



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



**SRI KRISHNA COLLEGE OF ENGINEERING
AND TECHNOLOGY**



**DEPARTMENT OF
COMPUTER SCIENCE AND ENGINEERING**

**REGULATION 2020
M.Tech. COMPUTER SCIENCE AND ENGINEERING
(5 Year Integrated)**

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 outreach 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 to PEO's

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

Mapping of PO's to PSO's

Programme Educational Objectives (PSO)	Programme Outcomes (PO)											
	1	2	3	4	5	6	7	8	9	10	11	12
PSO 1	2	3	2	1	2	1	1	1	2	1	2	1
PSO 2	2	2	3	1	2	1	2	1	1	1	2	1
PSO 3	1	1	1			1	1	1		3	1	3

Mapping of PEO's & PSO's

Programme Specific Outcomes (PSO)	Programme Educational Objectives (PEO)			
	PEO1	PEO2	PEO3	PEO4
1	3	2	2	2
2	3	3	3	2
3	2	2	2	2

1	Reasonably agreed	2	Moderately agreed	3	Strongly agreed
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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

Sem IX	Front end Frameworks Engineering	2	3	3						2		2	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 Computer and Network Security	Mobile Ad Hoc Networks	3	3	3	2	3	3	2	2		2		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	2	2		2	2	2			2		2
	Cyber Security and Ethical Hacking	2	2	3	3	3	2	2	3	2	2	2	3
	Advanced Databases	3	3	3	3	2	2						3
	Advanced Algorithms	3	3	3	2	3	3	2	2		2		2
	Software Product Management	2	3	3		2	2	2	2				3
	Information Ethics and Cyber Laws	1	2				2	2	3	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	19MAI101 / 20MAI101	Linear Algebra and Differential Calculus	3/1/0	4	4	50/50	BS
2	19CSI101 / 20CSI101	Problem Solving using C	3/0/0	3	3	50/50	PC
THEORY CUM PRACTICAL							
3	19ENI101 / 20ENI101	Business English Communication	2/0/2	4	3	40/60	HM
4	19PHI101 / 20PHI101	Engineering Physics	3/0/2	5	4	40/60	BS
PRACTICAL							
5	19CSI102 / 20CSI102	C Programming Laboratory	0/0/3	3	1.5	40/60	PC
6	19MEI101 / 20MEI101	Engineering Graphics	2/0/2	4	3	40/60	ES
MANDATORY COURSE							
7	19MCI101 / 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	19MAI201 / 20MAI201	Integral Calculus and Complex Variables	3/1/0	4	4	50/50	BS
2	19CSI201 / 20CSI201	Python Programming	3/0/0	3	3	50/50	PC
3	19CSI202 / 20CSI202	Data Structures	3/1/0	4	4	50/50	PC
THEORY CUM PRACTICAL							
4	19EEI201 / 20EEI201	Basics of Electrical and Electronics Engineering	3/0/2	5	4	40/60	ES
5	19ECI201 / 20ECI201	Digital Principles and System Design	3/0/2	5	4	40/60	ES
PRACTICAL							
6	19CSI203 / 20CSI203	Python Programming Laboratory	0/0/3	3	1.5	40/60	PC
7	19CSI204 / 20CSI204	Data Structures Laboratory	0/0/3	3	1.5	40/60	PC
MANDATORY COURSE							
8	19MCI201 / 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	19MAI301 / 20MAI301	Discrete Structures	3/1/0	4	4	50/50	BS
2	19CSI301 / 20CSI301	Operating Systems	3/0/0	3	3	50/50	PC
3	19CSI302 / 20CSI302	Design and Analysis of Algorithms	3/0/0	3	3	50/50	PC
4	19CSI303 / 20CSI303	Computer Architecture	3/0/0	3	3	50/50	PC
THEORY CUM PRACTICAL							
5	19CSI304 / 20CSI304	Object Oriented Programming using Java and UML	3/0/2	5	4	40/60	PC
PRACTICAL							
6	19CSI305 / 20CSI305	Operating Systems Laboratory	0/0/3	3	1.5	40/60	PC
7	19CSI306 / 20CSI306	Analysis of Algorithms Laboratory	0/0/3	3	1.5	40/60	PC
AUDIT COURSE							
8	19ACIXXX / 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	19CSI401 / 20CSI401	Database Management Systems	3/0/0	3	3	50/50	PC
3	19CSI402 / 20CSI402	Core Java Programming	3/0/0	3	3	50/50	PC
4	19CSI403 / 20CSI403	Enterprise Design Patterns	3/0/0	3	3	50/50	PC
THEORY CUM PRACTICAL							
5	19ECI401 / 20ECI401	Microprocessors and Microcontrollers	3/0/2	5	4	40/60	ES
PRACTICAL							
6	19CSI404 / 20CSI404	Database Management Systems Laboratory	0/0/3	3	1.5	40/60	PC
7	19CSI405 / 20CSI405	Java Laboratory	0/0/3	3	1.5	40/60	PC
AUDIT COURSE							
8	19ACIXXX / 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	19CSI501 / 20CSI501	Data Warehousing and Mining	3/0/0	3	3	50/50	PC
2	19CSI502 / 20CSI502	Artificial Intelligence	3/0/0	3	3	50/50	PC
THEORY CUM PRACTICAL							
3	19CSI503 / 20CSI503	JEE Framework	3/0/2	5	4	40/60	PC
4	19CSI504 / 20CSI504	PHP and JS framework	3/0/2	5	4	40/60	PC
5	19CSI505 / 20CSI505	Computer Networks	3/0/2	5	4	40/60	PC
6	19CSI506 / 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	19CSI601 / 20CSI601	Compiler Design	3/0/0	3	3	50/50	PC
2	19CSI9XX / 20CSI9XX	Professional Elective I	3/0/0	3	3	50/50	PE
THEORY CUM PRACTICAL							
3	19CSI602 / 20CSI602	Cryptography, Network Security and Application Security	3/0/2	5	4	40/60	PC
4	19CSI603 / 20CSI603	Software Validation and Testing	3/0/2	5	4	40/60	PC
5	19CSI604 / 20CSI604	Big Data Analytics	3/0/2	5	4	40/60	PC
6	19CSI605 / 20CSI605	Mobile Application Development	2/0/4	6	4	40/60	PC
PROJECT WORK							
7	19CSI606 / 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	19XXXXX / 20XXXXX	Open Elective I	3/0/0	3	3	50/50	OE
2	19CSI9XX / 20CSI9XX	Professional Elective II	3/0/0	3	3	50/50	PE
3	19CSI9XX / 20CSI9XX	Professional Elective III	3/0/0	3	3	50/50	PE
THEORY CUM PRACTICAL							
4	19CSI701 / 20CSI701	Block Chain Technology	3/0/2	5	4	40/60	PC
5	19CSI702 / 20CSI702	Internet of Things	3/0/2	5	4	40/60	PC
6	19CSI703 / 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	19CSI801 / 20CSI801	Microservices and Distributed Computing Architecture	3/0/0	3	3	50/50	PC
2	19XXXXX / 20XXXXX	Open Elective II	3/0/0	3	3	50/50	OE
3	19MGI801 / 20MGI801	Banking and Insurance	3/0/0	3	3	50/50	HM
4	19CSI9XX / 20CSI9XX	Professional Elective IV	3/0/0	3	3	50/50	PE
5	19CSI9XX / 20CSI9XX	Professional Elective V	3/0/0	3	3	50/50	PE
THEORY CUM PRACTICAL							
6	19CSI802 / 20CSI802	Machine Learning	3/0/2	5	4	40/60	PC
PROJECT WORK							
7	19CSI803 / 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	19CSI901 / 20CSI901	Front end Frameworks Engineering	3/0/2	5	4	40/60	PC
2	19CSI9XX / 20CSI9XX	Professional Elective VI	3/0/0	3	3	50/50	PE
PROJECT WORK							
3	19CSI902 / 20CSI902	Project Phase I	0/0/16	16	8	40/60	PW
Total				24	15	300	

SEMESTER X							
S No.	Course Code	Course	L/T/P	Contact hrs/week	Credit	Ext/Int	Category
PROJECT WORK							
1	19CSI903 / 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	19ENI101 / 20ENI101	Business English Communication	2/0/2	4	3	40/60	HM
2	19MGI801 / 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	19MAI101 / 20MAI101	Linear Algebra and Differential Calculus	3/1/0	4	4	50/50	BS
2	19PHI101 / 20PHI101	Engineering Physics	3/0/2	5	4	40/60	BS
3	19MAI201 / 20MAI201	Integral Calculus and Complex Variables	3/1/0	4	4	50/50	BS
4	19MAI301 / 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	19MEI101 / 20MEI101	Engineering Graphics	2/0/2	4	3	40/60	ES
2	19EEI201 / 20EEI201	Basics of Electrical and Electronics Engineering	3/0/2	5	4	40/60	ES
3	19ECI201 / 20ECI201	Digital Principles and System Design	3/0/2	5	4	40/60	ES
4	19ECI401 / 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	19CSI101 / 20CSI101	Problem Solving using C	3/0/0	3	3	50/50	PC
2	19CSI102 / 20CSI102	C Programming Laboratory	0/0/3	3	1.5	40/60	PC
3	19CSI201 / 20CSI201	Python Programming	3/0/0	3	3	50/50	PC
4	19CSI202 / 20CSI202	Data Structures	3/1/0	4	4	50/50	PC
5	19CSI203 / 20CSI203	Python Programming Laboratory	0/0/3	3	1.5	40/60	PC
6	19CSI204 / 20CSI204	Data Structures Laboratory	0/0/3	3	1.5	40/60	PC

7	19CSI301 / 20CSI301	Operating Systems	3/0/0	3	3	50/50	PC
8	19CSI302 / 20CSI302	Design and Analysis of Algorithms	3/0/0	3	3	50/50	PC
9	19CSI303 / 20CSI303	Computer Architecture	3/0/0	3	3	50/50	PC
10	19CSI304 / 20CSI304	Object Oriented Programming using Java and UML	3/0/2	5	4	40/60	PC
11	19CSI305 / 20CSI305	Operating Systems Laboratory	0/0/3	3	1.5	40/60	PC
12	19CSI306 / 20CSI306	Analysis of Algorithms Laboratory	0/0/3	3	1.5	40/60	PC
13	19CSI401 / 20CSI401	Database Management Systems	3/0/0	3	3	50/50	PC
14	19CSI402 / 20CSI402	Core Java Programming	3/0/0	3	3	50/50	PC
15	19CSI403 / 20CSI403	Enterprise Design Patterns	3/0/0	3	3	50/50	PC
16	19CSI404 / 20CSI404	Database Management Systems Laboratory	0/0/3	3	1.5	40/60	PC
17	19CSI405 / 20CSI405	Java Laboratory	0/0/3	3	1.5	40/60	PC
18	19CSI501 / 20CSI501	Data Warehousing and Mining	3/0/0	3	3	50/50	PC
19	19CSI502 / 20CSI502	Artificial Intelligence	3/0/0	3	3	50/50	PC
20	19CSI503 / 20CSI503	JEE Framework	3/0/2	5	4	40/60	PC
21	19CSI504 / 20CSI504	PHP and JS framework	3/0/2	5	4	40/60	PC
22	19CSI505 / 20CSI505	Computer Networks	3/0/2	5	4	40/60	PC
23	19CSI506 / 20CSI506	Agile Technology	3/0/2	5	4	40/60	PC
24	19CSI601 / 20CSI601	Compiler Design	3/0/0	3	3	50/50	PC
25	19CSI602 / 20CSI602	Cryptography, Network Security and Application Security	3/0/2	5	4	40/60	PC
26	19CSI603 / 20CSI603	Software Validation and Testing	3/0/2	5	4	40/60	PC
27	19CSI604 / 20CSI604	Big Data Analytics	3/0/2	5	4	40/60	PC
28	19CSI605 / 20CSI605	Mobile Application Development	2/0/4	6	4	40/60	PC
29	19CSI701 / 20CSI701	Block Chain Technology	3/0/2	5	4	40/60	PC
30	19CSI702 / 20CSI702	Internet of Things	3/0/2	5	4	40/60	PC
31	19CSI703 / 20CSI703	Cloud Computing	3/0/2	5	4	40/60	PC

32	19CSI801 / 20CSI801	Microservices and Distributed Computing Architecture	3/0/0	3	3	50/50	PC
33	19CSI802 / 20CSI802	Machine Learning	3/0/2	5	4	40/60	PC
34	19CSI901 / 20CSI901	Front end Frameworks Engineering.	3/0/2	5	4	40/60	PC

AUDIT COURSES (AC)

S.No.	Course Code	Course Title	Category
1	19ACI090 / 20ACI090	English for Research Paper Writing	AC
2	19ACI091 / 20ACI091	Disaster Management	AC
3	19ACI092 / 20ACI092	Sanskrit for Technical Knowledge	AC
4	19ACI093 / 20ACI093	Value Education	AC
5	19ACI094 / 20ACI094	Constitution of India	AC
6	19ACI095 / 20ACI095	Pedagogy Studies	AC
7	19ACI096 / 20ACI096	Stress Management by Yoga	AC
8	19ACI097 / 20ACI097	Personality Development through Life Enlightenment Skills	AC
9	19ACI098 / 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.	19CSI911 / 20CSI911	Mobile Ad Hoc networks	3/0/0	3	3	PE
2.	19CSI912 / 20CSI912	Mobile Computing	3/0/0	3	3	PE
3.	19CSI913 / 20CSI913	Distributed Systems	3/0/0	3	3	PE
4.	19CSI914 / 20CSI914	Wireless Sensor Networks	3/0/0	3	3	PE
5.	19CSI915 / 20CSI915	Cyber Security and Ethical Hacking	3/0/0	3	3	PE
6.	19CSI916 / 20CSI916	Advanced Databases	3/0/0	3	3	PE
7.	19CSI917 / 20CSI917	Advanced Algorithms	3/0/0	3	3	PE
8.	19CSI918 / 20CSI918	Software Product Management	3/0/0	3	3	PE
9.	19CSI919 / 20CSI919	Information Ethics and Cyber Laws	3/0/0	3	3	PE
Intelligent Systems						
10.	19CSI921 / 20CSI921	Soft Computing	3/0/0	3	3	PE
11.	19CSI922 / 20CSI922	Deep Learning	3/0/0	3	3	PE
12.	19CSI923 / 20CSI923	Human Computer Interaction	3/0/0	3	3	PE
13.	19CSI924 / 20CSI924	Image Processing and Pattern Recognition	3/0/0	3	3	PE
14.	19CSI925 / 20CSI925	Speech and Natural Language Processing	3/0/0	3	3	PE
15.	19CSI926 / 20CSI926	Social Network Analysis	3/0/0	3	3	PE
16.	19CSI927 / 20CSI927	Optimization Techniques	3/0/0	3	3	PE
17.	19CSI928 / 20CSI928	Data Visualization	3/0/0	3	3	PE
18.	19CSI929 / 20CSI929	Computer Vision	3/0/0	3	3	PE
Thriving Electives						
19.	19CSI931 / 20CSI931	Game Theory and its Applications	3/0/0	3	3	PE
20.	19CSI932 / 20CSI932	Computing for Digital Media	3/0/0	3	3	PE
21.	19CSI933 / 20CSI933	Business Intelligence	3/0/0	3	3	PE
22.	19CSI934 / 20CSI934	Quantum Computing	3/0/0	3	3	PE
23.	19CSI935 / 20CSI935	Robotics and Embedded Systems	3/0/0	3	3	PE
24.	19CSI936 / 20CSI936	Virtual Reality	3/0/0	3	3	PE
25.	19CSI937 / 20CSI937	Parallel Computing	3/0/0	3	3	PE
26.	19CSI938 / 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	19CSI001 / 20CSI001	Software Engineering	3	0	0	3	50/50
2	19CSI002 / 20CSI002	Data Structures and Algorithms	3	0	0	3	50/50
3	19CSI003 / 20CSI003	Fundamentals of Open Source Systems	3	0	0	3	50/50
4	19CSI004 / 20CSI004	Object Oriented Programming	3	0	0	3	50/50

ONE CREDIT COURSES

S.No	Course	Course Title
1.	19CSI811 / 20CSI811	SciKit
2.	19CSI812 / 20CSI812	Scrum
3.	19CSI813 / 20CSI813	Tensorflow
4.	19CSI814 / 20CSI814	MATLAB Programming
5.	19CSI815 / 20CSI815	SPSS
6.	19CSI816 / 20CSI816	SAP
7.	19CSI817 / 20CSI817	Laravel
9.	19CSI818 / 20CSI818	Foreign language / Spoken Hindi
10.	19CSI819 / 20CSI819	Patent Publications

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	1.5										1.5
9.	Mandatory Course (MC)											Non credit
10.	Audit courses (AC)											Extra Credit
Total		18.5	22	20	21	22	23.5	21	20.5	14	16	200

Nature of Course J (Problem Analytical)

Prerequisites -

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:

20 Hours

LINEAR ALGEBRA

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:

20 Hours

SEQUENCES AND SERIES

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:

20 Hours

CALCULUS

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: Differential 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.ManishGoyal, "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]	Examination [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

Nature of Course F (Theory Programming)

Prerequisites -

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:

15 Hours

Problem Solving Techniques: 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:

15 Hours

C Basics: 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:

15 Hours

Functions and Pointers: 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”, McGrawHill, Schaum’s outlines, 3rd Edition, 2014.

Reference Books:

- 1 S. Thamarai Selvi and R. Murugesan, “Programming in ANSI C”, 6th Edition, McGrawHill, 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

19ENI101 /
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:

15 Hours

Listening and Speaking

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:

15 Hours

Reading and Writing

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:

15 Hours

Parts of Speech

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
5 Extempore

[E]
[E]

Total Hours: 60 Hrs.

Text Books:

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

Reference Books:

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

Web References:

- <http://www.cambridgeindia.org>
- <http://www.cambridgeenglish.org/exams/business-certificates/business-vantage>
- <https://steptest.in>

Online Resources:

- <https://www.coursera.org/specializations/business-english>
- <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

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:

15 Hours

Wave optics :

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-Fraunhofer diffraction at single slit-Plane diffraction grating. Polarization-Introduction- Brewster's law, Malus law, Double refraction-Nicol's prism-construction and working.

Module 2:

15 Hours

Magnetic and Superconducting materials

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 hysteresis – 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 T_c super conductors– Application: Josephson effect - SQUID, magnetic levitation.

Module 3:

15 Hours

Semiconductor devices and Fibre Optic Communication:

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", DhanpatRai Publications, 2011

Reference Books:

- 1 AjoyGhatak, "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.fiberopticonline.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

19CSI102 /
20CSI102

C PROGRAMMING LABORATORY

0/0/3/1.5

Nature of Course M (Practical application)

Prerequisites -

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	End Semester
	Assessment [60 marks] (in %)	Examination [40 marks] (in %)
Remember	10	10
Understand	40	40
Apply	50	50
Analyse	-	-
Evaluate	-	-
Create	-	-

Nature of Course: M (Practical application)

Prerequisites : -

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 modelling 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 Involute)	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 Panchal V.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 BloomsTaxonomy)

Summative assessment based on Continuous and End Semester Examination

Bloom's Level	Rubric based	End Semester
	Continuous Assessment [60 marks] (in %)	Examination [40 marks] (in %)
Remember	30	30
Understand	30	30
Apply	20	20
Analyze	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

19MCI101 /
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.Meditationcentre/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

19MAI201 /
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:

20 Hours

INTEGRAL CALCULUS

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:

20 Hours

VECTOR CALCULUS

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 parallelepipeds.

Module 3:

20 Hours

COMPLEX VARIABLE

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, 13thEdition, 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, 4thEdition, 2012.
- 3 N.P.Bali and Dr.ManishGoyal, “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 [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
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

19CSI201 /
20CSI201

PYTHON PROGRAMMING

3/0/0/3

Nature of Course :F (Theory Programming)

Pre requisites : -

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:

15 Hours

INTRODUCTION, DATA, EXPRESSIONS, STATEMENTS :

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:

15 Hours

CONTROL FLOW, FUNCTIONS :

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, Linear Search, Binary Search.

Module 3:

15 Hours

LISTS, FILES, MODULES, PACKAGES:

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) 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.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**Continuous Assessment**

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

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:

20 Hours

Linear Data Structures – List, Stack, Queues : 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:

20 Hours

Non Linear Data Structures – Trees, Graphs: 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:

20 Hours

Searching, Sorting and Hashing Techniques: 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 DebasisSamanta, "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 NarasimhaKarumanchi, "Data Structures and Algorithms Made Easy: Data Structures and Algorithmic Puzzles", 5th Edition, CareerMonk, 2016.
- 3 ReemaThareja, "Data Structures Using C", 2nd Edition, Oxford University Press, 2011

Web References:

- 1 <http://freevidelectures.com/Course/2519/C-Programming-and-Data-Structures>
- 2 <http://freevidelectures.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]	Examination [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

19EEI201 /
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]
C2014	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:

15 Hours

DC Circuits and AC Circuits

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:

15 Hours

Electrical Machines and Installations

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:

15 Hours

Basics of Analog and Digital Electronics

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 thevenin'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 Edition 2015.
- 2 Vincent. Del. Toro, "Electrical Engineering Fundamentals", Prentice Hall 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-by-topic/#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

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: **15 Hours**

Introduction: 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: **15 Hours**

Combinational Logic: 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: **15 Hours**

Sequential Logic & Programmable Logic devices: 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-Memory decoding-PROM, Programmable Logic Array, Programmable Array Logic.

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", 6thEdition, Pearson, 2018.
- 2 C. H. Roth Jr., Larry L. Kinney "Fundamentals of Logic Design", 7thEdition, Cengage Learning, 2014.

Reference Books:

- 1 John F. Wakerly, "Digital Design: Principles and Practices", 5thEdition, Pearson, 2018.
- 2 Donald P leach, Albert Paul Malvino, GoutamSaha, "Digital Principles and Application", 8thEdition, McGraw Hill education Private Limited, 2015.
- 3 Clive Woods, Brian Holdsworth, "Digital Logic Design", 4thEdition, 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=wIT3-7wA-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			Practical	End Semester Examination
	Theory		CIA-3 [10marks]		
	CIA-1 [10 marks]	CIA-2 [10marks]			
Remember	10	20	20	Rubric based CIA [30 Marks]	(Theory) [40 marks]
Understand	40	20	20	30	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

19CSI203 / 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. Merge sort
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

45**Total Hours:****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.

19CSI204 /
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 10 students.
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 whenever 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 'writingprocess' 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 Circular Queue.

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:

$$p1=3x^7+5x^6+22.5x^5+0.35x^2$$

$$p2=0.25x^3+0.33x^2 -0.01$$

- 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 data set [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, Career Monk, 2016.
- 3 Reema Thareja, "Data Structures Using C", 2nd Edition, Oxford University Press, 2011

Web References:

- 1 <http://freevidelectures.com/Course/2519/C-Programming-and-Data-Structures>.
- 2 <http://freevidelectures.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	End Semester
	Assessment [60 marks] (in %)	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

19MC1201 /
20MC1201

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:

10 Hours

Natural Resources:

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:

10 Hours

Environmental Pollutions:

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:

10 Hours

Social issues and the Environment:

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 AnubhaKaushik 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		
	CIA-I [0 marks]	CIA-II [0 marks]	Term End Assessment [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		

19MAI301 /
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:

20 Hours

Propositional and Predicate calculus:

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:

20 Hours

Sets: 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:

20 Hours

Group Theory and Number Theory:

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

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:

15 Hours

INTRODUCTION 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:

15 Hours

PROCESS AND MEMORY MANAGEMENT Process Concept - Process Scheduling - Operations on Processes - Interprocess 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:

15 Hours

FILES AND I/O SYSTEMS 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.

Total Hours 45

Text Books:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts" 10th Edition, Wiley, 2018.
2. D.M.Dhamdhare, "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

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:

15 Hours

Fundamentals of Algorithm Analysis:

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:

15 Hours

Advanced Design Paradigms:

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: Prim's 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:

15 Hours

Limitations and Coping with the Limitations of Algorithm Power:

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

Reference Books:

1. Harsh Bhasin, "Algorithms Design and Analysis", Oxford university press, 2015.
2. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, "Computer Algorithms/ C++", 2ndEdition, Universities Press, 2008.
3. Sara Baase and Allen Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", Pearson Publications, 3rdEdition, 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

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:****15 Hours**

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

Control Unit: 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:**15 Hours**

I/O Interfacing and Concepts in ILP: 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 7th Generation Processors.

Total Hours: 45

Text Books:

- 1 Carl Hamachar, ZvoncoVranesic and SafwatZaky, "Computer Organization", McGraw Hill, 6thEdition 2018.
- 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

**19CSI304 / OBJECT ORIENTED PROGRAMMING USING JAVA AND
20CSI304 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:

15 Hours

Introduction to Object Oriented Technologies and the UML Method:

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:

15 Hours

Introduction to Object Oriented Programming:

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:

15 Hours

Analysis to Design in the Characterization Stage:

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 n 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. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: using UML, 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/uml-approach>
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					
Bloom's Level	Continuous Assessment				End Semester Examination (Theory) [40 Marks]
	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	Practical Rubrics based CIA [30 marks]	
Remember	20	20	20	20	20
Understand	20	20	20	20	20
Apply	60	40	30	30	40
Analyze	-	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

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 Metro cities. 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, GregGagne, "Operating System Concepts", 10thEdition, Wiley,2018.
2. D.M.Dhamdhere, "Operating systems A Concept based Approach", 3rdEdition, McGraw Hill,2017.

Reference Books:

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

Assessment Methods & Levels (based on BloomsTaxonomy)**Summative assessment based on Continuous and End Semester Examination**

Bloom's Level	Rubric based	End Semester
	Continuous Assessment[60 marks] (in %)	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

Nature of Course : L (Problem experimental)

Prerequisites : 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 set 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:

$$x(n) = x(n - 1) + 5 \text{ for } n > 1,$$

$$x(1) = 0$$
 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 c_1, c_2, \dots, c_n 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. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Pearson Publications, 3rdEdition, 2012.
2. Thomas H. Cormen, Charles E. Leiserson, R.L. Rivest, "Introduction to Algorithms", Prentice Hall of India Publications, 3rdEdition, 2009.

Reference Books:

1. Harsh Bhasin, "Algorithms Design and Analysis", Oxford university press, 2015.
2. Ellis Horowitz, SartajSahni and SanguthevarRajasekaran, "Computer Algorithms/ C++", 2ndEdition, Universities Press, 2008.
3. Sara Baase and Allen Van Gelder, "Computer Algorithms: Introduction to Design and Analysis", Pearson Publications, 3rdEdition, 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)

Prerequisites -

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: **20 Hours**

Probability and Random Variables:

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: **20 Hours**

Two dimensional random variables and Standard distributions:

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: **20 Hours**

Statistics:

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- χ^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://freevidelectures.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
	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
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

19CSI401 / DATABASE MANAGEMENT SYSTEMS
20CSI401

3/0/0/3

Nature of Course : G (Theory Analytical)

Prerequisites : -

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:

20 Hours

Introduction & Data Modelling:

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:

15 Hours

Storage Techniques and Query Processing: 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:**10 Hours**

Database Implementation and Recent trends: 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”, 6thEdition, Tata McGraw Hill,2011.

Reference Books:

- 1 Raghu Ramakrishnan, Gehrke, “Database Management Systems”, 3rdEdition, McGraw Hill,2006.
- 2 MaqsoodAlam, AalokMuley, ChaitanyaKadaru, 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
	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
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

19CSI402 / 20CSI402**CORE JAVA PROGRAMMING****3/0/0/3****Nature of Course** :K (Problem Programming)**Prerequisites** : -**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:**Module 1:****15 Hours**

FUNDAMENTALS OF JAVA TECHNOLOGY AND PROGRAMMING: JVM Internals – JVM Architecture, JDK, JRE, JIT, JVM Memory. Class fundamentals: Declaring objects, Assigning object reference variable, Methods & Method Signatures, Method returning 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:**15 Hours**

EXCEPTION, CONCURRENCY, ENUMERATION AND ANNOTATIONS: 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-SomeRestrictions.

Module 3:**15 Hours**

GENERIC: 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, Prentice Hall, 2012
- 2 Y. Daniel Liang, "Introduction to Java Programming", 9th Edition, 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

19ECI401 /
20ECI401

MICROPROCESSORS AND MICROCONTROLLERS

3/0/2/4

Nature of Course :G(Theory Concept)

Prerequisites : Digital Principles and System Design

Course Objectives:

1. To understand the architecture and Instruction set of 8086 and 8051
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:

10 Hours

ORGANIZATION AND ARCHITECTURAL FEATURES OF 8086 MICROPROCESSOR

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

Module 2:

15 Hours

MICROCONTROLLER

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:

20 Hours

ARM PROCESSOR

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 programs using 8086.	[AP]
2.	Assembly Language programs using 8051.	[AP]
3.	Stepper motor control using 8086 Microprocessor.	[AP]
4.	Interfacing 8051 with ADC.	[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", Pearson Education, 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", Addison Wesley, 2000.
3. Massimo 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

19CSI403 / 20CSI403

ENTERPRISE DESIGN PATTERNS

3/0/0/3

Nature of Course: G (Theory Analytical)

Pre requisites: Nil

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.	[E]
C403.4	Evaluate the different pattern interactions between various physical components and the user, managing a design solution through visual representations and simulation models.	[E]
C403.5	Illustrate different transformations of a product or a service through brainstorming and incremental approach.	[AP]

Course Contents:

Module 1:

15 Hours

Introduction to Design patterns: 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:

15 Hours

Design Thinking: 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:

15 Hours

Ideation: 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, Ralph 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.oodeesign.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			End Semester Examination [50 Marks]
	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	
Remember	-	-	-	-
Understand	30	-	10	10
Apply	-	50	20	20
Analyse	30	-	20	20
Evaluate	40	50	50	50
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

Nature of Course M (Practical Application)

Prerequisites -

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", 6thEdition, Tata McGraw Hill,2011.

Reference Books:

- 1 Carlos Coronel and Steven Morris, Database System Design and Implementation, Cengage learning, 11th Edition, 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

Nature of : K (Problem Programming)

Prerequisites : -

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 using basic 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 Hierarchical Inheritance.
6. Implementation of String Operations.
7. Implementation of exception handling mechanism using try 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 Lambda 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", Dream tech press, Kogent LearningSolutionsInc., 2011.
- 3 Paul Deitel, Harvey Deitel, "JavaHowToProgram", 10th Edition, Prentice Hall Publications, 2014
- 4 CayS.Horstmann and Gary Cornell, "Core Java, Vol.2: Advanced Features", 9th Edition, Prentice Hall, 2013.

Reference Books:

- 1 CayS.Horstmann and GaryCornell, "Core Java, Volume I Fundamentals", 9th Edition, Prentice Hall, 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

19CSI501 /
20CSI501

DATA WAREHOUSING AND MINING

3/0/0/3

Nature of Course G (Theory analytical)

Prerequisites -

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:

15 Hours

DATA WAREHOUSING - 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:

20 Hours

CLASSIFICATION - 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:

10 Hours

CURRENT TRENDS - 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, MichelineKamber and JianPei,“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 [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 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

19CSI502 /
20CSI502

ARTIFICIAL INTELLIGENCE

3/0/0/3

Nature of Course G (Theory analytical)

Prerequisites -

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:

15 Hours

Introduction: 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:

15 Hours

Logical Agents: 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:

15 Hours

Learning from Examples: 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

19CSI503 /
20CSI503

JEE Framework

3/0/2/4

Nature of Course F (Theory Programming)

Prerequisites 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:

15 Hours

Introduction to Jakarta Enterprise Edition (formerly called as Java EE):

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 MvnRepository, Dependency Plugins.

Module 2:

15 Hours

Core Technologies and Frameworks: 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. CaseStudy: Performing CURD operation using spring MVC and RESTFUL services. **Introduction to Tools:** Postman and SoapUI.

Module 3:

15 Hours

Data Persistence: Object/Relation Mapping using Simple JDBC Integration with native sql commands, JNDI(Java Naming and Directory Interface), JNDI Data source 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 – Many To One Relation, One To Many Relation, One To One Relation and Many To Many 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", Packt Publishing, 2015
- 4 Christian Bauer, Gavin King, and Gary Gregory, "Java Persistence with Hibernate", Second Edition, Manning publication, 2015
- 5 Joseph B.Ottinger, Jeff LinWood, Dave Minter, " Beginning Hibernate: for Hibernate 5", 4th Edition, Apress, 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			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

19CSI504 /
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 | Write PHP programs for web based applications | [AP] |
| C504.2 | Apply the structure of Java Script for real time examples | [AP] |
| C504.3 | Describe the features of React | [U] |
| C504.4 | Use Node.js for connectivity and session management | [AP] |

Course Contents:

Module 1:

15 Hours

PHP: 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:

15 Hours

JavaScript fundamentals: 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:

15 Hours

React: 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", Packt publishing, 2015
3. Basarat 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 Allsopp, 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			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

Nature of Course: F (Theory programming)

Prerequisites -

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:

15 Hours

Overview of data communication, Networking and physical layer: 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:

15 Hours

Data link layer: 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:

15 Hours

Transport layer: 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 Gallager "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 [10 marks]	CIA-3 [10 marks]		
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

Nature of Course D (Theory application)

Prerequisites -

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:

20 Hours

Agile and its Significance: 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:

10 Hours

Agile Methodology: 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:

15 Hours

Agile Practicing and Testing: 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 [10 marks]	CIA-3 [10 marks]		
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

19CSI601 /
20CSI601

COMPILER DESIGN

3/0/0/3

Nature of Course D (Theory Design)

Pre requisites Theory of Computation

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	Construct a parser through the application of grammar.	[AP]
C601.3	Explain intermediate code generation and symbol table organization techniques.	[U]
C601.4	Illustrate the code generation techniques with a simple program.	[AP]
C601.5	Demonstrate the code optimization strategies.	[AP]

Course Contents:

Module 1:

15 Hours

Introduction to Compilers and Syntax Analysis: 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:

15 Hours

Intermediate Code Generation and Code Generation: 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:

15 Hours

Code Optimization and Run Time Environments: 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.LeBlanc, "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. Dhamdhare, 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-yccscs1-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	Apply	Tutorial	10
C601.3, C601.4 & C601.5	Apply	Seminar	5

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 [50 marks]
	CIA-1 [10 marks]	Theory CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	20	20	20	20
Understand	30	40	30	30
Apply	50	40	50	50
Analyse	-	-	-	-
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
C601.2	2	2	3		2							2	2	2	2
C601.3	2	2	2									2	2		2
C601.4	2	3	3									3	2	3	3
C601.5	3	3	3									3	2		3

19CSI602 /
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 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 | Apply various application security and network security. | [AP] |

Course Contents

Module 1:

15 Hours

Introduction: 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:

15 Hours

Public-Key Encryption and Hash Functions: 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:

15 Hours

Network Security and Application Security: 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 [U]
 - a. DES
 - b. RSA Algorithm
 - 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 AtulKahate, "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	20	20
Understand	40	40	30	20	30
Apply	40	60	40	30	50
Analyze	-	-	-	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
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

19CSI603 /
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.	U
C603.2	Examine and solve various functionality problems by designing and selecting testing models and methods	U
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	AP
C603.5	Apply debugging process and techniques for software engineering problems	AP

Course Contents:

Module 1:

15 Hours

Introduction : 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:

15 Hours

Verification and Validation Testing, Object Oriented Testing: 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:

15 Hours

Debugging and Test Maturity models, Test Automation: 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, Gopaldaswamy 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	50	40	20	20	20
Apply	20	40	60	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
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

19CSI604 /
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:

15 Hours

INTRODUCTION TO BIG DATA: 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:

15 Hours

PREDICTIVE MODELING AND MACHINE LEARNING: 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:

15 Hours

BIG DATA HADOOP FRAMEWORK: 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:Frequency,Mean,Median,Mode,Variance,Standard deviation,
 - (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 ReduceI/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=bAyrObI7TYE>
- 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

19CSI605

/

MOBILE APPLICATION DEVELOPMENT

2/0/4/4

20CSI605

Nature of Course F (Theory Programming)

Pre requisites Nil

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.

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 methods in storing, sharing and retrieving data in Android applications.	AP
C605.5	Discuss the performance of android applications and understand the role of permissions and security.	AP
C605.6	Describe the steps involved in publishing Android application to share with the world.	AP

Course Contents:

Module 1: **10 Hours**

INTRODUCTION TO ANDROID DEVELOPMENT ENVIRONMENT

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: **10 Hours**

GRAPHICS AND UI PERFORMANCE

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: **10 Hours**

ANDROID STORING AND RETRIEVING DATA

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	Total Hours	60 Hours
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).		

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. AnubhavPradhan, 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	40	20	10	10	20
Understand	30	30	30	30	30
Apply	30	50	60	60	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
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
C605.6	3	3	2	3	3				3			3	3	2	2

19CSI911 /
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 about the energy management in adhoc networks.	[U]
C911.4	Demonstrate various types of mesh networks.	[AP]
C911.5	Discuss about sensor networks.	[U]

Course Contents:

Module 1:

15 Hours

INTRODUCTION: 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:

15 Hours

ENERGY MANAGEMENT AD HOC NETWORKS: 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:

15 Hours

MESH NETWORKS: 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 Quality of Service in Ad hoc 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 Sebastian 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

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	20	20	20
Apply	50	30	30	30
Analyze	-	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	2		3	2			2				2	
C911.4		2			3								3	3	2
C911.5		2	2	2	3	3	2			2		2	3	3	2

19CSI912 /
20CSI912

MOBILE COMPUTING

3/0/0/3

Nature of Course H (Theory Technology)

Course

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 | Demonstrate and apply working knowledge on mobile computing platforms, technologies and mobile application protocols | [AP] |
| C912.5 | Illustrate use of mobile transaction models and mobile commerce to develop mobile content applications. . | [AP] |

Course Contents:

Module 1:

15 Hours

Introduction: 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:

15 Hours

Mobile Network Layer: 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:

15 Hours

Mobile Platforms, Applications, Mobile Transaction Models: 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-gVlbr>

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	Apply	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

Continuous Assessment

Bloom's Level	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	50	50	50	50
Analyse	-	-	-	-
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

19CSI913 /
20CSI913

DISTRIBUTED SYSTEMS

3/0/0/3

Nature of Course G (Theory Analytical)

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:

15 Hours

Introduction: 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:

15 Hours

Synchronization: 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:

15 Hours

Distributed Deadlock Detection: 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.
- 4

Reference Books:

- 1 SunitaMahajan, Seema Shah, " Distributed Computing", Oxford, second edition, 2013
- 2 Pradeep K. Sinha, "Distributed Operating Systems", Prentice Hall of India Private, 2012.
- 3 Fokink 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/102IB2/>
- 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	Analyze	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 [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 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

19CSI914 /
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:

15 Hours

Overview of Wireless Sensor Networks:

Challenges for Wireless Sensor Networks - Enabling Technologies for Wireless Sensor Networks – WSN Standards-IEEE 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:

15 Hours

Time Synchronization and Localization:

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:

15 Hours

Routing Protocols and Operating Systems:

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 KazemSohraby, Daniel Minoli and TaiebZnati, Wireless Sensor Network- Technology, Protocolsand Applications, John Wiley, 2007

Reference Book:

- 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://ijctjournal.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	Analysis	Group Assignment	5
C914.4	Apply	Group Assignment	5
C914.5	Understand	Class Presentation	4

Summative assessment based on Continuous and End Semester Examination
Continuous Assessment

Bloom's Level	Continuous Assessment			End Semester Examination
	CIA-1 [10 Marks]	CIA-2 [10 Marks]	CIA-3 [10 Marks]	[50 marks]
Remember	50	20	30	30
Understand	50	20	30	30
Apply	-	30	20	20
Analyze	-	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		1	2	1			2		2	3	2	1
C914.3	3	2	2		1	2	2			2		2	3	2	3
C914.4	3	2	3		2	2	2			3		3	2	3	1
C914.5	3	2	3		3	2	2			2		3	2	2	2

19CSI915 /
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:

15 Hours

Foundations of Cyber Security Concepts: 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:

15 Hours

Cyber Laws and Forensics: 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 Scene, 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:

15 Hours

Introduction to Ethical Hacking: 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	Analyze	Mini Project	5

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 [50 marks]
	CIA-1 [10 marks]	Theory 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		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	2	2	3		2	2	2	2				3	2	2	3
C915.3	2		3	3	3		2			2		3	2	3	3
C915.4	2		3	2		2	2	3	2				2	2	3
C915.5	2	2		3	3	3	2	2	2	2	2	3		3	3

**19CSI916 /
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 | Apply the rule set in the database to implement intelligent databases | [AP] |

Course Contents:

Module 1:

15 Hours

PARALLEL AND DISTRIBUTED DATABASES

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:

15 Hours

OBJECT RELATIONAL DATABASE

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:

15 Hours

INTELLIGENT DATABASES

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 Raghuram 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	Apply	Assignment	5

Assessment Methods & Levels (based on Blooms' Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Continuous Assessment

Bloom's Level	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	60	30	30	30
Apply	20	50	50	50
Analyse	-	-	-	-
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

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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 | Demonstrate the knowledge of string matching algorithms and their design paradigm | [AP] |
| 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:

15 Hours

PROBABILISTIC ANALYSIS AND ADVANCED RANDOMIZATION: Hiring Problem - Indicator Random Variables - Randomization - Probabilistic Analysis. Algorithm for Bipartite Matching - Constructing Perfect Matching - Randomized Markov Chains - Ergodicity - Time Reversal.

Module 2:

15 Hours

MULTITHREADED AND PARALLEL ALGORITHMS: 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:

15 Hours

ONLINE ALGORITHMS AND STRING MATCHING: 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 AnanyLevitin, "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 AlgorithmsII, MIT Press, England, 2009.

Reference Books:

- 1 Mark Allen Weiss, —Data structures and Algorithm Analysis in CII, Pearson Education, New Delhi, 2006.
- 2 Ellis Horowitz and Sartaj Sahni, —Fundamentals of Data StructuresII, Galgotia Publications, New Delhi, 2000.
- 3 Allan Borodin and Ran El-Yaniv, —Online Computation and Competitive AnalysisII, 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	Analysis	Online Quiz	5
C917.2	Apply	Assignment	5
C917.3	Apply	Assignment	5
C917.4,5	Apply	Tutorial	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
Analyze	-	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	2		3	3	2		3		2	3	2	
C917.2		3			3									3	2
C917.3	3	3	3	2		3	2			2				2	
C917.4		2			3								3	3	2
C917.5	3	2	2	2	3	3	2			2		2	3	3	2

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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	Demonstrate various software design techniques in software and measure the applicability of process models.	[AP]
C918.5	Apply techniques to measure and visualize project progress	[AP]

Course Contents:

Module 1:

15 Hours

Software Product - 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:

15 Hours

Software Pricing - 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:

15 Hours

Software Product Management and Pricing in the Corporate Structure - 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	Apply	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			End Semester Examination Theory [50 marks]
	CIA-1 [10 marks]	CIA-2 [10 marks]	CIA-3 [10 marks]	
Remember	30	20	20	20
Understand	50	40	40	30
Apply	20	40	40	50
Analyse	-	-	-	-
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	2	3	3		2	2	2					2	3	2	2
C918.2	2	3	3		2	2	3	2				3	3	2	3
C918.3	2	3	3		2	2	2	2				3	3	3	2
C918.4	2	3	3		2	2	3					3	3	3	3
C918.5	2	3	3		2	2	2					3	3	3	3

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INFORMATION ETHICS AND CYBER LAWS

3/0/0/3

Nature of Course D (Theory Application)

Pre requisites nil

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] |

Course Contents:

Module 1:

15 Hours

ETHICS IN IT: 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:

15 Hours

ETHICAL THEORIES : 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:

15 Hours

INTELLECTUAL PROPERTY AND CYBER LAWS : 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.
6. 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. PennyDuquenoy, 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 & C919.4	Understand	Case Study (Indian Cyberspace)	10

Assessment Methods & Levels (based on Blooms' Taxonomy)

Summative assessment based on Continuous and End Semester Examination

Continuous Assessment

Bloom's Level	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	50	50	50	50
Analyse	-	-	-	-
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