – Run length coding - Block transform coding. **Image segmentation:** Point, Line, and Edge Detection - Canny edge detector - Marr-Hildreth edge detector - Basic Global Thresholding - MATLAB tool for image processing- Basic image manipulations – DCT - DWT -Filters- Basic JPEG encoding.

Module 3: Pattern Recognition 15 Hours

Feature space construction - Classifiers – Concepts-Nearest Neighbors Classification Method-Support Vector Machines. **Classification:** Decision Trees - Ensemble Classifiers-Bayes Classifiers - Evaluation - **Clustering**: Fuzzy C-Means clustering method - k-Means Clustering - Quality of clustering results - Hierarchical clustering - Overview of Neural Networks and Deep Learning.

Total Hours 45 Hours

Text Books:

1. Rafael C. Gonzalez, Richard E. Woods, Digital Image Processing, 4th Edition, Pearson Education,2018
2. S. Sridhar, “Digital Image Processing”, Second Edition, Oxford University Press,2016
3. Wtadstaw Homenda, Witold Pedrycz, "Pattern Recognition: A quality of data perspective", Wiley, 2018.
4. J G Proakis and D G Manolakis, "Digital Signal Processing," Pearson, Fourth edition, 2007

Reference Books:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, “Image Processing Analysis and Machine Vision”, Fourth Edition, Cengage India, 2017.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, PHI, 2011.
3. Scott E Umbaugh, "Digital Image Processing and Analysis: Applications with

MATLAB and CVIP tools", CRC Press, 3rd Edition, 2017.
4. Fabio Nelli, "Python Data Analytics: With Pandas, NumPy and Matplotlib", Apress, 2nd Edition,2018.

Web References:

1. https://www.tutorialspoint.com/dip/index.htm
2. http://cgm.cs.mcgill.ca/~godfried/teaching/pr-web.html

Online Resources:

1. https://www.coursera.org/learn/digital
2. https://onlinecourses.nptel.ac.in/noc22_ee48/

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C924.1 & 4	Understand	Quiz	5
C924.2& 3	Apply	Assignment	5
C924.5	Analyse	Case Study	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment(30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	20	20	20	20
Understand	40	30	30	30
Apply	30	30	30	30
Analyse	10	20	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C924.1	3	3	3	3	2	2						2	3	3	2
C924.2	3	3	3	3	3	3	3	2		2		2	2	2	2
C924.3	3	3	3	2	2	2			2			2	2	2	2
C924.4	3	3	3	2	2	2			2			2	2	2	2
C924.5	3	3	3	3	3	3	3	2		2		2	2	2	2

20CSI925 SPEECH AND NATURAL LANGUAGE PROCESSING 3/0/0/3

Nature of Course D (Theory Application)
Pre requisite Compiler Design
Course Objectives:

1. To recognize the basic concepts of word level analysis and speech.
2. To examine the syntactic and semantic analysis of Natural Language Processing.
3. To analyse the working principles of Natural Language Generation and machine translation.
4. To describe the process of information retrieval from the natural language.

Course Outcomes:

Upon completion of the course, students shall have ability to

C925.1	Explain regular expression and automata for word level analysis and speech.	[U]
C925.2	Illustrate the syntactic and semantic analysis of natural language processing.	[AP]
C925.3	Discover the architecture, representation and application of NLG.	[AP]
C925.4	Experiment Natural Language Processing.	[A]
C925.5	Apply in-depth knowledge in real world applications	[AP]

Course Contents:

Module 1: Machine Translation and Words Level Analysis 15 Hours

Machine Translation: Introduction - Problems in Machine Translation- Characteristics of Indian Languages- Machine Translation Approaches-Translation involving Indian Languages. **Words Level Analysis:** Regular Expressions and automata - Words and transducers - N-grams. **Part-of-speech Tagging:** Hidden Markov Model - Maximum Entropy Model - Morphological Rich Language.

Module 2: Language Modelling and Semantic Analysis of NLP 15 Hours

Origins and challenges of NLP-Language and Grammar-Processing Indian Languages - NLP Applications-Information Retrieval. **Language Modelling:** Grammar based Language Models-Statistical Language Model. **Semantic Analysis**: Meaning Representation-Lexical Semantics – Ambiguity-Word Sense Disambiguation.

Module 3: Discourse Processing and Information Retrieval 15 Hours

Discourse Processing: Cohesion-Reference Resolution- Discourse Coherence and Structure. **Natural Language Generation:** Architecture of NLG Systems- Generation Tasks and Representations-Application of NLG. **Information Retrieval**: Design features of Information Retrieval Systems – Classical- Non-classical - Alternative Models of Information Retrieval. **Case Study:** Text to Speech Conversion - Speech to Text Conversion and ChatBot.

Total Hours 45 Hours

Text Books:

1. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition”, 2nd Edition, Prentice Hall, 2009.
2. Dan Jurafsky and James H. Martin, Speech and Language Processing,3rd edition, 2019.
3. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

Reference Books:

1. James Allen, “Natural Language Understanding”, 2nd edition, Pearson Education, 2002.

Web References:

1. https://towardsdatascience.com/a-practitioners-guide-to-natural-language-processing-part processing-understanding-text-9f4abfd13e72
2. https://dl.acm.org/doi/book/10.5555/1738958
3. https://prodi.gy/docs
4. https://www.lighttag.io/

Online Resources:

1. https://nptel.ac.in/courses/117/105/117105145/
2. https://learning.edx.org/course/course-v1:Microsoft+DEV287x+1T2019a/home
3. https://www.coursera.org/learn/language-processing

Assessment Methods & Levels (based on Blooms’ Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C925.1 &2	Understand	Assignment	5
C925.3	Apply	Case study	5
C925.4	Analyse	Tutorial	5
C925.5	Apply	Quiz	5

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment			End Semester Examination
	CIA-1 (10 Marks)	CIA-2 (10 Marks)	CIA-3 (10 Marks)	(50 Marks)
Remember	20	20	20	20
Understand	30	30	40	40
Apply	30	40	30	30
Analyse	20	10	10	10
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C925.1	1	3		2	1			2	2	3		3	3	2	3
C925.2	3	3		2	2			3	2	2		3	3	2	2
C925.3	2	3		2	3			3	2	3		3	2	2	2
C925.4	2	2		2	3			3	2	3		2	3	2	2
C925.5	2	2		2	3			3	2	3		2	3	3	2
C925.6	2	2		2	3			3	2	3		2	3	3	2

20CSI926 **SOCIAL NETWORK ANALYSIS** **3/0/0/3**

Nature of Course G (Theory analytical)
Pre requisites Big Data Analytics

Course Objectives:

1. To explore the concept of semantic web technologies.
2. To illustrate the knowledge representation using ontology.
3. To examine human 184behaviour184 in social web and related communities.
4. To discuss visualization of social networks.

Course Outcomes:

Upon completion of the course, students shall have ability to

C926.1	Describe the concepts in semantic web and social network.	[U]
C926.2	Understand semantic web related applications.	[U]
C926.3	Interpret knowledge representation using ontology.	[AP]
C926.4	Examine the methods used in community detection and mining	[AP]
C926.5	Extract human behaviour in social web and related communities.	[A]
C926.6	Analyse different social network representations.	[A]

Course Contents:

Module 1: Semantic Technology for Social Network Analysis **15 Hours**

Introduction to Social Network Analysis: Limitations of current Web – Development of Semantic Web – Emergence of the Social Web. **Social Network Analysis**: Key concepts and measures in network analysis –Electronic sources. **Ontology and their role in the Semantic Web:** Ontology-based knowledge Representation – Modelling and aggregating social network data – Ontological representation of social individuals and relationships – Aggregating and reasoning with social network data.

Module 2: Social Network Infrastructures and Communities **15 Hours**

Extracting Evolution of Web Community from a Series of Web Archive- Detecting communities in social networks –Applications of community mining algorithms – Tools for detecting communities – Understanding and predicting human behavior for social communities– User data management – Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness. **Privacy in online social networks**: Trust in online environment – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons.

Module 3: Visualization and Applications of Social Networks **15 Hours**

Graph theory – Centrality – Clustering – Node-Edge Diagrams- Matrix representation. **Visualizing online social networks:** Matrix-based representations– Matrix and Node-Link Diagrams – Hybrid representations. **Applications:** Covert networks – Community welfare – Collaboration networks – Co-Citation networks.

Total Hours 45 Hours

Text Books :

1. Peter Mika, “Social Networks and the Semantic Web”, First Edition, Springer 2007.
2. Borko Furht, “Handbook of Social Network Technologies and Applications”, 1st Edition, Springer, 2010.
3. Newman, M.E.J, “Networks: An Introduction”, First Edition, Oxford University Press. 2010.

Reference Books:

1. Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and applications”, First Edition Springer, 2012.
2. Dion Goh and Schubert Foo, “Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively”, IGI Global Snippet, 2008.

3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, “Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling”, IGI Global Snippet, 2009.
4. John G. Breslin, Alexandre Passant and Stefan Decker, “The Social Semantic Web”, Springer, 2009.

Web References:

1. https://www.cl.cam.ac.uk/teaching/1415/L109/materials.html
2. https://www.youtube.com/watch?v=IiUDKDxScxI

Online Video Resources:

1. https://nptel.ac.in/courses/106106169
2. https://www.coursera.org/learn/social-network-analysis

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C926.1& 2	Understand	Quiz	5
C926.4 & 6	Analyse	Assignment	5
C926.3 & 5	Apply	Case Study	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA-1 (10 Marks)	CIA-2 (10 Marks)	CIA-3 (10 Marks)	(50 Marks)
Remember	20	20	20	20
Understand	20	40	40	40
Apply	40	20	20	20
Analyse	20	20	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C926.1	3	3	3	3	3	3	3		3	3		3	3	3	3
C926.2	3	3	3	3	3	3	3		3	3		3	3	3	3
C926.3	3	3	3	3	3	3	3		3	3		3	3	3	3
C926.4	3	3	3	3	3	3	3		3	3		3	3	3	3
C926.5	3	3	3	3	3	3	3	3	3	3		3	3	3	3
C926.6	3	3	3	3	3	3	3	3	3	3		3	3	2	2

20CSI927 **OPTIMIZATION TECHNIQUES** **3/0/0/3**

Nature of Course J (Problem Analytical)

Pre requisites Data Structures

Course Objectives:

1. To formulate and solve linear programming problems
2. To determine the optimum solution to constrained and unconstrained optimization problems
3. To apply dynamic programming principle to linear programming problems
4. To determine the integer solutions to linear programming problems

Course Outcomes:

Upon completion of the course, students shall have ability to

C927.1	Formulate and solve linear programming problems	[AP]
C927.2	Interpret the optimum solution to constrained and unconstrained problems.	[A]
C927.3	Apply dynamic programming principle to linear programming problems	[AP]
C927.4	Determine the integer solutions to linear programming problems	[A]
C927.5	Apply different integer algorithms to real world problems	[AP]

Course Contents:

Module 1: Introduction and Linear Programming **15 Hours**

Scope and hierarchy of optimization – Typical Application of Optimization – Linear Programming Formulations – Solutions – Graphical method – Algebraic method – Simplex algorithm – Duality and Sensitivity analysis – Transportation problem - Assignment problem – Knapsack Problem

Module 2: Non-linear Programming & Dynamic Programming **15 Hours**

Non-Linear Programming: Unconstrained Extremum Points – Constrained Optimization problems – Lagrangean method for Equality Constraints – Kuhn Tucker Conditions for Inequality constraints – Quadratic Programming. **Dynamic Programming**: Stage Coach Problem – Reliability Problem - Equipment Replacement Problem - Continuous Variables – Factorizing the terms – Shortest path network problems – Manpower Planning problem – Applications in Production

Module 3: Integer Programming **15 Hours**

Formulation – Types – Zero-One problems - Solutions using Implicit Enumeration – Gomory's Cutting Plane Algorithm – Branch and Bound Algorithm for Integer Programming –Integer Algorithms - Dual algorithm - Primal algorithm – Benders partitioning algorithm.

Total Hours 45 Hours

Text Books:

1. G.Srinivasan, "Operations Research: Principles and Applications", 3rd Edition, PHI Learning, 2017.
2. Dr. P.K Mohanty, Dr. S.K Patel, "Operations Research", Scientific Publishers,2017.
3. J.C.Pant, "Introduction to Operations Research", Jain Brothers, New Delhi, 2008.

Reference Books:

1. Hillier F and Liberman G J, Introduction to Operations Research, McGraw Hill, 2014.
2. Singiresu S Rao, Engineering optimization theory and Practice, John Wiley, 2014.
3. Kanti Swarup, Man Mohan and P.K.Gupta, "Introduction to Operations Research", S.Chand & Co, 2006.

Web References:

1. https://www.tutorialspoint.com/linear_programming/index.asp
2. https://www.udemy.com/optimisation/

Online Resources:

1. https://nptel.ac.in/courses/111105039/
2. https://nptel.ac.in/courses/105108127/
3. http://www.nptelvideos.in/2012/11/numerical-optimization.html

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C927.1& 2	Apply	Case Study	10
C927.3&5	Apply	Assignment	5
C927.4	Analyse	Online Quiz	5

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	[50 Marks]
Remember	20	20	20	20
Understand	30	20	20	20
Apply	50	30	30	30
Analyse	-	30	30	30
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C927.1	3	3		2	3			2	3	3		2	3	2	2
C927.2	3	3		2	2			3	3	3		2	3	3	2
C927.3	3	3		2	2			2	3	2		3	3	2	2
C927.4	3	2		2	2			2	2	2		3	3	3	2
C927.5	3	3		3	3			2	3	3		3	3	3	2

20CSI928 **DATA VISUALIZATION** **3/0/0/3**

Nature of Course H (Theory Technology)
Pre requisites Python programming

Course Objectives:

1. To discuss the fundamentals of Data Visualization.
2. To provide insights of Python visualization libraries.
3. To Identify appropriate data visualization techniques with exploratory data analysis.
4. To explore appropriate design principles in the creation of presentations and visualizations
5. To implement interactive and security visualization.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C928.1	Describe fundamentals of data visualization techniques.	[U]
C928.2	Demonstrate data visualization with widgets.	[U]
C928.3	Apply and analyse Python visualization libraries for 3D data visualization.	[A]
C928.4	Import and analyse process data from the web and different file types.	[A]
C928.5	Implement appropriate interactive sessions with Seaborn plotting functions.	[AP]
C928.6	Analyse and Correlate appropriate security visualization for any real world data set.	[A]

Course Contents:

Module 1: Introduction to Data Visualization **15 Hours**

Introduction - Context of data visualization - Definition - Methodology - Visualization design objectives - Data representation - Data Presentation - Seven stages of data visualization - widgets. **Data visualization tools:** Drawing Plots and Customization with Python Visualization Libraries - Bokeh - Matplotlib - Plotly - Making 3D Visualizations.

Module 2: Data Visualization processes **15 Hours**

Acquiring data - Tools for Acquiring Data from the Internet - Locating Files for Use with Processing - Exploratory Data Analysis with Python. **Importing data:** CSV - Microsoft Excel Files - Fixed width data Files - Tab delimited Files - JSON Resource - Using Database - Dealing with Large Number of Files.

Module 3: Interactive and Security Visualization **15 Hours**

Drawing with data - Scales - Axes - Updates - Transition and Motion - Layouts -Plotting Charts with Images and Maps - Seaborn plotting Functions - Security Visualization - Firewall log visualization - Intrusion detection log visualization - Attacking and defending visualization systems**. Case Study:** Google Charts - Google Data Studio -Tableau.

Total Hours 45 Hours

Text Books:

1. Claus Wilke, “Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures”, O’Reilly Media, Inc., 2019.
2. Igor Milovanovic, “Python Data Visualization Cookbook”, Packt Publishing Ltd, 2013.
3. Ben Fry, “Visualizing Data”, O" Reilly Media, Inc., 2007.
4. Greg Conti, “Security Data Visualization: Graphical Techniques for Network Analysis”, No Starch Press Inc, 2007.

Reference Books:

1. Scott Murray, “Interactive data visualization for the web”, O" Reilly Media, Inc., 2013.
2. Greg Conti, “Security Data Visualization: Graphical Techniques for Network Analysis”, No Starch Press Inc, 2007
3. Abha Belorkar, Sharath Chandra Guntuku, Shubhangi Hora, Anshu Kumar “Interactive Data Visualization with Python: Present your data as an effective and compelling story”, 2nd Edition.

Web References:

1. http://www.nptel.ac.in
2. https://www.udemy.com/course/learning-python-for-data-analysis-and-visualization/
3. https://www.coursera.org/learn/python-for-data-visualization

Online Resources:

1. https://www.kaggle.com/learn/data-visualization
2. https://seaborn.pydata.org/tutorial.html
3. https://www.intellspot.com/python-visualization-tools
4. https://www.simplilearn.com/tutorials/python-tutorial/data-visualization-in-python
5. https://matplotlib.org/

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C928.1 & 2	Understand	Quiz	5
C928.3 & 4,5	Analyse	Tutorial	10
C928.6	Apply	Assignment	5

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment (30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	10	10	10	10
Understand	30	20	20	20
Apply	40	50	50	40
Analyse	20	20	20	30
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C928.1	3	3	3	2	2	2	2		2	2		2	3	2	2
C928.2	3	3	3	2	2	2	2		2	2		2	2	2	2
C928.3	3	3	3	3	2	2	2		2	2		2	2	2	2
C928.4	3	3	3	2	2	2	2		2	2		2	2	2	2
C928.5	3	3	3	2	2	2	2	2	2	2		2	2	2	2
C928.6	3	3	3	2	2	2	2	2	2	2		2	2	2	2

20CSI929 **COMPUTER VISION** **3/0/0/3**

Nature of Course H (Theory Technology)
Pre requisite Image Processing

Course Objectives:

1. To provide knowledge on shape and region analysis.
2. To describe Hough Transform and its applications in detecting lines, circles and ellipses.
3. To explain 3D image analysis and motion analysis techniques.
4. To discuss some of the applications of computer vision algorithms

Course Outcomes :

Upon completion of the course, students shall have ability to:

C929.1	Illustrate various shape models and region descriptors	[U]
C929.2	Apply Hough transform for detecting lines, circles and ellipses in real time images.	[AP]
C929.3	Demonstrate 3D object recognition methods using computer vision tools	[A]
C929.4	Apply motion based methods in real time applications	[AP]
C929.5	Develop applications using computer vision techniques	[AP]

Course Contents:

Module 1: Shapes, Regions and Hough Transform **15 Hours**

Introduction to Computer Vision: Binary Shape Analysis – Connectedness – Object Labeling and Counting – Size Filtering – Distance Functions – Skeletons and Thinning – Deformable Shape Analysis – Boundary Tracking Procedures – Active Contours – Shape Models and Shape Recognition – Centroidal Profiles – Handling occlusion – Boundary length Measures- Boundary Descriptors – Region Descriptors – Moments. **Line detection**: Hough transform (HT) – Foot-of-Normal method – Line Localization – Line Fitting – RANSAC - **HT based Circular Object Detection** – Accurate Center Location – Speed Problem – Ellipse Detection.

Module 2: 3D Vision And Motion **15 Hours**

Methods for 3D Vision – Projection Schemes – Shape from Shading – Photometric Stereo – Shape from Texture – Shape from Focus – Active Range Finding – Surface Representations – Point-based Representation – Volumetric Representations – 3D Object Recognition – 3D Reconstruction – Introduction to Motion – Triangulation – Bundle Adjustment – Translational Alignment – Parametric Motion – Spline-based Motion – Optical Flow – Layered Motion.

Module 3: Applications **15 Hours**

Photo album – Face Detection – Face Recognition – Eigen Faces. **Active Appearance and 3D Shape Models of Faces Application:** Surveillance – Foreground & Background Separation – Particle Filters – Chamfer Matching, Tracking, and Occlusion – Combining Views from Multiple Cameras – **Human Gait Analysis Application**: In-vehicle Vision System - Locating Roadway – Road Markings – Identifying road Signs – Locating Pedestrians. **Case Study:** Human Iris Location- Hole Detection – OpenCV.

Total Hours **45 Hours**

Text Books:

1. E. R. Davies, Computer & Machine Vision Ⅱ, Fourth Edition, Academic Press, 2012.
2. D. L. Baggio et al., Mastering OpenCV with Practical Computer Vision Projects, Packt Publishing, 2012.
3. Jan Erik Solem, Programming Computer Vision with Python: Tools and algorithms for analyzing images, O'Reilly Media, 2012.

Reference Books:

1. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.
2. R. Szeliski, Computer Vision: Algorithms and Applications, Springer 2011.
3. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.

Web References:

1. https://www.cs.cmu.edu/~cil/v-pubs.html
2. http://homepages.inf.ed.ac.uk/rbf/CVonline/
3. https://machinelearningmastery.com/computer-vision-books/
4. https://www.cl.cam.ac.uk/teaching/1617/E4F12/materials.html
5. https://www.kdnuggets.com/2016/08/seven-steps-understanding-computer-vision.html
6. https://www.ibm.com/topics/computer-vision
7. https://tryolabs.com/resources/introductory-guide-computer-vision/

Online Resources:

1. https://nptel.ac.in/courses/106/105/106105216/
2. https://www.coursera.org/learn/advanced-computer-vision-with-tensorflow

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C929.1	Understand	Online Quiz	5
C929.2, 4 & 5	Apply	Assignment	5
C929.3	Analyse	Case Study	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA-1 (10 Marks)	CIA-2 (10 Marks)	CIA-3 (10 Marks)	(50 Marks)
Remember	20	20	20	20
Understand	30	30	30	30
Apply	40	40	30	30
Analyse	10	10	20	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C929.1	3	2	2	2	2	2	2		2			2	2	1	1
C929.2	3	3	2	2	3	2	2		2			2	3	3	1
C929.3	3	3	3	3	2	3	2		3			3	2	1	
C929.4	3	3	3	3	3	3	2		3	2	2	2	3	3	3
C929.5	3	3	3	3	3	3	3	2	2	2	2	3	3	3	3

20CSI931 GAME THEORY AND ITS APPLICATIONS 3/0/0/3

Nature of Course D (Theory Application)
Pre requisites -
Course Objectives:

1. To learn the basics of game theory and mixed strategies
2. To apply the concept of Nash Equilibrium and Gamification
3. To illustrate extensive games with perfect information
4. To explore the variants and extensions of game theory
5. To examine the applications of game theory

Course Outcomes:

Upon completion of the course, students shall have ability to:

C931.1	Explain the concepts of game theory and design rules for deconstructing games	[U]
C931.2	Demonstrate both pure and mixed strategy Nash Equilibrium	[AP]
C931.3	Illustrate the notion of subgames with finite and infinite horizons	[AP]
C931.4	Determine strategies for extensive games with perfect information	[AP]
C931.5	Estimate all possible outcomes while making decisions with imperfect information.	[A]
C931.6	Analyze the real-time case studies and applications	[A]

Course Contents:

Module 1: Nash and Mixed Strategy Equilibrium 15 Hours

Introduction to Game Theory - **Nash Equilibrium:** Strategic games – Examples of Nash Equilibrium – Best Response Functions - Dominated actions - Equilibrium in a single population – Illustrations of Nash Equilibrium - **Mixed Strategy Equilibrium:** Strategic games with random players - Dominated actions - Illustrations – Extensions - **Deconstructing Games:** Gamification - Design Rules - Breaking Games Down.

Module 2: Extensive games 15 Hours

Extensive games with perfect information - Strategies and outcomes - Nash Equilibrium - Subgame perfect equilibrium - Backward induction – **Illustrations:** The ultimatum game and the holdup game - Stackelberg's model of duopoly – **Extensions:** Entry into a monopolized industry - Electoral competition with strategic voters - Committee decision-making - Exit from a declining industry - Coalitional Games.

Module 3: Variants, Extensions and Case Studies 15 Hours

Bayesian Games - Strictly Competitive Games and Max Minimization – Rationalizability – Evolutionary Equilibrium - **Case studies:** Oligopoly in Water Management - Forestry Management Problem - Human–Environment Social System - Application of Game Theory in Disaster Recovery

Total Hours: 45

Text Books:

1. Martin Osborne, “An Introduction to Game Theory”, Oxford University Press,2012
2. Akio Matsumoto and Ferenc Szidarovszky, “Game Theory and its Applications”, McGraw Hill Education (India) Private Ltd, 2016
3. Richard Alan Gillman, David Housman, “Game Theory A Modeling Approach”,CRC Press, 2019

Reference Books:

1. Hans Peters, ‘Game Theory – A Multilevel Approach’, Second Edition, Springer-Verlag Berlin Heidelberg, 2015
2. Steven Tadelis, ‘Game Theory – An Introduction’, Princeton University Press, 2013
3. Avinash Dixit and Susan Skeath, ‘Games of Strategy’, Second Edition, McGraw Hill Education India Private Ltd., 2013

4. Leyton-Brown, K Shoham Y, 'Essentials of Game Theory: A Concise Multidisciplinary Introduction', Morgan and Claypool Publishers, 2008

Web References:

1. https://plato.stanford.edu/entries/game-theory/
2. https://www.businessmanagementideas.com/management/game-theory-assumptions-application-and-limitations/523

Online Resources:

1. https://www.coursera.org/learn/game-theory-introduction
2. https://www.coursera.org/learn/game-theory-1
3. https://www.coursera.org/learn/gamification#syllabus
4. https://onlinecourses.nptel.ac.in/noc19_ge32/preview

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C931.1, C932.2	Understand	Quiz	5
C931.3, C931.4	Apply	Assignment	5
C931.5, C931.6	Analyse	Case Study	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment (30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	30	20	20	20
Understand	50	30	20	30
Apply	20	50	30	30
Analyse	-	-	30	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C931.1	3	3	3	2		2		2				2	2	2	2
C931.2	3	3	3	2		2		2				2	2	2	2
C931.3	3	3	3	2		2		2				2	2	2	2
C931.4	3	3	3	2		2		2				2	2	2	2
C931.5	3	3	3	2		2		2				2	2	2	2
C931.6	3	3	3	2		2		2				2	2	2	2

20CSI932 COGNITIVE SCIENCE AND DECISION MAKING 3/0/0/3

Nature of Course D (Theory Application)
Pre requisites Artificial Intelligence

Course Objectives:

1. To study the basic concepts and approaches in the field of cognitive science.
2. To apply the concepts of planning, reasoning and learning models in cognitive applications.
3. To understand the cognitive models for decision making.
4. To analyze language and semantic models of cognitive process.

Course Outcomes:

Upon completion of the course, students shall have the ability to:

C932.1	Understand the concepts of cognitive science and the knowledge representations.	[U]
C932.2	Build reasoning strategies to real world applications.	[AP]
C932.3	Explore cognitive models for decision making.	[AP]
C932.4	Analyze the role of cognitive science in natural language processing.	[A]
C932.5	Demonstrate the application of research approaches with cognitive science.	[AP]

Course Contents:

Module 1: Introduction to Cognitive Science 15 Hours

Fundamental Concepts of cognitive science – Computers in Cognitive Science – Applied Cognitive Science – The Interdisciplinary Nature of Cognitive Science – **Knowledge representation:** Semantic networks, frames, conceptual dependency, scripts, Ontology Understanding, Common Sense Reasoning. Reasoning by analogy – Explanation based reasoning – Case based reasoning - Constraint Satisfaction - Constraint Propagation - Temporal reasoning – Temporal Constraint Networks - Spatial reasoning - Visual Spatial reasoning - Meta reasoning – Learning by correcting mistakes - AI ethics

Module 2: Cognitive Modeling 15 Hours

Declarative/ logic-based computational cognitive modelling - connectionist models of cognition - Bayesian models of cognition - Cognitive Models of Memory and Language - Computational models of episodic and semantic memory - modelling psycholinguistics - modelling the interaction of language, memory and learning - Classical models of rationality - symbolic reasoning and decision making under uncertainty - Formal models of inductive generalization causality - Categorization and similarity analysis.

Module 3: Language and Semantic Processing 15 Hours

Knowledge Acquisition – Semantics in Cognitive Science – Meaning and Entailment – Cognitive and Computational Models of Semantic Processing – Information Processing Models of the Mind Physical symbol systems and language of thought - Applying the Symbolic Paradigm - Neural networks and distributed information processing - Neural network models of Cognitive Processes - Dynamical systems and situated cognition. Case Study: Role of Cognitive Science in Augmented Gaming, Autonomous Vehicle and Health Care.

Total Hours: 45

Text Books:

1. Mallick, Pradeep Kumar, Borah, Samarjeet," Emerging Trends and Applications in Cognitive Computing", IGI Global Publishers, 2019
2. José Luis Bermúdez, "Cognitive Science: An Introduction to the Science of the Mind", Cambridge University Press, New York, 2014.
3. Paul Miller, "An Introductory Course in Computational Neuroscience", MIT Press, 2018.

Reference Books:

1. Stuart J. Russell, Peter Norvig, “Artificial Intelligence - A Modern Approach”, Third Edition, Pearson Publishers, 2015.
2. Elaine Rich, Kevin Knight, Shivashankar B. Nair, “Artificial Intelligence”, Third Edition, Tata McGraw-Hill Education, 2012.
3. Jerome R. Busemeyer, Zheng Wang, James T. Townsend, Ami Eidels(Ed), “The Oxford Handbook of Computational and Mathematical Psychology”, Oxford University Press, 2015
4. Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, “Cognitive Science: An Introduction”, Second Edition, MIT press, 1995.

Web References:

1. https://www.valamis.com/hub/cognitive-learning
2. https://www.simplypsychology.org/cognitive.html
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6480974/

Online Resources:

1. https://in.coursera.org/learn/philosophy-cognitive-sciences
2. https://onlinecourses.nptel.ac.in/noc20_hs29/preview
3. https://www.udemy.com/course/cognitive-psychology/

Assessment Methods & Levels (based on Blooms’ Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C932.1 & 2	Understand	Quiz	5
C932.3 & 4	Apply	Assignment	10
C932.5	Analyse	Case Study	5

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment(30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	30	20	20	20
Understand	30	30	20	20
Apply	40	50	30	40
Analyse	-	-	30	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C932.1	3	3	3	3		2						2	3	3	2
C932.2	3	3	3	3		2						2	3	3	2
C932.3	3	3	3	3		2						2	3	3	2
C932.4	3	3	3	3		2						2	3	3	2
C932.5	3	3	3	3		2						2	3	3	2

20CSI933 **BUSINESS INTELLIGENCE** **3/0/0/3**

Nature of Course D (Theory application)
Pre requisites Data Warehousing and Mining

Course Objectives:

1 To learn the fundamentals of business intelligence system.
2 To Identify the technological architecture that makes up BI systems.
3 To understand the different knowledge delivery methods for data.
4 To facilitate the use of modelling aspects behind Business Intelligence.
5 To gain knowledge about various tools available for Business Intelligence.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C933.1	Demonstrate business intelligence architectures.	[U]
C933.2	Use various knowledge delivery methods.	[AP]
C933.3	Illustrate efficiency measures used in business intelligence.	[AP]
C933.4	Apply various modeling techniques.	[AP]
C933.5	Infer business intelligence concepts in a problem domain.	[A]

Course Contents:

Module 1: Introduction and Basics of Enterprise Reporting **15 Hours**

Data, Information and Knowledge - Effective and timely decisions – Role of mathematical models – Business intelligence architectures - Cycle of a business intelligence analysis – Enabling factors in business intelligence projects – Development of a business intelligence system – Ethics and business intelligence. Introduction to enterprise reporting - Concepts of dashboards - Balanced scorecards - Introduction to SSRS Architecture - Enterprise reporting using SSRS.

Module 2: Knowledge Delivery and Efficiency **15 Hours**

Business intelligence user types - Standard Reports - Interactive Analysis and Ad Hoc Querying - Parameterized Reports and Self-Service Reporting - Dimensional Analysis - Alerts/Notifications - Data envelopment analysis (DEA) - Efficiency measures – CCR model - Definition of target objectives - Peer groups.

Module 3: Tools and Applications **15 Hours**

Marketing models – Logistic and Production models - Text Analysis - Entity Recognition and Entity Extraction - Sentiment Analysis - Mobile Business Intelligence - Event Stream Processing - Embedded Predictive Analytic Models. **Tools:** KPI dashboard tools - Gecoboard - Salesforce - Grow - Tableau. KPI Applications on data analytics and business intelligence.

Total Hours: 45

Text Books:

1. Carlo Vercellis, “Business Intelligence: Data Mining and Optimization for Decision Making”, Wiley Publications, 2013.
2. RN Prasad and SeemaAcharya , “Fundamentals of Business Analytics”, 1st Edition, Wiley India
3. David Loshin Morgan, Kaufman, “Business Intelligence: The Savvy Manager"s Guide”, 2nd Edition, 2012.

Reference Books:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, “Decision Support and Business Intelligence Systems”, 10th Edition, Pearson 2014.
2. S.K. Shinde, Uddagiri Chandrasekhar ,“Data Mining and Business Intelligence”, Wiley Publications, 2014
3. Ralph Kimball, Margy Ross , Warren Thornthwaite, Joy Mundy, Bob Becker, “The Data Warehouse Lifecycle Toolkit”, 2nd Edition, Wiley Publication Inc.,2008.

4. Jiawei Han, Micheline Kamber and Jian Pei, “Data mining concepts and Techniques”, 3rd Edition, Elsevier Publisher, 2006

Web References:

1. https://en.wikipedia.org/wiki/Business_intelligence
2.. http://www.webopedia.com

Online Resources:

1. https://www.coursera.org/learn/business-intelligence-tools
2. https://www.coursera.org/courses?query=business%20intelligence
3. https://www.coursera.org/specializations/data-warehousing

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C933.1	Understand	Quiz	5
C933.2, C933.3 &C933.4	Apply	Assignment	10
C933.5	Analyse	Case Study	5

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment (30)			End Semester Examination [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	30	40	20	20
Understand	50	40	40	40
Apply	20	20	30	30
Analyse	-	-	10	10
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C933.1	3	3	2	1		2	2				1	2	1	2	2
C933.2	3	3	3	2		2	2				2	2	2	2	2
C933.3	3	3	3	2		2	2				2	2	2	2	2
C933.4	3	3	3	2		2	2				2	2	2	2	2
C933.5	3	3	3	2		2	2				2	2	2	2	2

20CSI934 **QUANTUM COMPUTING** **3/0/0/3**

Nature of Course G (Theory Analytical)
Pre requisites -

Course Objectives:

1 To provide conceptual overview of quantum mechanics.
2 To discuss the quantum model of computation.
3 To facilitate the use of quantum algorithms and quantum errors.
4 To acquire the significance of quantum models and classical models.
5 To explore the knowledge of quantum cryptography.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C934.1	Describe the fundamental principles of quantum mechanics using the concepts of quantum bits.	[U]
C934.2	Interpret quantum model of computation and quantum mechanics.	[U]
C934.3	Analyze the behavior of quantum algorithms.	[A]
C934.4	Demonstrate the concept quantum noise and error correction.	[AP]
C934.5	Illustrate the concepts of quantum information theory.	[AP]

Course Contents:

Module 1: Overview of Quantum Mechanics and Computational Models **15 Hours**

Introduction – Global Perspectives – Quantum Bits – Quantum Computation – Experimental Quantum Information Processing – Quantum Information. Quantum Mechanics – Linear Algebra – Postulates of Quantum Mechanics – Density Operator – The Shmidt Decomposition and Purifications – EPR and the Bell Inequality. Computational Model –Turing Machines – Circuits – Analysis of Computational Problems.

Module 2: Algorithms and Error Correction **15 Hours**

Quantum Algorithms – Deutsch - Jozsa Algorithm– Bernstein - Vazirani Algorithm – Universal Quantum Gates – Quantum Circuit Model of Computation – Quantum Fourier Transform–Quantum Factoring – Shor's Algorithm – Quantum Search Algorithm – Grover's Algorithm – Quantum Computers –Quantum Noise and Quantum Operations – Classical Noise and Markov processes – Quantum Operations – Distance Measures for Quantum Information – Quantum Error Correction.

Module 3: Quantum Information Theory **15 Hours**

Quantum States and Accessible Information – Data Compression – Classical Information Over Noisy Quantum Channels – Quantum Information Over Noisy Quantum Channels – Entanglement as a Physical Resource – Quantum Cryptography and Key Distribution - Quantum Inspired Computing.

Total Hours: 45

Text Books:

1. Parag K. Lala, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education, First Edition 2020.
2. Michael A. Nielsen, Issac L. Chuang, "Quantum Computation and Quantum Information", Tenth Edition, Cambridge University Press, Seventh Edition, 2010.
3. P. Kaye, R. Laflamme, and M. Mosca, "An introduction to Quantum Computing", Oxford University Press,First Edition, 2006.

Reference Books:

1. Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, First Edition,2013.
2. Benenti G., Casati G. and Strini G., "Principles of Quantum Computation and Information", Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific, First Edition,2007.

3. N. David Mermin, “Quantum Computer Science: An Introduction”, Cambridge University Press, First Edition,2007.
4. Chris Bernhardt, “Quantum Computing for everyone”, MIT Press, 2019.

Web References:

1. http://www.nptelvideos.com/physics/quantum_physics.php
2. https://www.cse.iitk.ac.in/users/ppk/notes/krp.pdf
3. http://www.cse.iitd.ernet.in/~suban/quantum/index.html
4. http://www.quiprocone.org/Protected/DD_lectures.htm
5. https://www.pqi.org/videos/lectures

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc21_cs103/preview
2. https://online.stanford.edu/courses/soe-yeeqmse01-quantum-mechanics-scientists-and-engineers
3. https://courses.cs.washington.edu/courses/cse599d/06wi/
4. https://www.coursera.org/learn/introduction-to-quantum-information
5. http://patrickjmt.com/
6. https://qiskit.org/textbook/preface.html
7. https://cognitiveclass.ai/

Assessment Methods & Levels (based on Blooms’ Taxonomy)
Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C934.1	Understand	Quiz	5
C934.2	Understand	Presentation	5
C934.3	Analyse	Assignment	5
C934.4 & C934.5	Apply	Case Study	5

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment (30)			End Semester Examination [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	20	20	20	20
Understand	20	30	40	30
Apply	60	30	40	40
Analyse		20		10
Evaluate				
Create				

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C934.1	3	3	3	2		2	2					2	2	2	2
C934.2	3	3	3	2		2	2					2	2	2	2
C934.3	3	3	3	2		2	2					2	2	2	2
C934.4	3	3	3	2		2	2					2	2	2	2
C934.5	3	3	3	2		2	2					2	3	2	2

20CSI935 ROBOTICS AND ITS APPLICATIONS 3/0/0/3

Nature of Course D (Theory Application)

Pre requisites Microprocessors and Microcontrollers

Course Objectives:

1 To understand the basics of robotic parts.
2 To highlight importance of Robotics synergistic integration in computer science field.
3 To emphasis embedded language to integrate robotic sensory devices.
4 To concentrate on the control of robots for specific applications.

Course Outcomes:

Upon completion of the course, students shall have ability to

C935.1	Discuss the basic concepts of robot and its hardware	[U]
C935.2	Design functional sensors in the robot	[A]
C935.3	Implement embedded language to interact with robotic parts	[AP]
C935.4	Develop a robotic motion using microcontroller programming language	[AP]
C935.5	Identify right kind of robot for advanced applications	[AP]

Course Contents:

Module 1: Introduction to Robotics 15 Hours

Definition and origin of robotics - Different types - Generations of Robots - Degrees of freedom - Robot Anatomy - Asimov‘s laws of robotics - Multiple robots - Machine interface - Robots in manufacturing and non-manufacturing applications - Robot cell design - Selection of robot.

Module 2: Robotics Embedded Language 15 Hours

Robot Languages - Classification of Robot Languages - Computer Control and Robot Software - Robot Operating Systems (ROS) - Raspberry Pi based programming for robots - Inverse Kinematics and Path Planning - Programming using ROS - Microprocessors and Microcontrollers based robotic controllers - Peripheral Interfacing with microcontrollers and its programming in C.

Module 3: Service Robots 15 Hours

Service robots – Classification - Social and ethical implications of robotics - Robot for welding - Painting and REEM Robots - Robotic sensory devices and perception - Need for service robots – **Applications:** Patrolbot - Underground robots - Roomba and gita robots. Specifications of service and field Robots - Bio hybrid robots powered by artificial muscle tissue – Soft hands for reliable grasping strategies – Tubular continuum robots for microsurgical applications. **Case Study:** Military Fields, Manufacturing and Automation, Medical Robots, Role of Robotics in Kawasaki Industries, Nuclear Fields.

Total hours : 45

Text Books:

1 Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotic Engineering – An Integrated Approach", Prentice Hall of India, 2021.
2 G. S. R. Deb and S. Deb, “Robotics Technology and Flexible Automation”, Second Edition, Tata McGraw Hill Education Pvt, Ltd., New Delhi, 2017.

Reference Books:

1 S. K. Saha, “Introduction to Robotics”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2008.
2 R. K. Mittal, I. J. Nagrath, “Robotics and Control”, Tata McGraw-Hill Publishing Company Ltd, 2005.
3 Alex Zelinsky, “Field and Service Robotics”, United Kingdom: Springer London, 2012.
4 Amir Jafari, Nafiseh Ebrahimi, “Soft robotics in rehabilitation”, Elsevier Science, 2021

Web References:

1 http://nptel.ac.in/courses/112101099/
2 http://nptel.ac.in/downloads/112101098/
3 https://http://pal-robotics.com/en/products/reem/

4 https://eos.org/features/underground-robots-how-robotics-is-changing-the-mining-industry

5 https://link.springer.com/chapter/10.1007/978-1-4471-1273-0_9

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C935.1 & C935.2	Understand	Quiz	**5**
C935.3 & C935.4	Apply	Assignment	**10**
C935.5	Analyse	Case Study	**5**

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	[50 Marks]
Remember	30	20	20	20
Understand	30	30	30	30
Apply	20	50	50	30
Analyse	20	-	-	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C935.1	3	3	3	2	2	1			2			3	3	3	2
C935.2	3	3	3	2	2	1			2			3	3	3	2
C935.3	3	3	3	2	2	2			3			3	3		2
C935.4	3	3	3	2	2	2			3			3	3	3	2
C935.5	3	3	3	2	2	2			3			3	3	3	2

20CSI936 **VIRTUAL REALITY** **3/0/0/3**

Nature of Course D (Theory Application)
Pre requisites Human Computer Interaction

Course Objectives:

1. To gain knowledge of how Virtual Reality system works.
2. To learn the fundamentals of perceptual modalities.
3. To experiment virtual environment using suitable devices and architectures.
4. To configure and design programs for virtual reality applications.

Course Outcomes:

Upon completion of the course, students shall have the ability to:

C936.1	Describe the fundamental characteristics and components of virtual reality.	[U]
C936.2	Apply design guidelines for perceptual modalities.	[AP]
C936.3	Demonstrate Virtual Reality system with rendering hardware.	[AP]
C936.4	Examine the behavior of VR modeling techniques.	[AP]
C936.5	Acquire programming knowledge to deploy VR experiences. .	[AP]

Course Contents:

Module 1: Introduction to Virtual Reality **15 Hours**

History of VR – Reality systems – Immersion, Presence and Reality Trade-offs - VR Interaction concepts - Perceptual illusions – Objective and subjective reality - Perceptual modalities – Space, time and motion perception – Perceptual stability - attention and action - Design guidelines for perception.

Module 2: Devices, Architectures and Modeling **15 Hours**

Input Devices: Trackers - Navigation - Gesture Interfaces - **Output Devices:** Graphics - Three-Dimensional Sound, Haptic Displays - **Computing Architectures For VR:** Rendering Pipeline - PC Graphics Architecture, Workstation-Based Architectures, Distributed VR Architectures – **Modeling:** Geometric – Kinematics - Physical and Behavior Modeling**.**

Module 3: VR Programming and Applications **15 Hours**

VR Programming: Toolkits and Scene Graphs - WorldToolKit, Java 3D - General Haptics Open Software Toolkit - Robot Programming - VR development in Unity - Medical Applications of VR - VR in Education - Military VR Applications - VR Applications in Manufacturing. **Case study:** Modular Interactive Virtual Surgical Environment - Intelligent Tutoring - Industrial System Monitoring

Total Hours 45

Text Books:

1. William Sherman, Alan Craig, “Understanding Virtual Reality: Interface, Application, and Design”, 2nd Edition, Morgan Kaufmann, 2018.
2. Grigore C. Burdea, Philippe Coiffet, “Virtual Reality Technology”, 2nd Edition, Wiley-IEEE Press, 2017.
3. Jason Jerald, “The VR Book: Human-Centered Design for Virtual Reality”, ACM Books, 2016.

Reference Books:

1. Tony Parisi, “Learning Virtual Reality”, O'Reilly, 2015.
2. Jonathan Linowes, “Unity Virtual Reality Projects”, Packt Publishing, 2015.
3. Philippe Fuchs and Guillaume Moreau, “Virtual Reality: Concepts and Technologies”, CRC Press, 2012.
4. Alan B. Craig, William R. Sherman and Jeffrey D. Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.

Web References:

1. https://uxplanet.org/designing-user-experience-for-virtual-reality-vr-applications-fc8e4faadd96
2. https://techooid.com/input-devices-vr
3. https://learn.unity.com/course/create-with-vr

Online Resources:

1. https://www.coursera.org/learn/introduction-virtual-reality
2. https://www.udemy.com/course/multiplayer-virtual-reality-vr-development-with-unity/
3. https://www.edx.org/course/creating-virtual-reality-vr-apps-2
4. https://www.edx.org/course/how-virtual-reality-works

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C936.1 & 2	Understand	Quiz	5
C936.3 & 4	Apply	Assignment	10
C936.5	Apply	Case Study	5

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment(30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	30	20	20	20
Understand	30	30	20	30
Apply	40	50	60	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C936.1	3	3	3	3		2						2	3	3	2
C936.2	3	3	3	3		2						2	3	3	2
C936.3	3	3	3	3		2						2	3	3	2
C936.4	3	3	3	3		2						2	3	3	2
C936.5	3	3	3	3		2						2	3	3	2

20CSI937 HIGH PERFORMANCE COMPUTING 3/0/0/3

Nature of Course D (Theory Application)
Pre requisites Computer Architecture

Course Objectives:

1. To familiarize the aspects of high performance computing.
2. To describe distributed memory programming using Message Passing Interface (MPI).
3. To understand shared memory paradigm with OpenMP.
4. To learn the GPU based parallel programming using OpenCL and CUDA.

Course Outcomes:

Upon completion of the course, students shall have the ability to:

C937.1	Understand the parallel programming platforms.	[U]
C937.2	Recognize the aspects of parallel algorithm model.	[U]
C937.3	Develop distributed memory programs using MPI framework.	[AP]
C937.4	Illustrate shared memory parallel programs using OpenMP.	[AP]
C937.5	Implement Graphical Processing OpenCL and CUDA programs.	[AP]

Course Contents:

Module 1: HPC Paradigms and Parallel Programming Platforms 15 Hours

Introduction to High Performance Computing (HPC) – Levels of parallelism – Parallel architectures – **HPC Paradigms:** Supercomputing - Cluster Computing - Grid Computing - Cloud Computing - Many core Computing, Petascale Systems. **Parallel Programming Platforms:** Implicit Parallelism - Memory System Performance - Dichotomy of Parallel Computing Platforms - Physical Organization of Parallel Platforms - Communication Costs in Parallel Machines - Routing Mechanisms for Interconnection Networks - Impact of Mapping Techniques

Module 2: Modeling of Parallel Programs and OPENMP 15 Hours

Modeling of Parallel Programs: Sources of Overhead - Performance Metrics – Scheduling – Scalability – Synchronization - Resource Management - Operating systems for scalable HPC. Programming using Message Passing Interface (MPI). **OPENMP**: Basics - Scope of Variables - User Directives and Functions – Threads - Environment Variables - Scheduling Loops - Cache Issues, Tasking.

Module 3: Parallel Programming 15 Hours

OpenCL: Programming model and application structure - Coordinates and Indexing - Synchronization Functions - Sample OpenCL application. **CUDA:** Heterogeneous computing – Threads – Blocks – Grids - Trapezoidal rule - CUDA implementation. **Case study:** Simulating Galaxy Evolution - NASA'S Space Shuttle Computer System - Parallel Computing Toolbox

Total Hours: 45

Text Books:

1. Peter S Pacheco, Matthew Malensek, "An Introduction to Parallel Programming", 2nd Edition, Morgan Kaufmann, 2022
2. Pawet Czarnul, "Parallel Programming for Modern High Performance Computing Systems", CRC Press, 2018.
3. Jaegeun Han, Bharatkumar Sharma, "Learn CUDA Programming", Packt publisher, 2019.

Reference Books:

1. Victor Eijkhout, Edmond Chow, Robert van de Geijn, “Introduction to High Performance Scientific Computing”, 2nd Edition, 2016.
2. Rob Farber, “CUDA application design and development”, Morgan Haufmann, 2011.
3. A. Munshi, B. Gaster, T. G. Mattson, J. Fung, and D. Ginsburg, “OpenCL programming guide”, Addison Wesley, 2011
4. Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, “Introduction to Parallel Computing”, 2nd Edition, Addison-Wesley, 2003.

Web References:

1. https://www.khronos.org/opencl/
2. https://www.openmp.org/
3. https://developer.nvidia.com/cuda-toolkit

Online Resources:

1. https://nptel.ac.in/courses/106102163
2. https://www.mooc-list.com/course/fundamentals-parallelism-intel-architecture-coursera
3. https://www.udemy.com/topic/cuda/

Assessment Methods & Levels (based on Blooms’ Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C937.1 & 2	Understand	Quiz	5
C937.3 & 4	Apply	Assignment	10
C937.5	Apply	Case Study	5

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment (30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	40	20	20	20
Understand	60	30	40	30
Apply	-	50	40	50
Analyse	-	-	-	-
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C937.1	3	3	3	3	2							2	3	3	2
C937.2	3	3	3	3	2							2	3	3	2
C937.3	3	3	3	3	2							2	3	3	2
C937.4	3	3	3	3	2							2	3	3	2
C937.5	3	3	3	3	2							2	3	3	2

20CSI938 **DEVOPS** **3/0/0/3**

Nature of Course D (Theory Application)
Pre requisites Python Programming, Core Java Programming

Course Objectives:

1. To learn basics of DevOps and its components
2. To discuss concepts of managing source code and automating builds
3. To understand virtualization tools
4. To create containers and dockers using different tools.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C938.1	Analyze DevOps and the modern DevOps toolset	[A]
C938.2	Ability to automate all the aspects of a modern code delivery and deployment pipeline	[A]
C938.3	Design a complete infrastructure to deploy, configure, test, and monitor software	[A]
C938.4	Create a DevOps-related cloud and virtualization architecture	[AP]
C938.5	Implement continuous integration and reduce time-to-market of software	[AP]

Course Contents:

Module 1: Introduction to DevOps **15 Hours**

Introduction - SDLC - Types Of SDLC Methods - Agile Methodology - SCRUM Methodology - Need for DevOps Culture - DevOps Infrastructure - Development, Release and Deployment - Test Driven Development - Application Development - Continuous Delivery - Continuous Development - Infrastructure Automation - Misconceptions - Anti-Patterns **Case Study:** Docusign-Forter-Turnitin-Gengo-Etsy-Netflix.

Module 2: Virtualization **15 Hours**

Virtualization - Vagrant & Virtualbox - Linux Environment - Commands and File systems - Filters - Redirections – Users - Groups - File Permission - Package Management - Services - Processes - Vagrant File Initialization - Vagrant Automation - Vagrant IP - RAM & CPU - Vagrant Sync Directories - Multi VM Vagrant file. **Case Study:** Reatail DevOps-Government Agency-Agile Implementation in a Large Regulated Industry.

Module 3: Container **15 Hours**

Containers - Docker - Microservices - Docker logs and Docker volumes - Building images - Docker Compose - Kubernetes - Object and Documentations - Namespace - Namespace - Service - Deployment - Jenkins - Jenkins integration with GIT. **Case Study:** Self-service developer deployment, an example of continuous deployment - Relying on production Telemetry for ATM System

Total Hours: 45

Text Books:

1. Gene Kim, Jez Humble, Patrick Debois, John Willis, “The Devops Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations” It Revolution Press; 2nd Edition, 2021.
2. Jennifer Davis and Ryn Daniels, “Effective Devops Building a Culture of Collaboration, Affinity, and Tooling at Scale” Shroff/O'Reilly; First edition, 2016.
3. Nigel Poulton, “Docker Deep Dive: Zero to Docker in a single book” May 2020

Reference Books:

1. Nigel Poulton, Pushkar Joglekar “The Kubernetes Book: 2022 Edition”
2. Nicole Forsgren PhD, Jez Humble, Gene Kim, “Accelerate: The Science of Lean Software and DevOps: Building and Scaling High Performing Technology Organizations”, IT Revolution Press; 1st edition, 2018.
3. Gene Kim, “The Phoenix Project: A Novel about It, Devops, and Helping Your Business Win”, It Revolution Press; 5th Anniversary ed. Edition,2018.

4. Gene Kim, Frankie Corzo, IT Revolution Press, “The Unicorn Project: A Novel About Developers, Digital Disruption, and Thriving in the Age of Data”, IT Revolution Press, 2019

Web References:

1. https://azure.microsoft.com/en-in/solutions/devops/tutorial/
2. https://web.devopstopologies.com/

Online Resources:

1. https://www.udemy.com/course/decodingdevops/
2. https://github.com/adit0503/Reading_Books/tree/master/Devops

Assessment Methods & Levels (based on Blooms’ Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom’s Level	Assessment Component	Marks
C938.1	Understand	Quiz	5
C938.2 & C938.3	Apply	Assignment	5
C938.4 & C938.5	Analyse	Case Study	10

Summative assessment based on Continuous and End Semester Examination

Bloom’s Level	Continuous Assessment (30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	30	20	20	30
Understand	30	20	20	30
Apply	20	30	30	20
Analyse	20	30	30	20
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C938.1	3	3	3	2	2							2	3	3	2
C938.2	3	3	3	2	2							2	3	3	2
C938.3	3	3	3	2	2							2	3	3	2
C938.4	3	3	3	2	2							2	3	3	2
C938.5	3	3	3	2	2							2	3	3	2

20CSI001 **MULTIMEDIA APPLICATIONS** **3/0/0/3**

Nature of Course C (Theory Concepts)
Pre requisite -
Course Objectives:

1. To identify basics concepts and architecture of multimedia system.
2. To illustrate different multimedia components.
3. To explain file formats of different multimedia components.
4. To analyze different compression algorithms.
5. To describe various animation techniques.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C001.1	Demonstrate the basic concepts of multimedia and its architecture.	[U]
C001.2	Create applications using audio compression techniques.	[AP]
C001.3	Develop applications with image compression techniques.	[AP]
C001.4	Apply video compression techniques and file formats.	[AP]
C001.5	Illustrate animation project using OpenGL2 and apply morphing techniques	[A]

Course Contents:

Module 1: Multimedia Fundamentals **15 Hours**

Introduction to basic concepts of multimedia - Multimedia System Architecture - Components of multimedia - Web and Internet multimedia applications - Transition from conventional media to digital media .**Usage of text in Multimedia:** Families and faces of fonts - Outline fonts - Bitmap fonts - International character sets and hypertext - Digital fonts.

Module 2: Audio and Image Representations15 Hours

Audio Representation : Digitization of sound - Frequency and bandwidth - Decibel system - Data rate - Audio file format - Sound synthesis - MIDI - Wavetable - Compression and transmission of audio on Internet - Adding sound to your multimedia project - Audio software and hardware. **Image Representation :** Colour Science - Colour Models - Colour palettes - Dithering - Image Compression and File Formats - Use of image editing software - White balance correction - Dynamic range correction - Gamma correction - Photo Retouching.

Module 3: Video and Animation **15 Hours**

Video: Analog - Digital - Broadcast Video Standards - Video Recording and Tape formats - Video Compression and File Formats - Motion Compensation. **Animation:** Introduction - The Power of Motion - Principles of Animation - Animation by Computer - Animation techniques using OpenGL 2 – Morphing.

Total Hours 45 Hours

Text Books:

1. Parekh Ranjan, “Principles of Multimedia”, Tata McGraw-Hill, 2017.
2. Tay Vaughan, “Multimedia making it work”, Tata McGraw-Hill, Ninth Edition, 2014.
3. Raval, M. S., Dandawate, Y. H., Joshi, K. R., Joshi, M. A., Metkar, S. P. ,”Image and Video Compression: Fundamentals, Techniques, and Applications”, CRC Press,2014.
4. Ralf Steinmetz & Klara Nahrstedt, Multimedia Systems, Springer, 2013.

Reference Books:

1. Malay K. Pakhira ,"Computer Graphics Multimedia and Animation", PHI Publisher, Second Edition,2010.
2. Rajneesh Aggarwal& B.B Tiwari, "Multimedia Systems", Excel Publication, New Delhi, 2007.

Online Resources:

1. https://www.coursera.org/lecture/internet-of-things-multimedia/multimedia-technologies-YQGDv
2. https://unacademy.com/course/introduction-to-multimedia-class-12/FWJBCUCT

Web References:

1. https://www.tutorialspoint.com/multimedia/index.html

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C1001.1	Understand	Quiz	5
C1001.2, 3 & 4	Apply	Assignment	5
C1001.5	Analyse	Case Study	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment(30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	20	20	20	20
Understand	20	40	40	40
Apply	60	40	30	30
Analyse	-	-	10	10
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C001.1	3	3	3	3	3	2						2	2	2	2
C001.2	3	3	3	3	2		2	1	1	1		2	2	2	2
C001.3	3	3	3	3	3	3	3	1	1	1	2	2	2	2	2
C001.4	3	3	3	3	3		3				2	2	2	3	3
C001.5	3	3	3	3	3	2	2	1	1	1	2	3	3	2	2

20CSI002 .NET FRAMEWORK FOR APPLICATION DEVELOPMENT 3/0/0/3

Nature of Course C (Theory Concept)
Pre requisite Object Oriented Concepts

Course Objectives:

1 To Introduce Visual Studio Programming Environment.
2 To illustrate the characteristics of Object Oriented Programming using C#.
3 To implement Interfaces and define custom interfaces for application.
4 To construct custom collections, generics and query expressions in C#.

Course Outcomes:

Upon completion of the course, students shall have ability to:

C002.1	Express the syntax and semantics of C#.	[U]
C002.2	Demonstrate Object Oriented Programming concepts in C#.	[U]
C002.3	Develop interfaces concepts in building complex applications.	[AP]
C002.4	Illustrate the use of generics and collections in C#.	[A]
C002.5	Practice file operations using IO streams.	[AP]

Course Contents:

Module 1: Introduction to .NET Framework 15 Hours

Features of .Net - Common Type System-Common Language Specification-**C# Basics:** Variables - Operators – Expressions-Methods – Scope- Decision Statements and Control Statements-Compound Assignment and Iteration Statements. Arrays – Strings-Structures and Enumerations.

Module 2: C# Object Model 15 Hours

Classes and Objects- Methods and Properties- Data Encapsulation - Data Abstraction- Abstract Classes and Sealed Classes-Constructor and Destructor - Values and References - Inheritance-Creating interfaces - Static and Instance Members- Garbage Collection and Resource Management-Delegate – Unicast and Multicast- Managing Errors and Exceptions.

Module 3: Extensible Types with C# 15 Hours

Operator Overloading- Partial Class - Partial methods- Extension Methods-Anonymous Types - Tuples. Collections - Enumerating Collections- Decoupling Application Logic and Event Handling. **IO Streams:** Types of Streams – FileMode – FileAccess – FileShare –Binaryreader - Binarywriter- Serialization - Deserialization.

Total Hours 45 Hours

Text Books:

1. John Sharp, Microsoft Visual C# Step by Step, 8th Edition, PHI Learning Pvt. Ltd. 2016
2. Herbert Schildt, C# 4.0 The Complete Reference, McGraw Hill Education, 1st edition, 2017.

Reference Books:

1. Christian Nagel, “C# 6 and .NET Core 2.0”, 1st Edition, Wiley India Pvt Ltd, 2018.
2. Andrew Stellman and Jennifer Greene, “Head First C#”, 4th Edition, O’Reilly Publications, 2020.
3. Mark Michaelis, “Essential C# 6.0”, 7th Edition, Pearson Education India, 2020.
4. Andrew Troelsen, “Prof C# 6.0 and the .NET 4.6 Framework”, 7th Edition, Apress and Dreamtech Press, 2015.

Web References:

1. https://www.coursera.org/learn/introduction-programming-unity
2. https://www.udemy.com/course/c-net-for-beginners/
3. https://dotnet.microsoft.com/en-us/learn

Online References:

1. https://www.tutorialsteacher.com/csharp
2. https://zetcode.com/lang/csharp/
3. https://learncs.org/

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C002.1 &2	Understand	Quiz	5
C002.4	Analyse	Assignment	5
C002.3 & 5	Apply	Case study	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment(30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	30	20	20	20
Understand	40	30	40	40
Apply	30	50	30	30
Analyse	-	-	10	10
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C002.1	3	3	3	3	2	3			3			3	3	3	2
C002.2	3		3	3				2	3				3	3	3
C002.3	3	3	3	2	2				3				3	3	2
C002.4	3	3	3	3	3	3		2	3	3		3	3	3	2
C002.5	3	3	3	3	3	3		2	3	3		3	3	3	3

20CSI003 **DEPENDABLE COMPUTING** **3/0/0/3**

Nature of Course C (Theory Concept)
Pre requisites -
Course Objectives:

1. To explain the fundamentals of dependable computing.
2. To explore various modelling techniques for dependable computing.
3. To discuss various fault tolerant design techniques.
4. To examine dependability evaluation tools and techniques.
5. To interpret the features of real time Fault tolerant systems.

Course Outcomes:
Upon completion of the course, students shall have ability to:

C003.1	Discuss the fundamentals of dependable computing techniques.	[U]
C003.2	Interpret modelling techniques of dependable computing systems.	[U]
C003.3	Describe the defects, faults and errors in dependable computing systems.	[U]
C003.4	Simulate dependability evaluation techniques using tools.	[AP]
C003.5	Illustrate fault tolerant scheduling and routing in real time systems.	[AP]
C003.6	Analyse the fault tolerance in distributed systems.	[A]

Course Contents:

Module 1: Fundamentals of Dependable Computing **15 Hours**

Introduction - Dependable system - Techniques for achieving dependability - Dependability measures - Combinational Modelling - Modeling by Case Analysis -Series and Parallel Systems - Classes of k-out-of-n Systems - Reliability Block Diagrams - Reliability Graphs - Fault-Tree Method.

Module 2: Defects, Faults and Errors **15 Hours**

Faults – Errors – Defects - Faults manifestation - Classification of faults and failures - Fault detection – Masking – Containment – Location – Reconfiguration - Recovery. **Dependability Evaluation Techniques:** Hardware Redundancy - Software Redundancy - Time Redundancy - Information Redundancy - HIMAP tool.

Module 3: Fault Tolerance in Real Time Distributed Systems **15 Hours**

Introduction to Real Time Distributed Systems-Byzantine General problem - Consensus protocols - Checkpointing and recovery - Stable storage and RAID architectures - Data replication and Resiliency - Time-space tradeoff - Fault Tolerant Scheduling Algorithms - Dependable channels - Survivable networks - Fault-tolerant Routing. **CASE STUDY:** Amazon Web Services - Reliability Pillar.

Total Hours 45 Hours

Text Books:

1. Israel Koren, Fault Tolerance Systems, Elseiver, 2020.
2. D. P. Siewiorek and R. S. Swarz, Reliable Computer Systems: Design and Evaluation second edition Digital Press.,1998.
3. D. K. Pradhan, Fault Tolerant Computer System design, Prentice Hall., 1996.
4. Pankaj Jalote, Fault Tolerance in Distributed Systems, PTR Prentice Hall, 1994.

Reference Books:

1. Behrooz Parhami, Dependable Computing: A Multilevel Approach, 2015.
2. B.W. Johnson, Design and Analysis of Fault Tolerant Digital Systems, Addison Wesley, 1989.
3. Jean-Claude Geffroy, G. Motet, Design of Dependable Computing Systems, Springer., 2002.

Web References:

1. https://web.ece.ucsb.edu/~parhami/text_dep_comp.htm
2. https://www.docsity.com/en/terminology-and-concepts-dependable-computing-systems-lecture-notes/333794/
3. https://depend.csl.illinois.edu/our-research/nftape-2/#sthash.MaWOOCos.dpbs
4. https://docs.aws.amazon.com/wellarchitected/latest/reliability-pillar/welcome.html

Online Resources:

1. https://folk.idi.ntnu.no/noervaag/papers/IDI-TR-6-99.pdf
2. http://esfandi.ir/files/ebook/FTS-koren.pdf

Assessment Methods & Levels (based on Blooms' Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C003.1 & 2	Understand	Quiz	5
C003.3 ,4 & 5	Apply	Assignment	5
C003.6	Analyse	Case Study	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment(30)			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	40	20	20	20
Understand	60	40	40	40
Apply	-	40	30	30
Analyse	-	-	10	10
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C003.1	3	3	3	2	2								3	2	2
C003.2	3	3	3	2	2								3	2	2
C003.3	3	3	3	3	2								2	2	2
C003.4	3	3	3	2	2	2	2	2	2	2		2	2	2	2
C003.5	3	3	3	3	2	2	2	2	2	2		2	2	2	2
C003.6	3	3	3	3	2	2	2	2	2	2		2	2	2	2

20CSI004 **BUSINESS INFORMATION SYSTEMS** **3/0/0/3**

Nature of Course C (Theory Concept)
Pre requisite -
Course Objectives:

1. To introduce the fundamental principles of computer-based information systems, analysis and design.
2. To assess the impact of Internet technology on electronic commerce and electronic business.
3. To use various knowledge representation methods and different expert system structures in order to make business more competitive.

Course Outcomes:
Upon completion of the course, students shall have ability to:

C004.1	Explain the basic concepts and technologies used in the field of Business information systems.	[U]
C004.2	Apply various information systems to accomplish ERP, SCMand SRM in an organization.	[AP]
C004.3	Create and manage an IT balanced scorecard for E- commerce applications.	[AP]
C004.4	Describe the role of emerging information technologies and decision support systems in solving business problems.	[U]
C004.5	Survey the ethical, social, and security issues in information systems.	[A]

Course Contents:

Module 1: Introduction to Business Information Systems(BIS) **15 Hours**

Types of BIS – Capabilities – Complements - CCR Framework - Role of manager with respect to IT in an organization. Database management systems, Data Warehousing -Foundations of business intelligence - Data and Text Mining. Strategic Enterprise Systems – ERP - SCM, CRM - SRM.

Module 2: Operational Support Systems **15 Hours**

Manufacturing Systems - Sales and Marketing Systems - HRIS, Finance and Accounting Systems. IT Strategy and Balanced Scorecard – IT strategies - IT- business alignment, balanced scorecard - cloud and vendor strategies. **Mobile and E-commerce** – B2C - B2B and e-procurement - C2C and mobile commerce

Module 3: Emerging Technologies **15 Hours**

Cloud computing - Big Data Technologies - Internet of Things - Bring Your Own Device (BYoD) Virtual Reality - Augmented Reality - Block chain - Artificial Intelligence. **Knowledge Management** – Decision Support Systems - Expert Systems - Learning Management Systems - Executive Information Systems - Social - Ethical and Security Issues in BIS.

Total Hours 45 Hours

Text Books:

1. Kenneth C. Laudon & Jane P. Laudon. “Management Information Systems”. Pearson Publishing, 2016.
2. Jams. A O’Brien, Management Information systems- managing information technology in the internet worked enterprise, Tata McGraw Hill publishing company limited,2002.
3. Jessica Keyes, ”Implementing the Project Management Balanced Scorecard” CRC Press,2010
4. Austin, Robert D., Lynda M. Applegate, and Deborah Soule. Corporate Information Strategy and Management: Text and Cases. 8th ed. McGraw-Hill, 2008.

Reference Books:

1. S. Sadogopan , Management Information systems-PHI 1998
2. Carol V. Brown, Daniel W. DeHayes, Jeffrey Slater, Wainright E. Martin, William C. Perkins, Managing Information Technology: What Managers Need to Know, Pearson Education, 2011

Web References:

1. http://www.extension.harvard.edu/academics/courses/information-systems-management/12528
2. https://hbsp.harvard.edu/import/425333

Online Resources:

1. https://nptel.ac.in/courses/110/105/110105148/
2. https://www.coursera.org/specializations/information-systems

Assessment Methods & Levels (based on Bloom's Taxonomy)

Formative assessment based on Capstone Model (Max. Marks:20)

Course Outcome	Bloom's Level	Assessment Component	Marks
C004.1 & C004.4	Understand	Quiz	5
C004.2&3	Apply	Assignment	5
C004.5	Analyse	Case Study	10

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	[50 marks]
Remember	20	40	20	20
Understand	80	60	40	50
Apply	-	-	30	20
Analyse	-	-	10	10
Evaluate	-	-	-	-
Create	-	-	-	-

Formative Assessment	Summative Assessment		Total
	Continuous Assessment	End Semester Examination	
20	30	50	100

Course Outcome (CO)	Programme Outcomes (PO)												Programme Specific Outcomes(PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C004.1	3	3	3	3	3	1						1	2		2
C004.2	3	3	3	3	2	1	2		2	2	2	3	2	2	3
C004.3	3	3	3	3	2	1			2	2	2	2	3	2	2
C004.4	3	3	3	3	3	2	2		2	2		2	3	2	2
C004.5	3	3	3	3	3	2	2	2	2	2		3	3	2	2

20ACI090 **ENGLISH FOR RESEARCH PAPER WRITING** **3/0/0/3**

Nature of Course C (Theory Concept)

Pre requisites -

Course Objectives:

1. To develop skills for effective writing through controlled and guided activities.
2. To familiarize learners with the nuances of effective writing.

Course Outcomes

Upon completion of the course, students shall have ability to

C090.1	Communicate effectively in writing in a variety of situations.	[U]
C090.2	Express ideas on different occasions with the notions of appropriateness and accuracy.	[AP]
C090.3	Describe techniques for adding nuance to sentences.	[U]
C090.4	Examine, punctuate and essay like a professional.	[AP]
C090.5	Discover interests in creative writing.	[U]

Course Contents:

Module 1: Introduction **10 hours**

Introduction to Effective Writing - Effective Writing as an Art - Principles of Effective Writing Types and Stages of Effective Writing - Notions of Correctness and Appropriateness, Part I - Notions of Correctness and Appropriateness, Part II.

Module 2: Essay Writing and Business Writing **10 hours**

Introduction to Essay Writing - Types of Essays - Essentials of Academic Writing, Part I - Essentials of Academic Writing, Part II - Business Writing and its Functions - Mechanics of Business Writing - Business Letters and Memos - Format of Business Letters and Memos - Types of Business Letter.

Module 3: Report Writing **10 hours**

Introduction to Sales, Complaint and Adjustment Letters - Report Writing - Strategies and Structure of Reports - Style of Report Writing - Creative Writing.

Total Hours **30**

Text Books:

1. Turk, Christopher and John Kirkman. Effective Writing. London and New York: Chapman & Hall. Indian Reprint 2003.
2. Pinker, Steven. The Sense of Style: The Thinking Person's Guide to Writing in the 21st Century. Penguin Books, Reprint edition,2015.
3. Seely, John. Oxford Guide to Effective Writing and Speaking. OUP 2nd edition, 2005.

Reference Books:

1. Goins, Jeff. You Are a Writer (So Start Acting Like One). Tribe Press, 2014.
2. Brohaugh, William. Write Tight: Say Exactly What You Mean with Precision and Power,1993.
3. Janzer. Anne. The Writer's Process: Getting Your Brain in Gear. Cuesta Park Consulting, 2016.
4. King, Stephen. On Writing: A Memoir of the Craft. Scribner, 2010.

Web References:

1. https://www.hamilton.edu/academics/centers/writing/writing-resources/habits-of-effective-writers
2. http://orelt.col.org/module/4-effective-writing

Online Resources:

1. https://www.nptel.ac.in/noc/courses/noc21/SEM1/noc21-hs44/
2. https://www.coursera.org/specializations/good-with-words

Assessment Methods & Levels (based on Revised Bloom's Taxonomy)
Formative assessment based on Capstone Model (Max. Marks: 40)

Course Outcome	Bloom's Level	Assessment Component	Marks
C090.1& 3	Understand	Quiz	20
C090.2 & 4	Apply	Assignment	10
C090.5	Understand	Case Study	10

Summative assessment based on Continuous Assessment

Revised Bloom's Level	Term End Examination [60 marks]
Remember	30
Understand	40
Apply	30
Analyse	-
Evaluate	-
Create	-

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C090.1						3	2	3	3			2	3	3	
C090.2						2	2	2	3			2	2	2	
C090.3						3	1	3	2			2	2	1	
C090.4						2	2	2	3			2	1	1	
C090.5						2	1	3	2			2	1	1	

20ACI097 **PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS** **2/0/0/2**

Nature of Course C (Theory Concept)

Pre requisites -

Course Objectives:

1. To develop communication competence in prospective engineers.
2. To enable them to convey thoughts and ideas with clarity and focus.
3. To develop report writing skills
4. To equip them to face interview & Group Discussion.
5. To inculcate critical thinking process.
6. To prepare them on problem solving skills.
7. To provide symbolic, verbal, and graphical interpretations of statements in a problem description

Course Outcomes

Upon completion of the course, students shall have ability to

C097.1	Define and identify different life skills required in personal and professional life.	[U]
C097.2	Develop an awareness of the self and apply well-defined techniques to cope with emotions and stress.	[AP]
C097.3	Explain the basic mechanics of effective communication and demonstrate these through presentations.	[A]
C097.4	Use appropriate thinking and problem solving techniques to solve new problems.	[AP]
C097.5	Understand the basics of teamwork and leadership	[U]

Course Contents:

Module 1: Communication Skill **10 Hours**

Introduction to Communication - The Process of Communication - Barriers to Communication - Listening Skills - Writing Skills - Technical Writing - Letter Writing - Job Application - Report Writing - Non-verbal Communication and Body Language - Interview Skills - Group Discussion - Presentation Skills - Technology-based Communication.

Module 2: Critical Thinking & Problem Solving **10 Hours**

Creativity - Lateral thinking - Critical thinking -Multiple Intelligence - Problem Solving - Six thinking hats Mind Mapping & Analytical Thinking. **Teamwork:** Groups – Teams - Group Vs Teams - Team formation process - Stages of Group - Group Dynamics - Managing Team Performance & Team Conflicts.

Module 3: Ethics, Moral & Professional Values **10 Hours**

Human Values - Civic Rights, Engineering Ethics - Engineering as Social Experimentation - Environmental Ethics - Global Issues - Code of Ethics like ASME, ASCE, IEEE. **Leadership Skills:** Leadership - Levels of Leadership - Making of a leader - Types of leadership - Transactions Vs Transformational Leadership - VUCA Leaders - DART Leadership - Leadership Grid & leadership Formulation.

Total Hours 30 Hours

Text Books:

1. Barun K. Mitra, "Personality Development & Soft Skills", First Edition, Oxford Publishers, 2011.
2. Kalyana, "Soft Skill for Managers", 1" Edition, Wiley Publishing Ltd, 2015. 3 Larry James. "The First Book of Life Skills", 1" Edition, Embassy Books, 2016.

Reference Books:

1. Shalini Verma, "Development of Life Skills and Professional Practice", 1 Edition Sultan Chand (G/L) & Company, 2014.
2. John C. Maxwell, The 5 Levels of Leadership", Centre Street, A division of Hachette Book Group Inc, 2014.

Web References:

1. http://psydilab.univer.kharkov.ua/resources/ucheba/softskills/Chapter_1_Introduction
2. https://mu.ac.in/wp-content/uploads/2021/07/Soft-Skills-Development

Online Resources:

1. https://onlinecourses.nptel.ac.in/noc19_hs32/preview
2. https://www.coursera.org/learn/teamwork-skills-effective-communication

Assessment Methods & Levels (based on Revised Bloom's Taxonomy)

Formative assessment based on Capstone Model (Max. Marks: 40)

Course Outcome	Bloom's Level	Assessment Component	Marks
C097.1& 5	Understand	Quiz	20
C097.2 & 4	Apply	Assignment	10
C097.3	Analyse	Case Study	10

Summative assessment based on Continuous Assessment

Revised Bloom's Level	Term End Examination [60 marks]
Remember	30
Understand	40
Apply	30
Analyse	-
Evaluate	-
Create	-

Course Outcomes (CO)	Programme Outcomes (PO)												Programme Specific Outcomes (PSO)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
C097.1						3	2	3	3			2	3	2	
C097.2						2	2	2	1			3	2	3	
C097.3						1	1	1	2			1	3	1	
C097.4						1	2	1	1			3	2	2	
C097.5						2	1	1	2			2	1	1	