KUMARAGURU COLLEGE OF TECHNOLOGY,

An autonomous Institution affiliated to Anna University, Chennai

COIMBATORE – 641 049.

B.E., COMPUTER SCIENCE AND ENGINEERING

REGULATIONS 2018A (2021 Batch)

CURRICULUM AND SYLLABI

I to VIII Semesters

Department of Computer Science and Engineering

VISION

To evolve as a School of Computer Science with centers of excellence having international reputation to serve the changing needs of Indian industry and society.

MISSION

- Computer Science and Engineering department is committed to bring out career oriented graduates who are industry ready through innovative practices of teaching-learning process.
- To cultivate professional approach, strong ethical values and team spirit along with leadership qualities among the graduates by organizing workshops, seminars and conferences periodically. Association with professional bodies and invitation to external experts should help this.
- To contribute towards techno-economic and social development of the nation through quality human resource and encouraging entrepreneurship among the young graduates.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The objectives of the Under Graduate programme in Computer Science and Engineering are to:

I. Enable graduates to be successful in their chosen careers, by applying their continual learning of Computer Science and Engineering in their work and life situations.

II. Enable graduates of the program to continue to adopt latest technologies and be critical learners displaying creativity and demonstrate to be leaders.

III. Prepare graduates of the program to be innovative product engineers catering to the requirements of the enterprises and society.

PROGRAM OUTCOMES (POs)

Graduates of BE-CSE programme will have the following abilities:

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

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

PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

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

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

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

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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

PO 12: Life-long learning: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Graduates of the Computer Science and Engineering Undergraduate Program will have the ability to:

PSO 1: Proficiently develop useful products by applying appropriate hardware and software technologies.

PSO 2: Organize heterogeneous data for accurate large-scale data processing using appropriate algorithms and tools

PSO 3: Understand modern networking technologies and apply programming skills to create scalable real-time applications.

KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE – 641 049

REGULATIONS 2018A

B.E COMPUTER SCIENCE AND ENGINEERING

CURRICULUM

List of Courses

S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	Pre-requisite
BASIC SCIENCES(BS)										
1	U18MAI1202	Linear Algebra and Calculus	Embedded - Theory & Lab	BS	3	0	2	0	4	
2	U18PHI1202	Engineering Physics	Embedded - Theory & Lab	BS	3	0	2	0	4	
3	U18MAI2201	Advanced Calculus and Laplace Transforms	Embedded - Theory & Lab	BS	3	0	2	0	4	U18MAI1202
4	U18BTI2201	Computational Biology	Embedded - Theory & Lab	BS	3	0	2	0	4	
5	U18MAT3102	Discrete Mathematics	Theory	BS	3	1	0	0	4	
6	U18MAI4201	Probability and Statistics	Embedded - Theory & Lab	BS	3	0	2	0	4	
								Total Credits	24	

S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	Pre-requisite
HUMANITIES AND SOCIAL SCIENCES (HS)										
1	U18ENI1202	Fundamentals of Communication -I	Embedded - Theory & Lab	HS	2	0	2	0	3	
2	U18ENI2202	Fundamentals of Communication-II	Embedded - Theory & Lab	HS	2	0	2	0	3	
3	U18VET4101	Universal Human Values 2: Understanding Harmony	Theory	HS	3	0	0	0	3	
4	U18CST5004	Social Media Marketing	Theory	HS	3	0	0	0	3	
								Total Credits	12	

S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	Pre-requisite
ENGINEERING SCIENCES (ES)										
1	U18CSI1201	Structured Programming using C	Embedded - Theory & Lab	ES	3	0	2	0	4	
2	U18EEI1201	Basic Electrical and Electronics Engineering	Embedded - Theory & Lab	ES	3	0	2	0	4	
3	U18INI1600	Engineering Clinic-I	Project based course with lab	ES	0	0	4	2	3	

4	U18CSI2201	Python Programming	Embedded - Theory & Lab	ES	2	0	2	0	3	
5	U18INI2600	Engineering Clinic-II	Project based course with lab	ES	0	0	4	2	3	U18INI1600
6	U18INI3600	Engineering Clinic-III	Project based course with lab	ES	0	0	4	2	3	U18INI2600
7	U18INI4600	Engineering Clinic-IV	Project based course with lab	ES	0	0	4	2	3	U18INI3600
Total Credits									23	

S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	Pre-requisite
PROFESSIONAL CORE (PC)										
1	U18CSI2202	Digital Logic and Microprocessor	Embedded - Theory & Lab	PC	3	0	2	0	4	U18EEI1201
2	U18CSI3201	Data Structures	Embedded - Theory & Lab	PC	3	0	2	0	4	
3	U18CSI3202	Object Oriented Programming	Embedded - Theory & Lab	PC	3	0	2	0	4	
4	U18CST3003	Computer Architecture	Theory	PC	3	0	0	0	3	
5	U18CSI3204	Database Management Systems	Embedded - Theory & Lab	PC	3	0	2	0	4	
6	U18CST4001	Design and Analysis of Algorithms	Theory	PC	3	0	0	0	3	U18CSI3201
7	U18CSI4202	Operating Systems	Embedded - Theory & Lab	PC	3	0	2	0	4	U18CST3003
8	U18CST4003	Theory of Computation	Theory	PC	3	0	0	0	3	U18MAT3102
9	U18CSI4204	Software Engineering	Embedded - Theory & Lab	PC	3	0	2	0	4	U18CSI3202
10	U18CSI5201	Computer Networks	Embedded - Theory & Lab	PC	3	0	2	0	4	
11	U18CST5002	Agile Software Development	Theory	PC	3	0	0	0	3	U18CSI4204
12	U18CSI5203	No SQL Databases	Embedded - Theory & Lab	PC	3	0	2	0	4	U18CSI3204
13	U18CSI5205	Mobile Application Development using Android	Embedded - Theory & Lab	PC	1	0	4	0	3	U18CSI3202
14	U18CSI6201	Internet and Web Programming	Embedded - Theory & Lab	PC	3	0	2	0	4	
15	U18CST6002	Wireless Networks and Mobile Systems	Theory	PC	3	0	0	0	3	U18CSI5201
16	U18CSI6203	Data Warehousing and Data Mining	Embedded - Theory & Lab	PC	3	0	2	0	4	U18CSI5203
17	U18CST6004	Software Testing	Theory	PC	3	0	0	0	3	U18CST5002
18	U18CSI7201	Cloud Computing	Embedded - Theory & Lab	PC	3	0	2	0	4	U18CST3003

19	U18CST7002	Machine Learning Techniques	Theory	PC	3	0	0	0	3	U18MAI4201
Total Credits									**68**	

S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	Pre-requisite
PROJECT WORK (PW)										
1	U18CSP7703	Project Phase-I	Project only Course	PW	0	0	0	6	3	
2	U18CSP8701	Project Phase-II	Project only Course	PW	0	0	0	24	12	
Total Credits									15	

S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	Pre-requisite
PROFESSIONAL ELECTIVE (PE)										
1	U18...*	Professional Elective 1	Theory/ Embedded	PE	*	*	*	*	3	
2	U18...*	Professional Elective 2	Theory/ Embedded	PE	*	*	*	*	3	
3	U18...*	Professional Elective 3	Theory/ Embedded	PE	*	*	*	*	3	
4	U18...*	Professional Elective 4	Theory/ Embedded	PE	*	*	*	*	3	
Total Credit									**12**	

S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	Pre-requisite
OPEN ELECTIVE (OE)										
1	U18...*	OPEN ELECTIVE 1	Theory	OE	3	0	0	0	3	
2	U18...*	OPEN ELECTIVE 2	Theory	OE	3	0	0	0	3	
Total Credit									**6**	

Professional Electives/Honors - Professional Electives (2021 Batch), Specialization Track (From 2022 Batch) and minors for non-Computing Departments (From 2023 Batch).

S. No.	Specialization Track	Course Code	Course Name	Course Mode	L	T	P	J	C	Pre-requisite	Offered to
LIST OF PROFESSIONAL ELECTIVE (PE)											
1.	Extended Reality	U18CSE0314	3D Modeling and Game Design	Embedded - Theory & Project	2	0	0	2	3	U18CSI3202	CSE, IT, AIDS
2.		U18CSE0315	Augmented Reality and Virtual Reality Application Development	Embedded - Theory & Project	2	0	0	2	3	U18CSI3202	CSE, IT, AIDS
3.		U18CSE0016	Advanced Metaverse Technologies	Theory	3	0	0	0	3	Nil	CSE, IT, AIDS
4.		U18CSE0228	Game Programming	Embedded - Theory & Lab	2	0	2	0	3	U18CSI3202	CSE, IT, AIDS
5.	IoT, Edge, UAV	U18CSE0217	Embedded Systems for IoT	Embedded - Theory & Lab	2	0	2	0	3	U18CSI2202	CSE, IT, AIDS
6.		U18CSE0318	IoT Systems Design	Embedded - Theory & Project	2	0	0	2	3	U18CSI2202	CSE, IT, AIDS
7.		U18CSE0219	IoT Application Development	Embedded - Theory & Lab	2	0	2	0	3	U18CSI2202	CSE, IT, AIDS
8.		U18CSE0220	3D Printing	Embedded - Theory & Lab	2	0	2	0	3	Nil	CSE, IT, AIDS
9.		U18CSE0221	Robotic Operating Systems	Embedded - Theory & Lab	2	0	2	0	3	U18CSI4202	CSE, IT, AIDS
10.		U18CSE0022	Software Defined Vehicle	Theory	3	0	0	0	3	U18CST3003	CSE, IT, AI&DS
11.	Cyber Security	U18CSE0223	Ethical Hacking and Network Defence	Embedded - Theory & Lab	2	0	2	0	3	U18CSI5201	CSE, IT, AI&DS
12.		U18CSE0024	Cyber Ethics and Laws	Theory	3	0	0	0	3	Nil	CSE, IT, AI&DS

13.		U18CSE0225	Secure Software Development	Embedded - Theory & Lab	2	0	2	0	3	U18CSI5201	CSE, IT, AI&DS
14.		U18CSE0226	Network Security Administration	Embedded - Theory & Lab	2	0	2	0	3	U18CSI5201	CSE, IT, AI&DS
15.		U18CSE0227	Digital Forensics	Embedded - Theory & Lab	2	0	2	0	3	U18CSI5201	CSE, IT, AI&DS
16.	Automation and Artificial Intelligence	U18AIE0210	Deep Learning	Embedded - Theory & Lab	2	0	2	0	3	U18MAI1202, U18MAT3102	CSE
17.		U18AIE0211	Computer Vision	Embedded - Theory & Lab	2	0	2	0	3	U18MAI1202, U18MAT3102	CSE,IT,ISE
18.		U18AIE0212	Intelligent Automation Systems	Embedded - Theory & Lab	2	0	2	0	3	U18MAI1202, U18MAT3102	CSE, IT, ISE, AI&DS
19.		U18AIE0213	Natural Language Processing	Embedded - Theory & Lab	2	0	2	0	3	U18MAI1202, U18MAT3102	CSE, ISE
20.		U18AIE0214	Generative AI	Embedded - Theory & Lab	2	0	2	0	3	U18MAI1202, U18MAT3102	CSE, IT,ISE, AI&DS
21.		U18AIE0015	Responsible AI	Theory	3	0	0	0	3	U18MAI1202, U18MAT3102	CSE, IT,ISE, AI&DS
22.	Data Science, Analytics and Visualization	U18AIE0216	Principles of Data Science	Embedded - Theory & Lab	2	0	2	0	3	U18MAI4201	CSE, IT, ISE
23.		U18AIE0217	Data Processing Techniques	Embedded - Theory & Lab	2	0	2	0	3	U18CSI3204	CSE,IT,ISE, AI & DS
24.		U18AIE0218	Data Modelling	Embedded - Theory & Lab	2	0	2	0	3	U18CSI3204	CSE,IT,ISE, AI&DS
25.		U18AIE0219	Data Analysis and Visualization	Embedded - Theory & Lab	2	0	2	0	3	U18CSI3204	CSE,IT,ISE
26.		U18AIE0220	Business Intelligence for Decision Making	Embedded - Theory & Lab	2	0	2	0	3	U18CSI2201	CSE,IT,ISE, AI&DS

27.		U18AIE0021	Data Ethics and Privacy	Theory	3	0	0	0	3	U18CSI3204	CSE,IT,ISE, AI&DS
28.	Network and Distributed Computing	U18ITE0218	Smart Contract Development	Embedded - Theory & Lab	2	0	2	0	3	U18CSE0012	CSE, IT
29.		U18ITE0019	Decentralized Finance	Theory	3	0	0	0	3	U18CSI5201	CSE, IT
30.	Cloud Computing	U18ITE0220	Virtualization and Resource Management	Embedded - Theory & Lab	2	0	2	0	3	U18CST3003	CSE, IT, ISE, AI&DS
31.		U18ITE0221	Cloud Infrastructure and Architecture	Embedded - Theory & Lab	2	0	2	0	3	U18CST3003	CSE, IT, ISE, AI&DS
32.		U18ITE0222	Cloud Storage Management	Embedded - Theory & Lab	2	0	2	0	3	U18CST3003	CSE, IT, ISE, AI&DS
33.		U18ITE0323	Cloud Application Development	Embedded - Theory & Project	2	0	0	2	3	U18CSI7201	CSE, IT, ISE, AI&DS
34.		U18ITE0224	Cloud Security	Embedded - Theory & Lab	2	0	2	0	3	U18CSI7201	CSE, IT, ISE, AI&DS
35.		U18ITE0325	Cloud Automation	Embedded - Theory & Project	2	0	0	2	3	U18CSI7201	CSE, IT, ISE, AI&DS
36.	Web and Software Development	U18ITE0226	Full Stack Software Development	Embedded - Theory & Lab	2	0	2	0	3	U18CSI6201	CSE, IT, AIDS
37.		U18ITE0227	UI and UX Design	Embedded - Theory & Lab	2	0	2	0	3	U18CSI6201	CSE, IT, AIDS
38.		U18ITE0228	Principles of DevOps	Embedded - Theory & Lab	2	0	2	0	3	U18CSI4204	CSE, IT, AIDS

Professional Electives (PE)										
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	**Pre Requisite**
1.	U18CSE0001	Big Data Technologies	Theory	PE	3	0	0	0	3	U18CSI3204
2.	U18CSE0002	Data Visualization	Theory	PE	3	0	0	0	3	
3.	U18CSE0003	Artificial Intelligence	Theory	PE	3	0	0	0	3	U18MAI1202, U18MAT3102

4.	U18CSE0004	IoT Architecture and Protocols	Theory	PE	3	0	0	0	3	
5.	U18CSE0005	Adhoc and Sensor Networks	Theory	PE	3	0	0	0	3	U18CSI5201
6.	U18CSE0006	Software Defined Networks	Theory	PE	3	0	0	0	3	
7.	U18CSE0007	Cryptography and Network Security	Theory	PE	3	0	0	0	3	U18CSI5201
8.	U18CSE0012	Blockchain Technology and Applications	Theory	PE	3	0	0	0	3	
9.	U18CSE0008	Principles of Compiler Design	Theory	PE	3	0	0	0	3	U18CST4003
10.	U18CSE0009	Graphics and Multimedia	Theory	PE	3	0	0	0	3	
11.	U18CSE0010	Information Security	Theory	PE	3	0	0	0	3	
12.	U18CSE0011	Declarative Development of Customized Applications	Theory	PE	2	0	0	2	3	U18CSI3204
13.	U18CSE0013	Professional Readiness for Innovation, Employability and Entrepreneurship	Theory	PE	0	0	6	0	3	

S.No	Course code	Course Title	Course Mode	CT	L	T	P	J	C	Pre-requisite
Mandatory Courses (MC)										
1	U18CHT4000	Environmental Science and Engineering	Theory	Mandatory	3	0	0	0	0	
2	U18INT5000	Constitution of India	Theory	Mandatory	2	0	0	0	0	
Total Credits									2	

Courses Offered by Forge (for Protosem Students)

S.No	Course Code	Course Name	Course Type	Credits
1.	U18CSE0828	Computational Hardware	PE	3
2.	U18CSE0829	Coding For Innovators	PE	3
3.	U18CSE0830	Industrial Design & Rapid Prototyping Techniques	PE	3
4.	U18CSE0831	Industrial Automation	PE	3
5.	U18CSP0532	MUP Development	Practical	12

TENTATIVE SEMESTER

Semester I										Pre-requisite
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U18MAI1202	Linear Algebra and Calculus	Embedded - Theory & Lab	BS	3	0	2	0	4	
2	U18ENI1202	Fundamentals of Communication I	Embedded - Theory & Lab	HS	2	0	2	0	3	
3	U18PHI1202	Engineering Physics	Embedded - Theory & Lab	BS	3	0	2	0	4	
4	U18CSI1201	Structured Programming using C	Embedded - Theory & Lab	ES	3	0	2	0	4	
5	U18EEI1201	Basic Electrical and Electronics Engineering	Embedded - Theory & Lab	ES	3	0	2	0	4	
6	U18INI1600	Engineering Clinic-I	Project based course with lab	ES	0	0	4	2	3	
								Total Credits	22	
								Total Contact Hours/week	30	

Semester II										Pre-requisite
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U18MAI2201	Advanced Calculus and Laplace Transforms	Embedded - Theory & Lab	BS	3	0	2	0	4	U18MAI1201
2	U18ENI2202	Fundamentals of Communication-II	Embedded - Theory & Lab	HS	2	0	2	0	3	
3	U18BTI2201	Computational Biology	Embedded - Theory & Lab	BS	3	0	2	0	4	
4	U18CSI2201	Python Programming	Embedded - Theory & Lab	ES	2	0	2	0	3	
5	U18CSI2202	Digital Logic and Microprocessor	Embedded - Theory & Lab	PC	3	0	2	0	4	U18EEI1201
6	U18INI2600	Engineering Clinic-II	Project based course with lab	ES	0	0	4	2	3	U18INI1600
								Total Credits	21	
								Total Contact Hours/week	29	

Semester III										Pre-requisite
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U18MAT3102	Discrete Mathematics	Theory	BS	3	1	0	0	4	
2	U18CSI3201	Data Structures	Embedded - Theory & Lab	PC	3	0	2	0	4	
3	U18CSI3202	Object Oriented Programming	Embedded - Theory & Lab	PC	3	0	2	0	4	
4	U18CST3003	Computer Architecture	Theory	PC	3	0	0	0	3	
5	U18CSI3204	Database Management Systems	Embedded - Theory & Lab	PC	3	0	2	0	4	
6	U18INI3600	Engineering Clinic-III	Project based course with lab	ES	0	0	4	2	3	U18INI2600
								Total Credits	22	
								Total Contact Hours/week	28	

Semester IV										Pre-requisite
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U18MAI4201	Probability and Statistics	Embedded - Theory & Lab	BS	3	0	2	0	4	
2	U18CST4001	Design and Analysis of Algorithms	Theory	PC	3	0	0	0	3	U18CSI3201
3	U18CSI4202	Operating Systems	Embedded - Theory & Lab	PC	3	0	2	0	4	U18CST3003
4	U18CST4003	Theory of Computation	Theory	PC	3	0	0	0	3	U18MAT3102
5	U18CSI4204	Software Engineering	Embedded - Theory & Lab	PC	3	0	2	0	4	U18CSI3202
6	U18INI4600	Engineering Clinic-IV	Project based course with lab	ES	0	0	4	2	3	U18INI3600
7	U18VET4101	Universal Human Values	Theory	HS	3	0	0	0	3	

		2:Understanding Harmony								
8	U18CHT4000	Environmental Science & Engineering	Theory	MC	3	0	0	0	0	
								Total Credits		24
								Total Contact Hours/week		33

Semester V										**Pre-requisite**
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U18CSI5201	Computer Networks	Embedded - Theory & Lab	PC	3	0	2	0	4	
2	U18CST5002	Agile Software Development	Theory	PC	3	0	0	0	3	U18CSI4204
3	U18CSI5203	No SQL Databases	Embedded - Theory & Lab	PC	3	0	2	0	4	U18CSI3204
4	U18CST5004	Social Media Marketing	Theory	PC	3	0	0	0	3	
5	U18CSI5205	Mobile Application Development using Android	Embedded - Theory & Lab	ES	1	0	4	0	3	
6	U18OE-----	Open Elective	Theory	OE	3	0	0	0	3	
7		Professional Elective- I	Theory	PE	3	0	0	0	3	
8	U18INT5000	Constitution of India	Theory	MC	2	0	0	0	0	
								Total Credits		23
								Total Contact Hours/week		29

Semester VI										**Pre-requisite**
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U18CSI6201	Internet and Web Programming	Embedded - Theory & Lab	PC	3	0	2	0	4	
2	U18CST6002	Wireless Networks and Mobile Systems	Theory	PC	3	0	0	0	3	U18CSI5201
3	U18CSI6203	Data Warehousing and Data Mining	Embedded - Theory & Lab	PC	3	0	2	0	4	U18CSI5203
4	U18CST6004	Software Testing	Theory	PC	3	0	0	0	3	U18CST5002

5	U18CSI7201	Cloud Computing	Embedded - Theory & Lab	PC	3	0	2	0	4	U18CSI5201
6	U18OE-----	Open Elective	Theory	OE	3	0	0	0	3	
7	U18CSE----	Professional Elective- II	Theory	PE	3	0	0	0	3	
								Total Credits	24	
								Total Contact Hours/week	27	

Semester VII										**Pre-requisite**
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U18CST7002	Machine Learning Techniques	Theory	PC	3	0	0	0	3	U18CSI6203
2		Professional Elective- III	Theory/ Embedded	PE	*	*	*	*	3	
3		Professional Elective- IV	Theory/ Embedded	PE	*	*	*	*	3	
4	U18CSP7703	Project Phase-I	Project only Course	PW	0	0	0	6	3	
								Total Credits	12	
								Total Contact Hours/week	15	

Semester VIII										**Pre-requisite**
S.No	**Course code**	**Course Title**	**Course Mode**	**CT**	**L**	**T**	**P**	**J**	**C**	
1	U18CSP8701	Project Phase-II	Project only Course	PW	0	0	0	24	12	
								Total Credits	12	
								Total Contact Hours/week	24	
								Total Credits	160	

BASIC SCIENCES (BS)

U18MAI1202 **LINEAR ALGEBRA AND CALCULUS**
(Common to All branches)

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Identify eigenvalues and eigenvectors and apply Cayley Hamilton theorem.
CO2: Apply orthogonal diagonalisation to convert quadratic form to canonical form.
CO3: Solve first order ordinary differential equations and apply them to certain physical situations.
CO4: Solve higher order ordinary differential equations.
CO5: Evaluate the total derivative of a function, expand the given function as series and locate the maximum and minimum for multivariate function.
CO6: Determine Rank, Inverse, Eigenvalues, Eigenvectors of the given matrix, Maxima-Minima of the function and Solving Differential equations using MATLAB

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	S			M				M	M		M	M	M	M
CO2	S	S			M				M	M		M	M		M
CO3	S	S			M				M	M		M	M	M	M
CO4	S	S			M				M	M		M		W	M
CO5	S	S			M				M	M		M		M	
CO6	S	S			M				M	M		M	M	M	M

COURSE ASSESSMENT METHODS:

DIRECT

1. Continuous Assessment Test I, II (Theory component)
2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component)
3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
4. Model Examination (lab component)
5. End Semester Examination (Theory and lab components)

INDIRECT

1. Course-end survey

THEORY COMPONENT CONTENTS

MATRICES **6 Hours**

Rank of a matrix – Consistency of a system of linear equations - Rouche's theorem - Solution of a system of linear equations - Linearly dependent and independent vectors– Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley Hamilton theorem (excluding proof)

DIAGONALISATION OF A REAL SYMMETRIC MATRIX **6 Hours**

Orthogonal matrices – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS **11 Hours**

Leibnitz's equation – Bernoulli's equation – Equations of first order and higher degree - Clairauts form – Applications: Orthogonal trajectories.

HIGHER ORDER LINEAR DIFFERENTIAL EQUATIONS **11 Hours**

Linear equations of second and higher order with constant coefficients – Euler's and Legendre's linear equations – Method of variation of parameters – First order Simultaneous linear equations with constant coefficients – Applications.

FUNCTIONS OF SEVERAL VARIABLES **11 Hours**

Total derivative – Taylor's series expansion – Maxima and minima of functions of two variables – Constrained maxima and minima: Lagrange's multiplier method with single constraints – Jacobians.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 41st Edition, 2011.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
3. Kreyzig E., "Advanced Engineering Mathematics", Tenth Edition, John Wiley and sons, 2011.
4. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2007
5. Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics", S. Chand & Co., New Delhi, (Reprint) 2008
6. Venkataraman M.K., "Engineering Mathematics", The National Pub. Co., Chennai,2003
7. Weir, MD, Hass J, Giordano FR: Thomas' Calculus, Pearson education 12th Edition, 2015
8. P.Bali., Dr. Manish Goyal., Transforms and partial Differential equations, University Science Press, New Delhi, 2010
9. G.B.Thomas and R.L.Finney, Calculus and analytical geometry, 11th Edition, PearsonEducation, (2006)

LAB COMPONENT CONTENTS **30 Hours**

List of MATLAB Programmes:

1. Introduction to MATLAB.
2. Matrix Operations - Addition, Multiplication, Transpose, Inverse
3. Rank of a matrix and solution of a system of linear equations
4. Characteristic equation of a Matrix and Cayley-Hamilton Theorem.
5. Eigenvalues and Eigenvectors of Higher Order Matrices
6. Curve tracing
7. Solving first order ordinary differential equations.
8. Solving second order ordinary differential equations.
9. Determining Maxima and Minima of a function of one variable.
10. Determining Maxima and Minima of a function of two variables.

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

U18PHI1202 ENGINEERING PHYSICS

L	T	P	J	C
3	0	2	0	4

(Common to All B.E., B .Tech.)

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Understand the principles of motion and rotation of a rigid body in the plane.

CO2: Enhance the fundamental knowledge in properties of matter and its applications relevant to various

streams of Engineering and Technology.

CO3: Recognize the nature and role of the thermodynamic parameters.

CO4: Compute electrostatic field and electric potential due to point and distributed charges.

CO5: Use electrostatic & magneto static boundary conditions to relate fields in adjacent media.

CO6: Introduce and provide a broad view of the smart materials and Nano science to undergraduates.

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	M										M			
CO2	S	M			S							M			
CO3	S	M			S							M			
CO4	S	M			S							M			
CO5	S	M			S							M			
CO6	S	M					M					M	S		

COURSE ASSESSMENT METHODS:

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) **5.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

KINEMATICS & RIGID BODY MOTION 9 Hours

Definition and motion of a rigid body in the plane; Rotation in the plane; Kinematics in a coordinate system rotating and translating in the plane; Angular momentum about a point of a rigid body in planar motion; Euler's laws of motion, their independence from Newton's laws, and their necessity in describing rigid body motion; Examples.

PROPERTIES OF MATTER AND MATERIALS TESTING 9 Hours

Properties of matter: Hooke's Law Stress - Strain Diagram - Elastic moduli - Relation between elastic constants - Poisson's Ratio - Expression for bending moment and depression - Cantilever - Expression for Young's modulus by Non uniform bending and its experimental determination.

Materials testing: Mechanism of plastic deformation, slip and twinning – types of fracture – Vickers Hardness test - fatigue and creep test.

HEAT 9 Hours

Specific heat capacity, thermal capacity. Temperature rise. Coefficient of linear thermal expansion. Methods of measurement of thermal expansion. Thermal stresses in composite structures due to non-homogeneous thermal expansion. Applications -The bimetallic strip. Expansion gaps and rollers in engineering structures. Thermal conductivity: differential equation of heat flow. Lee's disc apparatus for determination of thermal conductivity. Thermal Insulation. Convection and radiation. Applications to refrigeration and power electronic devices.

ELECTROSTATICS & MAGNETOSTATICS 10 Hours

ELECTROSTATICS : Maxwell's equation for electrostatics – E due to straight conductors, circular loop, infinite sheet of current - electric field intensity (D) - Electric potential - dielectrics - dielectric polarization - internal field – Clasious - Mosotti equation - dielectric strength - applications.

MAGNETOSTATICS: Maxwell's equation for magnetostatics - B in straight conductors, circular loop, infinite sheet of current - Lorentz force, magnetic field intensity (H) – Biot–Savart's Law – Ampere's Circuit Law –Magnetic flux density (B) – magnetic materials – Magnetization – Applications.

NEW ENGINEERING MATERIALS AND NANO TECHNOLOGY 8 Hours

New Engineering Materials: Metallic glasses – preparation, properties and applications – Shape memory alloys (SMA) – characteristics, properties of NiTi alloy applications - advantages and disadvantages of SMA.

Nano Materials: synthesis - Ball milling - Sol-gel - Electro deposition — properties of nano particles and applications. – Carbon Nano Tubes – fabrication by Chemical Vapour Deposition - structure, properties & applications.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Elements of Properties of Matter, Mathur D.S., Shyamlal Charitable Trust, New Delhi, 1993.
2. Properties of matter, brijlal and Subharamaniam, S.Chand and Co, New Delhi, 2004.
3. Fundamentals of General Properties of Matter by Gulati H.R., R. Chand & Co., New Delhi, 1982.
4. Engineering Mechanics (2nd ed.), Harbola M. K., Cengage publications, New Delhi, 2009.
5. Introduction to Mechanics, Verma M. K. (CRC Press), University Press, 2000.
6. Thermodynamics: An Engineering Approach (SI Units), yunus a. cengel & michael a. boles 7th edition, mcgraw-hill companies 2014.
7. Engineering Electromagnetics, W. H. Hayt and John A. Buck, 6th Edition, Tata McGraw Hill, New Delhi, 2014.
8. Electromagnetic Field Theory, 5th Edition, Gangadhar K.A. and Ramanathan P.M., Khanna Publishers, New Delhi, 2013.
9. Problems and Solutions in Electromagnetics, 1st Edition, J.A. Buck and W. H. Hayt, Tata McGraw Hill, New Delhi, 2010.
10. Theory and Problems of Electromagnetic Schaum's Outline Series, 5th Edition, Joseph A. Edminister, Tata McGraw Hill Inc., New Delhi, 2010.
11. Engineering Physics, Rajendran V., Tata McGraw-Hill Education Pvt. Ltd., 2010
12. Nano – the Essentials, Pradeep T., McGraw-Hill Education, Pvt. Ltd., 2007.

LAB COMPONENT CONTENTS

LIST OF EXPERIMENTS

1. Determination of thermal conductivity of a bad conductor - Lee's disc
2. Determination of Acceleration due to Gravity – Compound Pendulum
3. Determination of wavelength of light, Numerical aperture and acceptance of optical fibre
4. Determination of band gap of a semiconductor
5. Determination of compressibility of a given liquid - Ultrasonic Interferometer
6. Determination of thickness of thin sheet – Air wedge
7. Determination of frequency of an electrically maintained turning fork – Melde's string
8. Determination of wavelength of mercury source using diffraction grating - Spectrometer
9. Determination of solar cell efficiency using Lux Meter
10. Determination of Young's Modulus – Non-uniform bending

EXPERIMENTS FOR DEMONSTRATION:

1. Hall effect
2. Hardness Test
3. Four probe experiment
4. Hysteresis curve

Theory: 0	Tutorial: 0	Practical: 30	Project:0	Total: 30 Hours

REFERENCES

1. Laboratory Manual of Engineering Physics, Dr. Y. Aparna & Dr. K. Venkateswara Rao, V.G.S Publishers.
2. Practical Physics, G.L. Squires, Cambridge University Press, Cambridge, 1985.
3. Great Experiments in Physics, M.H. Shamos, Holt, Rinehart and Winston Inc., 1959.
4. Experiments in Modern Physics, A.C. Melissinos, Academic Press, N.Y., 1966.

U18MAI2201 **ADVANCED CALCULUS AND LAPLACE TRANSFORMS**
(Common to All branches)

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Evaluate double and triple integrals in Cartesian coordinates and apply them to calculate area and volume.

CO2: Apply various integral theorems for solving engineering problems involving cubes and rectangular parallelepipeds.

CO3: Construct analytic functions of complex variables and transform functions from z-plane to w-plane and vice-versa, using conformal mappings.

CO4: Apply the techniques of complex integration to evaluate real and complex integrals over suitable closed paths or contours.

CO5: Solve linear differential equations using Laplace transform technique.

CO6: Determine multiple integrals, vector differentials, vector integrals and Laplace transforms using MATLAB.

Pre-requisite: U18MAI1202/Linear Algebra and Calculus

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO MAPPING**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	S			M				M	M		M	M		M
CO2	S	S			M				M	M		M	M		M
CO3	S	S			M				M	M		M	M	M	M
CO4	S	S			M				M	M		M	M		M
CO5	S	S			M				M	M		M	M		M
CO6	S	S			M				M	M		M	M	M	M

COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test I, II (Theory component)
2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) (Theory component)
3. Pre/Post - experiment Test/Viva; Experimental Report for each experiment (lab component)
4. Model examination (lab component)
5. End Semester Examination (Theory and lab component)

INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

MULTIPLE INTEGRALS **9 Hours**

Double integration – Cartesian coordinates – Change of order of integration - Triple integration in Cartesian coordinates – Applications: Area as double integral and Volume as triple integral.

VECTOR CALCULUS **9 Hours**

Gradient, divergence and curl – Directional derivative – Irrotational and Solenoidal vector fields - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (excluding proofs) – Verification of theorem and simple applications.

ANALYTIC FUNCTIONS **9 Hours**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy- Riemann equations in Cartesian coordinates and sufficient conditions (excluding proofs)– Properties of analytic function – Construction of analytic function by Milne Thomson method – Conformal mapping : $w = z + c$, cz , $1/z$ – Bilinear Transformation

COMPLEX INTEGRATION **9 Hours**

Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series – Singularities –Residues –Residue theorem –Application of residue theorem for evaluation of real integrals – Contour Integration (excluding poles on the real axis).

LAPLACE TRANSFORMS **9 Hours**

Definition - Properties: Superposition, Shift in t or Time Delay, Shift in s, Time Derivatives, Time Integral-Initial Value Theorem - Final Value Theorem - Transform of periodic functions - Inverse transforms - Convolution theorem – Applications: Solution of linear ordinary differential equations of second order with constant coefficients.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 41st Edition, 2011.
2. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
3. Veerarajan T., Engineering Mathematics (for First Year), Tata McGraw Hill Pub. Co. Ltd., New Delhi, Revised Edition, 2007.
4. Kandasamy P., Thilagavathy K., and Gunavathy K., "Engineering Mathematics", S. Chand & Co., New Delhi, (Reprint) 2008.
5. Kreyzig E., "Advanced Engineering Mathematics", Tenth Edition, John Wiley and sons, 2011.

6. Venkataraman M.K., “Engineering Mathematics”, The National Pub. Co., Chennai, 2003.
7. Weir, MD, Hass J, Giordano FR: Thomas’ Calculus Pearson education 12th ED, 2015.

LAB COMPONENT CONTENTS **30 Hours**

List of MATLAB Programmes:

1. Evaluating double integral with constant and variable limits.
2. Area as double integral
3. Evaluating triple integral with constant and variable limits
4. Volume as triple integral
5. Evaluating gradient, divergence and curl
6. Evaluating line integrals and work done
7. Verifying Green’s theorem in the plane
8. Evaluating Laplace transforms and inverse Laplace transforms of functions including impulse.
9. Heaviside functions and applying convolution.
10. Applying the technique of Laplace transform to solve differential equations.

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

U18BTI2201 **COMPUTATIONAL BIOLOGY**

(Common to CSE, IT)

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Understand the fundamentals of evolution theory, and classify the type of organisms [K3].

CO2: Draw and differentiate the type of cell organelles using functional characteristics [K3, S2]

CO3: Analyze and appraise the functional impact of biological macromolecules [K5, S2]

CO4: Understand the structural and functional characteristics of nucleic acids, differentiate the impact of biological information process, and evaluate the derangement of information flow due to mutation [K5]

CO5: Apply the fundamental concepts of pattern matching methods and interpret the alignment of biological sequences [K5, S2]

CO6: Understand, apply and evaluate the molecular phylogeny of biological sequences [K5, S2]

Pre-requisites :Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	S											M		
CO2	S	S										M	M		
CO3	S	S	M	M	M	S			S	S		S	S		
CO4	S	S				S						M	M		
CO5	S	S	M	S	S	M			S	S		S	S		
CO6	S	S		S	S	M			S	S		S	S		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) **5.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

BASIS OF LIFE **9 Hours**

Origin of life–theory of evolution, Uniqueness of life on earth; Characteristics of living organisms,Tree of life classification –archaea, prokaryotes,eukaryotes.

INTRODUCTION TO BIOMOLECULES AND CYTOLOGY **12 Hours**

Biomolecules (Carbohydrates, lipids and proteins, nucleic acids) – Functions; Cells and its organelles (plasma membrane, mitochondria, nucleus, Golgi apparatus) – structure and functions.

INFORMATION STORAGE AND TRANSFER **12 Hours**

Heredity and DNA; organization of DNA in cells; Genes and chromosomes; Central dogma of

information transfer; transcription and Protein synthesis; Cell division and cell cycle.

Mutation and cancer.

ANALYSIS OF DNA AND PROTEIN SEQUENCES **12 Hours**

Basics of Sequence analysis-Pairwise sequence alignment, Basic Local Alignment Search Tool,

Multiple sequence alignment, Molecular phylogeny and evolution; High throughput Gene expression analysis.

Theory: 45 Hours	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45**

REFERENCES

1. Satyanarayan, U.,&Chakrapani, U.(1999) Ed. June 2017. Textbook of Biochemistry.
2. Verma, P. S., Agarwal,V. K., &Verma, P. S. (2007). *Cell biology, genetics, molecular biology, evolution and ecology*. S. chand &Company Limited.
3. Taylor,D.J.,Green,N.P.,Stout,G.W.,&Soper,R.(1997).*Biologicalscience*(Vol.983). Cambridge,United Kingdom: Cambridge University Press.
4. Campbell, N. A., Mitchell,L. G., Reece, J. B.,& Taylor, M. R. (2000).*Biology: concepts& connections* (No. QH308. 2 C35 1996). Benjamin/Cummings.
5. Rastogi, S. C., Rastogi, P., &Mendiratta, N. (2008). *Bioinformatics Methods And Applications: Genomics Proteomics And Drug Discovery3RdEd*. PHI Learning Pvt. Ltd..
6. Fumento, M. (2003).Bioevolution: how biotechnology is changing our world.

LAB COMPONENT CONTENTS **30 Hours**

Wet Lab Experiments:

1. Isolation and Quantification of DNA byuv-vis method (MS-Excel: Calculation using simple regression equation and analysis of Karl pearson correlation coefficient values)

2. Quantification of protein by colorimetry/ Uv-vis method (MS-Excel: Calculation using simple regression equation and analysis of Karl pearson correlation coefficient values)
3. Qualitative analysis of carbohydrates (glucose, sucrose and starch)
4. Separation of cell organelles using centrifugation [DEMO]

***In silico* based Experiments:**

1. Retrieval of data from public biological databases
2. Sequence alignment using EMBOSS tool (Percent similarity finding method)
3. Sequence alignment using k-tuple method (BLAST or FASTA(Database search method using percent similarity).
4. Phylogenetic analysis using EMBOSS/ BLAST tool (Clustering sequence using percent similarity).
5. Development of a simple sequence analysis tool

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

U18MAT3102 **DISCRETE MATHEMATICS**

L	T	P	J	C
3	1	0	0	4

(Common to CSE/IT/ ISE)

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Understand the concepts of set theory and apply them to situations involving inclusion and exclusion

CO2: Acquire the knowledge of relations, and analyse equivalence relations and their properties.

CO3: Understand and analyse the properties of different kinds of functions.

CO4: Apply mathematical induction to prove mathematical facts, analyse and use the concept of permutation and combination and solve recurrence relations.

CO5: Evaluate the validity of logical arguments and construct simple mathematical proofs.

CO6: Determine whether given graphs are isomorphic and apply Dijkstra's algorithm to find the shortest path.

Pre-requisite courses: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO MAPPING**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	M	M											M	M	M
CO2	M		S										M	M	
CO3	L												M	M	M
CO4	M		S										M	M	M
CO5	S	S	S									S	M	M	M
CO6	S	S	S									S	M	M	M

COURSE ASSESSMENT METHODS:

DIRECT
1. Continuous Assessment Test I, II 2. Written Assignment, Offline quiz, Written tests-2 **3.** End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENTS CONTENTS

SET THEORY **9+3 Hours**

Algebra of sets – The power set – Ordered pairs and Cartesian product – principle of inclusion and exclusion.

Relations on sets –Types of relations and their properties - Equivalence relations –Relational matrix and the graph of relation – Operations on relations.

FUNCTIONS **7+2 Hours**

Functions –Type of functions – Injective, surjective and bijective functions –Composition of functions – Inverse functions –Permutation functions.

COMBINATORICS **9+3 Hours**

Mathematical induction- The basics of counting–Permutations and combinations-Recurrence relations-Solving linear recurrence relations

LOGIC **11+4 Hours**

Propositions- Logical operators- Normal forms –Rules of inference-Consistency and inconsistency-Propositional logic- Proofs-Predicates- Quantifiers- Universe of discourse – Logical equivalences and implications for quantified statements-Rules of specification and generalization – Validity of arguments.

GRAPH THEORY **9+3 Hours**

Graphs- Types of graphs- Matrix representation of graphs- Graph isomorphism- Walk - Path- Cycles- Eulerian graphs -Hamiltonian graphs- Planar graphs- Euler formula- Shortest path algorithm: Dijkstra's algorithm

Theory: 45 Hours Tutorials: 15 Hours Practical: 0 Hours Total Hours: 60 Hours

REFERENCES

1. Liu C.L, "Elements of Discrete Mathematics, Second Edition, McGraw Hill 1985.
2. Mott J.L, Kandel A. and Baker T.P.,"Discrete Mathematics for Computer Scientists and Mathematicians, Second Edition, Prentice Hall India, 1986.
3. J.P.Trembly, R. Manohar, Discrete Mathematical Structures with applications to Computer Science, TMH International Edition (Latest Edition).
4. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science, Prentice – Hall, Engle Cliffs, N. J.
5. Harary F, Graph Theory, Narosa, 1969.
6. Thomas H.C., A Leiserson C.E., Rivest R.L, Stein C.A., "Introduction to a algorithms(2nd Edition),MIT press and McGraw-Hill.2001.

U18MAI4201 **PROBABILITY AND STATISTICS**
(Common to CSE, IT, ISE)

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Compute correlation between variables, and predict unknown values using regression.
CO2: Understand and apply the concept of probability and random variables and predict probabilities of events in models following normal distribution.
CO3 : Perform hypothesis testing and interpret the results.
CO4 : Understand the principles of design of experiments and perform analysis of variance.
CO5: Sketch control charts and comment on the process control.
CO6: Apply the above concepts to solve problems using R Studio.

Pre-requisites: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO MAPPING**		
Cos	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	S							M	M		M		M	M
CO2	S	S							M	M		M		M	M
CO3	S	S							M	M		M		M	M
CO4	S	S							M	M		M		M	M
CO5	S	S							M	M		M		M	M
CO6	S	S							M	M		M		M	M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) **5.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

CORRELATION AND REGRESSION **6 Hours**

Correlation – Karl Pearson’s Correlation coefficient – Spearman’s Rank Correlation – Regression lines.

PROBABILITY AND RANDOM VARIABLES **12 Hours**

Axioms of probability - Conditional probability – Total probability – Bayes' theorem - Random variable – Distribution function – properties – Probability mass function – Probability density function – moments-moment generating functions.

NORMAL DISTRIBUTION **5 Hours**

Normal distribution – Moments, Moment Generating functions and properties.

TESTING OF HYPOTHESIS **9 Hours**

Small samples tests based on t and F distributions (single mean, difference of means, paired *t*- test and variance ratio test) – Chi-square test for independence of attributes and goodness of fit

DESIGN OF EXPERIMENTS **8 Hours**

Analysis of Variance (ANOVA) – Completely Randomized Design (CRD) – Randomized Block Design (RBD) – Latin Square Design (LSD).

STATISTICAL QUALITY CONTROL **5 Hours**

Concept of process control - Control charts for variables: Mean and Range charts – Control charts for attributes: p, np, c – charts.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Veerarajan T., Probability, Statistics and Random Processes, Tata McGraw Hill,3rd edition, 2008.
2. Gupta S. P, "Statistical Methods", Sultan Chand & Sons Publishers, 2014.
3. Johnson R. A., Miller & Freund's "Probability and Statistics for Engineers", Sixth Edition, Pearson Education, Delhi, 2000.
4. Gupta.S.C and Kapoor.V.K, Fundamentals of Mathematical Statistics, 11th extensively revised edition, Sultan Chand & Sons, 2007.
5. Walpole R. E., Myers S.L. & Keying Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education Inc, 9th edition, 2012.
6. Gupta S.C, and KapurV.K "Fundamentals of Applied Statistics", Sultan Chand, New Delhi, 4th Edition, 2014.
7. Charles Henry Brase and Corrinne Pellillo Brase "Understandable Statistics", D.C. Heath and Company, Toronto, 9th edition, 2007.

HUMANITIES AND SOCIAL SCIENCES (HS)

U18ENI1202 FUNDAMENTALS OF COMMUNICATION-I

L	T	P	J	C
2	0	2	0	3

(Common to all Branches of I Semester B.E/B/Tech Programmes)

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Communicate in English with correct grammar
CO2: Communicate effectively (Oral and Written)
CO3: Use communication skills in the real world

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1										S		S	M	M	M
CO2		M		W		W			M	S		S	S	S	S
CO3		M		M		W			M	S		S	S	M	S

COURSE ASSESSMENT METHODS:

DIRECT
1. Continuous Assessment of Skills 2. Assignment 3. Written Test 4. End Semester Examination
INDIRECT
1. Course-end survey

No	Topic	Hours
MODULE I - 12Hrs		
1.1	Parts of Speech	2
1.2	Subject Verb Agreement	2
1.3	Speak up (Self Introduction, JAM)	4
1.4	Writing sentences using ‘Be-forms’	3
1.5	Test	1
MODULE II - 12Hrs		
2.1	Articles, Gerunds, Infinitives	2
2.2	Speak up (Greetings & Polite English)	4
2.3	Dialogue Writing	3
2.4	Skimming & Scanning	2
2.5	Listening Skills - I	1

MODULE III - 12Hrs		
3.1	Tenses & Voice	2
3.2	Sentences & its kinds	2
3.3	Speak up (Narration & Description)	4
3.4	Summarizing & Note-making	3
3.5	Listening Skills - II	1
MODULE IV - 12 Hrs		
4.1	Framing Questions – 4 types	2
4.2	Speak up (Role play)	4
4.3	Letter writing – Formal and Informal & Email Writing	3
4.4	Reading Comprehension & Cloze test	2
4.5	Listening Skills - III	1
MODULE V - 12 Hrs		
5.1	Degrees of Comparison	2
5.2	Clauses	2
5.3	Speak up (Power Point Presentation)	4
5.4	Writing (Picture perception)	3
5.5	Test	1
Total		**60**

REFERENCES

1. A Modern Approach to Non Verbal Reasoning (English, Paperback, Dr. R S Aggarwal)
2. The Power of Words(Bloomsbury, UK, 2012, Hyacinth Pink)http://play.google.com/store/apps/details?id=com.solutions.kd.aptitudeguru
3. Word Power Made Easy: The Complete Handbook for Building a Superior Vocabulary (By Norman Lewis)
4. Effective Technical Communication Tata McGraw Hills Publications (Ashraf Rizvi)
5. English and Soft skills Orient Black Swan Publishers (S. P. Dhanavel)
6. Know Your Grammar: Trans.in Tamil & Malayalam –A Bilingual Approach (Bloomsbury, UK, 2012, Hyacinth Pink)

U18ENI2202 FUNDAMENTALS OF COMMUNICATION - II

(Common to all branches of II Semester B.E/B/Tech Programmes)

COURSE OUTCOMES:

AFTER THE COURSE THE STUDENT WILL BE ABLE TO:

CO1: Read, understand, and interpret material on technology.
CO2: Communicate knowledge and information through oral and written medium.
CO3: Compare, collate and present technical information according to the audience and purpose.

Pre requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1		**W**		**S**					**S**	**S**		**S**	M	M	M
CO2				**S**					**S**	**S**		**W**	S	S	S
CO3				**M**					**S**	**S**		**S**	S	M	S

COURSE ASSESSMENT METHODS

Direct
1. Continuous Assessment of Skills 2. Assignment 3. Written Test 4. End Semester Examination
Indirect
1. Course-end survey

No	TOPIC	
	MODULE I	**12 Hrs**
1.1	Introduction to Technical Writing Technical Definitions	2
1.2	Writing Instructions / Instruction Manual	2
1.3	Writing Recommendations	2
1.4	Speaking Activity I	6
	MODULE II	**12 Hrs**
2.1	Process Writing	2
2.2	Review Writing I - Product	2
2.3	Review Writing II – Article	2
2.4	Speaking Activity II	6
	MODULE III	**12 Hrs**

3.1	Interpreting and Transcoding Graphics	2
3.2	Types of Report / Writing a Report	2
3.3	Reading & Responding to texts	2
3.4	Speaking Activity III	6
	MODULE IV	**12 Hrs**
4.1	Drafting a project proposal	2
4.2	Listening to technical talks	2
4.3	Preparing a survey Questionnaire	2
4.4	Speaking Activity IV	6
	MODULE V	**12 Hrs**
5.1	Writing Memos, Circulars, Notices	2
5.2	Writing Agenda and Minutes	2
5.3	Inferential Reading	2
5.4	Speaking Activity V	6
	Total	**60**

REFERENCES

1. Technical English Workbook, VRB Publishers Pvt. Ltd (Prof. Jewelcy Jawahar, Dr.P.Ratna)
2. Effective Technical Communication, Tata McGraw Hills Publications (Ashraf Rizvi)
3. Technical Communication – English Skills for Engineers, Oxford Higher Education (Meenakshi Raman, Sangeeta Sharma)

U18VET4101 **UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY**

L	T	P	J	C
2	1	0	0	3

COURSEOUTCOMES:

After successful completion of this course, the students shall be able to

CO1:	Develop a holistic perspective based on self- exploration about themselves (human being), family, society and nature/existence.
CO2:	Understand(or develop clarity) of the harmony in the human being, family, society and nature/existence
CO3:	Strengthen their self-reflection.
CO4:	Develop commitment and courage to act.

Pre-requisites:-None. Universal Human Values 1(Desirable)

CO-PO AND CO-PSO MAPPING:

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1						M	M	M	S			M	-	-
CO 2						S	M		S	S		S	-	-
CO 3								M	M		W	S	-	-
CO 4								S	M		M	M	-	-

COURSEASSESSMENTMETHODS:

Direct
1. Assessment by faculty mentor 2. Self-assessment 3. Socially relevant project/Group Activities/Assignments 4. End Semester Examination
Indirect

1.Assessmentbypeers(Survey form)

COURSECONTENTS:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I.

2. Self-Exploration–what is it?-Its content and process; 'Natural Acceptance' and Experiential Validation-as the process for self-exploration.

3. Continuous Happiness and Prosperity-A look at basic Human Aspirations

4. Right understanding, Relationship and Physical Facility-the basic requirements for fulfilment of aspirations of every human being with their correct priority.

5. Understanding Happiness and Prosperity correctly-A critical appraisal of the current scenario

6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module2: Understanding Harmony in the Human Being-Harmony in Myself!

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'.

2. Understanding the needs of Self ('I') and 'Body' –happiness and physical facility.

3. Understanding the Body as an instrument of 'I'(I being the doer, seer and enjoyer).

4. Understanding the character is tics and activities of 'I' and harm on yin 'I'.

5. Understanding the harmony of with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail.

6. Programs to ensure S any am and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life.
Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Module3: Understanding Harmony in the Family and Society-Harmony in Human-Human Relationship

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

2. Understanding the meaning of Trust; Difference between intention and competence

3. Understanding the meaning of Respect, Difference between respect and differentiation; the others alient values in relationship

4. Understanding the harmony in the society (society being an extension of family):Resolution,Prosperity,fearlessness (trust)and co-existence as comprehensive Human Goals

5. Visualizing a universal harmonious order in society-Undivided Society, Universal Order-from family to world family.

Include practice session store flecton relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Module4: Understanding Harmony in the Nature and Existence- Whole existence as Coexistence

1. Understanding the harmony in the Nature

2. Interconnectedness and mutual fulfilment among the four orders of nature-recyclability and self-regulation in nature.

3. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.

4. Holistic perception of harmony at al levels of existence.

5. Include practice sessions to discuss human being as cause of imbalance in nature (film“Home” can be used), pollution, depletion of resources and role of technology etc.

Module5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values

2. Definitiveness of Ethical Human Conduct

3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

4. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

5. Case studies of typical holistic technologies, management models and production systems

6. Strategy for transition from the present state to Universal Human Order:

a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers

b. At the level of society:as mutually enriching institutions and organizations

7. Sumup.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. To discuss the conduct as an engineer or scientist etc

COURSE DURATION:

No	MODULE	HOURS
1	Module1	[7Theory+3Tutorial] 10Hrs
2	Module2	[6Theory+3 Tutorial]9Hrs
3	Module3	[7Theory+3Tutorial] 10Hrs
4	Module4	[5Theory+3 Tutorial]8Hrs
5	Module5	[5Theory+3 Tutorial]8Hrs
	Total	**45**

TEXT BOOK

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCE BOOKS

1. JeevanVidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi.
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Weblinks

1. https://www.youtube.com/watch?v=E1STJoXCXUU&list=PLWDeKF97v9SP_Kt6jqzA3pZ3yA7g_OAQz
2. https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAx6AhQ
3. https://www.uhv.org.in/uhv-ii

U18CST5004 SOCIAL MEDIA MARKETING

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Identify and describe the different social media services, tools, and platforms.[K3]
CO2: Demonstrate understanding and evaluate new tools and social media platforms[K3]
CO3: Develop skills in using the predominant social media tools for business marketing.[K5]
CO4: Discover innovative uses for social media in a variety of business areas and processes [K4]
CO5: Develop a strategic plan for identifying opportunities for using social media.[K5]

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S									M		M			
CO2	S	S			S					M		M			
CO3	S		S							M		M			
CO4	S									M		M			
CO5	S	S	S		S	S			M	M	S	M	M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignment 3. Mini Project 4. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

UNDERSTANDING FACEBOOK AND LEVERAGING FACEBOOK FOR MARKETING 8 Hours

Introduction to basic FB terminologies-Creating a powerful personal profile for business-Marketing applications of Face book- Fundamentals of creating and maintaining fan pages-Creating groups for marketing-Face book marketing checklist-Basics of Sentimental analysis

INTRODUCTION TO TWITTER AS A MARKETING TOOL 10 Hours

Setting up a Twitter profile- Fundamental of Twitter: Tweet, direct messages, replies and Trending topics-Managing your Twitter experience- Fundamentals of Tweet Deck-Managing multiple Twitter accounts- Tweet management- Twitter Grader- Twitter Counter-Tweet burner- Twitter marketing checklist- Tree induction techniques.

FUNDAMENTALS OF YOUTUBE FOR CREATING COMPELLING ONLINE PRESENCE **10 Hours**

Fundamentals of video marketing- Creating a YouTube channel- Creating your own Internet TV channel for marketing

USING LINKEDIN FOR MARKETING **8 Hours**

LinkedIn for B2b marketing- creating a profile in LinkedIn Powerful corporate searches and connections - Recommendations and testimonials.

UNDERSTANDING CONTENT MARKETING AND USING BLOGS TO BUILD AND ENGAGE AUDIENCE **9 Hours**

Basics of inbound marketing-Webinars and tele- seminars-Podcasting basics- creating blogs and building a following White papers and info graphics- Fundamentals of content curation

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Liana Li Evans, "Social Media Marketing :Strategies for Engaging in Facebook, Twitter & Other Social Media", Que Press; Ed 2010
2. Andrew Macarthy," 500 Social Media Marketing Tips: Essential Advice, Hints and Strategy for Business: Facebook, Twitter, Pinterest, Google+, YouTube, Instagram, LinkedIn, and More!" ,Springer 2017
3. Ann Handley, "Content Rules: How to Create Killer Blogs, Podcasts, Videos, Ebooks, Webinars (and More) That Engage Customers and Ignite Your Business ",Johnwiley and sons,2012
4. Barker, "Social Media Marketing: A Strategic Approach" ,Cengage; 1 edition 2013

Other References:

https://learndigital.withgoogle.com/digitalunlocked
http://www.digitalvidya.com/blog/best-social-media-marketing-books-2016-top-10/

ENGINEERING SCIENCES (ES)

U18CSI1201 STRUCTURED PROGRAMMING USING C

(Common to CSE, ISE & IT)

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Acquire knowledge on different problem solving techniques.
CO2: Use appropriate data types and control structures for solving a given problem.
CO3: Execute different array and string operations.
CO4: Experiment with the usage of pointers and functions.
CO5: Organize data using structures and unions.
CO6: Demonstrate data persistency using files**.**

Pre-requisite :Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	M							L				S		
CO2	S	M							L	L				S	
CO3	S	L			L	L			L	L		L	M		
CO4	M	L	M	L	L	L			L	L		M	M		
CO5	M	L	M	L	L	L			L	L		M			M
CO6	L	L	M	L	L	L			L	L		L			M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory Component) 2. Assignment (Theory Component) 3. Group Presentation (Theory Component) 4. Pre/Post - experiment Test/Viva; Experimental Report for each experiment (lab component) 5. Model examination (lab component) 6. End Semester Examination (Theory and lab component)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

STRUCTURED PROGRAMMING **7 Hours**

Algorithms, building blocks of algorithms (instructions/statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving.

ARRAYS AND STRINGS **11 Hours**

Introduction to C Programming – Operators and Expressions – Data Input and Output – Control Statements. Defining an array – Processing an array – Multidimensional Arrays Character Arithmetic – Defining a string – NULL character – Initialization of Strings – Reading and Writing Strings – Processing Strings –Searching and Sorting of Strings.

FUNCTIONS, STORAGE CLASSES **9 Hours**

Defining a function – Accessing a function – Function prototypes – Passing arguments to a function – Passing arrays to functions – Function with string - Recursion – Storage classes

POINTERS **9 Hours**

Pointer Fundamentals – Pointer Declaration – Passing Pointers to a Function – Pointers and one dimensional arrays – operations on pointers– Dynamic memory allocation

STRUCTURES, UNIONS AND FILES **9 Hours**

Structures and Unions: Defining a Structure – Processing a Structure – User defined data types (Typedef) – Unions
Files: Opening and Closing a Data File – Reading and writing a data file – Processing a data file – Unformatted data files – Concept of binary files – Accessing a file randomly using fseek

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Byron S Gottfried and Jitendar Kumar Chhabra, “Programming with C”, Tata McGraw Hill Publishing Company, Third Edition, New Delhi, 2011.
2. Pradip Dey and Manas Ghosh, “Programming in C”, Second Edition, Oxford University Press, 2011.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
4. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
5. Reema Thareja, “Programming in C”, Second Edition, Oxford University Press, 2011.

LAB COMPONENT CONTENTS

LIST OF EXPERIMENTS 30 Hours

1. Writing algorithms, flowcharts and pseudo codes for simple problems.
2. Programs on expressions and conversions
3. Programs using if, if-else, switch and nested if statements
4. Programs using while, do-while, for loops
5. Programs on one dimensional arrays, passing arrays to functions and array operations
6. Programs using two dimensional arrays, passing 2D arrays to functions
7. Programs using String functions
8. Programs using function calls, recursion, call by value
9. Programs on pointer operators, call by reference, pointers with arrays

10. Programs using structures and unions.
11. Programs on file operations and modes.
12. Working with text files, random files and binary files

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

REFERENCES

1. Byron S Gottfried and Jitendar Kumar Chhabra, “Programming with C”, Tata McGraw Hill Publishing Company, Third Edition, New Delhi, 2011.
2. Pradip Dey and Manas Ghosh, “Programming in C”, Second Edition, Oxford University Press, 2011.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006
4. Ashok N. Kamthane, “Computer programming”, Pearson Education, 2007.
5. Reema Thareja, “Programming in C”, Second Edition, Oxford University Press, 2011.

U18EEI1201 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

(Common to CSE, IT, ISE)

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1	Acquire basic knowledge on DC and AC circuits.	K_2
CO2	Understand the construction, working principle and applications of DC machines	K_2
CO3	Understand the construction, working principle and applications of AC machines and transformers.	K_2
CO4	Acquire basic knowledge on logic gates, semiconductor devices and their applications.	K_2
CO5	Identify electronic components and use them to design simple circuits.	K_2

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												**CO/PSO MAPPING**		
Cos	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	M	M										W			
CO2	M	M										W			
CO3	M	M										W			
CO4	M	M										W			
CO5	M	M										W			

COURSE ASSESSMENT METHODS:

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) **5.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

DC CIRCUITS **9 Hours**

Basic circuit elements and sources, Ohms law, Kirchhoff's laws, series and parallel connection of circuit elements, Node voltage analysis, Mesh current analysis.

AC CIRCUITS **9 Hours**

Alternating voltages and currents – Single Phase Series RL, RC, RLC Circuits, Power in AC circuits –Power Factor.

ELECTRICAL MACHINES **9 Hours**

Construction, Working Principle and applications of DC generators, DC Motors, single phase Transformers, three phase and single phase induction motors.

SEMICONDUCTOR DEVICES AND CIRCUITS **9 Hours**

PN junction diode – Zener Diode – Half wave and Full wave rectifier-voltage regulators – Bipolar Junction transistors, JFET, MOSFET – characteristics

DIGITAL SYSTEMS **9 Hours**

Binary Number System – Logic Gates – Boolean algebra – Half and Full Adders -sbutractor– Multiplexer – Demultiplexer-decoder-flip flops.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

LAB COMPONENT CONTENTS

1. Measurement of electrical quantities–voltage, current, power & power factor in RL, RC and RLC circuits.
2. Verification of Kirchoff's Voltage and Current Laws.
3. Verification of Mesh and Nodal analysis.
4. Load test on DC shunt motor.
5. Load test on single phase transformer.
6. Load test on single phase induction motor.
7. Verification of truth tables of OR, AND, NOT, NAND, NOR, EX-OR, EXNOR gates.
8. Full wave rectifier with and without filter.
9. Input and output Characteristics of BJT – CE configuration.
10. Characteristics of PN junction diode and Zener diode.

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

TEXT BOOKS

1. Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.
2. Sedha R.S., "Applied Electronics", S. Chand & Co., 2006.

REFERENCES

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, “Basic Electrical, Electronics and Computer Engineering”, Tata McGraw Hill, Second Edition, 2017.
2. Nagsarkar T K and Sukhija M S, “Basics of Electrical Engineering”, Oxford press 2005.
3. Mehta V K, “Principles of Electronics”, Third Edition, S.Chand & Company Ltd, 1994.
4. Mahmood Nahvi and Joseph A. Edminister, “Electric Circuits”, Schaum’ Outline Series, McGraw Hill, 2002.
5. Premkumar N, “Basic Electrical Engineering”, Anuradha Publishers, 2003.

U18INI1600 ENGINEERING CLINIC - I

L	T	P	J	C
0	0	4	2	3

COURSE OBJECTIVES

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO:

CO1: Identify a practical problems and find a solution
CO2: Understand the project management techniques
CO3: Demonstrate their technical report writing and presentation skills

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	S	S	M	W		S			S	S		
CO2											S		S		
CO3										S					

COURSE ASSESSMENT METHODS:

DIRECT
1. Project reviews 50% 2. Workbook report10% 3. Demonstration & Viva – voce 40%
INDIRECT
1. Course-end survey

CONTENT:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the first semester, students will focus primarily on IOT with C programming using Arduino.

GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Theory: 0	**Tutorial: 0**	**Practical: 60**	**Project: 30**	**Total: 90 Hours**

U18CSI2201 PYTHON PROGRAMMING

L	T	P	J	C
2	0	2	0	3

(Common to All Branches)

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO:

CO1: Classify and make use of python programming elements to solve and debug simple logical problems.(K4,S3)

CO2: Experiment with the various control statements in Python.(K3,S2)

CO3: Develop Python programs using functions and strings.(K3,S2)

CO4: Analyze a problem and use appropriate data structures to solve it.(K4,S3)

CO5: Develop python programs to implement various file operations and exception handling.(K3,S2)

Pre-requisite :Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO MAPPING		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		S			M					M		M			
CO2			M							M		M			
CO3			M							M		M		M	
CO4	S	S	M		M					M		M	M	M	
CO5			M							M		M			

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test, Assignment 3. Viva, Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) 5. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

BASICS OF PYTHON PROGRAMMING **6 Hours**

Introduction-Python Interpreter-Interactive and script mode -Values and types, operators, expressions, statements, precedence of operators, Multiple assignments, comments.

CONTROL STATEMENTS AND FUNCTIONS IN PYTHON **6 Hours**

Conditional (if), alternative (if-else), chained conditional (if-elif-else)-Iteration-while, for, break, continue, pass – Functions - Introduction, inbuilt functions, user defined functions, passing parameters, return values, recursion, Lambda functions.

DATA STRUCTURES: STRINGS,LISTS and SETS **7 Hours**

Strings-String slices, immutability, string methods and operations -Lists-creating lists, list operations, list methods, mutability, aliasing, cloning lists, list and strings, list and functions-list processing-list comprehension, searching and sorting, Sets-creating sets, set operations.

DATA STRUCTURES: TUPLES, DICTIONARIES **5 Hours**

Tuples-Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value-Dictionaries-operations and methods, Nested Dictionaries.

FILES, MODULES, PACKAGES **6 Hours**

Files and Exception-Text files, reading and writing files, format Operator-Modules-Python Modules-Creating own Python Modules-packages, Introduction to exception handling.

Theory: 30	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 30 Hours**

REFERENCES

1. Ashok NamdevKamthane,Amit Ashok Kamthane, “Programming and Problem Solving with Python” , Mc-Graw Hill Education,2018.
2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second edition, Updated for Python 3, Shroff / O’Reilly Publishers, 2016.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”, Pearson India Education Services Pvt. Ltd., 2016.
4. Timothy A. Budd,” Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.
5. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, CENGAGE Learning, 2012.
6. Charles Dierbach, “Introduction to Computer Science using Python: A Computational Problem Solving Focus”, Wiley India Edition, 2013.

E BOOKS AND ONLINE LEARNING MATERIALS

1. www.mhhe.com/kamthane/python
2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff / O’Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)

LAB COMPONENT CONTENTS 30 Hours

LIST OF EXPERIMENTS

1. Implement simple python programs using interactive and script mode.
2. Develop python programs using id() and type() functions
3. Implement range() function in python
4. Implement various control statements in python.
5. Develop python programs to perform various string operations like concatenation, slicing, Indexing.
6. Demonstrate string functions using python.
7. Implement user defined functions using python.
8. Develop python programs to perform operations on list
9. Implement dictionary and set in python
10. Develop programs to work with Tuples.
11. Create programs to solve problems using various data structures in python.
12. Implement python program to perform file operations.
13. Implement python programs using modules and packages.

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

ONLINE COURSES AND VIDEO LECTURES:

http://nptel.ac.in
https://www.edx.org/course/introduction-to-python-fundamentals-1
https://www.edx.org/course/computing-in-python-ii-control-structures-0
https://www.edx.org/course?search_query=Computing+in+Python+III%3A+Data+Structures

U18INI2600 ENGINEERING CLINIC - II

L	T	P	J	C
0	0	4	2	3

COURSE OBJECTIVES

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO:

CO1: Identify a practical problems and find a solution

CO2: Understand the project management techniques

CO3: Demonstrate their technical report writing and presentation skills

Pre-requisite: U18INI1600/Engineering Clinic-I

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	S	S	M	W		S			S	S		
CO2											S		S		
CO3										S					

COURSE ASSESSMENT METHODS:

DIRECT
1. Project reviews 50% 2. Workbook report10% 3. Demonstration & Viva – voce 40%
INDIRECT
1. Course-end survey

CONTENT:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the second semester, students will focus primarily on Raspberry pi based controllers with Python programming Arduino.

GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Theory: 0	**Tutorial: 0**	**Practical: 60**	**Project: 30**	**Total: 90 Hours**

U18INI3600

ENGINEERING CLINIC – III

L	T	P	J	C
0	0	4	2	3

COURSE OBJECTIVES

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO:

CO1: Identify a practical problems and find a solution

CO2: Understand the project management techniques

CO3: Demonstrate their technical report writing and presentation skills

Pre-requisite: U18INI2600/Engineering Clinic-II

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	S	S	M	W		S			S	S		
CO2											S		S		
CO3										S					

COURSE ASSESSMENT METHODS:

DIRECT
1. Project reviews 50% 2. Workbook report10% 3. Demonstration & Viva – voce 40%
INDIRECT
1. Course-end survey

CONTENT:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the third semester, students will focus primarily on Design project combining concepts learnt in Engineering clinics I and II.

GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Theory: 0	**Tutorial: 0**	**Practical: 60**	**Project: 30**	**Total: 90 Hours**

U18INI4600 ENGINEERING CLINIC - IV

L	T	P	J	C
0	0	4	2	3

COURSE OBJECTIVES

- To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO:

CO1: Identify a practical problems and find a solution
CO2: Understand the project management techniques
CO3: Demonstrate their technical report writing and presentation skills

Pre-requisite: U18INI3600/Engineering Clinic-III

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	S	S	M	W		S			S	S		
CO2											S		S		
CO3										S					

COURSE ASSESSMENT METHODS:

DIRECT
1. Project reviews 50% 2. Workbook report10% 3. Demonstration & Viva – voce 40%
INDIRECT
1. Course-end survey

CONTENT:

The course will offer the students with an opportunity to gain a basic understanding of computer controlled electronic devices and apply the concepts to design and build simple to complex devices. As a practical project based embedded course, the students will be taught the concepts using a variety of reference material available in the public domain. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from toys to robots and flying machines.

In the fourth semester, students will focus primarily on Reverse engineering project to improve performance of a product.

GUIDELINES:

1. Practical based learning carrying credits.
2. Multi-disciplinary/ Multi-focus group of 5-6 students.
3. Groups can select to work on a specific tasks, or projects related to real world problems.
4. Each group has a faculty coordinator/Instructor who will guide/evaluate the overall group as well as individual students.
5. The students have to display their model in the 'Engineering Clinics Expo' at the end of semester.
6. The progress of the course is evaluated based on reviews and final demonstration of prototype.

Theory: 0	**Tutorial: 0**	**Practical: 60**	**Project: 30**	**Total: 90 Hours**

PROFESSIONAL CORE (PC)

U18CSI2202	DIGITAL LOGIC AND MICROPROCESSOR	L	T	P	J	C
		3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Demonstrate how the logic gates and minimization techniques work K3
CO2: Design a combinational circuit for performing arithmetic functions K5
CO3: Analyze and study a few sequential circuits K4
CO4: Develop programing code with 8086 for the basic problems K5, S1
CO5: Perform interfacing of 8086 with peripherals K3

Pre-requisite :

1. U18EEI1201/Basic Electrical and Electronics Engineering

CO/PO MAPPING (S/M/W indicates strength of correlation)S-Strong, M-Medium, W-Weak													CO/PSO		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M		M							M			
CO2	S												M		
CO3	S				M										
CO4	S	M										M			
CO5		M										M	M		

COURSE ASSESSMENT METHODS

Direct
1. Internal Tests 2. End Semester Exam 3. Assignments
Indirect
1. Course-end survey

THEORY COMPONENT CONTENTS

COMBINATIONAL CIRCUITS **10 Hours**

Logic gates: NAND, NOR gate as universal building blocks -Simplification of four-variable Boolean equations using Karnaugh maps - Half adder, Full adder, Half subtractor, Full subtractor - 4-bit parallel adder and subtractor - 3-bit binary decoder – Decimal to BCD encoder – 8-to-1 multiplexer, 1-to-8 Demultiplexer

SEQENTIAL LOGIC CIRCUITS **11 Hours**

Flip-flops: SR flip-flop, Edge-triggered flip-flops (SR,D,JK and T), 4-bit binary asynchronous and synchronous counter - Decade counter (asynchronous and synchronous) -Shift registers (SISO,SIPO,PISO,PIPO) - Ring counter

D/A AND A/D CONVERTERS **6 Hours**

Ladder type D/A converter - Dual slope A/D converter - Successive approximation A/D converter- case study of DAC0800 and ADC0809 chips

8086 MICROPROCESSOR ARCHITECTURE AND INSTRUCTION SET **12 Hours**

Pin diagram - CPU architecture - Memory segmentation - Internal operations - Addressing modes -Instruction formats - Data transfer instructions, Arithmetic instructions, Logical instructions, Branch-and-loop instructions – Interrupts: Software and Hardware interrupts

PERIPHERAL CHIPS **6 Hours**

8254 (Timer), 8257 (DMA), 8259 (PIC), 8251 (USART), 8279 (Keyboard -Display Interface)

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. M. Morris Mano, Digital Logic and Computer Design, 5th Edition., Pearson Education, 2017
2. Douglas V. Hall, Microprocessors and Interfacing, TMH
3. Thomas L. Floyd, "Digital Fundamentals", Pearson Education, Inc, New Delhi, 2013
4. Yu-Cheng Liu, Glenn A. Gibson, Microcomputer Systems: The 8086/8088 Family, PHI
5. Barry B. Brey, Microprocessors and Peripherals, CBS Publishers & Distributors, Delhi
6. R.K. Gaur, Digital Electronics and Microcomputers Thomas L Floyd, Digital Fundamentals, Universal Books, New Delhi

LAB COMPONENT CONTENTS:

30 Hours

List of Experiments

I. Digital Electronics

1. Study of Logic Gates
2. Implementation of Logic Circuits
3. Adder and Subtractor
4. Combinational Circuit Design
    a) Design of Decoder and Encoder
    b) Design of Code Converter
    c) Design of multiplexers and de multiplexers
5. Sequential Circuit Design
    a) Implementation of Shift registers, Serial Transfer
    b) 4-bit Binary Counter
    c) BCD Counter

II. Microprocessors

6. ALP Arithmetic programming
   a) Write an ALP to find out factorial of a given hexadecimal number using 8086 Data: OAH, OFH, 1OH
   b) Write an ALP to perform 16 bit arithmetic operations (ADD, SUB, MUL, DIV)
   c) Write an ALP to generate the sum of first 'N' natural numbers using 8086 MP
7. Sorting and Data Movement
   a) Write an ALP to order give set of hexadecimal numbers in ascending and descending order. Data: 0AH, 0FH, 0DH, 10H, 02H
   b) Write an ALP to move block of data from locations 1200H-1205H to 2200H – 2205H
   c) Write an ALP to reverse the given string of data: WELCOME

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

U18CSI3201 **DATA STRUCTURES**

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1:	Develop applications using stack and queue data structures [K5, S2]
CO2:	Develop applications to retrieve records from database using hashing techniques [K5, S2]
CO3:	Compare efficiency of various searching techniques using different tree data structures. [K4, S2]
CO4:	Compare efficiency of various sorting techniques using different data structures. [K4, S2]

Pre-requisite :Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S		M							M		M			
CO2	S		M							M		M			
CO3		S		M										S	
CO4		S		M										S	

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component)
2. Assignment; Group Presentation, Project Demonstration etc (as applicable) (Theory component)
3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
4. Model Examination (lab component)
5. End Semester Examination (Theory and lab components)
INDIRECT
1.Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION **6 Hours**

Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. **Searching:** Linear Search and Binary Search Techniques and their complexity analysis.

STACKS AND QUEUES **9 Hours**

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

LINKED LIST **9 Hours**

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis

TREES **12 Hours**

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with Complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

SORTING AND HASHING **9 Hours**

Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
2. M.A.Weiss, "Data Structures and Algorithm Analysis in C++", Fourth Edition, Pearson Education Asia, 2013.
3. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.

E BOOKS AND ONLINE LEARNING MATERIALS

1. http://users.cis.fiu.edu/~weiss/
2. http://nptel.ac.in/courses/10610206

LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

1. Implement the concepts of Stack, Simple Queue, Circular Queue and Priority Queue ADT using Arrays. [S2]
2. Implement Singly, Doubly and Circular Linked list. [S2]
3. Implement Stack and Queue ADT using Linked list. [S2]
4. Create program to perform tree traversals and other operations in a Binary Search Tree. [S1]
5. Create program to perform tree traversals and other operations in a Binary Search Tree. [S1]
6. Develop applications for Hashing. [S1]
7. Implement Sorting & Searching algorithms based on a given scenario. [S2]

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

U18CSI3202 OBJECT ORIENTED PROGRAMMING

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO:

CO1: Analyze a problem and identify classes, objects and the relationships among them.(K4,S3)
CO2: Develop applications using various types of Inheritance and Interfaces(K3,S2)
CO3: Develop applications or programs using exception handling and multithreading. (K3,S2)
CO4: Analyze an application and make use of object oriented concepts for its implementation. (K4,S3)

CO5: Develop programs using collections, files and streams in java.(K3,S2)

Pre-requisite:Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO MAPPING		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M							M		M	M	M	
CO2			W							M		M			
CO3		M								M		M			
CO4	S	S			M					M		M	M	M	
CO5			W							M		M			

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test, Assignment 3. Viva, Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) 5. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION TO OBJECT ORIENTED PROGRAMMING AND JAVA7 Hours

Introduction to OOP– Java Fundamentals -Data Types, Variables, and Arrays - Operators- Control Statements – Classes – Methods –Constructors- Garbage Collection.

INHERITANCE AND EXCEPTION HANDLING **10 Hours**

Inheritance –Packages and Interfaces - Exception Handling Fundamentals – Java's Built-in Exceptions-Creating new Exception subclasses.

POLYMORPHISM AND MULTITHREADING IN JAVA **10 Hours**

Polymorphism- Abstract classes and methods-Overloading-Overriding-final methods and classes –Multithreaded programming –The Thread class and the Runnable Interface-Creating multiple threads-Synchronization-Autoboxing and Annotations (Metadata).

STRING HANDLING AND COLLECTION FRAMEWORK **11 Hours**

String Constructors-String Operations-Generic classes and methods-The Collection Framework-Collections-List-ArrayList, LinkedList, Set-HashSet, Linked HashSet, Queue-PriorityQueue, Map-HashMap, SortedMap, TreeMap.

FILES AND STREAMS IN JAVA **7 Hours**

Files and streams –Byte Stream-I/O Stream, File I/O Stream, ByteArray I/O Stream-Character Stream-File Reader and Writer, CharArrayReader and Writer-Serialization.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Herbert Schildt, "Java the Complete Reference", Ninth edition Tata Mc Graw Hills, 2014.
2. Paul Deitel and Harvey Deitel, ―"Java How to Program (Early Objects)", Tenth Edition, Pearson Prentice Hall 2014.
3. Timothy Budd, ―"An Introduction to Object-Oriented Programming", Third Edition, Pearson Education, 2008.
4. E.Balaguruswamy,"Programming with Java", Second Edition, TMH, 2009

E BOOKS AND ONLINE LEARNING MATERIALS

1. Herbert Schildt, "Java the Complete Reference", Eighth edition Tata Mc Graw Hills, 2011.

LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

1. Develop simple programs in java using classes and methods.
2. Implement user defined Exception Handling.
3. Implement method overloading and method overriding in java
4. Develop java programs using inheritance and interfaces
5. Create Threads in java using Thread Class and Runnable Interface
6. Create an application using multiple threads
7. Develop programs using inbuilt methods of String class.
8. Implement collections like List, Set, Queue, Map in java.

9. Implement Input streams and Output streams in java.
10. Develop java programs to access and perform various operations in file contents.
11. Implement the given use case/project using various Object oriented concepts in java

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

ONLINE COURSES AND VIDEO LECTURES:

https://www.javatpoint.com/java-tutorial

U18CST3003 **COMPUTER ARCHITECTURE**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1 Identify the different addressing modes used in a processor (K3)

CO2 Apply the knowledge of arithmetic operations in the design of a fast adder (K3)

CO3 Classify the control units present in a processor. (K3)

CO4 Analyse the various performance enhancement techniques of Cache memories. (K4)

CO5 Point out how the pipeline processor improves performance of a computer. (K4)

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO MAPPING		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	M										M			
CO2	S		M									M	M		
CO3	S									M					
CO4	S	S								M					
CO5		S	M							M			M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignment, Group Presentation 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

BASIC STRUCTURE OF COMPUTERS **7 Hours**

Functional Units - Basic Operational Concepts - Bus Structures - Performance - Memory Locations and Addresses - Memory Operations - Instruction and Instruction Sequencing - Addressing Modes - Basic I/O Operations.

ARITHMETIC UNIT **11Hours**

Addition and Subtraction of Signed Numbers - Design of Fast Adders - Multiplication of Positive Numbers - Signed Operand Multiplication - Fast Multiplication - Integer Division - Floating Point Numbers and Operations.

BASIC PROCESSING UNIT **9 Hours**

Fundamental Concepts - Execution of a Complete Instruction - Multiple Bus Organization - Hardwired Control – Microprogrammed Control – Microinstructions- Microprogram Sequencing- Wide Branch Addressing

MEMORY SYSTEM **8 Hours**

Basic Concepts - Speed, Size and Cost - Cache Memories - Performance Considerations - Virtual Memories- memory management requirements

PIPELINING AND I/O ORGANIZATION **10 Hours**

Basic Concepts - Data Hazards - Instruction Hazards – Influence on instruction sets - Data path and control considerations - Superscalar operation – Accessing I/O devices- Interrupts – Enabling and disabling interrupts- Handling multiple devices - Direct Memory Access.
Case study - ARM interrupt structure

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, 5th Edition, McGraw-Hill, 2014.
2. William Stallings, “Computer Organization and Architecture - Designing for Performance”, 9th Edition, Prentice Hall, 2012.
3. David A.Patterson and John L.Hennessy, “Computer Organization and Design: The hardware / software interface”, 5th Edition, Morgan Kaufmann, 2014.
4. John P.Hayes, “Computer Architecture and Organization”, 3rd Edition, McGraw Hill, 2002.
5. https://onlinecourses.nptel.ac.in/noc18_cs29

U18CSI3204 DATABASE MANAGEMENT SYSTEMS

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Construct ER Model for a given database application. [K3, S3]
CO2: Design relational schema using database design principles. [K3, S2]
CO3: Identify the Key Constraints for relations and devise queries using SQL. [K4, S3]
CO4: Apply indexing techniques to access and generate user reports for a database. [K3, S2]
CO5: Building Web Applications using PHP & MySQL. [K5, S3]
CO6: Illustrate the concepts for transaction processing and concurrency control for RDBMS. [K3, S2]

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO MAPPING		
Cos	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	M								M				M	
CO2		M	W										M		
CO3		S	M		S									M	
CO4				S										M	
CO5			M		S				M		M		S		
CO6	S						S								

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION TO DATABASE AND RELATIONAL MODEL 10 Hours

Introduction: Database applications, Purpose of database systems, Views of data, Database Development Life cycle, Architecture of DBMS. Overview of query processing.

Relational Databases: Relational model, Database schema, Keys, Formal Relational Query Languages

DATABASE DESIGN **13 Hours**

Logical Database Design: Different approaches in Logical design, ER Modeling, ER notations, Steps in ER modeling. Physical database design: Converting ER Model to Relational Database Design, Normalization -Functional Dependency, 1NF,2NF,3NF (optional: multi-valued dependency and 4th Normal form).

STORAGE AND INDEXING **10 Hours**

Storage and File structure: File Organization, RAID. Indexing: Concepts, Clustered and Non-Clustered Indices, B-tree and B+-tree. Basics of Hashing (Static, Dynamic).

TRANSACTION MANAGEMENT **12 Hours**

Transactions: Concept and purpose, ACID properties and their necessity. Transaction Schedules: Conflicts and Aborts, Serializability, Recoverability. Concurrency Control: lock-based protocols, 2-phase locking, Timestamp based protocols. Deadlock handling.

Overview emerging database technologies and applications(Spatial databases, temporal, multimedia databases)**.** Case study: Open source Relational DBMS

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Abraham Silberschatz, Henry Korth, and S. Sudarshan, “Database System Concepts”, Sixth Edition, McGraw-Hill.2011.
2. R. Elmasri and S. Navathe, “Fundamentals of Database Systems”, Sixth Edition, Pearson Education, 2011.
3. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, 3nd Edition, McGraw Hill, 2003.
4. Thomas M. Connolly and Carolyn E. Begg, “Database Systems - A Practical Approach to Design, Implementation and Management”, Fifth edition, Pearson Education, 2010.
5. C.J.Date, A.Kannan and S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

OTHER REFERENCES:

1. Infosys Foundation Program: Module 2
2. https://onlinecourses.nptel.ac.in/noc17_cs33/course
3. http://www.db-book.com
4. http://nptel.ac.in/courses/IIT-MADRAS/Intro_to_Database_Systems_Design
5. http://www.iitg.ernet.in/awekar/teaching/cs344fall11/
6. www.w3schools.com/sql/

LAB COMPONENT CONTENTS

DATABASE APPLICATION DEVELOPMENT

SQL: Database languages, Basic SQL query structure, specifying integrity constraints in SQL, SQL Built in functions, Set operations, Nested subqueries, Aggregation, Join expressions, Data base objects, Views. Functions, Procedures and Triggers.
Accessing Databases through programming language, Building Web Applications using PHP &MySQL.

LIST OF EXPERIMENTS: (Open Source RDBMS-MySQL/Maria DB/POSTGRES)

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Creating relational database to set various constraints
3. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
4. Creation of Views and Indexes.
5. Working on TCL,DCL commands
6. Creating relationship between the databases.
7. Building Web Applications using PHP & MySQL
8. Mini Project

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

U18CST4001 DESIGN AND ANALYSIS OF ALGORITHMS

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Compare various graph traversal techniques(K4,S2)
CO2: Apply algorithm analysis techniques for a given algorithms(K3)
CO3: Examine algorithm design techniques for a given application(K4,S3)
CO4: Analyse different algorithms for solving a given problem (K4,S2)
CO5: Develop application using chosen algorithm technique (K5,S2)

Pre-requisites : U18CSI3201/Data Structures

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO MAPPING		
Cos	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M													
CO2	S	w													
CO3	S	S	M	M						M		M			
CO4		S		M						M			M		
CO5	S	S	M							M		M	M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II
2. Assignment, Group Presentation
3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

GRAPH AND TREE ALGORITHMS 9 Hours

Introduction to graph – types of graphs - Graph representations - Traversal algorithms- Depth First Search (DFS) and Breadth First Search (BFS) - Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting.

ALGORITHM ANALYSIS TECHNIQUES 8 Hours

Fundamentals of algorithmic problem solving – Important problem types – Analysis framework - Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem – Algorithm visualization.

BRUTE FORCE AND DIVIDE AND CONQUER TECHNIQUES **9 Hours**

Brute-Force: Sequential Search- Brute-Force string matching.

Divide and Conquer Method: Multiplication of large integers-Strassen's Matrix Multiplication.

GREEDY AND DYNAMIC PROGRAMMING TECHNIQUES **9 Hours**

Greedy Technique: Job sequencing with deadlines - Knapsack problem,

Dynamic Programming: Traveling Salesman Problem - Optimal Binary Search Tree

BACKTRACKING AND BRANCH AND BOUND TECHNIQUES **10 Hours**

Backtracking: N-Queen's Problem -Graph colouring.

Branch and Bound: Assignment Problem - Traveling Salesman Problem.

Computability classes – P, NP, NP-complete and NP-hard.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education Asia, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Second Edition, Universities Press, Hyderabad, 2008.
3. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, Second Edition, Prentice Hall of India,New Delhi, 2007
4. Sara Baase and Allen Van Gelder, "Computer Algorithms - Introduction to Design and Analysis", Pearson Education Asia, 2003.
5. A.V.Aho, J.E. Hopcroft and J.D.Ullman, "The Design and Analysis of Computer Algorithms",Pearson Education Asia, 2003.

U18CSI4202 **OPERATING SYSTEMS**

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

- **CO1:** Apply the concepts of CPU scheduling and Process synchronization (K3,S2)
- **CO2:** Experiment creation of different virtual machines in a hypervisor (K5, S3)
- **CO3:** Simulate the principles of memory management (K3,S2)
- **CO4:** Identify appropriate file system and disk organizations for a variety of computing scenario (K3)
- **CO5:** Examine the features of various open source operating systems. (K4)

Pre-requisite:U18CST3003/Computer Architecture

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO**		
Cos	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	S	M	M							M		M			M
CO2	S	S			S				M	M		M			M
CO3	S	M								M					
CO4	S	M								M					
CO5	S	S			M				M	M		M	M		

COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test I, II (Theory component)
2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component)
3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
4. Model Examination (lab component)
5. End Semester Examination (Theory and lab components)

INDIRECT

1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION AND PROCESS CONCEPT 9 Hours

Operating System Structure – Operating System Operations – Process Management – Memory Management – Storage Management – Protection and Security – System Structures: Operating System Services – User and Operating System Interface – System Calls – Types of System Calls – System Programs. Process Scheduling – Operations on Processes – Inter-process Communication.

Case Study: Kernel data structures for various open source operating systems.

MULTITHREADED PROGRAMMING AND PROCESS SCHEDULING 9 Hours

Overview of threads – Multicore programming-Multithreading Models – Threading Issues Basic Concepts of process scheduling – Scheduling Criteria – Scheduling Algorithms – Multiple-Processor Scheduling – Synchronization – The Critical-Section Problem – Peterson's Solution Synchronization Hardware – Semaphores – Classic problems of Synchronization – Monitors.

Case Study: Linux Scheduling.

DEADLOCK AND MEMORY MANAGEMENT STRATEGIES 9 Hours

System Model – Deadlock Characterization – Methods for Handling Deadlock – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery from Deadlock.

Swapping – Contiguous Memory Allocation – Paging – Structure of the Page Table-Segmentation.

VIRTUAL MEMORY MANAGEMENT AND FILE SYSTEM 9 Hours

Demand Paging – Copy on Write – Page Replacement – Allocation of Frames – Thrashing File Concept – Access Methods – Directory Structure – File Sharing – Protection.

IMPLEMENTING FILE SYSTEMS AND SECONDARY STORAGE STRUCTURE 9 Hours

File System Structure – File System Implementation – Directory Implementation – Allocation Methods – Free-space Management.

Disk Structure – Disk Scheduling – Disk Management – Swap-Space Management.

Case Study: Linux File system

Theory: 45 Hours	Tutorial: 0	Practical: 0	Project: 0	Total: 45

REFERENCES

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", John Wiley & Sons (Asia) Pvt. Ltd, Ninth Edition, 2016.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Third Edition Prentice Hall of India Pvt. Ltd, 2010.
3. Harvey M. Deitel, "Operating Systems", Pearson Education Pvt. Ltd, Second Edition, 2002.
4. William Stallings, "Operating System", Pearson Education, Sixth Edition, 2012.

ONLINE COURSES AND VIDEO LECTURES:

1. http://nptel.ac.in

LAB COMPONENT CONTENTS

30 Hours

LIST OF EXPERIMENTS

1. Develop programs for process creation and communication.
   To write simple shell programs.
   Creation of process and child process
   Demonstration of inter-process communication
   Creation of Zombie and Orphan process
   Creation of threads
2. Demonstration of shared memory concept
3. Simulation of the CPU scheduling algorithms
4. Demonstration of Semaphores
5. Implementation of Producer-Consumer problem
6. Simulation of Bankers algorithm for deadlock avoidance
7. Creation of virtual machine in a hypervisor

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

U18CST4003 THEORY OF COMPUTATION

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Design or convert an automaton for any given problem and experiment and document using JFLAP tool (K5).

CO2: List the various closure properties of languages in Chomsky hierarchy (K4).

CO3: Construct Context Free Grammars to generate strings from a context free language and convert them into normal forms (K3).

CO4: Identify the hierarchy of formal languages, grammars and machines.(K3)

CO5: Distinguish between computability and non-computability; decidability and undecidability (K4)

Pre-requisite :U18MAT3102/Discrete Mathematics

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO MAPPING		
Cos	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S		S							M	M		
CO2	S				M							M	M		
CO3	S		M									M	M		
CO4	S	M										M	M		
CO5	S											M	M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignment; Simulation using tool 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

AUTOMATA **9 Hours**

Introduction: Alphabets, languages, Chomsky hierarchy of languages.

Basic Machines Finite Automata(FA)-Deterministic Finite Automata(DFA)-Non-Deterministic Finite Automata (NFA) – Finite Automata with Epsilon transitions- Equivalence of DFA and NFA- NFA to DFA conversion-Applications of finite automata

REGULAR EXPRESSIONS AND LANGUAGES **9 Hours**

Regular Expression (RE) - Converting Regular Expression to FA- Converting FA to Regular Expression - Closure and Decision properties of Regular Expression - Equivalence and minimization of Automata.

CONTEXT-FREE GRAMMAR AND LANGUAGES **11 Hours**

Context-Free Grammar (CFG) - Parse Trees - Ambiguity in grammars and languages - Definition of the Pushdown automata - Languages of a Pushdown Automata - Equivalence of Pushdown automata and CFG, Deterministic Pushdown Automata-Normal forms for CFG – Chomsky Normal Form (CNF) – Greibach Normal Form (GNF)- Closure Properties of CFL.

TURING MACHINES **9 Hours**

The basic model for Turing machines (TM), Techniques for Turing machine construction, Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages, variants of Turing machines, unrestricted grammars

UNDECIDABILITY **7 Hours**

Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages-PCP.

Case Study: Realization of the automaton using JFLAP tool.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. J.E.Hopcroft, R.Motwani and J.D Ullman, "Introduction to Automata Theory, Languages and Computations", Third Edition, Pearson Education, 2011
2. John C.Martin, "Introduction to Languages and the Theory of Computation", Fourth Edition, Tata McGraw Hill, 2010.
3. Kavi Mahesh, "Theory of Computation, A Problem-solving Approach" Wiley India Pvt, Ltd, 2012.
4. H.R.Lewis and C.H.Papadimitriou, "Elements of The theory of Computation", Second Edition, Pearson Education/PHI, 2003.
5. Micheal Sipser, "Introduction of the Theory and Computation", Thomson Brokecole,1997

U18CSI4204 SOFTWARE ENGINEERING

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS WILL BE ABLE TO:

CO1	Design a application using UML modeling.	[K4,S2]
CO2	Test the given application with various test case using a testing tool	[K4,S2]
CO3	Create a application with all the stages of software engineering lifecycle	[K5,S3]
CO4	Apply project management and change management	K3

Pre-requisite: U18CSI3202 - Object Oriented Programming

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO MAPPING		
Cos	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	M	S				M				M			M		
CO2	M	M	S						M	M		M	M		
CO3	M		M						M	M	M	M	M		
CO4	M										S	M			

COURSE ASSESSMENT METHODS:

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) **5.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION TO SOFTWARE ENGINEERING AND UML 9 Hours

The Nature of Software -Software Engineering Failures- Software Engineering - Software Process Structure - Software Lifecycle Models - Agile Development - Scrum - Prototyping- Modeling with UML -Modeling Concepts

PROJECT MANAGEMENT AND REQUIREMENTS ANALYSIS 9 Hours

Project Organization Concepts - Project Communication Concepts - UML Activity Diagram- Requirements Elicitation - Usability - Requirement Analysis - UML Use Case Diagram - UML Analysis Object Class Diagram

DESIGN **9 Hours**

System Design Concepts-System Design Activities: From Objects to Subsystems- Patterns - Architectural Patterns - UML Component and Deployment Diagram - Object Design - Design Patterns - UML Class and Communication Diagram

MAPPING MODELS TO CODE & TESTING **9 Hours**

Mapping Models to Code- Overview of Mapping - Mapping Concepts- Mapping Activities - Managing Implementation-Testing- Overview of Testing- Testing Concepts-Faults, Erroneous States, Failures-Test Cases- Test Stubs and Drivers- Corrections-Testing Activities- Component Inspection – Usability Testing-Unit Testing-Integration Testing-System Testing-Managing Testing-Planning Testing-Documenting Testing-Assigning Responsibilities-Regression Testing-Automating testing

MANAGING CHANGE **9 Hours**

Rationale Management- Overview of Rationale - Rationale Concepts- Rationale Activities: from Issues To Decisions-Managing Rationale- Configuration Management Concepts- Configuration Management Activities - Managing Configuration Management

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Bernd Bruegge & Allen H. Dutoit, “Object-Oriented Software Engineering”, Third Edition, 2014.
2. R.S. Pressman, “Software Engineering – A Practitioner‟s Approach”, Eighth Edition, McGraw Hill International Edition, 2015
3. Ivar Jacobson, “Object-Oriented Software Engineering”, Pearson Education, Revised Edition 2009.
4. Stephen R.Schach, “Object-Oriented Classical Software Engineering”, Mcgraw Hill, Eighth Edition 2010.
5. S. Thangasamy, “Essentials of Software Engineering”, Wiley India, First Edition, 2012.
6. Yogesh Singh, “Object-Oriented Software Engineering”, 2012.
7. M. Blaha and J. Rumbaugh, “Object Oriented Modeling and Design with UML”, Second Edition, Prentice-Hall India, 2007.

LAB COMPONENT CONTENTS

To choose a real use case-based software development project, design, develop and test the software system with following milestones.

Milestones

1 Identify a application and model it using UML Use-Case Diagrams.(Star UML/ArgoUML/..)
2 Software Requirement Specification & UML Analysis Object Design Diagram

3 Module Description, Design & UML Component Diagram
4 Detailed Design & UML Deployment Diagram
5 Implementation & UML Object Design Class Diagram
6 Testing (Selenium tool/SonarQube/…)

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

U18CSI5201 COMPUTER NETWORKS

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

- **CO1:** Summarize the functionality and protocols operating in each layer of OSI reference model. [K3]
- **CO2:** Compare network topology, devices and transmission medium. [K4]
- **CO3:** Analyze error control, flow control and routing protocols. [K3][S2]
- **CO4:** Analyze IP, TCP and UDP header formats. [K4] [S2]
- **CO5:** Analyze Network traffic characteristics and congestion control mechanism. [K5][S3]

Pre-requisite :Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S									M					
CO2	S	S	M	S						M		M			
CO3	S	M	M	M	M				M	M		M			M
CO4	S	S		S	M					M		M		M	
CO5	S	S		S	S			M	M	M		M			M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) **5.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

DATA COMMUNICATIONS **8 Hours**

Data Communication – The OSI Model – TCP/IP Protocol Suite – Addressing – Transmission Media – Networking devices – Network Topologies.

DATA LINK LAYER **8 Hours**

Encoding - Error Detection – Reliable Transmission – MAC protocols – CSMA/CD – CSMA/CA.

NETWORK LAYER **11 Hours**

Circuit Switching – Packet Switching – Bridges and LAN Switches: Spanning Tree algorithm – Internetworking – IPv4 - Subnetting – IPv6 – Routing Techniques: Distance vector (RIP) – Link state (OSPF) — Interdomain Routing (BGP).

TRANSPORT LAYER **11 Hours**

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

APPLICATION LAYER **7 Hours**

Domain Name System – Electronic Mail (SMTP, MIME, IMAP) – File Transfer (FTP) – WWW (HTTP).

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth edition, Morgan Kaufmann Publishers Inc., 2011.
2. William Stallings, “Data and Computer Communications”, Tenth edition, Pearson Education, 2013.
3. Behrouz A Forouzan, “Data Communications and Networking”, Fifth edition, Tata McGraw–Hill, New Delhi, 2013.
4. James F. Kurose, Keith W. Ross, “Computer Networking, A Top–Down Approach Featuring the Internet”, Sixth edition, Pearson Education, 2012.

ONLINE COURSES AND VIDEO LECTURES:

https://www.coursera.org/specializations/computer-communications#courses
https://nptel.ac.in/courses/106105080/
https://nptel.ac.in/courses/106105081/

LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

1. Develop client server based TCP applications using UNIX socket programming functions.
2. Develop client server based UDP applications using UNIX socket programming functions.
3. Simulation of data link and network layer protocols.
4. Performance analysis of TCP and UDP protocol using simulation tool.
5. Performance analysis of routing protocols using simulation tool.

6. Demonstrate the working of network tools such as Ping, TCPDump, Traceroute, Netstat, IPconfig.
7. Analyze the network traffic using Wireshark tool/Packet tracer tool.

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

U18CST5002 AGILE SOFTWARE DEVELOPMENT

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Apply design principles and refactoring to achieve Agility [K3]
CO2: Analyze automated build tools, version control and continuous integration [K4]
CO3: Perform testing activities within an Agile project [K4, S2]
CO4: Finding initial product backlog items as user stories, order your product backlog.[K4]
CO5: Choose the size of the backlog items and perform sprint planning [K5]

Pre-requisite :U18CSI4204/Software Engineering

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S											M			
CO2	M				M				M			M			
CO3					M							M	M		
CO4	S				M				S	M		M	S		M
CO5	S				S				S	M		M			

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignment; Group Presentation 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

FUNDAMENTALS OF AGILE 9 Hours

The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools

AGILE SCRUM FRAMEWORK 9 Hours

Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management.

AGILE TESTING **9 Hours**

The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), Unit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester

AGILE SOFTWARE DESIGN AND DEVELOPMENT **9 Hours**

Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control

AGILE INDUSTRY TRENDS **9 Hours**

Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. David J. Anderson and Eli Schragenheim, ―Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
2. Hazza and Dubinsky, ―Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.
3. Craig Larman, ―Agile and Iterative Development: A Managers Guide, Addison-Wesley, 2004.
4. Kevin C. Desouza, ―Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

OTHER REFERENCES

1. Agile Software Development with Scrum By Ken Schawber, Mike Beedle Publisher: Pearson
2. Agile Testing: A Practical Guide for Testers and Agile Teams By Lisa Crispin, Janet Gregory Publisher: Addison Wesley
3. Agile Software Development, Principles, Patterns and Practices By Robert C. Martin Publisher: Prentice Hall
4. Agile Software Development: The Cooperative Game By Alistair Cockburn Publisher: Addison Wesley
5. User Stories Applied: For Agile Software By Mike Cohn Publisher: Addison Wesley

U18CSI5203 NOSQL DATABASES

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Outline fundamental concepts in the context of a number of different NOSQL products.[K3]
CO2: Construct refined logical database model with consideration of data semantics and dependency.[K4]
CO3: Build a database system and demonstrate competence with the fundamental tasks involved with its modeling, designing, and implementation.[K4, S2]
CO4: Examine MongoDB tools to develop and deploy various applications.[K5,S3]

Pre-requisite:U18CSI3204/Data Base Management System

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S									M		M		M	
CO2		M		M						M		M		M	
CO3		M		M	M					M				M	
CO4		S		S	M					M				M	

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component)
2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component)
3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
4. Model Examination (lab component)
5. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION TO NOSQL **9 Hours**

Definition of NOSQL, History of NOSQL and Different NOSQL products, Exploring MondoDB Java/Ruby/Python, Interfacing and Interacting with NOSQL

NOSQL BASICS **9 Hours**

NOSQL Storage Architecture, CRUD operations with MongoDB, Querying

NOSQL MANAGEMENT **9 Hours**

Modifying and Managing NOSQL Data stores, Indexing and ordering datasets(MongoDB/CouchDB/Cassandra)

WORKING WITH NOSQL **9 Hours**

Surveying Database Internals, migrating from RDBMS to NOSQL, Web Frameworks and NOSQL, using MySQL as a NOSQL

DEVELOPING WEB APPLICATION WITH NOSQL AND NOSQL ADMINISTRATION

9 Hours

Php and MongoDB, Python and MongoDB, Creating Blog Application with PHP, NOSQL Database Administration

Theory: 45 Hours	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. "Professional NOSQL" by Shashank Tiwari, 2011, WROX Press (Chapter 1,2,3,4,5,6,7, 8, 9,10.11.12.13.15)
2. The Definitive guide to MongoDB, The NoSQL Database for Cloud and Desktop Computing, Apress 2010 (Chapter 6,7,8,9).
3. David Hows, "The definitive guide to MongoDB", 2nd edition,Apress Publication, 2009, 8132230485.
4. Shakuntala Gupta Edward, "Practical Mongo DB ", Second edition,Apress Publications, 2016, ISBN 1484206487
5. Daniel Perkins, "Mongo DB, Third Edition, CreateSpace Independent Publishing Platform, 2016, ISBN 152396300
6. Steve Hoberman, "Data Modelling for Mongo DB", First Edition, Technics Publication, 2014, ISBN 9781935504702

LAB COMPONENT CONTENTS **30 Hours**

1. Implement database with suitable example using MongoDB and implement all basic operations and administration commands using two tier architecture.
2. Use MongoDB to process semi structured and unstructured data collections such as Rfid, images, blogs use python/Java MongoDB interface.
3. Implement python/Java application using MongoDB to maintain the blog for composing the blog consists of text columns, images and videos also calculate the hit or users visited by drawing 2D graphs.
4. Implement using MongoDB to compose a web news-letter consisting of videos, images, text use python MongoDB interface.
5. Aggregation with suitable example using MongoDB.
6. Indexing with suitable example using MongoDB.
7. Querying with MongoDB using suitable example.
8. Aggregation and indexing with suitable example using RdfID based employees' attendance system

9. Connectivity with MongoDB using any Java application.
10. Using MongoDB create a database of employee performance, employee attendance on the workstation.

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

U18CSI5205 MOBILE APPLICATION DEVELOPMENT USING ANDROID

L	T	P	J	C
1	0	4	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

- **CO1:** Explain mobile application development and android development environment
- **CO2:** Design app user interface
- **CO3:** Describe Mobile Databases
- **CO4:** Explain programming with different sensors.
- **CO5:** Explain different wireless network programming in android.
- **CO6:** Explain testing and distribution of mobile applications.

Pre-requisite:U18CSI3202/ Object Oriented Programming

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	M				M				L				M		
CO2	M		M						L				M		
CO3	M				M				M	M			M		
CO4	M								M	M			M		
CO5	M								M	M			M		
CO6	M				M			M	L				M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) **5.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

GETTING STARTED WITH MOBILITY 9 Hours

Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, setting up the mobile app development environment along with an emulator, a case study on Mobile app development. App user interface designing – mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity- states and life cycle, interaction amongst activities.

BUILDING BLOCKS OF MOBILE APPS 6 Hours

App user interface designing – mobile UI resources (Layout, UI elements, draw-able, Menu), Activity- states and life cycle, interaction amongst activities. App functionality beyond user interface - Threads, Async task, Services – states and lifecycle, Notifications, Broadcast receivers, Telephony and SMS APIs

MOBILE DATABASES AND SENSORS 6 Hours

Native data handling – on-device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet). Location awareness, sensor programming- accelerometer and proximity sensor.

NETWORK PROGRAMMING 4 Hours

Managing Wi-Fi- Monitoring Wi-Fi connectivity and Active Wi-Fi connection details, Scanning Hotspots, Managing and creating Wi-Fi Configurations.

TAKING APPS TO MARKET 5 Hours

Android Testing Framework -JUnit- Creating a Test Case, The Test Case Base Class- Introducing Robotium. Versioning-signing and packaging mobile apps- distributing apps on mobile marketplace.

Theory: 30 Hours	Tutorial: 0	Practical: 0	Project: 0	Total: 30 Hours

References:

1. Anubhav Pradhan, Anil V. Deshpande, “Composing Mobile Apps: Learn. Explore. Apply. Using Android”, Wiley publication, 2014.
2. Reto Meier, "Professional Android 4 Application Development", Wiley Publication, 2012
3. Paul Blundell, Diego Torres Milano, “Learning Android Application Testing”, PACKT Publishing, 2015
4. Barry Burd, “Android Application Development All in one for Dummies”, John Wiley & Sons publication,2011.

LAB COMPONENT CONTENTS 30 Hours

List of Experiments:

1. Setting up Android Platform and Android Studio

2. Activity & Intents
   a) Creating activities
   b) Starting another activity and message passing using intents

3. UI Design- Layouts and Input Controls

a) Layouts- Linear, Relative, List View and Grid View
b) Widgets- Text Fields, Buttons, Radio Buttons, Spinners and Pickers

4. Input Events
   a) Event Listeners
   b) Event Handlers

5. User Notifications & Broadcast Receiver
   a) Creating and Managing Notification
   b) Register Receiver and send Broadcast

6. Threads and Async Tasks
   a) Creating threads
   b) perform background operations and publish results on the UI thread using Async

7. Location and Maps
   a) Getting the last known location and displaying a location Address
   b) Add maps to app and customize the map

8. SQLite databases
   a) Creating a database
   b) Put information into database
   c) Read Information from database

U18CSI6201 INTERNET AND WEB PROGRAMMING

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES:

AFTER SUCCESSFUL COMPLETION OF THIS COURSE THE STUDENTS SHOULD BE ABLE TO,

- **CO1:** Design a Website using HTML (K5, S3)
- **CO2:** Apply Cascading Style Sheet to design a HTML Webpage (K3, S2)
- **CO3:** Develop a HTML form and validate it using Java Script (K5, S2)
- **CO4:** Develop web application using JSP, Servlet (K5, S3)
- **CO5:** Develop an XML document and validate it using SCHEMA (K5, S2)

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1					S				S	S		M	M		
CO2					M				S	S					
CO3			S						S	S					
CO4			S		S										
CO5			S											M	M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component)
2. Open Book Test, Assignment, Mini Project and Group Presentation, Project Demonstration etc (as applicable) (Theory component)
3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component)
4. Model Examination (lab component)
5. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

XHTML AND CSS **9 Hours**

HTML Introduction- Basic XHTML syntax and Semantics- HTML Elements & Attributes - Lists- Tables-Frames-Forms-Defining XHTML Abstract Syntax-Creating HTML Documents; CSS -Features- Syntax- Cascading and Inheritance- Text Properties-Box Model- Flow-Other style Properties.

JAVASCRIPT **9 Hours**

JavaScript introduction-Basic Elements-Variable-Data Types- Operators and Literals-Functions-Objects-Arrays-Built-in- Object. JavaScript Debuggers-Event Handling-Validation.

SERVLETS **9 Hours**

Java Servlets: Architecture- Overview-Servlet Generating Dynamic Content-Life Cycle-Parameter Data-Sessions-Cookies.

JSP **9 Hours**

JSP Overview- Basic JSP: Architecture- Lifecycle- Directives-Actions-Implicit Objects-JavaBeans Classes and JSP- MVO Paradigm.

XML AND WEB SERVICES **9 Hours**

Xml: Namespaces- XML Processing- -XML Documents- XSL — XSLT, Web services: WSDL-XML Schema —Introduction to SOAP.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Jeffrey C.Jackson, "Web Technologies—A Computer Science Perspective", Person Education, 2013.
2. DeitalDeital Nieto, "Internet & World Wide Web How To Program", 5th ed., 2012.
3. Thomas A.Powell, "The Complete Reference HTML & CSS", 5th ed., 2010.
4. Steve Suehring, "JavaScript-Step by Step",PHI,2nd ed., 2010.
5. Frank. P. Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2013.
6. https://tutorialspoint.com/jsp

LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

1. Develop a webpage using HTML.
2. Apply style specification in HTML page using CSS.
3. Develop a HTML form and validate it using Java script.
4. Demonstrate exception handling using Java Script.
5. Develop a JSP form to collect user registration details.
6. Develop a JSP login form with cookies.
7. Apply JavaBean class to print information about a student class.
8. Develop a servlet program to add two numbers.
9. Develop an XML document and validate it using SCHEMA.
10. Develop an XML document and transform it into HTML using XSLT.

Theory: 0	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

U18CST6002 WIRELESS NETWORKS AND MOBILE SYSTEMS

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Compare various wireless transmission and media access techniques. K3
CO2: Identify and Interpret fields in GSM and GPRS frame structures. K3
CO3: Analyse physical, link and network layer characteristics of wireless networks K4
CO4: Compare Mechanisms for Improving TCP Performance over Wireless Links. K3
CO5: Understand 4G features and technologies K2

Pre-requisite:U18CSI5201 - Computer Networks

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	M										M			
CO2	S	M													
CO3	S	S			M					M		M			
CO4	M	M								M		M	M		
CO5	M	M										M	M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignment, Journal paper review, Group Presentation 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

MOBILE NETWORKS 9 Hours

Telecommunication Systems -– modulation – multiple access techniques - Wireless LAN – IEEE 802.11 Standards – GSM – Architecture – Protocols – Localization and calling – Handover – security - GPRS - Broadcast Systems – DAB – DVB

WIRELESS NETWORKS 8 Hours

Wireless LANs and PANs– IEEE 802.11 Standard – Architecture – Physical and MAC layer- MAC management– HiperLAN – Bluetooth- Wi-Fi – WiMAX.

ROUTING **9 Hours**

Mobile IP – DHCP – MANET: Routing – Classification – Table driven routing- On-Demand routing- Hybrid routing- Hierarchical state routing- Power-aware routing- Operations of Multicast routing

TRANSPORT AND APPLICATION LAYERS **8 Hours**

Traditional TCP– WWW -WAP – Architecture – WDP – WTLS – WTP – WSP – WAE – WML– WML Scripts- WTA Architecture.

4G & INTERWORKING **7 Hours**

4G features and challenges, 4G Technologies, Overview of LTE, Advanced LTE, Interworking Objectives and requirements, Schemes to connect WLANs and 3G Networks, Session Mobility, Interworking Architectures for WLAN and GPRS.

SIMULATION **4 Hours**

Simulation of MANET - media access protocols – routing protocols using OMNeT++ or NS3

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Jochen Schiller, “Mobile Communications”, PHI, Second Edition, 2011.
2. C.Siva Ram Murthy and B.S.Manoj, “Adhoc Wireless Networks: Architectures and Protocols”, Prentice Hall PTR, 2004
3. Vijay. K. Garg, ―Wireless Communication and Networking‖, Morgan Kaufmann Publishers, 2007.
4. Jochen Burkhardt, “Pervasive Computing: Technology and Architecture of Mobile Internet Applications”, Addison-Wesley Professional; Third Edition, 2007
5. Frank Adelstein, Sandeep KS Gupta, Golden Richard, “Fundamentals of Mobile and Pervasive Computing”, McGraw-Hill, 2005.
6. William Stallings, ―Wireless Communications and Networks‖, Pearson Education, 2009.
7. Stefano Basagni , et al, “Mobile Ad hoc Networking”, Wiley –IEEE press,2004

U18CSI6203 DATA WAREHOUSING AND DATA MINING

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

- **CO1:** Demonstrate data warehouse schema and process of data retrieval for real time applications. [K3]
- **CO2:** Identify necessity of data pre-processing and apply the appropriate procedure. [K4, S2]
- **CO3:** Design and deploy appropriate Classification/ Clustering techniques for various problems with high dimensional data using modern tools. [K5, S2]
- **CO4:** Apply the association rules for real life mining applications. [K4, S2]
- **CO5:** Synthesize various mining techniques and work in teams to develop project on complex data objects. [K5, S3]

Pre-requisite: U18CSI5203/No SQL Databases

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	S		M		S		S		M	S	M		M	
CO2	S	M		S	M					M		M		M	
CO3	S	S	M	S	S		S		M	M	S	M		M	
CO4	S	M			M					M		M		M	
CO5		S		S	S			S	S	M	S	M	M	M	M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Case Study, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) 5. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

DATA MINING INTRODUCTION AND PREPROCESSING **9 Hours**

KDD Process – Kinds of data can be mined – Kind of data can be mined – Technologies used – Kinds of Applications targeted – Issues in data mining - Data Objects and Attribute Types - Data preprocessing overview – Data Cleaning – Data Integration – Data Reduction – Data Transformation and Discretization.

DATA WAREHOUSING AND ONLINE ANALYTICAL PROCESSING 9 Hours

Data warehouse – Basic Concepts –Modeling - Data cube and OLAP – Data warehouse Design and Usage – Implementation - Data Generalization by Attribute Oriented Induction.

ASSOCIATION AND CLASSIFICATION 10 Hours

Frequent Pattern Mining – Basic Concepts – Frequent Itemset Mining methods - Classification Basic Concepts – Decision Tree Induction – Bayesian Classification – Rule Based Classification – Model Evaluation and Selection - Support Vector Machine - Lazy Learners – Other classification methods.

CLUSTERING AND OUTLER ANALYSIS 8 Hours

Cluster Analysis – Partitioning Methods - Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of Clustering - Outlier Analysis – Outlier detection Methods.

MINING COMPLEX DATA TYPES 9 Hours

Business Intelligence in the Era of Big Data and Cognitive Business - Time Series and Sequence Mining – Mining graphs and networks – Web Mining – Spatial Mining – Text Mining – Multimedia Mining – Data Mining Applications.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Jiawei Han, Micheline Kamber, Jain Pei “Data Mining: Concepts and Techniques”, Third edition, Elsevier, Morgan Kaufmann Publishers, 2012.
2. Alex Berson and Stephen J. Smith “Data Warehousing, Data Mining & OLAP”, Tata McGraw– Hill Edition, Tenth Reprint 2007.
3. Steve Williams, “Business Intelligence Strategy and Big Data Analytics”, First Edition, Elsevier, Morgan Kaufmann Publishers, 2016.
4. K.P. Soman, Shyam Diwakar and V. Ajay “Insight into Data mining Theory and Practice”,Easter Economy Edition, Prentice Hall of India, 2006.
5. Hand.D, Mannila H, Smyth.P, “Principles of Data Mining”, MIT press, USA,2001.
6. Dunham M, "Data Mining: Introductory and Advanced Topics”, Prentice Hall, New Delhi, 2002.

E BOOKS AND ONLINE LEARNING MATERIALS

1. www.db.standford.edu/`ullman/mining/mining.html

2. ocw.mit.edu/ocwweb/slon-School-ofmanagement/15-062DataMiningSpring2003/course home/index.htm
3. https://cs.nyu.edu/courses/spring03/G22.3033-015/
4. https://www.cs.purdue.edu/homes/clifton/cs490d/
5. https://freevideolectures.com/course/3609/data-warehousing
6. https://www.elsevier.com/books/business-intelligence-strategy-and-big-data-analytics/williams/978-0-12-809198-2
7. https://www.sciencedirect.com/science/article/pii/B9780128091982000026

LAB COMPONENT CONTENTS **30 Hours**

LIST OF EXPERIMENTS

1. Data Migration(Informatica)
2. Identification and Retrieval of dataset. (Kaggle/UCI Repository)
3. Statistical Descriptions of Data (R/Python)
4. Pre-processing of datasets using data mining tools. (Weka)
5. Implementation of Classification Algorithms (Python)
6. Implementation of Clustering Algorithms (Python)
7. Exercise on Discovering Association Rules (Python)
8. Comparison of classifiers model, evaluating and improving accuracy of models using data mining tool. (Weka/R)
9. Evaluation of various clustering methods using data mining tool. (Weka/R)
10. Build prediction/recommender data mining applications for real time problems.

Theory: 0	Tutorial: 0	Practical: 30	Project: 0	Total: 30 Hours

ONLINE COURSES AND VIDEO LECTURES:

1. https://www.edx.org/learn/data-mining
2. https://www.class-central.com/subject/data-mining\
3. https://www.edx.org/course/introduction-to-r-for-data-science
4. https://www.coursera.org/learn/data-mining-project
5. https://www.futurelearn.com/courses/data-mining-with-weka
6. https://www.datacamp.com/courses/intro-to-python-for-data-science

U18CST6004 **SOFTWARE TESTING**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1:	Apply software testing fundamentals and testing design strategies to enhance software quality.	K4
CO2:	Design test cases for unit test, integration test, system test, regression and acceptance test	K3
CO3:	Discover how work test plan components, test measurements and reviews	K3
CO4:	Perform Testing in software with various testing tools	K4
CO5:	Develop and validate a test plan.	K4

Pre-requisite: U18CST5002/Agile Software Development

CO/PO/PSO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	S					M	M			M	M	S
CO2	S	M													
CO3	M		M							M				S	
CO4	S		S						M						
CO5	S	M								M				S	S

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignments / Mini Projects / Group Presentations/ Case Studies, involving analysis of security of any information system / domain, and using security mechanisms to deliver security services 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION 8 Hours

Testing as an Engineering Activity - Role of Process in Software Quality - Testing as a Process- The six essentials of software testing - Basic Definitions: Software Testing Principles - The role of a software tester - Origins of defects- Defect classes the defect repository. Analysis of defect for a project

TEST CASE DESIGN STRATEGIES **9 Hours**

Introduction to Testing Design Strategies - Black Box testing - Random Testing - Equivalence Class Partitioning - Boundary Value Analysis - Cause and error graphing and state transition testing -White-Box testing - Test Adequacy Criteria - Coverage and Control Flow Graphs- Covering Code Logic Paths - White-box Based Test design. Case study: Additional White box testing approaches.

LEVELS OF TESTING **10 Hours**

The Need for Levels of Testing- Unit Test - Unit Test Planning- Designing the Unit Tests - Integration tests- Designing Integration Tests - system testing - Regression Testing. Alpha - Beta and Acceptance Test- Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing.

TEST MANAGEMENT: **9 Hours**

People and organizational issues in testing – Organization structures for testing teams – testing services -Testing and Debugging Goals and Policies - Test Planning - Test Plan Components - Test Plan Attachments - Locating Test Items - Reporting Test Results - The role of three groups in Test Planning and Policy Development - Process and the Engineering Disciplines.

TEST AUTOMATION AND MEASUREMENTS REVIEW: **9 Hours**

Software test automation – skills needed for automation – scope of automation – design and architecture for automation -- Measurements and Milestones for Controlling and Monitoring - Status Meetings -Reports and Control Issues - Criteria for Test Completion - SCM - Types of reviews - developing a review program - Components of Review Plans - Reporting review results.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. S Limaye, Software Testing Principles, Techniques and Tools, McGraw Hill, 2009.
2. Boris Beiser, Software Testing Techniques, Dreamtech press, New Delhi, 2009.
3. Srinivasan Desikan and Gopalaswamy Ramesh, ―Software Testing – Principles and Practices, Pearson Education, 2006.
4. Ron Patton, ―Software Testing, Second Edition, Sams Publishing, Pearson Education, 2007. AU Library.com
5. Introduction to Software Testing, Paul Ammann and Jeff Offutt, Cambridge University Press, 2nd edition, 2016.

Online Courses

1. http://www.tcs.com/SiteCollectionDocuments/WhitePapers/AFrameworkforAutomatin gTesti ngofNetworkingEquipment.pdf

2. https://onlinecourses.nptel.ac.in/noc17_cs32/preview
3. https://www.coursera.org/learn/ruanjian-ceshi
4. https://www.coursera.org/learn/software-processes

U18CSI7201 CLOUD COMPUTING

L	T	P	J	C
3	0	2	0	4

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Demonstrate server virtualization concept and create virtual servers [K3,CO2]
CO2: Apply network virtualization and create virtual private cloud [K3,S2]
CO3: Design Web Application in public cloud environment. [K5,S3]
CO4: Build databases in public cloud [K5,S3]

Pre-requisite: U18CST3003/Computer Architecture

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	S	S		S				M			M			S
CO2		M	M		M				M			M			S
CO3		M	M		M				M		M	M		M	S
CO4		M	M		M				M		M	M	M		S

COURSE ASSESSMENT METHODS:

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Case Study, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) **5.** End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENTS CONTENTS

INTRODUCTION 7 Hours

Brief history and evolution - History of Cloud Computing, Evolution of Cloud Computing, Traditional vs. Cloud Computing. Why Cloud Computing, Cloud service models (IaaS, PaaS & SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing. Introduction to AWS Public Cloud Vendor.

CLOUD VIRTUALIZATION **7 Hours**

Basics of virtualization, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing.

PRIVATE AND PUBLIC CLOUD **14 Hours**

Private Cloud Definition, Characteristics of Private Cloud, Private Cloud deployment models, Private Cloud Vendors - CloudStack, Eucalyptus and Microsoft, Private Cloud – Benefits and Challenges. Private Cloud implementation in Amazon EC2 service.

What is Public Cloud, Why Public Cloud, When to opt for Public Cloud, Public Cloud Service Models, and Public Cloud Vendors and offerings (IaaS, PaaS, SaaS). Demonstrating public cloud with AWS, Introduction to EC2 and Storage services of AWS. Private vs. Public Cloud – When to choose.

CLOUD SECURITY **10 Hours**

Explain the security concerns in Traditional IT, Introduce challenges in Cloud Computing in terms of Application Security, Server Security, and Network Security. Security reference model, Abuse and Nefarious Use of Cloud Computing, Insecure Interfaces and APIs, Malicious Insiders, Shared Technology Issues, Data Loss or Leakage, Account or Service Hijacking, Unknown Risk Profile, Shared security model between vendor and customer in IAAS/PAAS/SAAS, Implementing security in AWS.

FUTURE DIRECTIONS IN CLOUD COMPUTING **7 Hours**

When and not to migrate to Cloud, Migration paths for cloud, Selection criteria for cloud deployment, Issues/risks in cloud computing, Future technology trends in Cloud Computing.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES:

1. Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski, Cloud Computing: Principles and paradigms, 2011
2. Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, Cloud Computing for dummies, 2009.
3. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, 2008.
4. Anthony T. Velte, Toby J. Velte, and Robert Elsen peter, Cloud Computing: A Practical Approach, McGraw Hill, 2010.
5. Borko Furht, Handbook of Cloud Computing, Armando Escalante (Editors), Springer, 2010.
6. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, Morgan Kaufmann Publishers, 2012.
7. Rittinghouse John W, Ransome James F, Cloud Computing-Implementation, Management and Security, CRC Press, Taylor and Francis Group, 2012.

OTHER REFERENCES:

1. http://www.buyya.com/papers/CloudSim2010.pdf
2. http://thecloudtutorial.com/

3. http://www.top-windows-tutorials.com/cloud
4. https://docs.aws.amazon.com/AWSEC2/latest/UserGuide/ebs-attaching-volume.html

LAB COMPONENTS CONTENTS

1. Creating a virtual server in AWS public cloud**.**
2. Attaching AWS EBS volume to Amazon EC2.
3. Attaching additional virtual servers with existing application
4. Create and configure a Virtual Private cloud using Amazon VPC
5. Developing and hosting web applications in cloud (google App engine Heroku cloud application platform)
6. Hosting a static web page in Amazon S3
7. Creating MySQL instances in Amazon.
8. Create and carryout Read and Write operations on DynamoDB.

Theory: 45	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 30 Hours**

U18CST7002 MACHINE LEARNING TECHNIQUES

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Differentiate the implementation of mathematical model to various machine learning methods. (K4)

CO2: Illustrate graphical models and multiple learners. (K4)

CO3: Develop projects using appropriate machine learning approaches for real life problems. (K5, S3)

Pre-requisite: U18MAI4201/ Probability and Statistics

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	PROGRAMME OUTCOMES (POs)												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S			S	S	S	S		M		M		M	
CO2	S	M	M	S		M	M			M		M		M	
CO3	S	S	S			S	S			M	S	M	M	M	M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION AND SUPERVISED LEARNING 9 Hours

Introduction to Machine Learning – basic concepts in machine learning - Examples of machine learning applications -Supervised Learning: Learning a Class from Examples–Noise–Learning Multiple Classes–Regression–Model Selection and Generalization. Bayesian Decision Theory: Classification–Losses and Risks– Discriminant Functions–Association rules.

PARAMETRIC METHODS 9 Hours

Parametric Classification–Regression–Tuning Model Complexity–Model Selection Procedures.

Multivariate Methods: Data–Parameter Estimation–Estimation of Missing Values–Multivariate Normal Distribution–Multivariate Classification and Regression.

SEMI PARAMETRIC METHODS AND LINEAR MODEL 9 Hours

Semi parametric method: Clustering k–Means Clustering–Expectation–Maximization Algorithm–Latent Variable Models–Hierarchical Clustering. Linear Model: Generalizing linear model- Geometry of linear Discriminant-Pairwise Separations-Gradient Descent.

NON-PARAMETRIC METHODS 9 Hours

Nonparametric Methods: Nonparametric Density Estimation and Classification-Generalization to Multivariate Data–Condensed Nearest Neighbor–Smoothing Models. Decision Trees: Univariate Trees–Pruning–Rule Extraction–Learning Rules–Multivariate Trees.

GRAPHICAL MODEL AND MULTIPLE LEARNERS 9 Hours

Graphical Model- canonical cases for conditional Independence – example graphical models. Combining Multiple Learners: Voting–Error–Correcting Output Codes–Bagging–Boosting–Stacked Generalization–Cascading – Case Studies using machine learning tools.

Theory: 45 Hours	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45**

REFERENCES

1. Ethem Alpaydin, “Introduction to Machine Learning”, Second Edition, MIT Press, 2013
2. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
4. Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, “Learning from Data”, AML Book Publishers, 2012
5. K. P. Murphy, “Machine Learning: A probabilistic perspective”, MIT Press, 2012.
6. M. Mohri, A. Rostamizadeh, and A. Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012.

PROJECT WORK (PW)

U18CSP7703 PROJECT PHASE-I

L	T	P	J	C
0	0	0	6	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS WILL BE ABLE TO :

CO1	Describe the problem statement	K 2
CO2	Prepare the software requirement specification	K3
CO3	Identify the appropriate problem solving methodology	K4
CO4	Analyze and process the experimental information	K5
CO5	Evaluate the experimental results	K5
CO6	Develop a project report	K3

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	S	S	M	M	M	M	S	S	S	S	M	M	M	M
CO2	S	M	M	M					M	M			M	M	M
CO3	L	M	L	L	M			M	S		M		M	M	M
CO4	S	M		M				S				L	M	M	M
CO5	L		M	S				M	L				M	M	M
CO6	L							M	M	M	M		M	M	M

COURSE ASSESSMENT METHODS

DIRECT
1. Project reviews 2. End semester viva voce
INDIRECT
1. Course-end survey

U18CSP8701

PROJECT PHASE-II

L	T	P	J	C
0	0	0	24	12

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS WILL BE ABLE TO :

CO1	Plan an experimental design to solve Engineering problems	**K2**
CO2	Prepare the software requirement specification.	**K2**
CO3	Develop an attitude of team work and independent working on real time problems	**K3**
CO4	Analyze and process the experimental information	**K5**
CO5	Evaluate, interpret and justify the experimental results	**K4**
CO6	Develop a dissertation report	**K3**

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	S	S	M	M	M	M	S	S	S	S	M	S	S	S
CO2	S	M	M	M					M	M			S	S	S
CO3	L	M	L	L	M			M	S		M		S	S	S
CO4	S	M		M				S				M	S	S	S
CO5	S		M	S				S	M				S	S	S
CO6	L							M	M	M	M		S	S	S

COURSE ASSESSMENT METHODS

DIRECT
1. Project reviews 2. End semester viva voce
INDIRECT
1. Course-end survey

LIST OF PROFESSIONAL ELECTIVE (PE)

EXTENDED REALITY

U18CSE0314 3D MODELING AND GAME DESIGN

L	T	P	J	C
2	0	0	2	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Understand the foundational knowledge of 3D modeling and apply on a real time scenario in creating object and environment[K3].

CO2: Design and analyse the usage of Game objects and Assets using Physics and Lights[K4].

CO3: Apply Navigations, Particle systems and audio develop simple games[K3].

Pre–requisite: U18CSI3202/ Object Oriented Programming

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S		S		S							M			
CO2	M	S	S				M	M							S
CO3			M	S		S		M	S	S	W		S		S

THEORY COMPONENT CONTENT

BUILDING BLOCKS (6 Hours)

3D space- 3D objects- viewports and cPlane basics- selecting objects- solid object creation- outputting images- Boolean modeling and figured space- object snaps and transforms- Boolean modeling- Clipping plane.

OBJECT AND SURFACE MODELING (6 Hours)

Profile modeling – surface- cPlane- revolve- object modeling- project and pull- curves from objects- trimming surfaces- surface modeling – lofting- surface filleting and blending- surface from edge curves- patch surfaces.

GAME OBJECTS AND ASSETS (6 Hours)

Native Game Objects -Manipulating Game Objects - Components in the Game engine – Fundamentals working concept - Materials- Defining the Role of the Prefab - Textures: UV Mapping and Texturing Techniques - Discovering the Standard Shader.

IMPLEMENTATION OF ASSETS WITH PHYSICS AND LIGHTING (6 Hours)

Creating Hierarchies - Using Empty Game Objects as Pivots -Understanding the Physics System – Rigid body Components - Colliders - Scripting Collision Events - Lighting in Games- Analyzing the Different Lights and Properties.

NAVIGATION AND ANIMATIONS (6 Hours)

Animation in Game Development - Creating Animation in the Editor-Refining Animation- NavMesh - NavMesh Agent - NavMesh Obstacle-Creating the Player Controller Game Object- Particles in Video Games-Analyzing Existing Particle Effects-Audio in Game Development - Audio Effects.

REFERENCES

1. "The Ultimate Guide to Game Development with Unity" by Unity Technologies,2023.
2. The Art of Game Design: A Book Of Lenses, THIRD EDITION, Jesse Schell, CRC Press; 3rd edition , 2019.
3. Paris Buttfield-Addison, Jon Manning, Tim Nugent, "Unity Game Development Cookbook", O'Reilly Media, Inc. 2019.
4. 3D Modeling for Beginners: Learn Everything You Need to Know About 3d Modeling!, Danan Thilakanathan,2016.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/introduction-to-3d-modeling
2. https://www.coursera.org/specializations/game-design-and-development
3. https://www.coursera.org/learn/game-design
4. Control physics with C# in Unity (coursera.org)
5. Create basic behavior with C# in Unity (coursera.org)
6. The Complete Guide to 3D Modeling with Blender | Udemy

PROJECT:

Projects involving 3D modeling using Blender and design simple games with effective audio, light, animation and appropriate understanding of physics in Real time environment.

Theory: 30	**Tutorial: 0**	**Practical: 0**	**Project: 30**	**Total: 60 Hours**

U18CSE0315 AUGMENTED REALITY AND VIRTUAL REALITY APPLICATION DEVELOPMENT

L	T	P	J	C
2	0	0	2	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Attain a foundational understanding and difference of Augmented and Virtual reality technologies[K3].

CO2: Develop skills in placing assets, managing scale, addressing occlusion, and implementing realistic lighting in AR and VR projects. [K6]

CO3: Apply AR and VR in practical scenarios and conducting AR/VR based visualization case studies for product development. [K3]

Pre–requisite: U18CSI3202/ Object Oriented Programming

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S		M		S							M			
CO2	M	M	S	S			M	M					M		S
CO3			S	S		S		M	S	S	W		S		S

THEORY COMPONENT CONTENT

AUGMENTED AND VIRTUAL REALITY BASICS (8 Hours)

Introduction to Augmented Reality -MAR Market, Actors, and Value Chain - Application vs. Browser -MAR System Architecture- Difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

Virtual Reality and Virtual Environment: Introduction, Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark.

AR AND VR TECHNOLOGIES (8 Hours)

Placing and positioning assets - Scale and size of assets - Occlusion -Lighting for increased realism - Solid augmented assets – context awareness - tracking in AR - outside-in tracking - motion tracking - environmental understanding - feature points - plane finding – light estimation - anchors - interface issues and lack of UI metaphors -technical constraints – 3D barriers - computer vision limitations -constraints of occlusion and shading.

Levels of Immersion in VR Systems - Sensorimotor Contingency -Sensorimotor Contingency in VR - Introduction to the Three Illusions: Place Illusion (PI), Plausibility Illusion (Psi) - Necessary Conditions for Psi - Break of Presence - Presence, Immersion, PI, and Psi - The Pinocchio Illusion - The Rubber Hand Illusion - Psychological Effects of Embodiment Illusion - Visual-Tactile and Visual-Motor Synchrony.

AR CORE (7 Hours)

Android OS - limitations of low light conditions on AR on mobile -simple surfaces challenge AR – user flow - working with tech limitations - preparing your tools - design draft. surface

detection and creating plane - user interaction - placing with anchor points - occlusion between virtual assets - light estimation - virtual light to real light - multiplane detection and spatial mapping - processing needs in mobile AR - breaking immersion - framing as a creative device.

VR SYSTEMS AND HARDWARES (7 Hours)

The Virtual world space-positioning the virtual observer- perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory. Illumination models- Reflection models- Shading algorithms, Radiosity, Hidden Surface Removal- Realism - Stereographic image. VR Hardware- sensor hardware, Head-coupled displays, Acoustic hardware.

REFERENCES

1. Linowes, J., &Babilinski, K. (2017). Augmented Reality for Developers: Build Practical Augmented Reality Applications with Unity, ARCore, ARKit, and Vuforia. Packt Publishing Ltd.
2. XR Development with Unity-A beginner's guide to creating virtual, augmented, and mixed reality experiences using Unity by Anna Braun, Raffael Rizzo(2022).
3. Mastering Augmented Reality: A Comprehensive Guide to Learn Augmented Reality by by Cybellium Ltd, Kris Hermans (2023)
4. Peddie, J. (2017). Augmented Reality: where we will all live. Springer.
5. Ong, S. (2017). Beginning windows mixed reality programming. Berkeley, CA: Apress. Doi, 10, 978-1.
6. "The VR Book: Human-Centered Design for Virtual Reality (ACM Books)"by Jason Jerald (2015).

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/ar |Coursera
2. https://www.coursera.org/professional-certificates/meta-ar-developer |Coursera
3. https://www.coursera.org/specializations/extended-reality-for-everybody|Coursera
4. https://www.coursera.org/specializations/virtual-reality
5. https://www.coursera.org/learn/introduction-virtual-reality
6. https://www.coursera.org/learn/making-virtual-reality-game
7. https://www.coursera.org/learn/3d-models-virtual-reality
8. https://www.coursera.org/learn/intro-augmented-virtual-mixed-extended-reality-technologies-applications-issues

PROJECT 30 Hours

To Design and Integration of 3D Spatial audio and sound effects to the objects developed and exploring creative possibilities with AR Core, implement AR/VR navigation system (UX), AR/VR interaction system (UX), Applying AR/VR technologies in real time applications.

Theory: 30	Tutorial: 0	Practical: 0	Project: 30	Total: 60 Hours

U18CSE0016 ADVANCED METAVERSE TECHNOLOGIES

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Acquire knowledge to differentiate various Extended reality technologies in Metaverse.
CO2: Apply Metaverse Experiences with depth understanding on devices and interoperability.
CO3: Analyze Metaverse in various application domains.
CO4: Develop the Metaverse environment with the integration of other technologies.

Pre–requisite: Nil

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S		M									M			
CO2	M	M	S	S			M	M				S	M	M	M
CO3		S	S	M	S	M									
CO4	S		S			S		M	S	S	W		M		S

THEORY COMPONENT CONTENT

THE FOUNDATION OF XR & METAVERSE (7 Hours)

The Brain Science behind VR - Understanding Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR), Web XR - Differences & Similarities of VR/AR/MR-XR in Metaverse.

EXPERIENCE WITH METAVERSE (8 Hours)

Metaverse-Experiences in metaverse-Avatars in metaverse-Interoperability in the metaverse-connections and communications-Devices to access the metaverse.

APPLICATIONS OF METAVERSE (8 Hours)

Educational potential in metaverse-Learning in the metaverse-Health and architecture in metaverse-Arts, entertainment, and sports in the metaverse-Building a safe metaverse.

TECHNOLOGIES IN METAVERSE (11 Hours)

Web 3.0-Artificial Intelligence (AI) in Metaverse- Cyber Security aspects / How safe is Metaverse - Blockchain, NFT (non-fungible token) and crypto currency -Metaverse and NFTs - Metaverse Use Cases - Top Metaverse platforms - Current Challenges in Mass adoption of XR - Impact of 5G in XR - Role of Microsoft, Apple and Facebook in Metaverse

INTERACTING IN METAVERSE (11 Hours)

On-premise/Local hosting - Cloud Hosting & Streaming services - Distribution via Application Stores - Understanding UI & UX Design Essentials for AR/VR - Types of Navigation - Types of interaction (Understanding Hand controllers, gesture, gaze and voice controls) - Avatar implementations in VR (Torso/Full body) - AR/VR/Metaverse 3D Assets creation Tools Overview - 3D assets creation for VR/AR (Native polygonal modeling, Converting CAD models, 3D Scanning, Photogrammetry)

Theory:45	Tutorial:0	Practical:0	Project:0	Total: 45 Hours

REFERENCES

1. “The Metaverse: And How it Will Revolutionize Everything" by Matthew Ball. published in 2022.
2. Metaverse for Beginners: The Ultimate Guide to Understanding and Investing in Web 3.0, NFTs, Crypto Gaming, and Virtual Reality by Donn Newman in 2022
3. The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything by Robert Scoble, Shel Israel published in 2016

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/what-is-the-metaverse| Coursera
2. Metaverse Web 3.0 and DeFi: A Fintech Masterclass| Udemy

U18CSE0228 GAME PROGRAMMING

L	T	P	J	C
2	0	2		3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Develop a solid understanding of game programming by writing and executing basic scripts, and implementing Object Oriented Programming concepts.

CO2: Implement game mechanics and interactions, including player controls, physics, and scoring systems.

CO3: Design and script user-friendly UI elements and menus, handling user input and events effectively, by creating an interactive game interface.

CO4: Apply advanced programming techniques, including AI behaviors, serialization, and coroutines, to develop complex gameplay systems

Pre–requisite: U18CSI3202/ Object Oriented Programming

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		S											M		
CO2		S		M									S		S
CO3		S		M	S				M				S		S
CO4		S			S				M		M		S		S

THEORY COMPONENT CONTENT

OVERVIEW OF C# PROGRAMMING LANGUAGE 6 HOURS

Introduction to the Game Editor and C# scripting environment, Setting up editor for C# development , Basic syntax and data types in C# ,Writing and executing simple scripts ,OOPS concepts, Implementing OOP concepts , Design patterns and best practices in C# programming.

SCRIPTING GAME MECHANICS AND INTERACTIONS 6 HOURS

Implementing player controls and character movement, Collision detection and physics interactions, Handling user input for game interactions, Scripting game mechanics such as scoring, health and inventory systems, Debugging and optimizing scripts for better performance.

SCRIPTING UI ELEMENTS AND MENUS 6 HOURS

Introduction to UI system, Scripting UI elements such as buttons, text fields, and sliders, Creating interactive menus and user interfaces, Handling UI events and user input, Designing and implementing user-friendly UI for games.

ADVANCED C# PROGRAMMING TECHNIQUES 6 HOURS

Delegates, events, and lambda expressions in C#, Exception handling and error management, Working with collections and LINQ queries, Serialization and data persistence, Introduction to coroutines and asynchronous programming.

SCRIPTING GAMEPLAY SYSTEMS AND AI 6 HOURS

Implementing AI behaviours using finite state machines and behaviour trees, Scripting gameplay systems for enemy behaviour, pathfinding, and decision-making, Creating dynamic and interactive game environments, Integrating audio, animations, and visual effects with C# scripts, Testing, debugging, and optimizing gameplay scripts

LAB CONTENTS: **30 Hours**

1. Basic Script Setup and Syntax
2. Understanding Unity's Component System
3. Basic Player Movement
4. Understanding and Using Collections
5. Creating and Managing GameObjects
6. Handling Collisions and Triggers
7. Scriptable Objects for Data Management.
8. Advanced Player Interaction
9. Physics and Forces
10. Final Project: Integrating All Concepts

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project:**	**Total: 60 Hours**

REFERENCES

1. Joe Hocking ,"Unity in Action: Multiplatform Game Development in C#", Manning Publications 2018.
2. Simon Jackson ,"Mastering Unity 2D Game Development", Packt Publishing ,2014
3. Paris Buttfield-Addison, Jon Manning, and Tim Nugent," Unity Game Development Cookbook: Essentials for Every Game", O'Reilly Media, 2019.
4. Harrison Ferrone," Learning C# by Developing Games with Unity", Packt Publishing, 2018.

ONLINE LEARNING MATERIALS

1. https://learn.unity.com/
2. https://community.unity.com/

IOT, EDGE AND UAV

U18CSE0217 EMBEDDED SYSTEMS FOR IOT

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Identify the internal architecture and programming of an embedded processor. [K3]
- **CO2:** Utilize the basic architecture of Internet of Things based Devices [K3]
- **CO3:** Make use of hardware platforms and AI Enabled Boards for application development. [K3]
- **CO4:** Choose the software platforms to process the IoT Data.[K3]
- **CO5:** Build an embedded and IoT Solution for real world scenarios[K5]

Pre-requisite : U18CSI2202 / Digital Logic and Microprocessor

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	S	S		S	M								S	M	
CO2	S		S										S		
CO3	S	M	M	M									S		
CO4	S		S		S	M		M		M				S	
CO5	S	S		M	M	S			M				M		S

THEORY COMPONENT CONTENTS

EMBEDDED AND MICROCONTROLLER CONCEPTS 7 Hours

Introduction to embedded processors-Categories of embedded processors-Architecture-Introduction to PIC microcontrollers, architecture and memory organization, registers, I/O ports, interrupts, timer, instruction sets, Embedded Communication Protocols – UART, USART,I2C, SPI, Modbus-Introduction to Real-Time Operating Systems (RTOS)- RTOS Architecture: Layered Architecture of an RTOS -Kernel Components and Their Functions-Real-Time Operating System Services

INTERNET OF THINGS 5 Hours

Introduction to Internet of Things (IoT), Functional Characteristics, IoT building blocks - Architecture and working - Elements of an IoT ecosystem-IOT Application Development Cycle-Technology drivers, Business drivers, Trends and implications -Recent Trends in the Adoption of IoT, Role of cloud in IoT. IoT Enabling Technologies

HARDWARE PLATFORMS FOR IOT 6 Hours

Development Boards -Arduino, Raspberry Pi, ESP8266, AI Enabled Boards (Jetson Boards for IoT development), Sensors and actuators -Types-Functions, and applications: Gateways-connectivity options for Short range/Long range Communication- IoT device communication protocols Overview.

SOFTWARE DEVELOPMENT FOR IOT 6 Hours

IDEs for IoT prototyping- Arduino Programming - Arduino functions- Interfacing with sensors and actuators-Libraries -Input/Output From Pins - Raspberry Pi platform -Environmental -

Programming and interfacing with basic hardware components. Open Platforms- Platforms Overview- IBM Watson IoT—Bluemix, Eclipse IoT, AWS IoT, Microsoft Azure IoT Suite, Google Cloud IoT

APPLICATION DEVELOPMENT **6 Hours**

Development of IoT Applications - Cloud platforms for IoT, Cloud data logging and monitoring, Interfacing with web services.
IOT Prototyping - Home Automation –Smart Agriculture – Smart Cities – Smart Healthcare.

LAB CONTENTS: **30 Hours**

To understand the IoT tools and Platforms. Build a basic home automation system. IoT solution for agriculture, IoT-based smart parking system, Smart Cities - Smart Waste Management, Smart Street Lights, Healthcare - Baby Monitoring.
Sample Experiment:

1. Embedded C Programming and Interfacing with various peripherals
2. Integration of Actuators with node MCU (Servo motor/Relay).
3. Capture Image with node MCU.
4. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth).
5. Make use of cloud platform to log the data.
6. Build a basic home automation system using IoT devices.
7. Develop an IoT solution for agriculture.
8. Design an IoT-based smart parking system.

Theory: 30 **Tutorial: 0** **Practical: 30** **Project: 0** **Total: 60 Hours**

REFERENCES:

1. Perry Xiao, Designing Embedded Systems and the Internet of Things (IoT) with the ARM mbed, 1119363993,Wiley, First Edition, 2018.
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, CISCO Press, 2017.
3. Raj Kamal , “ Internet of Things: Architecture and Design”, McGraw Hill.2nd edition June 2022.
4. Arduino Programming in 24 hours, Richard Blum, 1st Edition, ISBN: 978-0672337123, Sams Tech Yourself Publishing.2014
5. Adrian Mcewen, Hakin Cassimally, “Designing The Internet of Things”, First Edition, Wiley, 2014

ONLINE COURSES:

1. https://onlinecourses.nptel.ac.in/noc22_cs53/preview
2. https://www.coursera.org/learn/iot-wireless-cloud-computing
3. https://www.udemy.com/course/complete-guide-to-build-iot-things-from-scratch-to-market/

U18CSE0318 **IOT SYSTEMS DESIGN**

L	T	P	J	C
2	0	0	2	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Choose relevant IoT reference architecture for providing a standardized framework for design and implementation of solutions. [K3]
- **CO2:** Design and implement IoT systems by selecting appropriate communication protocols to enable seamless data exchange between devices [K3]
- **CO3:** Demonstrate proficiency in managing and processing IoT data for real time scenarios. [K3]
- **CO4:** Articulate the issues and challenges involved in integration of large scale IoT system. [K3].

Pre-requisite: U18CSI2202 / Digital Logic and Microprocessor

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S											S		
CO2	S	S												S	M
CO3		S	S		M					M		M		S	
CO4		S	S		M					M		M	S		M

THEORY COMPONENT CONTENTS

IOT ARCHITECTURE 6 Hours

Types of IOT Architecture - Three-Tier IoT Architecture, Five-Tier IoT Architecture, Hierarchical IoT Architecture - Mesh IoT Architecture, Microservices IoT Architecture, Serverless IoT Architecture

IOT PROTOCOLS 6 Hours

Application Layer Protocols-MQTT , CoAP , HTTP , AMQP . Network Layer Protocol- IPv6, 6LoWPAN, RPL. Data Link Layer Protocols-ZigBee, BLE. Physical Layer Technologies-RFID-LoRa

DATA MANAGEMENT AND PROCESSING 6 Hours

Data Management -Data Ingestion-Edge and Fog Computing in Large-Scale IoT-Big Data Technologies for IoT-IoT Analytics

INTEGRATION AND STANDARDS 6 Hours

IoT Network Topologies- Scalability, reliability, and latency requirements-IoT Middleware-Interoperability and Standards -API Design for IoT Integration -Case Studies and Industry Practices

INTEGRATING LARGE-SCALE IOT SYSTEMS 6 Hours

Overview of Large-Scale IoT Systems-Challenges and Opportunities, Architectural Considerations-Scalable IoT Architectures-Distributed Systems and Microservices- IoT Security- Case Studies- Use cases in Industrial IoT.

PROJECT COMPONENT: **30 Hours**

Design and develop prototypes by applying suitable architecture models and protocols in scenarios like cloud-based smart facility management, healthcare, environment monitoring systems, etc.

Theory: 30 **Tutorial: 0** **Practical: 0** **Project: 30** **Total: 60 Hours**

REFERENCES :

1. Cirani, S., Ferrari, G., Picone, M., & Veltri, L., "Internet of Things Architectures, Protocols and Standards", Wiley, 2018.
2. Höller, J., Tsiatsis, V., Mulligan, C., Karnouskos, S., Avesand, S., & Boyle, D., " From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", Springer, 2019.
3. Gravina, R. (Ed.), Palau, C. E. (Ed.), Manso, M. (Ed.), Liotta, A. (Ed.), Fortino, G. (Ed.), "Integration, Interconnection, and Interoperability of IoT Systems (Internet of Things)", Springer, 2018.
4. Hanes, D., Salgueiro, G., Grossetete, P., Barton, R., Henry, J., "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", Cisco Press,2017.

ONLINE COURSES :

1. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/m2m-iot-interface-design-embedded-systems?source=search
2. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/iot-networking?source=search
3. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/iot-systems-and-industrial-automation-course-1?source=search
4. https://www.coursera.org/learn/advanced-iot-systems-and-industrial-applications-course-3
5. https://onlinecourses.nptel.ac.in/noc22_cs53/preview

U18CSE0219 IOT APPLICATION DEVELOPMENT

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Apply the concept of IoT for application development [K3]
- **CO2:** Build context-aware and gestural interfaces for IoT applications[K3]
- **CO3:** Construct prototype using wireframes for different device interfaces[K3]
- **CO4:** Make use of different testing strategies for IoT applications[K3]
- **CO5:** Develop an appropriate deployment architecture for an IoT project[K3]

Pre-requisite: U18CSI2202 / Digital Logic and Microprocessor

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S		M		S								S		
CO2	S		M											M	
CO3	S	S			M				M						M
CO4	S			S				M						M	
CO5	S		S				S						S		

THEORY COMPONENT CONTENTS

INTRODUCTION 5 Hours

Overview of IOT Application Development - UI/UX Considerations -Feasibility Study- Architecture and Design- User Interface for Device Management - Testing and Quality Assurance- Deployment- Monitoring and Optimization- End-of-Life Planning.

USER INTERFACE DESIGN 7 Hours

User-centered design principles- Device Control Interfaces- Multi-Device Interaction - Responsive Design for Various Screens -Navigation design- Voice and Natural Language Interfaces-Grid systems and layout-Typography in UI design-Color theory and its application-Creating effective user flows- Error Handling and Feedback- Context-Aware Interfaces- Gestural Interfaces.

PROTOTYPING AND WIRE FRAMING 6 Hours

Prototyping tools-Types of Prototypes- key elements of wireframes-creating basic wireframes- Device Interface Prototyping- Sensor Data Visualization- Interaction Flows- Mobile and Web Application Wire framing- Voice and Gesture Interaction Prototypes- Edge Computing Integration- Error Handling and Feedback Prototypes- Remote Monitoring Interfaces.

IOT TESTING 6 Hours

Challenges -Unit Testing for IoT Components- Integration Testing for IoT Device -Security Testing for IoT Devices and networks- End to End Testing - Automation Framework and Tools -Metrics of Performance testing- Device and Power Management

APPLICATION DEPLOYMENT **6 Hours**

IoT Deployment Strategies and Project Planning-Deployment Considerations- Challenges and Risks -Deployment Architecture-Configure and set up edge devices - Cloud Platform - Connectivity and Communication-Data Handling and Storage-Deployment Testing-Monitoring and Management.

LAB COMPONENT

Create a real-time IoT application by integrating UI/UX design tools (Sketch, Figma). Utilize wireframing techniques to prototype and visualize the IoT application's layout and operations. Deploy the IoT project to make it operational and accessible by users.

Sample Experiments:

1. Set up a basic IoT ecosystem with microcontrollers and sensors.
2. Simulate a small-scale smart factory using IoT devices
3. Develop prototypes for Smart City applications such as Smart Street Lights or Smart Waste Management.
4. Design a user interface that adjusts to various screen sizes.
5. Implement responsive design using CSS and HTML
6. Use tools like InVision or Marvel to create interactive prototypes for an IoT application
7. Design wireframes for the user interfaces of specific IoT applications (e.g., Smart Home Control).

Theory: 30 **Tutorial: 0** **Practical: 30** **Project: 0** **Total: 60 Hours**

REFERENCES

1. "Building the Internet of Things: Implement New Business Models, Disrupt Competitors, Transform Your Industry" by Maciej Kranz, ISBN: 978-1-119-28568-7, 2016.
2. "Prototyping: A Practitioner's Guide" by Todd Zaki Warfel,2009.
3. Designing in Figma: The Complete Guide to Designing with Reusable Components and Styles in Figma , Eugene Fedorenko, 2020
4. "Designing Connected Products: UX for the Consumer Internet of Things" by Claire Rowland, Elizabeth Goodman, Martin Charlier, and Ann Light, 2015
5. “IOT Deployment Handbook: A practical Guide to Implementing Successful IOT Projects” By Richard G. Brown, 2022

Online Course Links:

1. https://www.coursera.org/programs/coursera-for-campus-faculty-vg1y/learn/iot?source=search
2. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/specializations/interaction-design?source=search
3. https://www.udacity.com/course/ux-design-for-mobile-developers--ud849
4. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/prototyping-design?source=search
5. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/iot-systems-and-industrial-automation-course-1?source=search
6. https://www.udemy.com/course/master-the-secrets-of-figma-a-complete-beginners-course/

U18CSE0220 3D PRINTING

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Make use of 3D printing technologies and realize the applications[K3]

CO2: Identify 3D printing process chain in additive manufacturing.[K3].

CO3: Develop proficiency in using 3D modelling software.[K3]

CO4: Demonstrate problem-solving skills by identifying and addressing common 3D printing issues [K3]

CO5: Apply the concepts of advanced 3D printing techniques to develop applications [K3]

Pre-requisite: Nil

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S				M								S		
CO2		S			M							M	S		
CO3		M			M							M	M		
CO4	S				M					M			S		
CO5	S	M			M					M					M

THEORY COMPONENT CONTENTS

INTRODUCTION TO 3D PRINTING 5 Hours

Overview of 3D Printing technology - Historical background and advancements - Applications and real-world examples - Additive manufacturing techniques - Fused Deposition Modeling (FDM) - Stereolithography (SLA) - Digital Light Processing (DLP) -Selective Laser Sintering (SLS) - Direct Metal Laser Sintering (DMLS) - Other Types (MSLA, BJP, EBM, LOM) - Variations of FDM 3D Printing Machines

3D PRINTING PROCESS CHAIN & PHOTOPOLYMERIZATION PROCESSES 7 Hours

Steps in Additive manufacturing - Design for 3D printing - Software in 3D Printing - Materials for 3D Printing - Post-processing and finishing techniques; Introduction to Photopolymerization Processes - Photopolymerization Materials - Reaction Rates - Vector Scan SL - SL Resin Curing Process - SL Scan Patterns - Vector Scan Micro Stereolithography - Mask Projection Photopolymerization Technologies and Processes - Two-Photon SL

3D DESIGNING 6 Hours

Introduction to 3D modeling software - Creating 3D Models - Designing basic geometric shapes - CAD software and tools - Parametric modeling - Creating complex structures and assemblies; Preparing Models for 3D Printing - Design considerations for 3D printing - Mesh repair and optimization - File formats for 3D printing - Slicing software and its features - Layer height and resolution settings - Support structures; Print bed adhesion techniques – Orientation – Rafts.

TROUBLESHOOTING AND CALIBRATION 6 Hours

Components of FDM & Stereolithography printers - Identifying and resolving common print issues - Adjusting print settings for optimal results - Materials Handling Issues - Hardware & Software Calibrations.

ADVANCED 3D PRINTING TECHNIQUES **6 Hours**

Multi-Material Unit (MMU) and Multi-Color Printing - Overview of 3D scanning technologies - Point cloud data and mesh generation - Reverse engineering and modification of existing models - High-resolution printing - Large-scale printing - Applications - Industrial applications - Medical and healthcare applications - Automotive and aerospace industries - Art, Architecture, Fashion & Food - Education and prototyping.

LAB CONTENTS: **30 Hours**

This lab component focuses on teaching students the fundamentals of 3D printing and design, using various printing techniques, materials, and post-processing methods. Students will engage in hands-on experiments to understand the complete process of 3D printing, from design to troubleshooting.

Sample Experiments:

1. 3D Modeling with Basic Shapes: Introduction to 3D modeling software and creation of basic geometric shapes.
2. FDM Printing Basics and SLA Comparison: Use an FDM printer for a simple model, then print the same model with an SLA printer for comparison.
3. Calibrating and Optimizing 3D Printers: Learn to calibrate FDM printers, including bed leveling and extruder settings. Also, cover basic SLA printer settings.
4. Model Correction and Preparation: Identify and correct common 3D model issues, preparing the model for efficient printing.
5. Orientation and Support Structure Analysis: Experiment with model orientations and support structures for both FDM and SLA printing.
6. Choosing the Best Printing Method: Analyze a 3D model to determine the most suitable printing method, considering the model's geometry and application.
7. Post-Processing Techniques: Learn post-processing techniques for both FDM (like sanding and painting) and SLA prints (including resin curing and support removal).
8. Troubleshooting 3D Printers: Identify and resolve common issues in both FDM and SLA printing.
9. Material Analysis and Application: Study different printing materials for FDM and SLA, understanding their properties, strengths, and use cases.
10. Efficiency and Precision in 3D Printing: Focus on recreating a provided 3D model with precision and optimizing print settings for efficiency within a time limit.

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 60 Hour**

REFERENCES

1. "Mastering 3D Printing:A Guide to Modeling,Printing and Prototyoing" by Joan Horvath,Rich Camerona,published in May 2020.
2. 3D Printing Failures: How to Diagnose and Repair ALL Desktop 3D Printing Issues" by Sean Aranda and David Feeney published in January 2020.

3 ."Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing by Ian Gibson, David W Rosen, Brent Stucker published in 2010.

4. “Rapid Prototyping: Principles & Applications” by Chua Chee Kai, Leong Kah Fai published in January 2010

ONLINE COURSES

1. https://www.coursera.org/specializations/rapid-prototyping-using-3d-printing
2. https://www.coursera.org/learn/3d-printing-applications#modules.
3. https://www.coursera.org/specializations/3d-printing-additive-manufacturing
4. https://www.udemy.com/course/3d-printing-for-beginners/
5. https://www.udemy.com/course/3d-printing-from-start-to-finish/
6. https://www.udemy.com/course/learn-3d-printing/

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U18CSE0221 ROBOTIC OPERATING SYSTEMS

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Apply the concepts of ROS to enable the development of robotic system [K3]

CO2: Implement ROS topics and messages for efficient data transfer between nodes. [K3]

CO3: Utilize ROS visualization tools, such as RViz, to analyze and debug ROS applications. [K3]

CO4: Develop ROS perception packages for object detection, recognition, and tracking.[K3]

CO5: Apply ROS drivers for tasks such as sensor data acquisition, robot navigation, and object manipulation [K3]

Pre-requisite: U18CSI4202 - Operating Systems

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S				M								S		
CO2		S			M									M	
CO3					S								M		
CO4		S			M										M
CO5	S				M									M	

THEORY COMPONENT CONTENTS

INTRODUCTION **6 Hours**

Introduction to ROS-Installation of ROS on different platforms-ROS basic concepts-Components: Nodes, topics, messages, and services- ROS communication architecture-ROS Packages and Ecosystem

ROS TOOLS AND ENVIRONMENT **6 Hours**

ROS Tools and Environment- command-line tools- ROSIDEs- ROS Integrated Development Environments (IDEs)- graphical tools for visualization and debugging- Rviz, Rqt, and Gazebo-Creating and managing ROS workspaces-Version control with ROS

ROS COMMUNICATION **6 Hours**

ROS nodes and communication - ROS Topics - Publishing and subscribing to topics-Working with ROS topics and messages-ROS services and parameters-ROS launch files for managing multiple nodes-ROS Middleware-ROS Libraries

ADVANCED ROS TOPICS **7 Hours**

Perception in ROS- Perception libraries (OpenCV, PCL)- Integration of sensors: Cameras, Lidar, IMU - Basic computer vision techniques in ROS Robot Navigation and Control

- ROS navigation stack-Path planning algorithms-Simulating and executing robot navigation-ROS control stack

ROS AND ROBOT DRIVERS **5 Hours**

ROS and Robot Drivers-Writing drivers to interface hardware with ROS-Interfacing Sensors and Actuators-Connecting sensors and actuators to the ROS ecosystem-Integration with Robot Platforms- Working with popular robot platforms.

LAB COMPONENT

Create a simple ROS package with a publisher and a subscriber node-Extend the package to include a service, Expand the package to include an action server that moves a robot forward for a specified duration- Computer Vision with ROS- Integration with Hardware -Use RViz to visualize the movement of a robot as it receives commands from the publisher.

Sample Experiments:

1. Installation and Create a ROS workspace.
2. Create and run a simple ROS node-Publish and subscribe to ROS topics.
3. ROS Tools-Use Rviz for visualization.-Experiment with Rqt tools.
    a. Working with Launch Files:-Create a launch file to start multiple nodes-Pass parameters through launch files.
4. Design a simple robot using URDF
    a. Simulate the robot in Gazebo
    b. ROS Services and Actions:
5. Implement a simple ROS service
    a. Create and use a ROS action server.
    b. Navigation in ROS
    c. Set up the ROS Navigation Stack
    d. Implement basic path planning
6. Computer Vision with ROS
    a. Use OpenCV with ROS for image processing.
7. Integration with Hardware:
    a. Interface with a real-world sensor (e.g., Lidar or IMU) using ROS.
    b. Control actuators or motors using ROS commands.

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 60 Hour**

REFERENCES

1. Programming Robots with ROS: A Practical Introduction to the Robot Operating System, O'Reilly Media; by Morgan Quigley , Brian Gerkey , William D. Smart ,1st edition , 2015
2. Robot Operating System (ROS): The Complete Beginner's Guide" - Morgan Quigley, Apress; 1st edition , 2018
3. Robot Operating System (ROS) for Absolute Beginners: Robotics Programming Made Easy,Lentin Joseph,Apress, 1st edition ,2018,
4. ROS Robotics By Example , Carol Fairchild , Dr. Thomas L. Harman, Packt Publishing Limited,2016

ONLINE COURSES:

1. https://www.edx.org/learn/robotics/delft-university-of-technology-hello-real-world-with-ros-robot-operating-system
2. https://www.udemy.com/course/ros-essentials/
3. https://www.udemy.com/course/self-driving-and-ros-learn-by-doing-odometry-control/
4. https://www.udemy.com/course/ros-for-beginners/
5. https://www.coursera.org/learn/intro-self-driving-cars?specialization=self-driving-cars

U18CSE0022 **SOFTWARE DEFINED VEHICLE**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Identify the Software Defined Vehicle concepts and realize the paradigm shift from hardware to software centric vehicle design [K3]

CO2: Make use of core principles of SDV architecture, including the separation of hardware and software and the layered software stacks [K3]

CO3: Utilize the Model-Based Development (MBD) and AUTOSAR Standard for automotive software development [K3]

CO4: Apply the key technologies in Self-Driving Vehicles to create a robust and reliable autonomous system [K3]

Pre-requisite: U18CST3003/Computer Architecture

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S													S
CO2	S	S													S
CO3			S		M			M				M	S	S	
CO4			S		M			M				M	S		

INTRODUCTION 9 Hours

Overview of software-defined vehicles - Historical perspective and evolution - Essential system basics - Support processes for electronic systems and software development.

IN-VEHICLE SOFTWARE ARCHITECTURE 9 Hours

Software architectures - ECUs (Electronic Control Units) and their functions - Bus systems – CAN: Concepts, Components, Applications – LIN: Concept, Components - Event Triggered and Time Triggered Protocol - TTCAN - FlexRay - Evaluation of Automotive Software Architectures.

AUTOMOTIVE SOFTWARE DEVELOPMENT 9 Hours

Software development life cycle - Automotive Software Development - Core process for electronic systems and software engineering - Methods and tools for development - Model-Based Development (MBD) and AUTOSAR Standard - Detailed Design of Automotive Software.

CONNECTED VEHICLES 9 Hours

Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) communication - Vehicle-to-Everything (V2X) communication - Wireless Communication Technologies (DSRC, LTE, 5G) - Functional Safety of Automotive Software.

SDV ENABLING TECHNOLOGIES **9 Hours**

Levels of automation - Sensor technologies (LiDAR, RADAR, cameras) – Perception, Localization, Mapping, Decision Making, Planning and Control Systems - Over-the-Air (OTA) Updates - Regulatory Compliance

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hour**

REFERENCES:

1. Jörg Schäuffele (Author), Thomas Zurawka,"Automotive Software Engineering: Principles, Processes, Methods, and Tools", Society of Automotive Engineers, 2016
2. Miroslaw Staron, "Automotive Software Architectures An Introduction", Springer, 2017.
3. Colt Correa, John Simon, Martin Gubow, Samir Bhagwat, "Automotive Ethernet: The Definitive Guide", Intrepid Control Systems, 2nd edition, 2023.
4. Marco Di Natale, Haibo Zeng, Paolo Giusto, Arkadeb Ghosal, "Understanding and Using the Controller Area Network Communication Protocol Theory and Practice", Springer New York, NY,2012.
5. Navet, Nicolas, and Françoise Simonot-Lion, eds. "Automotive embedded systems handbook". CRC press, 2017.
6. Paret, Dominique. "Multiplexed networks for embedded systems: CAN, LIN, flexray, safe-by-wire...", John Wiley & Sons, 2007.

ONLINE RESOURCES:

1. https://www.coursera.org/learn/intro-self-driving-cars

CYBER SECURITY

U18CSE0223 ETHICAL HACKING AND NETWORK DEFENCE

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Illustrate the legal and ethical requirements related to ethical hacking (K3)

CO2:Interpret the vulnerabilities, mechanisms to identify vulnerabilities, threats, attacks (K3)

CO3: Perform penetration & security testing to identify the vulnerabilities in the application (K4)

CO4: Examine the different tools and techniques that ethical hackers employ (K4)

Pre-requisite: U18CSI5201/ Computer Networks

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M													
CO2	S	M			M	M	M								
CO3	S	M			M	M	M	M							
CO4	S	M			M										M

ETHICAL HACKING OVERVIEW & VULNERABILITIES (6 Hours)

Understanding the importance of security, Concept of ethical hacking and essential Terminologies-Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking.

FOOTPRINTING & PORT SCANNING (6 Hours)

Footprinting - Introduction to foot printing, Understanding the information gathering methodology of the hackers, tools used for the reconnaissance phase. Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting enumeration-Introduction, enumerating windows OS & Linux OS

SYSTEM HACKING (6 Hours)

Aspect of remote password guessing, Role of eavesdropping, Various methods of password cracking, Keystroke Loggers, Understanding Sniffers, Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing. Side-channel Attacks on Cryptographic Hardware: Basic Idea, Current-measurement based Side-channel Attacks. Hardware Trojans: Hardware Trojan Nomenclature and Operating Modes, Countermeasures Such as Design and Manufacturing Techniques to Prevent/Detect Hardware Trojans.

HACKING WEB SERVICES & SESSION HIJACKING (6 Hours)

Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws, protective http headers Understanding Session Hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session Hijacking Tools

HACKING WIRELESS NETWORKS (6 Hours)

Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Networks

Theory: 30	Tutorial: 0	Practical: 30	Project: 0	Total: 60 Hours

SAMPLE LAB EXPERIMENTS:

1. Working with Trojans, Backdoors
2. Foot Printing & port scanning
3. Password guessing and Password Cracking.
4. Understanding Data Packet Sniffers
5. Implement the SQL injection attack.
6. Denial of Service and Session Hijacking using Tear Drop, DDOS attack.
7. Wireless and mobile hacking and security

REFERENCES

1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2013
2. Michael T. Simpson, "Hands-on Ethical Hacking & Network Defense", Course Technology, 2016
3. Rajat Khare, "Network Seuciryt and Ethical Hacking", Luniver Press, 2006
4. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.). Packt Publishing, 2011
5. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003
6. Debdeep Mukhopadhyay and Rajat Subhra Chakraborty, "Hardware Security: Design, Threats, and Safeguards", CRC Press, 2015

ONLINE LEARNING MATERIALS

1. **https://www.coursera.org/learn/ethical-hacking-essentials-ehe**

U18CSE0024 **CYBER ETHICS AND LAWS**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Demonstrate a comprehensive understanding of electronic business models, including e-commerce, mobile commerce and its legal issues (K3)

CO2: Interpret Cyber Ethics and its significance in the context of technology and information systems. (K3)

CO3: Develop a solid foundation in the principles and concepts of cyber laws (K3)

CO4: Illustrate information Technology act and legislation addressing cybercrime, including laws pertaining to unauthorized access, hacking, identity theft, and online fraud slation. (K3)

Pre-requisite: Nil

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M														S
CO2	M					M									
CO3	M														
CO4	M					M									

ELECTRONIC BUSINESS AND LEGAL ISSUES 9 Hours

Evolution and developmennt in E-commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI,E-markets, Emerging Trends.

CYBER ETHICS 9 Hours

The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

INTRODUCTION TO CYBER LAW 9 Hours

Evolution of computer Technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access

INFORMATION TECHNOLOGY ACT 9 Hours

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

CYBER LAW AND RELATED LEGISLATION 9 Hours

Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure

Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, dominant Publisher, 2011
2. Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethics, 2018.
3. Information Security policy & Implementation Issues, PHI, 2003.
4. Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi, 2004.
5. Cyber Law- The law of Internet, Jonthan Rosenoer, Springer, 2011.
6. The right to Information Act 2005, S. R. Bhansali, Sudhir Naib, OUP India, 2011.
7. Cyber Crimes and Law Enforcement, Vasu Deva, Commonwealth Publishers, New Delhi, 2017.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/videos/business-of-cybersecurity-capstone/_OxfpG?query=CYBER+LAWS+AND+ETHICS
2. https://www.coursera.org/learn/business-of-cybersecurity-capstone/
3. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/-security-principles

U18CSE0225 SECURE SOFTWARE DEVELOPMENT

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES:

After successful completion of this course, the students should be able to

CO1: Demonstrate various vulnerabilities related to memory attacks. (K3)
CO2: Apply security principles in software development. (K3)
CO3: Evaluate the extent of risks. (K3)
CO4: Apply security principles in the testing phase of software development. (K3)
CO5: Use tools for securing software. (K3)

Pre-requisite: U18CSI5201/ Computer Networks

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M													
CO2	S	M			M								M		
CO3	S	M			M										
CO4	S	M			M								M		M
CO5	S				S										

NEED OF SOFTWARE SECURITY AND LOW-LEVEL ATTACKS (6 Hours)

Introduction - Software Assurance and Software Security –Threats to software security - Sources of software insecurity - Benefits of Detecting Software Security - Properties of Secure Software – Secure SDLC- Memory-Based Attacks: Low-Level Attacks Against Heap and Stack - Defense Against Memory-Based Attacks

SECURE SOFTWARE DESIGN (7 Hours)

Requirements Engineering for secure software - SQUARE process Model – Requirements elicitation and prioritization- Isolating The Effects of Untrusted Executable Content – Stack Inspection – Policy Specification Languages – Vulnerability Trends – Buffer Overflow – Code Injection - Session Hijacking. Secure Design - Threat Modeling and Security Design Principles

SECURITY RISK MANAGEMENT (5 Hours)

Risk Management Life Cycle – Risk Profiling – Risk Exposure Factors – Risk Evaluation and Mitigation – Risk Assessment Techniques – Threat and Vulnerability Management

SECURITY TESTING (8 Hours)

Traditional Software Testing – Comparison - Risk Based Security Testing – Prioritizing Security Testing With Threat Modeling – Penetration Testing – Planning and Scoping - Enumeration – Remote Exploitation – Web Application Exploitation - Exploits and Client Side Attacks – Post Exploitation – Bypassing Firewalls and Avoiding Detection - Tools for Penetration Testing

SECURE PROJECT MANAGEMENT (4 Hours)

Governance and security - Adopting an enterprise software security framework - Security and project management - Maturity of Practice

SAMPLE LAB EXPERIMENTS:

1. Implement the SQL injection attack.
2. Implement the Buffer Overflow attack.
3. Implement Cross Site Scripting and Prevent XSS.
4. Perform Penetration testing on a web application to gather information about the system, then
5. initiate XSS and SQL injection attacks using tools like Kali Linux.
6. Develop and test the secure test cases
7. Penetration test using kali Linux

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 60 Hours**

REFERENCES:

1. Julia H. Allen, “Software Security Engineering”, Pearson Education, 2009
2. Evan Wheeler, “Security Risk Management: Building an Information Security Risk Management Program from the Ground Up”, First edition, Syngress Publishing, 2011
3. Chris Wysopal, Lucas Nelson, Dino Dai Zovi, and Elfriede Dustin, “The Art of Software Security Testing: Identifying Software Security Flaws (Symantec Press)”, Addison-Wesley Professional, 2006
4. Robert C. Seacord, “Secure Coding in C and C++ (SEI Series in Software Engineering)”, Addison-Wesley Professional, 2005.
5. Jon Erickson, “Hacking: The Art of Exploitation”, 2nd Edition, No Starch Press, 2008.
6. Mike Shema, “Hacking Web Apps: Detecting and Preventing Web Application Security Problems”, First edition, Syngress Publishing, 2012
7. Bryan Sullivan and Vincent Liu, “Web Application Security, A Beginner's Guide”, Kindle Edition, McGraw Hill, 2012
8. Lee Allen, “Advanced Penetration Testing for Highly-Secured Environments: The Ultimate Security Guide (Open Source: Community Experience Distilled)”, Kindle Edition, Packt Publishing,2012.

U18CSE0226 NETWORK SECURITY ADMINISTRATION

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Identify types of security attacks, services and mechanisms (K3)
- **CO2:** Interpret the implementation of Internetwork security model and its standards (K3)
- **CO3:** Illustrate Email privacy system and compare Pretty Good Privacy (PGP) and S/MIME (K3)
- **CO4:** Interpret the primary components of a Three-Tier Architecture and explain how they work together firewall environment. (K3)
- **CO5:** Explain how communication is secured and how traffic is routed in firewall environment (K3)

Pre-requisite: U18CSI5201/ Computer Networks

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S			S								M		M
CO2	S	M	M												
CO3	S	M													
CO4	S	S			S								M		M
CO5	S	M			S										

NETWORK SECURITY BASICS 6 Hours

Security Attacks (Interruption, Interception, Modification and Fabrication), Security Services (Confidentiality, Authentication, Integrity, Non-repudiation, access Control and Availability) and Mechanisms, A model for Internetwork security, Internet Standards and RFCs, Buffer overflow & format string vulnerabilities, TCP session hijacking, ARP attacks, route table modification, UDP hijacking, and man-in-the-middle attacks.

NETWORK SECURITY ALGORITHM 6 Hours

Conventional Encryption Principles, Conventional encryption algorithms, cipher block modes of operation, location of encryption devices, key distribution Approaches of Message Authentication, Secure Hash Functions and HMAC

EMAIL SECURITY 6 Hours

Email privacy: Good Privacy (PGP) and S/MIME.IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

NETWORK SECURITY MANAGEMENT 6 Hours

Deploying Smart Console - Security Management Server - Security Gateway - Configuring Objects in Smart Console-Establishing Secure Internal Communication - Managing Administrator Access - Managing Licenses - Creating a Security Policy -Configuring Order Layers.

NETWORK SECURITY CONFIGURATION **6 Hours**

Configuring a Shared Inline Layer - Configuring NAT - Integrating Security with a Unified Policy - Elevating Security with Autonomous -Threat Prevention - Configuring a Locally Managed Site-to-Site VPN - Elevating Traffic View - Monitoring System States - Maintaining the Security Environment.

SAMPLE LAB EXPERIMENT:

1. Deploying Smart Console
2. Installing a Security Management Server and Security Gateway
3. Managing Administrator Access
4. Configuring Objects in Smart Console
5. Creating a Security Policy
6. Configuring NAT
7. Integrating Security with a Unified Policy
8. Elevating Security with Autonomous Threat Prevention
9. Configuring a Locally Managed Site-to-Site VPN
10. Elevating Traffic View
11. Monitoring System States and Maintaining the Security Environment

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 60 Hours**

REFERENCES

1. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education 2018.
2. Hack Proofing your network by Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, Wiley Dreamtech Published by Syngress, 2002
3. Network Security and Cryptography: Bernard Menezes, CENGAGE Learning, 2010
4. Network Security - Private Communication in a Public World by Charlien Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI 2002
5. Cryptography and network Security, Third edition, Stallings, PHI/Pearson 4. Principles of Information Security, Whitman, Cengage Learning, 2006

ONLINE LEARNING MATERIALS

1. https://www.checkpoint.com/mind/secureacademy#

U18CSE0227 DIGITAL FORENSICS

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Illustrate the digital forensics process and digital evidence acquisition. (K3)
CO2: Explain file systems and data recovery procedures. (K3)
CO3: Demonstrate computer, network and mobile forensics with specialized tools. (K3)
CO4: Analyze malware and report the relevant incident. (K3)
CO5: Utilize the forensics toolkit for efficient investigation and understand the legal aspects of digital forensics. (K3)

Pre-requisite: U18CSI5201/ Computer Networks

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M			M										
CO2	M	M													
CO3	M	M			M								M		
CO4	M	M		M	M										
CO5	M				M								M		M

OVERVIEW OF DIGITAL FORENSICS (6 Hours)

Understanding the role of digital forensics in investigations. Legal and Ethical Considerations: Adhering to legal and ethical standards in digital investigations. Digital Forensics Process: Introduction to the forensic investigation process.

Digital Evidence Acquisition: Types of Digital Evidence: Identifying and classifying digital evidence. Evidence Acquisition Tools: Using tools for acquiring data from different devices. Forensic Imaging: Creating forensic images of storage media

FILE SYSTEMS AND DATA RECOVERY (6 Hours)

File System Analysis: Understanding file systems and their structures. Deleted File Recovery: Techniques for recovering deleted files. File Carving: Extracting files from unallocated space.

COMPUTER, NETWORK AND MOBILE DEVICE FORENSICS (6 Hours)

Computer Forensics: Investigating computers for evidence- Network Forensics: Analysing network traffic and logs- Memory Forensics: Examining volatile memory for evidence.
Mobile Device Investigation: Extracting evidence from smartphones and tablets. App and Cloud Forensics: Investigating applications and cloud-based services. Challenges in Mobile Forensics: Addressing unique challenges in mobile investigations.

MALWARE ANALYSIS (6 Hours)

Introduction to Malware - Understanding different types of malware- Static and Dynamic Analysis: Analysing malware behaviour and code.
Responding to malware incidents- Incident Response and Forensic Tools- Incident Response Planning: Preparing for and responding to security incidents. Introduction to bug bounty – Working of bug bounty - Bug bounty program examples – Setting up bug bounty program.

AUTOMATED FORENSICS **(6 Hours)**

Introduction to popular forensic tools- Automated Forensics: Leveraging automation for efficient investigations-Automated Forensics: Leveraging automation for efficient investigations.

Legal Aspects of Digital Forensics: Expert Witness Role: Preparing for and testifying in court- Digital Forensics Laws and Regulations: Understanding legal frameworks - Case Studies: Analysing legal cases involving digital forensics.

SAMPLE LAB EXPERIMENT:

1. Use Autopsy tools to Identify and classify the digital evidence.
2. Demonstrate the data recovery techniques.
3. Demonstrate the process of analysing the network traffic and logs.
4. Demonstration of extracting the evidence from mobile phone.
5. Analyse the malware behaviour and its code.

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 60 Hours**

REFERENCES

1. Digital Forensics by André Årnes, Released July 2017,Publisher(s): Wiley, ISBN: 9781119262381.
2. Digital forensics and cybercrime : 10th International EAI Conference, ICDF2C 2018, New Orleans, LA, USA, September 10-12, 2018, Proceedings.
3. Cybercrime and Digital Forensics : An cybercrime And Digital Forensics : An Introduction, 3rd Edition May 2022 by Adam M. Bossler, Kathryn C. Seigfried-Spellar, Thomas J. Holt.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/digital-forensics-concepts
2. https://www.udemy.com/course/ifci-expert-cybercrime-investigators-course/?gad_source=1&gclid=CjwKCAiApuCrBhAuEiwA8VJ6JtQFDivymnmlFeE1agIwADZlrJE8xv8piHikMZLKreNBO9e0AlAL-hoCVbsQAvD_BwE&matchtype=b&utm_campaign=LongTail_la.EN_cc.INDIA&utm_content=deal4584&utm_medium=udemyads&utm_source=adwords&utm_term=_._ag_84769189328_._ad_670210149092_._kw_digital+forensics+course_._de_c_._dm__._pl__._ti_kwd-323936302499_._li_9298970_._pd__._
3. https://www.open.edu/openlearn/science-maths-technology/digital-forensics/content-section-0?active-tab=content-tab
4. https://www.edx.org/learn/computer-forensics/rochester-institute-of-technology-computer-forensics
5. What Is a Bug Bounty? [3 Bug Bounty Program Examples] (hackerone.com)

Automation and Artificial Intelligence

U18AIE0210 DEEP LEARNING

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES:

After successful completion of this course, the students should be able to

- **CO1:** Attain a foundational understanding of Neural Networks and Deep Learning[K3]
- **CO2:** Develop Convolution Neural Network for complex engineering problems using pretrained models[K3]
- **CO3:** Realize the significance of the Sequence Models[K4]
- **CO4:** Utilize an appropriate unsupervised deep learning approach for addressing sophisticated technology challenges[K4]

Pre–requisite: U18MAI1202/ Linear Algebra and Calculus, U18MAT3102 / Discrete Mathematics

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	M	S	M				S		S	S	S	S
CO2	S	S	S	S	S	S				S		S	S	S	S
CO3	S	S	S	S	S	S				S		S	S	S	S
CO4	S	S	S	S	S	M				S		S	S	S	S

THEORY COMPONENT CONTENT

INTRODUCTION **8 Hours**

Basic Concept of Neurons – Perceptron Algorithm – Activation Functions – Loss Functions - Feed Forward and Backpropagation Networks- Deep Feed-Forward Neural Networks – Gradient Descent for Neural Networks.

CONVOLUTION NEURAL NETWORKS **7 Hours**

Convolution and its variants – Pooling Layers – Down sampling, stride and padding - Transfer Learning – CNN Architectures: ResNet, AlexNet – Image Classification using Transfer Learning

SEQUENCE MODELING **8 Hours**

Recurrent and Recursive Nets – Recurrent Neural Networks – Deep Recurrent Networks – Bi-directional RNN - Recursive Neural Networks- LSTM and GRU – Attention and the transformer - Applications.

DEEP LEARNING MODELS **7 Hours**

Autoencoders (AE) – AE Variants - Deep Boltzmann Machine - Deep Belief Networks - Architecture - Greedy Learning – Speech Processing and Recognition using DBN.

LAB COMPONENT

Sample List of Lab Experiments**:**

1. Train Simple Perceptron with Gradient Descent for regression
2. Implement Backpropagation algorithms
3. CNN for image classification
4. Perform object detection with Transfer Learning

5. Implement Recurrent Neural Network
6. Implement Deep Belief networks
7. Transformer Implementation

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 60 Hour**

REFERENCES

1. Ian J. Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Magnus Ekman, Learning Deep Learning, Addison-Wesley Professional, 2021.
3. Ian J. Goodfellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
4. Magnus Ekman, Learning Deep Learning, Addison-Wesley Professional, 2021.
5. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.
6. Charu C. Aggarwal, "Neural Networks and Deep Learning", Springer 2018.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/neural-networks-deep-learning?source=search#modules
2. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/specializations/deep-learning?source=search

U18AIE0211 COMPUTER VISION

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES:

After successful completion of this course, the students should be able to

- **CO1:** Apply the fundamentals of computer vision to the formation and transformation of images [K3]
- **CO2:** Apply feature extraction Techniques in image and segmentation [K3]
- **CO3:** Ability to perform smoothing and image equalization [K4]
- **CO4:** Compare various projection and object recognition methods [K4]
- **CO5:** Evaluate performance of computer vision algorithms in various applications[K4]

Pre–requisite: U18MAI1202/ Linear Algebra and Calculus, U18MAT3102 / Discrete Mathematics

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PS O3
CO1	S	S	S										S		
CO2		S		S	S										
CO3				S				M				M			
CO4	S		M											S	
CO5			S					S		M					S

INTRODUCTION 6 Hours

Image Processing, Computer Vision - Low-level, Mid-level, High-level, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

FEATURE EXTRACTION AND FEATURE SEGMENTATION 6 Hours

Feature Extraction -Edges - Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT. Image Segmentation -Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation.

IMAGES, HISTOGRAMS, BINARY VISION 6 Hours

Simple pinhole camera model – Sampling – Quantisation – Colour images – Noise – Smoothing – 1D and 3D histograms - Histogram/Image Equalisation - Histogram Comparison - Back-projection - k-means Clustering.

3D VISION AND MOTION 6 Hours

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion–spline-based motion- optical flow – layered motion.

APPLICATIONS **6 Hours**

Overview of Diverse Computer Vision Applications: Document Image Analysis, Biometrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Virtual Reality and Augmented Reality-Pretrained models- VGG-16-ResNet50.

LAB COMPONENT

Sample List of Experiments:

1. Detect the RGB color from a webcam using Python – OpenCV
2. Face Detection using Python and OpenCV with a webcam
3. Face and Hand Landmarks Detection using Python – Media pipe, OpenCV
4. Real-Time Edge Detection using OpenCV
5. Implement Canny Edge Detector in Python using OpenCV
6. Gun Detection using Python-OpenCV
7. Real-time object color detection using OpenCV

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 60 Hour**

REFERENCES

1. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education.2nd Edition ,2015.
2. Joseph Howse , Joe Minichino " Learning OpenCV 4 Computer Vision with Python 3: Get to grips with tools, techniques, and algorithms for computer vision and machine learning, Packt Publishing Limited 3rd Edition , 2020.
3. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited,2011.
4. Sonka M, Hlavac V, Boyle R, Image processing, analysis, and machine vision, Cengage Learning; 2014.

ONLINE LEARNING MATERIALS

1. https://archive.nptel.ac.in/courses/106/105/106105216/
2. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/introduction-computer-vision-watson-opencv

U18AIE0212 **INTELLIGENT AUTOMATION SYSTEM**

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES:

After successful completion of this course, the students should be able to

- **CO1:** Analyze and articulate the benefits of implementing automation in production systems [K4]
- **CO2:** Identify industries best-suited for RPA adoption and evaluate case studies showcasing successful RPA implementations [K4]
- **CO3:** Develop automation solutions with practical examples using Sequence and Flowchart activities [K3]
- **CO4:** Implement best practices in recording and selector strategies to optimize automation workflows [K3]

Pre–requisite: U18MAI1202/ Linear Algebra and Calculus, U18MAT3102 / Discrete Mathematics

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	S	M	S			M	M				M			
CO2	M	S	M	S	M		M	M				M			
CO3	S	M	S	M								M		S	M
CO4	S	M	S	M								M		S	M

THEORY COMPONENT CONTENT

INTRODUCTION TO AUTOMATION 7 Hours

Automation in production system-Automation principles and strategies-Basic elements of an automated system-advanced automation Functions-levels of Automation-Hardware components for automation-sensors and actuators- Benefits of Automation -Limitations to Automation.

RPA AND ITS PLATFORMS 7 Hours

Introduction to Robotic Process Automation- Benefits of RPA- Overview of Industries Best-Suited for RPA- Advancements in RPA and Its Integration with AI. Components of RPA-RPA Platforms-About Ui Path- The future of automation.

WORKFLOW AND CONTROL FLOW 8 Hours

Sequencing the workflow Activities-Control flow, various types of loops, and decision-making using Sequence and Flowchart-Data Manipulation-Variables and Scope Collections-Arguments -Data table usage with examples -Clipboard Management-File operation mouse and keyboard activities- Working with UiExplorer- Handling events- Screen Scraping.

RECORDERS, SELECTORS 8 Hours

UiPath Studio Recording -Recorder Overview-Components of Recording Wizard-Comparison of Recording Types-Automatic Recording Activities-Manual Recording activities -Basic

Recorder-Desktop Recorder-Web Recorder-Selector-Selector Editor-Selectors with wild cards-UI Explorer in Selector-UI Explorer Window-Full Selectors and Partial Selectors-Errors, Exception and Debugging.

LAB CONTENTS

Sample list of Experiments:

1. Study on UI path Tool
2. Recording Modes
3. Notepad/Word Automation
4. Screen Scrapping Techniques to extract text from Images/Web/Document
5. YouTube Search Engine-BMI Calculator Robot-Excel Automation Basics
6. Fees Concession Robot
7. PDF Automation
8. Invoice Automation Robot
9. Exception Handling / Running Multiple Robots
10. Data Scrapping (Web) with AI Techniques in UiPath
11. Gmail Automation Robot
12. Orchestrator - UiPath Dashboard

Theory: 30	**Tutorial:0**	**Practical: 30**	**Project :0**	**Total:60 Hours**

REFERENCES

1. M.P.Groover, "Automation, Production Systems and Computer Integrated Manufacturing", 4th edition, Pearson Education, 2016.
2. Tom Taulli, The Robotic Process Automation Handbook : A Guide to Implementing RPA Systems,2020, ISBN-13 (electronic): 978-1-4842-5729-6, Publisher : A press,
3. Frank Casale, Rebecca Dilla, Heidi Jaynes ,Lauren Livingston, "Introduction to Robotic Process Automation: a Primer", Institute of Robotic Process Automation.2015.
4. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant,2018.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/specializations/roboticprocessautomation
2. https://www.coursera.org/professional-certificates/google-it-automation.

L	T	P	J	C
2	0	2	0	3

U18AIE0213 NATURAL LANGUAGE PROCESSING

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Apply lexical and parsing techniques to perform pre-processing steps of NLP [K3]
- **CO2:** Apply appropriate statistical models for a given natural language application [K3]
- **CO3:** Analyze various algorithms that suit any natural language for processing [K4]
- **CO4:** Suggest appropriate pre-processing steps essential for the various applications involving natural language processing [K4]

Pre–requisite: U18MAI1202/ Linear Algebra and Calculus, U18MAT3102 / Discrete Mathematics

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S											M			
CO2	S	M										M			
CO3	M		S		M							M	S	S	S
CO4	M			S								M	M	S	M

LEXICAL ANALYSIS AND MORPHOLOGY 9 Hours

Regular expression and Automata for string matching - Words and Word Forms - Morphology fundamentals - Morphological Diversity of Indian Languages - Morphology Paradigms - Finite State Machine / Transducers Based Morphology - Automatic Morphology Learning - Parts of Speech - N-gram Models - Hidden Markov Models.

SPEECH PROCESSING 9 Hours

Biology of Speech Processing - Place and Manner of Articulation - Word Boundary Detection - Argmax based computations - HMM and Speech Recognition - Text to Speech Synthesis - Rule based-Concatenative based approach.

PARSING 8 Hours

Parsing Theories of Parsing - Parsing Algorithms – Earley Parser - CYK Parser - Probabilistic Parsing - CYK - Resolving attachment and structural ambiguity - Shallow Parsing - Dependency Parsing - Named Entity Recognition - Maximum Entropy Models - Conditional Random Fields.

APPLICATIONS 4 Hours

Applications: Sentiment Analysis - Text Entailment - Machine Translation - Question Answering System - Information Retrieval - Information Extraction - Cross Lingual Information Retrieval (CLIR)

LAB COMPONENT

Sample List of Experiments:

1. Pre-processing of text (Tokenization, Filtration, Script Validation, Stop Word Removal, Stemming)
2. Morphological Analysis

3. N - gram model
4. POS tagging
5. Chunking
6. Named Entity Recognition
7. Applications

Theory: 30	**Tutorial:0**	**Practical: 30**	**Project :0**	**Total:60 Hours**

REFERENCES

1. Jurafsky Daniel, Martin James, "Speech and Language Processing", Second Edition, Tenth Impression, Pearson Education, 2018.
2. Christopher Manning, Schutze Heinrich, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.
3. Sowmya Vajjala, Bodhisattwa Majumder, Anuj Gupta, Harshit Surana " Practical Natural Language Processing: A Comprehensive Guide to Building Real-World NLP Systems", Oreilly Publications, 2020
4. Steven Bird , Ewan Klein , Edward Loper, "Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit". Oreilly Publications, 2007.

ONLINE LEARNING MATERIALS

1. https://www.udemy.com/course/nlp-natural-language-processing-with-python
2. https://www.coursera.org/specializations/natural-language-processing
3. https://www.edx.org/learn/natural-language-processing
4. https://www.simplilearn.com/natural-language-processing-training-course
5. https://www.mygreatlearning.com/nlp/free-courses

U18AIE0214 **GENERATIVE AI**

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES:

After successful completion of this course, the students should be able to

- **CO1:** Acquire insights into the key technological trends driving generative AI models [K3]
- **CO2:** Acquire the ability to apply effective prompt engineering techniques to enhance the performance and control the behaviour of generative AI models [K4]
- **CO3:** Build, train and apply generative models and develop familiarity with platforms [K4]
- **CO4:** Ability to comprehend ethical issues and limitations of generative AI models[K3]

Pre–requisite: U18MAI1202/ Linear Algebra and Calculus, U18MAT3102 / Discrete Mathematics

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	M	M							M			M		S	
CO2		S	S	M	S	M	S	S	M	M	S	M	S	S	
CO3			S	M	S	M	S	S	M	M	S	M	S	S	
CO4				M		M	S	S	M			M		S	

THEORY COMPONENT CONTENT

INTRODUCTION TO GENERATIVE AI 5 Hours

Capabilities - History and Evolution -Benefits- Challenges - Applications of Generative AI – Tools for Text, Image Code, Audio and Video generation– Economic Potential of Generative AI - Use cases

PROMPT ENGINEERING TECHNIQUES AND APPROACHES 6 Hours

Prompt Creation -Writing effective prompts -Techniques for using text prompts: Zero shot and few-shot prompt techniques – Prompt engineering approaches: Interview pattern, Chain-of Thought, Tree-of Thought - Benefits of using text prompts - Challenges in generating meaningful and coherent prompts.

MODELS FOR GENERATIVE AI 7 Hours

Basics of Sequential data processing – Building blocks of Generative AI - Discriminative modelling – Generative modelling –Recurrent Neural Networks – Long Short-Term Memory (LSTM) Networks - Generative Adversarial Networks (GANs) - Variational Autoencoders (VAEs) – Transformer–based Models - Diffusion models- Applications

PLATFORMS FOR GENERATIVE AI 7 Hours

Introduction to Platforms – Features of platforms – Capabilities -Applications - Pre-trained Models - Challenges – Generation of Text to Text – Generation of Text to Image – Text to Code Generation – Explainable AI – Benefits – Use cases.

ETHICAL ISSUES AND LIMITATIONS OF GENERATIVE AI 5 Hours

Limitations of Generative AI – Issues and concerns – Considerations for Responsible Generative AI – Economic Implications – Social Implications – Future and professional Growth of Generative AI.

LAB COMPONENT

Sample List of Experiments:

1. Generate text using Generative AI
2. Text Generation using ChatGPT and Bard
3. Image Generation using GPT and Stable Diffusion
4. Code Generation
5. Experimenting with Prompts
6. Approaches in Prompt Engineering
    - Chain-of-Thought Approach
    - Interview Pattern Approach
    - Tree-of-Thought Approach
7. Effective Text Prompts for Image Generation
8. Develop AI Applications with the Foundation Models
9. Develop AI Applications for Code Generation

Theory: 30	**Tutorial:0**	**Practical: 30**	**Project :0**	**Total:60 Hours**

REFERENCES

1. Deep Learning: Teaching Machines to Paint, Write, Compose and Play, David Foster, 2023. 2nd edition. O'Reilly Media, Inc.
2. Deep Learning, Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2016.
3. Hands-on Generative Adversarial Networks with Keras, Rafael Valle. Packt Publisher, 2019

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/generative-ai-introduction-and-applications?specialization=generative-ai-for-everyone
2. https://www.coursera.org/learn/generative-ai-prompt-engineering-for-everyone?specialization=generative-ai-for-everyone
3. https://www.coursera.org/learn/generative-ai-foundation-models-and-platforms?specialization=generative-ai-for-everyone
4. https://www.coursera.org/learn/generative-ai-ethical-considerations-and-implications?specialization=generative-ai-for-everyone

U18AIE0015 **RESPONSIBLE AI**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Comprehend the fundamental concepts of AI, recognize ethical considerations, and analyze biases and limitations through real-world case studies. [K3]
- **CO2:** Apply ethical theories and principles to implement responsible AI practices, emphasizing accountability, responsibility, and transparency.[K3]
- **CO3:** Evaluate the importance of interpretability, categorize methods, and apply them to models, ensuring effective communication of results [K3]
- **CO4:** Attain a comprehensive understanding of data privacy principles, employ effective privacy-preserving techniques in AI applications, and critically assess real-world instances emphasizing the equilibrium between privacy and utility[K4]
- **CO5:** Assess ethical reasoning approaches, design moral agents, and implement ethical deliberation, governance, and inclusion for responsible AI practices [K4]

Pre–requisite: U18MAI1202/ Linear Algebra and Calculus, U18MAT3102 / Discrete Mathematics

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	S	S	M	M	M	S		S		S		S	S	S	S
CO2	S	S	M	M	M	S		S		S		S	S	S	S
CO3	S	S	M	M	M	S		S		S		S	S	S	S
CO4	S	S	M	M	M	S		S		S		S	S	S	S
CO5	S	S	M	M	M	S		S		S		S	S	S	S

INTRODUCTION 11 Hours

Autonomy – Adaptability – Interaction – Need for Ethics in AI - Fairness and Bias: Sources of Biases – Exploratory data analysis, limitations of a dataset – Group fairness and individual fairness – Counterfactual fairness - AI harms – AI risks : Case Study

ETHICAL DECISION MAKING 8 Hours

Seven Principles of Responsible AI - Ethical theories – Values - Ethics in practice – Implementing Ethical Reasoning – The ART of AI : Accountability, Responsibility, Transparency

INTERPRETABILITY AND EXPLAINABILITY 10 Hours

Importance of Interpretability – Taxonomy of Interpretability Methods – Scope of Interpretability – Evaluation of Interpretability – Interpretable Models: Linear Regression – Logistic Regression – Decision Tree.

PRIVACY PRESERVATION 8 Hours

Introduction to data privacy - Methods of protecting data - Importance of balancing data privacy and utility - Attack model – Privacy Preserving Learning - Differential Privacy – Federated Learning – Case Study.

ENSURING RESPONSIBLE AI **8 Hours**

Approaches to Ethical Reasoning by AI – Designing Artificial Moral Agents – Implementing Ethical Deliberation – Levels of Ethical Behaviour – The ethical status of AI system – Governance for Responsible AI – Codes of Conduct – Inclusion and Diversity

Theory: 45	**Tutorial:0**	**Practical: 0**	**Project :0**	**Total:45 Hours**

REFERENCES

1. Virginia Dignum, "Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way" Springer Nature, 2019.
2. Christoph Molnar "Interpretable Machine Learning".Lulu, 1st edition, 2019.
3. Beena Ammanath, " Trustworthy AI", Wiley, 2022.
4. Adnan Masood, Heather Dawe, Dr. Ehsan Adeli, " Responsible AI in the Enterprise", Packt Publishing, 2023.

ONLINE LEARNING MATERIAL

1. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/introduction-to-responsible-ai?source=search.
2. https://www.coursera.org/programs/coursera-for-campus-faculty-ovg1y/learn/responsible-ai-in-generative-ai?source=search

Data Science, Analytics and Visualization

U18AIE0216 PRINCIPLES OF DATA SCIENCE

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Analyze the concepts of Data, Data Description, Relationship, and Data Wrangling(K4)
- **CO2:** Apply appropriate statistical tests to evaluate hypotheses related to means, proportions, and variances. (K3)
- **CO3:** Apply the knowledge on relationships between data. (K3)
- **CO4:** Apply the advanced Data Wrangling techniques for data(K3).

Pre-requisite: U18MAI4201/Probability and Statistics

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	M	S	M				S		S	S	S	S
CO2	S	S	S	S	S	S				S		S	S	S	S
CO3	S	S	S	S	S	S				S		S	S	S	S
CO4	S	S	S	S	S	M				S		S	S	S	S

THEORY COMPONENT CONTENT

INTRODUCTION (6 Hours)

Overview Of Data science– Research goals – Building the model– presenting findings and building applications - Data Mining - Data Warehousing -Retrieving data – Data preparation Big Data and Data Science - Big Data Analytics, Business intelligence vs Big data, big data frameworks, Current landscape of analytics.

DATA DESCRIPTION (6 Hours)

Exploratory Data Analysis -statistical measures- Representation- Data Analytics Lifecycle-Developing Initial Hypotheses-Identifying Potential Data Sources- testing hypotheses on means, proportions and variances.

DESCRIBING RELATIONSHIPS (7 Hours)

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –Regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –Regression towards the mean.

ADVANCED DATA WRANGLING (8 Hours)

Strings –Datetimes –Hierachical Indexing –Visualizing data Frames – Pandas Profiling – Data Transformation-handling Null values-categorical values-Data Aggregation-Data Filtering-handling Outliers.

SAMPLE LAB COMPONENTS

1. Data Retrieval and Preparation (Using Pandas)
2. Perform Exploratory Data Analysis on a dataset, exploring variables and visualizing distributions.

3. Calculate correlation coefficients between variables in a dataset
4. Create scatter plots and correlation matrices using Python
5. Implement simple linear regression on a dataset using Python's scikit-learn
6. Evaluate and interpret regression mode

Theory: 30	Tutorial: 0	Practical:30	Project: 0	Total: 60hour

REFERENCES

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.
4. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/specializations/data-science
2. https://www.coursera.org/professional-certificates/fractal-data-science

U18AIE0217 DATA PROCESSING TECHNIQUES

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Analyze the data processing concepts in data science. (K4)
- **CO2:** Apply the Real-time data processing in the machine learning model(K3)
- **CO3:** Illustrate the change Data capture Techniques and Strategies in Incremental Processing. (K4)
- **CO4:** Apply the Learning algorithms for incremental processing in data. (K3)
- **CO5:** Correlating the Traditional disk system with In-Memory Database(K4)

Pre-Requisite: U18CSI3204/ Database Management Systems

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S				M			S		S	S	M		
CO2	S	S		S										M	
CO3	S		S											M	
CO4	S			S											
CO5			M	W										M	

THEORY COMPONENT CONTENT DATA PROCESSING (8 Hours)

Overview of Data processing in Datascience–Importance of Efficiency and Scalability –, challeges in Big Data Processing– Parallel and Distributed Processing – Apache hadoop– Map reduce –Integration of Data mining system with a Data warehouse–Major issues in Data Mining– Data Preprocessing.

REAL TIME DATA PROCESSING (7 Hours)

Streaming Data Architectures–Message Brokers –Pub/Sub Systems– Queues– Apache-kafka for Real Time Data streaming– Producers-consumers-Kafka connect for Data Integration-stream processing-Frame works-Real Time analytics -Machine learning models

INCREMENTAL PROCESSING (7 Hours)

Incremental processing in Data science–Change Data Capture Techniques(CDC)-Strategies-Delta Processing for incremental updates- Incremental Learning algorithms.

IN-MEMORY PROCESSING (8 Hours)

Principles of In-Memory Processing-comparisons Of Traditional Disk based systems -In-Memory database and data structures-In-Memory computing in spark-Resilient Distributed datasets(RDD) And Data frames-In-Memory analytics with SAP HANA-Performance Tuning and optimisation .

SAMPLE LAB CONTENTS 30 Hours

1. Implement a program using the environment Apache Flink
2. Implementation of producer and consumer program using kafka
3. Implement a simple flink streaming application.

4. Explore and connect flink application to kafka for Real time data ingestion
5. Design and Deploy simple strom topology
6. Develop a real-time analytics application with a simple machine learning model.
7. Implement mechanisms for model updates in response to streaming data changes.

Theory:30	Tutorial:0	Practical:30	Project:0	Total: 60 Hours

REFERENCES

1. Practical Real-time Data Processing and Analytics: Distributed Computing and Event Processing using Apache Spark, Flink, Storm, and Kafka by shilpi Saxena and sharub gupta 1st Edition, Kindle Edition 2017
2. "Data Warehouse ETL Toolkit: Practical Techniques for Extracting, Cleaning, Conforming, and Delivering Data" by Ralph Kimball and Joe Caserta 1st Edition 2004
3. Building a Scalable Data Warehouse with Data Vault 2.0" by Dan Linstedt 2015
4. High Performance Spark: Best Practices for Scaling and Optimizing Apache Spark by Holden karau,Rachel warren 2017 1st edition

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/videos/big-data-integration-processing/zBKt2?query=IN+MEMEORY+DATA+PROCESSING&source=search
2. https://www.coursera.org/videos/machine-learning-accounting-python/j3M5H?source=search&source=search&query=data%20preprocessing

U18AIE0218 **DATA MODELING**

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Apply MySQL Workbench to design database model(K3)
- **CO2:** Apply logical Data model to design Patterns(K3)
- **CO3:** Design Geospatial data models for applications involving location-based analytics(K6)
- **CO4:** Analyze and choose appropriate NoSQL and NewSQL databases for specific modeling requirements. (K4)

Pre-requisite: U18CSI3204/ Database Management Systems

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1					S								M		
CO2					S								M		
CO3	S	S	S			S								S	
CO4	S	S	S		S										

THEORY COMPONENT CONTENT

INTRODUCTION TO ADVANCED DATA MODELING (6 Hours)

Overview of Data Modeling in Data science– Importance of Advanced data Modeling – Types of data Model– Dimensional modelling-Design-MySQL Workbench- Build Data model using MySQL workbench– Forward Engineering Feature-Converting Data model into Database schema,MySQL to reverse Engineering schema .

LOGICAL DATA MODEL (6 Hours)

Cross enterprise Analysis- Modern Driven analysis-Baseline data patterns-complex data Patterns-Generation of Entity types-Transition from meta data to data-static vs dynamic Entitytypes-data coupling -cohesion.

ADVANCED DATA PATTERNS (6 Hours)

Advanced subtype variations-Multi recursive networks-conditional Recursions-Rules based entity types-state Transition rules-Meta patterns.

GRAPH AND TEMPORAL DATA MODELING (6 Hours)

Graph Databases – Nodes – Edges – Properties– Graph query Languages – Understanding Temporal Databases – Valid time vs Transition Time– Temporal Datamining Techniques – Temporal query languages; No-SQL-New SQL: CAP theorem – Document-based: MongoDB data model and CRUD operations.

GEOSPATIAL AND METADATA MODELING (6 Hours)

Representing geospatial data in models-Geospatial Query Language-Applications in Mapping and Location-based Analytics-Metadata Definition and Importance-Encryption and Masking in Data Models-Access Controls and Authorization

SAMPLE LAB CONTENTS **30 Hours**

1. Explore a sample dataset and identify dimensions and facts.
2. Design and Implement schema for a dataset using MySQL workbench.
3. Design and implement a graph Data model for any dataset.
4. Implement a temporal data model for historical dataset
5. create Geospatial data models for location analyses
6. Explore the GEOJSON to represent spatial data.
7. create and manage a metadata for given dataset

Theory: 30	Tutorial: 0	Practical: 30	Project: 0	Total: 60 Hours

REFERENCES

1. The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling". Authors: Ralph Kimball and Margy Ross 2013 3rd Edition
2. Designing Data-Intensive Applications: The Big Ideas Behind Reliable, Scalable, and Maintainable Systems (Greyscale Indian Edition) 2017.
3. Data Modeling Made Simple: A Practical Guide for Business & IT Professionals Authors:Steve Hoberman: 2nd Edition.2009

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/lecture/advanced-data-modeling/introduction-to-advanced-data-modeling-eqENZ
2. https://www.coursera.org/learn/sql-data-science
3. https://www.coursera.org/learn/advanced-data-modeling
4. https://www.coursera.org/learn/nosql-databases
5. https://www.coursera.org/specializations/databases-for-data-scientists

U18AIE0219 DATA ANALYSIS AND VISUALIZATION

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Use the Exploratory data analysis concepts over the data(K3)

CO2: Apply the data visualization using Matplotlib. (K3)

CO3: Illustrate univariate data exploration and analysis.(K4)

CO4: Apply bivariate data exploration and analysis.(K3)

CO5: Use Data exploration and visualization techniques for multivariate and time series data.(K3)

Pre-requisite: U18CSI3204/ Database Management Systems

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S		M							M		M			
CO2	S		M							M		M			
CO3		S		M										S	
CO4		S		M										S	
CO5	S														

THEORY COMPONENT CONTENT

EXPLORATORY DATA ANALYSIS FUNDAMENTALS (6 Hours)

Overview – Significance of Exploratory Data Analysis(EDA) – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA - Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques - Grouping Datasets - data aggregation – Pivot tables and cross-tabulations.

VISUALIZING USING MATPLOTLIB (6 Hours)

Importing Matplotlib – Simple line plots – Simple scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

DASHBOARD CREATION USING POWERBI (6 Hours)

Creating Reports-table Visualization-Bar –Pie-column-donut –Navigation and accessibility-Bringing data to the user-Identifying Patterns and trends-case study.

UNIVARIATE & BIVARIATE ANALYSIS (6 Hours)

Introduction to Single variable: Distributions and Variables - Numerical Summaries of Level and Spread - Scaling and Standardizing – Inequality - Smoothing Time Series.Relationships between Two Variables - Percentage Tables - Analyzing Contingency Tables - Handling Several Batches - Scatterplots and Resistant Lines – Transformations.

MULTIVARIATE AND TIME SERIES ANALYSIS (6 Hours)

Introducing a Third Variable - Causal Explanations - Three-Variable Contingency Tables and Beyond - Longitudinal Data – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

LAB CONTENTS **30 Hours**

1. Implementation of Descriptive statistics for a dataset.
2. Implementation of Inferential statistics for a Dataset.
3. Implementation of data charts – Univariate analysis
4. Implementation of data visualization techniques – Bivariate Analysis
5. Implementation of data visualization techniques –multivariate Analysis
6. Implementation the Handling outliers and missing values
7. Implement Visual encoding of data
8. Develop a Dashboard for various domain

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 60 Hours**

REFERENCES

1. Suresh Kumar Mukhiya, Usman Ahmed, “Hands-On Exploratory Data Analysis with Python”, Packt Publishing, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", Oreilly, 1st Edition, 2016.
3. Catherine Marsh, Jane Elliott, “Exploring Data: An Introduction to Data Analysis for Social Scientists”, Wiley Publications, 2nd Edition, 2008.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/specializations/data-analysis-visualization-foundations
2. https://www.coursera.org/learn/data-analysis-and-visualization-with-power-bi
3. https://onlinecourses.nptel.ac.in/noc22_cs32/preview.

U18AIE0220 BUSINESS INTELLIGENCE FOR DECISION MAKING

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Analyze real-world business problems and models with analytical solutions. (K4)
- **CO2:** Evaluate the business processes for extracting Business Intelligence(K4)
- **CO3:** Apply predictive analytics for business forecasting. (K3)
- **CO4:** Apply analytics for supply chain and logistics management(K3)
- **CO5:** Use analytics for marketing and sales. (K3)

Pre Requisite: U18CSI2201/ Python Programming

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S			S	S				S		S			
CO2				S											
CO3			S			S									
CO4			S		S								S	S	S
CO5			S		S								M	S	M

THEORY COMPONENT

INTRODUCTION TO BUSINESS ANALYTICS (6 Hours)

Analytics and Data Science – Types of Analytics – Business Problem Definition – Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation – Interpretation – Deployment and Iteration

BUSINESS INTELLIGENCE (6 Hours)

Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence –OLAP – Analytic functions.

BUSINESS FORECASTING AND COMPETITIVE ANALYSIS (6 hours)

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics- Industry analysis- Profit Frontier, Risk vs Return, Competition Positioning- Enterprise Diagnosis

HR ANALYTICS (6 Hours)

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR- Applying HR Analytics to make a prediction of the demand for talent.

MARKETING & SALES ANALYTIC (6 Hours)

Marketing Strategy, Marketing Mix, Customer Behaviour –selling Process – Sales Planning – Analytics applications in Marketing and Sales - predictive analytics for customers' behaviour in marketing and sales.

SAMPLE LAB CONTENTS **30 Hour**

1. Explore the interface and basic features of the BI tool(Qlik)
2. Load and visualize a sample dataset.
3. Import a dataset into the BI tool. And Cleanse data by handling missing values, outliers, and inconsistencies.
4. Transform data to suit BI reporting requirements and Design a dashboard with key performance indicators (KPIs).
5. Develop interactive dashboards for dynamic data exploration.
6. Integrate data from various sources for comprehensive analysis
7. Implement advanced chart types (treemaps, heatmaps, etc.).
8. Apply BI tools for forecasting and predictive analytics.

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 60 Hours**

REFERENCES

1. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education,2018.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/data-analytics-business
2. https://www.coursera.org/learn/foundations-of-business-intelligence
3. https://www.coursera.org/specializations/bi-foundations-sql-etl-data-warehouse

U18AIE0021 DATA ETHICS AND PRIVACY

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Develop an awareness of the impact of data-related decisions on individuals and society
- **CO2:** Identify the challenges and consequences of Biased datasets. (K4)
- **CO3:** Examine the importance of Data Security and Accuracy (K3)
- **CO4:** Apply the aspects of distributed data and associated risks(K3)
- **CO5:** Apply the knowledge of encryption for data(K3)

Pre Requisite: U18CSI3204/ Database Management Systems

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S		M							M		M			
CO2	S		M							M		M			
CO3		S		M										S	M
CO4		S		M										S	M

THEORY COMPONENT CONTENT DATA BIAS (8 Hours)

Introduction,- Data vs Information vs Facts- Algorithmic Bias- Privacy- Biased Datasets- Purpose of Corporation/AI- Fairness, Predictive Analytics & Mistakes- Surveillance & Power- Disparate Treatment/Impact

ETHICS IN DATA SCIENCE (9 Hours)

Ethics in data management- Role of AI Ethics in Corp- Privacy & Shared Responsibility- Surveillance/Power and Shared Responsibility- Disparate Treatment/Impact- Economics of Trust- Transparency vs accountability.

ACCURACY AND PRIVACY (10 Hours)

Creating & Measuring Accuracy- Data Science Ethics- Data Science Hate Privacy- Respecting Data Science- Misconceptions About Data Science Ethics- Accountability and Governance- Data Provenance and Aggregation

PRIVACY ATTACKS (9 Hours)

Defining Differential Privacy- Privacy Loss- Privacy attacks- Types of privacy attacks- Privacy-Aware Machine Learning and Data Science- Architecting Privacy in Data and Machine Learning- Open Source Libraries for PPML Projects- Distributed Data- Federated Learning

DATA ENCRYPTION FOR PRIVACY (9 Hours)

Encrypted Computation- Types of Encrypted Computation- Real-World Encrypted Computation- Navigating the Legal Side of Privacy- GDPR: An Overview- Privacy and Practicality Considerations- Getting Practical: Managing Privacy and Security Risk

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45

REFERENCES

1. Katharine Jarmul, Practical Data Privacy Released April 2023 Publisher(s): O'Reilly Media, Inc. ISBN: 9781098129460
2. Loukides, Mike, Hilary Mason, and DJ Patil. 2018. Ethics and Data Science. Sebastopol, CA: O'Reilly Media.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/data-science-ethics
2. https://www.coursera.org/learn/northeastern-data-privac

Network and Distributed Computing

U18ITE0218 SMART CONTRACT DEVELOPMENT

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Interpret Ethereum components required to design a smart contract [K3]

CO2: Design and develop smart contracts using Solidity programming. [K3]

CO3: Create and deploy a DApp on a Ethereum test network. [K3]

CO4: Deploy and manage Ethereum blockchain networks using Ganache and Truffle. [K3]

Pre-requisite: U18CSE0012 - Blockchain Technology and Applications

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S					M									
CO2	S		M			S	M								
CO3	S	M	M		M	M	M	S		M		S	M		M
CO4	S	S	S		M	M	M	S	S	S	M	S	M		M

THEORY COMPONENT CONTENT

ETHEREUM FOUNDATIONS 8 Hours

Ethereum Eco System – Components – Ethereum Virtual Machine (EVM) – Ethereum and Turing Completeness – Smart Contract Basics – Smart Contract Lifecycle – Structure of Smart Contract. Ether currency units - Ethereum wallets – Ethereum accounts – Ethereum Tokens – Transactions, Gas and Fees – Ethereum mining - Externally owned accounts and contracts.

SMART CONTRACT DEVELOPMENT 11 Hours

Building a smart contract with Solidity – Ethereum Contract ABI – Programming with Solidity: Data Types & Variables – Operators – Control Structures - Predefined Global variables – Storage & Memory - Contracts – Functions – Function Modifiers - Constructor – Inheritance - Events and logs – Error handling - Inter-contract execution - Libraries and Ethereum package manager – Tokens - Introduction to Ethereum Name Service (ENS) – Designing Smart Contracts.

BUILDING DAPP AND WEB 3 11 Hours

Running an Ethereum Client: Go Ethereum (Geth) - Processing and deploying smart contracts in Remix IDE. Introduction to Web3 - Using the web3.js javascript library - Generating Ethereum accounts.

Truffle Framework & Ganache: Environment Setup for Truffle & Ganache, Truffle Project Creation, – Truffle Compile – Migrate and Create Commands - Decentralized App Creation:

Smart Contract Creation, Front-End Creation, Connecting Smart Contract with Front-End Application – Deploying DApp – Validation – Testing of DApp.

Sample List of Experiments **30 Hours**

1. Getting Started with MetaMask
    a. Creating a Wallet
    b. Interacting with Remix IDE
    c. Switching Networks
    d. Getting some Test Ethers
    e. Sending Ether from MetaMask
    f. Exploring the transaction details of an account
2. Building smart contract using Solidity, compiling and deploying it on Remix IDE
3. Use of setter and getter functions to interact with the contracts.
4. Smart contract to withdraw funds from a contract to a restricted account, preferably the owner's, with different levels of security restrictions.
5. Build a DApp and deploy a smart contract on an external blockchain by using Ganache and Truffle. Interact with a front end developed using Web 3.js.

Theory:30	**Tutorial:0**	**Practical:30**	**Project:0**	**Total: 60 Hours**

REFERENCES

1. Mastering Ethereum: Building Smart Contracts and DApps by Andreas M. Antonopoulos, Gavin Wood, 2018, O'Reilly Media
2. Modi, Ritesh, Solidity Programming Essentials: A beginner's guide to build smart contracts for Ethereum and Blockchain, 2018, Packt Publishing Ltd, United Kingdom
3. Imran. Bashir. Mastering block chain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained. Packt Publishing, 2nd Edition, 2018

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/decentralized-apps-on-blockchain?specialization=blockchain
2. https://www.coursera.org/learn/smarter-contracts#syllabus
3. https://101blockchains.com/course/smart-contracts-development
4. https://www.tcsion.com/courses/industry-honour-course/ethereum-smart-contracts/
5. https://onlinecourses.swayam2.ac.in/aic21_ge01/preview
6. https://trufflesuite.com/docs/truffle/

U18ITE0019 DECENTRALIZED FINANCE

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Interpret the features of decentralized finance required to build its infrastructure. [K3]
CO2: Examine key trends and basic primitives of decentralized finance to design innovative financial solutions. [K3]
CO3: Apply diverse DeFi operations for providing blockchain-based financial solutions. [K3]
CO4: Identify the risks associated with decentralized finance. [K3]
CO5: Analyse ethical and regulatory issues associated with Decentralized Finance. [K4]

Pre-requisite: U18CSI5201 / Computer Networks

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M														
CO2	S	M										M			M
CO3	S	M					M		M	M					M
CO4	M			M		M		M	M	M					
Co5	M			M		M		M	M	M					

THEORY COMPONENT CONTENT

DECENTRALIZED FINANCE(DEFI) INFRASTRUCTURE 8 Hours

Issues in Centralized Finance – History and Overview of Decentralized Finance - Overview of Cryptocurrency – Cryptographic hashing – Proof of work – Smart Contracts – Gas - Stable coins – Tokenomics – Altcoins - Blockchain and DeFi

DEFI PRIMITIVES 8 Hours

Transactions – Fungible tokens – Non Fungible tokens – custody – Supply adjustment – Incentives – Swap – Collateralized loans – Flash loan - Problems solved by DeFi- Ineffeciency – Limited Access – Opacity – Centralized control and lack of Interoperability

DEFI OPERATIONS 10 Hours

Credit /Lending and borrowing protocols – Decentralized Exchanges – Derivatives – Tokenization – Hot and cold wallets – Moving centralized exchanges funds to blockchain - Automated market makers – Bridging – Staking - Oracles

DECENTRALIZED IDENTITY AND SECURITY 10 Hours

Decentralized Identity (DID) – Security risks and measures in DeFi – Smart contract risk - Governance risk – Oracle risk – scaling risk – DEX risk – Custodial risk – Regulatory risk. Smart Contract Auditing – Yield Farming strategies – Liquidity mining

REGULATORY AND ETHICAL CONSIDERATIONS **9 Hours**

Global Regulations – Ethical issues – DAO – Government mechanisms – Crypto hackers – DeFi Usecases -Case study: Crypto Exchange Platforms and Gitcoin

Theory:45	Tutorial:0	Practical:0	Project:0	Total: 45 Hours

REFERENCES

1. Campbell R. Harvey, Ashwin Ramachandran, Joey Santoro, Vitalik Buterin, "DeFi and the Future of Finance", Wiley 1st Edition.
2. Melanie Swan, Blockchain: Blueprint for a new economy, Shroff Publisher/O'Reilly Publisher.
3. Ron Quaranta, Blockchain in Financial Markets and Beyond: Challenges and Applications, Risk Books Publisher.
4. Richard Hayen, Blockchain & FinTech: A Comprehensive Blueprint to Understanding Blockchain & Financial Technology - Bitcoin, FinTech, Smart Contracts, Cryptocurrency, Risk Books Publisher.

ONLINE LEARNING MATERIALS

1. https://www.udemy.com/course/masteringdefi/
2. https://www.coursera.org/specializations/decentralized-finance-duke
3. https://101blockchains.com/ebooks/decentralized-finance-defi-guide/

Cloud Computing

L	T	P	J	C
2	0	2	0	3

U18ITE0220 VIRTUALIZATION AND RESOURCE MANAGEMENT

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Analyze the use of different resource virtualizations used in cloud environment [K4].
- **CO2:** Apply the factors of cloud economics on migration and development [K3].
- **CO3:** Develop applications in different public cloud platform [K3].
- **CO4:** Select appropriate service model for an application[K3].
- **CO5:** Choose a suitable cloud service provider based on application domain[K3].

Prerequisite: U18CST3003/Computer Architecture

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S				M			M			M	S	M		M
CO2	S	M									M	S			M
CO3	S			M			M	M	M			S	M		M
CO4	S	M			M						M	S	M		M
CO5	S		M	M				M			M		M		M

THEORY COMPONENT CONTENTS

VIRTUALIZATION 4 Hours

Roles of Virtualization, Hypervisor, Types of Virtualization – Server virtualization – Storage virtualization – Network virtualization – Desktop virtualization – Application Virtualization.

CLOUD ECONOMICS AND MIGRATION 5 Hours

Cost models and optimization, Economies of Scale, Resource Optimization, Reduced Capital Expenditure - Total Cost of Ownership (TCO), Cost Transparency and Management, Risk Mitigation and Security, Performance vs. Cost Trade-offs.

Cloud Migration Strategies, Iterative Seven-step Model of Migration into the Cloud, Assessment and Planning, Choosing the Right Cloud services and Provider, Change Management and Training, Performance and Monitoring, Testing and Validation, Backups, Post-Migration Optimization.

INFRASTRUCTURE AS A SERVICE 7 Hours

Compute: AWS EC2, Azure Virtual Machines, Google Compute Engine. Containers – Microservices, Docker, Kubernetes containers. Storage: Amazon EBS, Amazon S3, Azure disk storage, Google cloud storage. Autoscaling – AWS autoscaling, Azure app service, Google compute engine. Load balancing – AWS ELB, Azure traffic manager, Google cloud load balancer. Network: Amazon VPC, Azure virtual network, Google cloud VPN.

PLATFORM AS A SERVICE 7 Hours

PaaS: Serverless computing - AWS Lambda, Azure functions, Google Cloud functions, AWS Apprunner, Elastic beanstalk, Google App engine, Google Cloud Functions, Amazon RDS,

DynamoDB, Azure SQL database, Azure CosmosDB, Google cloud SQL, Google cloud database.

SOFTWARE AS A SERVICE **7 Hours**

Amazon chime, Workmail, Workdocs, Microsoft 365, Microsoft power platform, Azure active directory, Azure DevOps, Azure IoT central, Azure cost management, Google Maps platform, Google workspace, Google analytics, Google cloud identity, Google Cloud search, Firebase.

LAB CONTENTS:

Few exercise related to AWS, Azure, Google platform services that fall under IaaS, PaaaS and SaaS.

Sample Exercises:

1. Demonstrate the virtualization by enabling the OS virtualization on single machine by creating instances oracle virtual box/VMware.
2. Installation of VM Ware/ virtual box and implement multiple OS.
3. Creating VMs in public cloud.
4. Deploying application in Docker/Kubernetes.
5. Static Web site hosting
6. Dynamic Website hosting
7. Balancing network traffic using load balancer
8. Scale the Compute resource with auto scaling
9. E-mail notification using serverless architecture.
10. Configuring a cloud network

Theory: 30	Tutorial: 0	Practical: 30	Project: 0	Total: 60 Hours

REFERENCES:

1. Dr. Rajesh Kumar Pathak , “Cloud Computing Fundamentals, Notion Press, 2023.
2. A. B. Lawal, “Cloud Computing Fundamentals: Learn the Latest Cloud Technology and Architecture with Real-World Examples and Applications”, A. B. Lawal publication, 2020.
3. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, “Mastering Cloud Computing: Foundations and Applications Programming”, Morgan Kaufmann publications, 2013.
4. Cloudonomics: The Business Value of Cloud Computing" by Joe Weinman, John Wiley & Sons Inc, 2012.
5. Mastering AWS Development" by Uchit Vyas, Ingram short title, 2015.
6. Microsoft Azure Essentials - Fundamentals of Azure, Second Edition" by Michael Collier and Robin Shahan, Microsoft Press, 2015.
7. Google Cloud Platform for Developers: Build highly scalable cloud solutions with the power of Google Cloud Platform" by Ted Hunter and Steven Porter, Packt Publishing Limited, 2018.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/cloud-computing-basics
2. https://www.coursera.org/learn/meta-cloud-computing
3. https://www.coursera.org/learn/cloud-computing-foundations-duke
4. https://www.coursera.org/browse/information-technology/cloud-computing
5. https://www.mygreatlearning.com/cloud-computing/courses
6. http://www.infocobuild.com/education/audio-video-courses/computer-science/CloudComputing-IIT-Kharagpur/lecture-12.html
7. https://www.coursera.org/specializations/aws-fundamentals
8. https://www.coursera.org/learn/cloud-azure-intro
9. https://www.coursera.org/learn/gcp-infrastructure-foundation

U18ITE0221 CLOUD INFRASTRUCTURE AND ARCHITECTURE

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Construct the architecture for a private cloud [K3]
- **CO2:** Develop a cloud environment at small scale [K3]
- **CO3:** Inspect Security of services and applications in private cloud [K4]
- **CO4:** Make use of concepts and features related to Virtualized datacenter to configure cloud storage [K3].
- **CO5:** Build environment to manage IT resources [K3].

Prerequisite: U18CST3003/Computer Architecture

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1			M					M	M		M		M		M
CO2			M	M	M		M		M		M				M
CO3			M		M	M	M		M		M		M		M
CO4			M						M		M			M	
CO5			M		M		M		M		M		M		M

THEORY COMPONENT CONTENTS

INTRODUCTION TO CLOUD INFRASTRUCTURE 7 Hours

Introduction to cloud Infrastructure/virtual infrastructure, General Architecture of virtual infrastructure: Architecture of OpenStack, project, services, mode of deployment, workflow, Openstack Components: Nova, Swift, cinder, Nuetron, Glance, Keystone, Horizon. Virtualization environment with KVM. OpenStack API.

CLOUD COMPUTE ARCHITECTURE 7 Hours

Configuring Horizon Dashboard, OpenStack CLI client - Create and manage flavors, compute instances, generate and manage SSH keys, accessing instances, configure an instance with a floating IP address, create instances with security groups, manage Nova host consoles, instance snapshots. Openstack image service: image repository, manage images, metadata, image types, bundling, exporting, migrating images.

CLOUD STORAGE ARCHITECTURE 8 Hours

Swift: features, architecture of swift, swift installation and configuration, data management lifecycle, backup and archival, media storage with swift. Use the command line client to upload and manage files to Swift containers, manage permissions on a container in object storage,

Cinder: Architecture of cinder clock storage, Volume provisioning and management- create and manage volumes, attach volumes to instances, manage volume quotas, backup and restore volumes, manage volume snapshots.

CLOUD NETWORK ARCHITECTURE **8 Hours**

Software defined networking, Neutron Architecture, Manage network resources, create external/public networks, create project networks, create project routers, attach routers to public and project networks, manage network services for a virtual environment, manage network quotas, manage network interfaces on compute instances, create and manage project security groups and rules, assign security group to instance, create and manage floating IP addresses, assign floating IP address to instance, detach floating IP address from instance. Identity and access management-keystone: users, roles, groups.

LAB CONTENTS

Deployment of OpenStack components.

Sample Exercises:

1. Configure NOVA compute Node
2. Configure Swift object storage
3. Construct a cinder block node
4. Build a horizon node – Monitor node
5. Launching an instance- Register an account at openstack, Create SSH Key, validate network.
6. Sharing project environment among multiple users.

Theory: 30	Tutorial: 0	Practical: 30	Project: 0	Total: 60 Hours

REFERENCES

1. Ben Silverman, Michael Solberg, "OpenStack for Architects :Design Production-ready Private Cloud Infrastructure", 2nd Edition, Packt Publishing, 2018.
2. Michael Solberg, Ben Silverman, "OpenStack for Architects" , Packt Publishing,· 2017
3. Alok Shrivastwa, Sunil Sarat, Kevin Jackson, Cody Bunch, Egle Sigler, Tony Campbell, "OpenStack: Building a Cloud Environment", Packt Publishing, 2016
4. James Denton, "Learning OpenStack Networking (Neutron)", Packt Publishing, 2015.

ONLINE LEARNING MATERIAL

https://www.coursera.org/learn/juniper-openstack-and-kubernetes?

U18ITE0222 CLOUD STORAGE MANAGEMENT

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Make use of cloud storage technologies in applications [K3].
- **CO2:** Correlate different storage networking technologies [K3].
- **CO3:** Make use of the design principles of virtualization techniques in cloud resource management [K3]
- **CO4:** Analyze different cloud storage life cycle strategies [K4].
- **CO5:** Select appropriate backup and recovery strategies [K3].

Prerequisite: U18CST3003/Computer Architecture

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S					M			M		M		M	M	M
CO2	M	M	M							M		M			M
CO3	M	S	S				M						M		
CO4	M				M								M		
CO5	M	M											M		

THEORY COMPONENT CONTENTS

INTRODUCTION TO CLOUD STORAGE 7 Hours

Overview of cloud storage concepts - Advantages and challenges of cloud storage - Comparison of traditional storage vs. cloud storage, Evolution of Storage Architecture, Data Center Infrastructure, **Storage Technologies :** Block, file, and object storage - Storage protocols (iSCSI, NFS, SMB, etc.) - Data replication, snapshots, and backups in the cloud.

STORAGE NETWORKING TECHNOLOGIES 8 Hours

Network-Attached Storage: General-Purpose Servers versus NAS Devices, Benefits of NAS, File Systems and Network File Sharing, Components of NAS, NAS I/O Operation, NAS Implementations, NAS File-Sharing Protocols, Factors Affecting NAS Performance , File-Level Virtualization. Fibre Channel Storage Area Networks: Fibre Channel Overview, The SAN and Its Evolution, Components of FC SAN, FC Connectivity, Switched Fabric Ports, Fibre Channel Architecture, Fabric Services, Switched Fabric Login Types, Zoning, FC SAN Topologies, Virtualization in SAN. IP SAN and FCoE: iSCSI, FCIP, FCoE

LIFE CYCLE MANAGEMENT AND SECURITY 8 Hours

Introduction to storage tiers **,** Different Storage Classes Offered by Cloud Providers - Choosing the Right Storage Class for Different Use Cases - Access Control and Security - Identity and Access Management (IAM) - Encryption in Transit and at Rest

BACKUP AND DISASTER RECOVERY **7 Hours**

Introduction to Business Continuity: Information Availability, BC Terminology, BC Planning Life Cycle, Failure Analysis, Business Impact Analysis, BC Technology Solutions. Backup and Archive: Backup Purpose, Backup Considerations, Backup Granularity, Recovery Considerations, Backup Methods, Backup Architecture, Backup and Restore Operations, Backup, Backup in NAS Environments, Backup Targets, Data Deduplication for Backup, Backup in Virtualized Environments, Data Archive, Archiving Solution Architecture

LAB CONTENTS

Attaching volume to instances, Creating snapshots from volumes, Migrating a file among different storage classes, Managing access control over a file/storage, Enabling client and server-side encryption for an object.

Sample Exercise:

1. Attaching volume to instances.
2. Creating snapshots for volumes.
3. Migrating a file among different storage classes.
4. Managing access control over a file/storage.
5. Enabling client and server side encryption for an object.

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 60 Hours**

REFERENCES

1. Data Intensive Storage Services for Cloud Environments by Athanasios Voulodimos, Dimosthenis P. Kyriazis, Spyridon V. Gogouvitis, Theodora Varvarigou, Business Science Reference, 2013.
2. Cloud Storage Management in Contemporary IT Environments by Michael O'Dell and Michael Corey, Packt Publishing, 2012.
3. Borko Furht, Armando Escalante Handbook of Cloud Computing, Springer Science+Business Media, LLC 2010
4. Information Storage and Management by Emc Education S, John Wiley & Sons, Incorporated, 2012.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/data-storage-microsoft-azure
2. https://www.udemy.com/course/introduction-to-cloud-storage-apps-a-beginners-course/
3. https://www.coursera.org/learn/cloud-storage-big-data-analysis-sql
4. https://www.classcentral.com/course/linkedin-learning-learning-cloud-computing-cloud-storage-30444

U18ITE0323 CLOUD APPLICATION DEVELOPMENT

L	T	P	J	C
2	0	0	2	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Analyse the use cases for cloud application development [K4]
- **CO2:** Compare web and cloud application and analyze appropriate cloud platforms requirements [K3]
- **CO3:** Build applications using APIs and Cloud services [K3]
- **CO4:** Apply agile application development and manage application life cycle using DevOps [K3]

Prerequisite: U18CSI7201/Cloud Computing

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M	M										M	M	
CO2		M	M		S					M			M		
CO3	M				S							S	M	M	
CO4		S			M					M					M

INTRODUCTION TO APLLICATION DESIGN 6 Hours

Business case for implementing cloud application, Requirements, collection for cloud application development, Cloud service models and deployment models, Open challenges in Cloud Computing: Cloud inter-operability and standards, scalability and fault tolerance, security, trust and privacy.

APPLICATION DEVELOPMENT FRAMEWORK 8 Hours

Accessing the clouds: Web application vs Cloud Application, Frameworks: Model View Controller (MVC), Struts, Spring. Cloud platforms in Industry – Google AppEngine, Microsoft Azure, Openshift, CloudFoundry

CLOUD SERVICE DELIVERY ENVIRONMENT AND API 8 Hours

Storing objects in the Cloud, Session management, Working with third party APIs: Overview of interconnectivity in Cloud ecosystems. Facebook API, Twitter API, Google API. **Architecting for the Cloud :** Best practices Best practices in architecture cloud applications in AWS cloud, Amazon Simple Queue Service (SQS), RabbitMQ, Amazon Simple Notification Service (Amazon SNS), multi-player online game hosting on cloud resources, Building content delivery networks using clouds.

DEVOPS IN CLOUD 8 Hours

Continuous Integration/Continuous Deployment (CI/CD), collaboration among development, operations, and other stakeholders, Agile and lean principles: Embracing agile methodologies and lean practices to enable faster development and delivery cycles. Automating development pipelines, Monitoring and Logging, Implementing monitoring solutions for cloud applications, Containerization: Docker basics and container orchestration with Kubernetes.

PROJECT:

Projects involving Google AppEngine, Microsoft Azure, Openshift, Cloud Foundry services will be done.

Theory: 30	Tutorial: 0	Practical: 0	Project:30	Total: 60 Hours

REFERENCES

1. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud by George Reese, Oreilly Publication, 2021.
2. Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation by Jez Humble and David Farley, 2020.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/specializations/ibm-cloud-application-development-foundations
2. https://www.udemy.com/course/cloud-computing-development-essentials/
3. https://www.coursera.org/learn/cloud-native-devops-agile-nosql?specialization=ibm-cloud-application-development-foundations
4. https://www.edx.org/certificates/professional-certificate/ibm-cloud-and-application-development-foundations

L	T	P	J	C
2	0	2	0	3

U18ITE0224 CLOUD SECURITY

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Analyze the security breaches of IaaS, PaaS and SaaS. [K4]
- **CO2:** Apply various data encryption methods and security mechanisms to get the administrative control using IAM service.[K3]
- **CO3:** Inspect compliance, governance and risk management [K4]
- **CO4:** Make use of CI/CD pipeline in application security [K3].
- **CO5:** Analyze security in edge computing [K4]

Pre-requisite: U18CSI7201/Cloud Computing

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				M											M
CO2			M			M						M		M	
CO3					S	M		M					M		
CO4		S		M									M		
CO5		M			M										

THEORY COMPONENT CONTENTS

INTRODUCTION TO CLOUD SECURITY 6 Hours

Overview of cloud computing and its security challenges - Importance of cloud security for organizations - Shared responsibility model in cloud security. **Cloud Service Models and Security:** Security considerations for IaaS, PaaS, and SaaS, Risks and security measures specific to each service model, Case studies highlighting security vulnerabilities in cloud services.

CLOUD SECURITY ARCHITECTURE AND DATA PROTECTION 6 Hours

Designing secure cloud architectures, Identity and access management (IAM) in the cloud Network security in a cloud environment. Encryption techniques for data at rest and in transit Key management best practices, Data loss prevention (DLP) strategies in the cloud

COMPLIANCE, GOVERNANCE, AND RISK MANAGEMENT 6 Hours

Compliance requirements in the cloud (e.g., GDPR, HIPAA), Risk assessment and management in cloud environments, Implementing governance frameworks for cloud security, Cloud-specific threats and vulnerabilities, Security monitoring and logging in the cloud, Incident response planning and execution in cloud environments.

SECURE DEVELOPMENT AND DEVSECOPS 6 Hours

Security considerations in cloud-native application development, Implementing security in CI/CD pipelines, Best practices for DevSecOps in the cloud.

EMERGING TRENDS AND FUTURE OF CLOUD SECURITY 6 Hours

Edge computing and its security implications, Zero-trust security models in the cloud, Future directions and trends in cloud security.

LAB CONTENTS

Securing Free tier account, IAM, account bills, instances within Virtual Private Cloud, Role based access control with cloud platform IAM, Instance with firewall rules , Data encryption and decryption using cloud platforms, restricting access to storage, Configuring networking firewall for an application

Sample exercises:

1. Securing free tier account in cloud platform
2. Securing free tier account in cloud platform with IAM user
3. Creating IAM role, Group.
4. Securing free tier account setting billing in cloud platform
5. Securing instances in cloud platform within Virtual Private Cloud
6. Implementing role based access control with cloud platform IAM
7. Securing instances with firewall rules
8. Data encryption and decryption using cloud platforms
9. Securing and restricting access to storage
10. Configuring networking firewall for an application

Theory: 30	Tutorial: 0	Practical: 30	Project: 0	Total: 60 Hours

REFERENCES

1. Cloud Security Attacks, Techniques, Tools and Challenges by Preeti Mishra, Emmanuel S Pilli, R C Joshi · 2021
2. Cloud Security: Concepts, Applications and Perspectives by Brij B. Gupta · 2021
3. Securing the Cloud: Cloud Computer Security Techniques and Tactics by Vic (J.R.) Winkler
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing by Ronald L. Krutz, Russell Dean Vines · 2010
5. Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice) 1st Edition, by Tim Mather (Author), Subra Kumaraswamy (Author), Shahed Latif (Author) 2009.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/cloud-security-basics
2. https://www.coursera.org/learn/sscp-4th-ed-course-6
3. https://www.coursera.org/learn/cloud-data-security
4. https://www.checkpoint.com/cyber-hub/cloud-security/what-is-cloud-security/
5. https://www.zscaler.com/resources/security-terms-glossary/what-is-cloud-security
6. https://medium.com/@goodycyb/exploring-cloud-security-in-depth-labs-and-insights-for-

aws-and-gcp-50ca038478c4
7. https://goodycyb.hashnode.dev/

U18ITE0325 CLOUD AUTOMATION

L	T	P	J	C
2	0	0	2	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Identify appropriate cloud automation tools for an application [K3].
- **CO2:** Take part in automating DevOps using tools [K4]
- **CO3:** Make use of storage automation in an application [K3].
- **CO4:** Apply automation tools in monitoring services [K3]
- **CO5:** Utilize tools for the cloud resource scaling and management [K3]

Prerequisite: U18CSI7201/Cloud Computing

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M		M	M	M				M			M		M
CO2	M								M		M				
CO3	S	S										M	M		
CO4	M				M										M
CO5	M	S			M						M		M		

THEORY COMPONENT CONTENTS

INTRODUCTION CLOUD AUTOMATION 7 Hours

Benefits of cloud automation - Types of cloud automation tools - Use cases for cloud automation. Managing and provisioning infrastructure through code (using tools like Terraform, Ansible, Puppet, Chef), Automating code integration and verification through tools like Jenkins, GitLab CI, or CircleCI, Automating the deployment process to push code changes into production environments reliably.

CLOUD RESOURCE SCALLING AND STORAGE AUTOMATION 8 Hours

Automating resource allocation, de-allocation, and right-sizing of resources based on usage. Kubernetes - Salt -CircleCI - Ansible and puppet, AWS DataSync, Azure Data Factory.

CLOUD AUTOMATION TOOLS FOR DEVOPS 7 Hours

DuploCloud - Puppet - Heroku -HashiCorp, Monitoring and Logging Tools – Prometheus, Grafana, Docker, Raygun, Splunk, Git, Ansible, Jenkins, Bamboo.

CLOUD DEPLOYMENT AUTOMATION 8 Hours

NetApp Cloud Volumes ONTAP - CFEngine -VMware vs Realize Automation - Cisco Intelligent - Automation for Cloud - Microsoft Azure Automation - Google Cloud Deployment Manager - AWS CloudFormation - IBM Cloud Schematics

PROJECT

Projects involving different cloud platform services like Puppet, Heroku, HashiCorp and monitoring & Logging Tools – Prometheus, Grafana, Docker, Raygun, Splunk, Git, Ansible, Jenkins, Bamboo.

Theory: 30	Tutorial: 0	Practical: 0	Project: 30	Total: 60 Hours

REFERENCES

1. Mikael Krief,, "Learning DevOps: The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps", Packt Publishing; 1st edition, 2019.
2. Marcelo Pinheiro, "Mastering DevOps Automation", Packt Publishing Limited, 2018.
3. Jeff Geerling, "Ansible for DevOps: Server and Configuration Management for Humans", Midwestern Mac, LLC; 1st edition, 2015.
4. John Rhoton and James Stanger, "Cloud Automation and DevOps: Transforming Your IT Environment:, 2015.

ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/automation-in-aws
2. https://www.coursera.org/learn/gcp-infrastructure-scaling-automation
3. https://www.udemy.com/course/aws-cloud-security-proactive-way/
4. https://www.edx.org/learn/computer-programming/google-cloud-elastic-google-cloud-infrastructure-scaling-and-automation

Web and Software Development

U18ITE0226 FULL STACK SOFTWARE DEVELOPMENT

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

CO1: Create a Web Server with Node.js for a simple application. (K3)

CO2: Develop a Web Application in Express.js Framework. (K3)

CO3: Build an application with Node.js and MongoDB. (K3)

CO4: Deploy the developed application in GitHub repository. (K3)

Prerequisite: U18CSI6201/ Internet and Web Programming

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	S	M	M		S						M	M	S		M
CO2	S	M	M		S						M	M	S		M
CO3	S	M	M		S						M	M	S		M
CO4					S	M	M	M	M	M	M	M		S	

THEORY COMPONENT CONTENT

INTRODUCTION TO FULL STACK DEVELOPMENT & VERSION CONTROL 6 Hours

Overview of HTML, CSS, JavaScript, and Bootstrap.
Web Development Stack - Full Stack – Introduction – Types: MERN, MEAN, MEVN, LAMP, Ruby on Rails, Django, NET, JAMSTACK
Version Control – Need - Popular version control tools like Git - create a GitHub account - Use the GitHub web interface to create a repository - add a file to Git and commit the changes – Git commands.

INTRODUCTION TO NODE.JS 6 Hours

Introduction to Node.js - Server-Side JavaScript and Node.js - Creating a Web Server with Node.js - Working with Node.js Modules - Overview of Node Package Manager

SERVER-SIDE JAVASCRIPT 6 Hours

Asynchronous I/O with Callback Programming - Creating Callback Functions - Using Anonymous Callback Functions in Node.js - Issues with Callbacks - Working with JSON – Handling errors and debugging Node.js applications.

EXPRESS WEB APPLICATION FRAMEWORK 6 Hours

Extending Node.js - Working with Third Party Node.js Extensions - Introduction to Web Frameworks - Express Web Application Framework - Working with Back-end JavaScript Frameworks and Express - Routing, Middleware, and Templating - Authentication in Node JS - Middleware & Routers - HTTP Methods and Rest APIs.

MONGODB AND DEPLOYMENT OF NODE.JS APPLICATIONS 6 Hours

NoSQL databases and MongoDB - Setting up a MongoDB development environment - Building

MongoDB schema and models with Mongoose – Connecting Node.js application with MongoDB – Testing and Deploying Node.js applications with server configurations.

LAB CONTENTS

Sample List of Lab Experiments:

1. Create your own Node.js module and import and use modules in your web server application.
2. Develop asynchronous functions with callbacks, error handling, and control flow using callbacks.
3. Demonstrate JSON file data read and write using Node.js.
4. Create a RESTful API to serve JSON data.
5. Demonstrate RESTful endpoints using Express and HTTP methods to handle GET, POST, PUT, and DELETE requests.
6. Integrate a template engine (e.g., EJS or Pug) with Express and Render dynamic HTML views using templates.
7. Implement user authentication in your Express application.
8. Explore and integrate third-party Node.js extensions into your Express app and showcase the benefits of using extensions for specific features.
9. Create a multi-page web application with authentication, routing, and RESTful APIs.
10. Create a simple Employee Management Application with MongoDB and Node.js.

Theory: 30	**Tutorial: 0**	**Practical: 30**	**Project: 0**	**Total: 60 Hours**

REFERENCES

1. “Mastering HTML, CSS & JavaScript Web Publishing” by Laura Lemay, Rafe Colburn, Jennifer Kyrnin, BPB Publications, 2016.
2. "Node.js Web Development: Server-side web development " by David Herron, 5th Edition, 2020
3. "Node.js in Action" by Alex Young, Bradley Meck, Mike Cantelon, Tim Oxley, Marc Harter, T.J. Holowaychuk, and Nathan Rajlich, Manning, 2nd Edition, 2017
4. "Node.js Design Patterns" by Luciano Mammino and Mario Casciaro, 3rd Edition, 2022.
5. 5.“Web Development with MongoDB and Node JS” by Mithun Satheesh, Bruno Joseph D'mello, Jason Krol, Packt Publishing Limited; 2nd edition, 2015.
6. "Web Development with Node and Express" by Ethan Brown, O’Reilly Media, Inc. 2nd Edition, 2019.
7. “Pro Git” by Scott Chacon, Ben Straub, Apress, 2nd edition, 2014.

ONLINE LEARNING MATERIALS

1. Introduction to Web Development with HTML, CSS, JavaScript | Coursera
2. Getting Started with Git and GitHub | Coursera
3. Developing Back-End Apps with Node.js and Express | Coursera
4. Introduction to MongoDB | Coursera
5. [Project] Build a CRUD Node.js and MongoDB employee management web-app | Coursera

U18ITE0227 **UI AND UX DESIGN**

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Understand the difference between UI and UX design to explain the significance of empathy techniques in gathering user insights.[K2]
- **CO2:** Apply UI design principles to implement visual design standards and UI components to enhance user interaction.[K3]
- **CO3:** Understand UX research techniques to align user and business goals with the industry based design process. [K2]
- **CO4:** Apply wireframing and prototyping techniques to create and test responsive designs [K3]
- **CO5:** Apply essential concepts of Figma to create interactive user centered design.[K3]

Prerequisite: U18CSI6201/ Internet and Web Programming

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	S		M							M		M			S
CO2	S		M							M		M			S
CO3		S		M										S	
CO4		S		M										S	
CO5	S		M							M		M			S

THEORY COMPONENT CONTENTS

UNIT I -INDUSTRY-RELEVANT DESIGN THINKING 6 Hours

Understanding UI vs. UX Design, Design Thinking Framework, Innovative Thinking Methods, Empathy Techniques for User Insights.

UNIT II- UI DESIGN PRINCIPLES FOR INDUSTRY 6 Hours

Visual Design Standards, UI Components and Design Patterns, User Interaction and Engagement, Branding Integration and Style Guides.

UNIT III -UX RESEARCH AND STRATEGY IN THE INDUSTRY 6 Hours

UX Fundamentals for Business Impact Design Process, Industry Research Techniques,Aligning User and Business Goals.

UNIT IV -WIREFRAMING, PROTOTYPING AND TESTING 6 Hours

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing - Creating Wireflows - Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns - Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings - Prototype Iteration.

UNIT V -LOW CODE -NO CODE TOOLS **6 Hours**

Low code- No code Tools Essential Concepts of Figma - Setup and Configure Figma - Images, Shapes, and Tools - Working with Figma - Figma Components - Styles and Libraries in Figma - Cards and Layout Grids in Figma .

LAB CONTENTS: **30 Hours**

Sample Experiments:

1. Designing a Responsive layout for an societal application.
2. Exploring various UI Interaction Patterns
3. Developing an interface with proper UI Style Guides
4. Developing Wireflow diagram for application using open source software
5. Exploring various open source collaborative interface Platform
6. Hands on Design Thinking Process for a new product
7. Brainstorming feature for proposed product
8. Defining the Look and Feel of the new Project
9. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)
10. Identify a customer problem to solve.
11. Designing a User Interface with Figma
12. Creating and Managing Layout Grids and Components in Figma.

Theory: 30 **Tutorial: 0** **Practical: 30** **Project: 0** **Total: 60 Hours**

REFERENCES:

1. Joel Marsh, UX for Beginners, O'Reilly, 2022.
2. Jon Yablonski, Laws of UX: Using Psychology to Design Better Products & Services, O'Reilly, 2021.
3. Don Norman, The Design of Everyday Things: Revised and Expanded Edition, Basic Books, 2013.
4. Steve Krug, Don't Make Me Think: A Common Sense Approach to Web Usability, New Riders, 2014.
5. Jeffrey Zeldman and Ethan Marcotte, Responsive Web Design, A Book Apart, 2011.
6. Kim Goodwin, Designing for the Digital Age: How to Create Human-Centered Products and Services, Wiley, 2009.

ONLINE COURSES:

1. https://www.coursera.org/learn/designing-user-interfaces-and-experiences-uiux

U18ITE0228 **PRINCIPLES OF DEVOPS**

L	T	P	J	C
2	0	2	0	3

COURSE OUTCOMES

After successful completion of this course, the students should be able to

- **CO1:** Apply DevOps principles to meet software development requirements.[K3]
- **CO2:** Understand different actions performed through Version control tools like Git[K2]
- **CO3:** Apply the microservices architecture in the DevOps Environment.[K3]
- **CO4:** Apply continuous integration and continuous deployment using Jenkins and docker[K3]
- **CO5:** Analyze the use of configuration management tools like Ansible to distinguish between different approaches to infrastructure. [K4]

Prerequisite: U18CSI4204/ Software Engineering

COs	CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
	PROGRAMME OUTCOMES (POs)												PSOs of CSE		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	S		M							M		M			
CO2	S		M							M		M			
CO3		S		M										S	
CO4		S		M										S	
CO5															

THEORY COMPONENT CONTENTS

INTRODUCTION TO DEVOPS 6 HOURS

Overview of DevOps-DevOps Lifecycle-Essential Characteristics of DevOps- Tools and Technologies- Social Coding Principle-Version control systems: Git and GitHub-Importance of version control in CICD pipeline.

MICROSERVICES 6 HOURS

Monolith vs SOA vs Microservices - Microservices- Microservices Patterns - Introduction to Serverless Computing- Introduction to the FaaS Model- The Serverless Framework.

CONTINUOUS INTEGRATION USING JENKINS 6 HOURS

Essentials of Continuous Integration- Jenkins tool Management- Installing Jenkins- Architecture- Creating a Jenkins Job- Configuration- Customizing Jenkins with plugins- database user creation Creating a Jenkins Build and Jenkins workspace

CONFIGURATION MANAGEMENT 6 HOURS

Introduction - Infrastructure as Code- Configuration Management Tools- Automating Infrastructure Provisioning-Introduction to Ansible – Installation and Configuration- Ansible Architecture, Ansible and Infrastructure Management

CONTINUOUS DEPLOYMENT 6 HOURS

Overview of Docker-Benefits of Docker Workflow- Process Simplification-Architecture-Docker Containers-Docker Workflow- Anatomy of Dockerfile-Building an Image-Running an Image-Custom base Images, Storing Images.

LAB CONTENTS: **30 Hours**

1.Version Control with Git and GitHub.
2. Continuous Integration with Jenkins
3. Customizing Jenkins with Plugins
4. Infrastructure as Code with Ansible
5. Creating and Running Docker Containers.
6. Continuous Deployment with Docker and Jenkins.
7. Configuration Management and Infrastructure Provisioning with Ansible
8. Building and Managing Docker Workflows

Theory: 30 **Tutorial: 0** **Practical: 30** **Project: 0** **Total: 60 Hours**

REFERENCES:

1. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer", Second Edition, 2019. 6.
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humans", First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps", Second Edition, 2016. 5. Mariot Tsitoara.

ONLINE COURSES:

1) https://www.coursera.org/professional-certificates/devops-and-software-engineering
2) https://www.coursera.org/learn/intro-to-devops?specialization=devops-and-software-engineering
3) https://www.coursera.org/learn/intro-to-devops?specialization=devops-and-software-engineering
4) https://www.jenkins.io/user-handbook.pd

Professional Electives (PE)

U18CSE0001 BIG DATA TECHNOLOGIES

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Identify the components of Hadoop Distributed File System for big data processing [K4,S3]
CO2: Develop Big Data Solutions using Hadoop Eco System[K3,S3]
CO3: Examine various framework in Big data Processing [K4,S2]
CO4: Illustrate the big data security issues with Hadoop and the need of AWS for Hadoop environment.[K3]

Pre-requisite: U18CSI3204/ Database Management Systems

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO MAPPING**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1		S	M										M		
CO2					M				M	M				S	
CO3					M				M	M				S	
CO4		M			W				M	M					
CO5															

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Open Book Test; Cooperative Learning Report, Assignment; Journal Paper Review, Group Presentation, Project Report, Poster Preparation, Prototype or Product Demonstration etc (as applicable) (Theory component) 3. Pre/Post - Experiment Test/Viva; Experimental Report for each Experiment (lab Component) 4. Model Examination (lab component) 5. End Semester Examination (Theory and lab components)
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION TO BIG DATA **8 Hours**

Classification of digital data – Characteristics of data – Challenges – Five Vs- Typical Hadoop environment- Classification of analytics- Data science – Terminologies used in big data environments- Parallel Vs Distributed Environment-Big data applications

INTRODUCTION TO HADOOP ECO SYSTEM **10 Hours**

Introduction to Hadoop Eco system- Hadoop core components- Hadoop distributions- HDFS- Common Hadoop Shell commands- Processing data with Hadoop- Name Node- Secondary Name Node, and Data Node - Hadoop Map Reduce paradigm- Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

HADOOP ECOSYSTEM COMPONENTS **9 Hours**

Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators, Hive : Hive Shell, Hive Services, Hive Metastore, HiveQL, Tables, Querying Data and User Defined Functions. Base: HBase Concepts, Clients, Example, Zookeeper - Building applications with Zookeeper, Oozie-Workflows of Oozie

RECOMMENDATION SYSTEM **9 Hours**

Collaborative Recommendation- Content Based Recommendation – Knowledge Based Recommendation- Hybrid Recommendation Approaches.

HADOOP SECURITY AND AWS **9 Hours**

Security challenges – Authentication – Authorization – Network encryption – Security enhancement – Introduction to AWS- Running Hadoop on AWS – EMR Hadoop relationship – AWS S3

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Seema Acharya, Subhashini Chellappan, " Big Data and Analytics" Wiley, First Edition, 2015.\
2. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.
3. Chris Eaton, Dirk deroos et al. , "Understanding Big data ", McGraw Hill, 2012.
4. Tom White, "HADOOP: The definitive Guide" , O Reilly 2012.
5. Vignesh Prajapati, "Big Data Analytics with R and Haoop", Packet Publishing 2013.
6. Tom Plunkett, Brian Macdonald et al, "Oracle Big Data Handbook", Oracle Press,2014.
7. Jy Liebowitz, "Big Data and Business analytics",CRC press, 2013.
8. EMC Education Services, "Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", Wiley publishers, 2015.

9. Bart Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, Wiley Publishers, 2015.
10. Dietmar Jannach and Markus Zanker, “Recommender Systems: An Introduction”, Cambridge University Press, 2010.
11. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
12. David Loshin, “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph”, Morgan Kaufmann/Elsevier Publishers, 2013.

E BOOKS AND ONLINE LEARNING MATERIALS

1. https://intellipaat.com/tutorial/hadoop-tutorial/big-data-overview/
2. https://www.guru99.com/learn-oozie-in-5-minutes.html
3. https://www.youtube.com/watch?v=R26Gvoa-Hbc
4. https://www.youtube.com/watch?v=DpgGXN5ubk0
5. https://opensource.com/life/14/8/intro-apache-hadoop-big-data
6. https://www.guru99.com/hive-tutorials.html
7. http://www.bigdatauniversity.com/

ONLINE COURSES AND VIDEO LECTURES

1. http://www.coreservlets.com/hadoop-tutorial/
2. https://oozie.apache.org/docs/3.1.3-incubating/DG_Examples.html
3. https://oozie.apache.org/docs/4.2.0/AG_Install.html
4. https://www.ukdataservice.ac.uk/media/604456/hiveworkshoppractical.pdf
5. https://aws.amazon.com/blogs/big-data/submitting-user-applications-with-spark-submit/

U18CSE0002

DATA VISUALIZATION

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES:

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

- **CO1** Outline the theoretical foundations of information visualization and use it for better understanding of data [K3]
- **CO2** Interpret the information available with network visualization, web based visual displays and maps using appropriate tools [K4, S2]
- **CO3** Examine methods to acquire knowledge to visualize Big data content[K5, S3]

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S				M				M	M		M		M	
CO2		M		S	M				M	M				M	
CO3		M		S	M				M	M				M	

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignment; Group Presentation 3. End Semester Examination
INDIRECT
4. Course-end survey

INTRODUCTION TO INFORMATION VISUALIZATION 9 Hours

Information visualization – Theoretical foundations – Information visualization types – Design principles - A framework for producing data visualization
STATIC DATA VISUALIZATION – tools – working with various data formats

DYNAMIC DATA DISPLAYS 9 Hours

Introduction to web based visual displays – deep visualization – collecting sensor data – visualization – D3 framework - Introduction to Many eyes and bubble charts

9 Hours

MAPS
Introduction to building choropleth maps – Normalization – Classification

9 Hours

TREES
Network visualizations – Displaying behaviour through network graphs

BIG DATA VISUALIZATION **9 Hours**
Visualizations to present and explore big data – visualization of text data and Protein sequences

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Colin Ware and Kaufman M,, Visual thinking for design‖, Morgan Kaufmann Publishers, 2008.
2. Chakrabarti, S, ―Mining the web: Discovering knowledge from hypertext data ―,Morgan Kaufman Publishers, 2003.
3. Fry, Visualizing data, Sebastopo‖,O'Reily, 2007.

U18CSE0003 ARTIFICIAL INTELLIGENCE

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Develop solutions for problems using various Artificial Intelligence concepts. K5,S3

CO2: Design applications using PROLOG for making inferences. K4,S2

CO3: Demonstrate usage of planning and decision making. K3

CO4: Apply the concepts of learning using Tensor Flow and any other programming language. K4,S2

Pre-requisites : U18MAI1202/ Linear Algebra and Calculus, U18MAT3102 / Discrete Mathematics

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	S	M		S	S			S	M		M	M	M	M
CO2	S	S	S		M				M	M		M		M	
CO3	S	M								M		M		M	

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc a. (as applicable) 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION AND PROBLEM SOLVING 9 Hours

Definitions of AI - Intelligent Agents. Problem solving by searching: Problem-solving agents- Example problems – Search for solutions Uninformed search strategies – Informed search strategies – Heuristic functions.

LOGIC **9 Hours**

Logical agents: Knowledge-based agents – The Wumpus world. Logic – Propositional logic: A very simple logic-Propositional theorem proving.

First order logic: Representation – Syntax and semantics of first order logic – Using first order logic-PROLOG basics

Inference in first order logic: Propositional versus first order inference– Unification and lifting – Forward chaining – Backward chaining – Resolution.

PLANNING AND DECISION MAKING **9 Hours**

Classical Planning: Definition – Algorithms for planning as state-space search-Planning graphs – Other classical planning approaches.

Making simple Decisions-Combining beliefs and desires under Uncertainty-Utility theory-Utility functions-Multi attribute utility functions-Decision networks- The value of information-Decision theoretic expert systems.

LEARNING **9 Hours**

Quantifying uncertainty: Acting under uncertainty - Probability basics – Bayes' Rule and its use. Probabilistic reasoning: Representing knowledge in uncertain domain- The semantics of Bayesian networks. Forms of learning - Supervised learning - Learning decision trees. Reinforcement Learning: Passive Learning – Active Learning – Learning an Action-Value function using Q Learning.

ANN AND DEEP LEARNING **9 Hours**

Introduction to artificial neural networks, Perceptrons, Multi-layer feed forward network, Application of ANN - Deep feed forward networks – Convolution Neural networks – Applications-Use of Tensorflow.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Stuart Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", 3rd Edition, Pearson Education / Prentice Hall of India, 2015.
2. Elaine Rich, Kevin Knight, Shivashankar.B.Nair, "Artificial Intelligence", Tata Mc Graw Hill, Third Edition , 2009
3. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000
4. George F. Luger, "Artificial Intelligence-Structures and Strategies For Complex Problem Solving", Pearson Education / PHI, 2002
5. David L. Poole, Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.
6. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", An MIT Press Book, 2016.
7. Li Deng , Dong Yu, "Deep Learning: Methods and Applications", Now Publishers, 2014.

OTHER REFERENCES

1. http://aima.cs.berkeley.edu
2. http://www-formal.stanford.edu/jmc/whatisai/
3. http://nptel.ac.in/courses/106106126/4
4. https://www.coursera.org/specializations/deep-learning#courses
5. https://www.coursera.org/specializations/machine-learning-tensorflow-gcp
6. https://www.deeplearningbook.org/
7. https://medium.freecodecamp.org/an-introduction-to-q-learning-reinforcement-learning-14ac0b4493cc

U18CSE0004 IOT ARCHITECTURE AND PROTOCOLS

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

- **CO1:** Categorize M2M communication and IoT Technology. [K4]
- **CO2:** Examine IoT Reference Architecture and Real World Design Constraints. [K4]
- **CO3:** Make use of appropriate IoT protocols for various applications. [K3]
- **CO4:** Build applications of IoT in real time scenario. [K3]
- **CO5:** Identify the challenges in developing industrial applications. [K3, S2]

Pre-requisite :Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S									M		M			
CO2	S									M		M			
CO3		M								M		M	M		
CO4			M							M		M			M
CO5	S									M		M	M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) 3. End Semester Examination
INDIRECT
4. Course-end survey

THEORY COMPONENT CONTENTS

OVERVIEW **9 Hours**

IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service(XaaS), M2M and IoT Analytics, Knowledge Management

REFERENCE ARCHITECTURE **9 Hours**

IoT Architecture-State of the Art – Introduction, State of the art, Reference Model and architecture, IoT Reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control.

PHYSICAL AND MAC LAYER PROTOCOLS **9 Hours**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN

NETWORK AND APPLICATION LAYER PROTOCOLS **9 Hours**

Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

CASE STUDIES / INDUSTRIAL APPLICATIONS **9 Hours**

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks Reference Model - Smart and Connected Cities: Layered architecture, Smart Lighting, Smart Parking Architecture and Smart Traffic Control

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
2. Peter Waher, “Learning Internet of Things”, PACKT publishing, BIRMINGHAM – MUMBAI
3. Bernd Scholz-Reiter, Florian Michahelles, “Architecting the Internet of Things”, ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
4. Daniel Minoli, “Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications”, ISBN: 978-1-118-47347-4, Willy Publications
5. Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
6. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

ONLINE COURSES AND VIDEO LECTURES

1. https://www.coursera.org/learn/internet-of-things-communication
2. https://www.edx.org/course/iot-networks-and-protocols

U18CSE0005 ADHOC AND SENSOR NETWORKS

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Analyze mobility impact on MAC and routing protocols. [K5][S3]
CO2: Compare and analyze ad hoc network protocol performance.[K5][S3]
CO3: Identify various security threats to ad hoc networks and examine various security solutions. [K3]
CO4: Illustrate the sensor network characteristics, sensor databases and query processing mechanisms. [K3]

Pre-requisite : U18CSI5201/Computer Networks

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
Cos	**PROGRAMME OUTCOMES (Pos)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	S			S				M	M		M			M
CO2	S	S		S	S				M	M		M		M	
CO3	S	M		M						M		M		M	
CO4	S									M		M			

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Case study report, Project Presentation & Report, Assignment; Group Presentation, Poster preparation, etc (as applicable) 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION **9 Hours**

Characteristics of wireless channel - Wireless local loop - IEEE 802.16 standard – HIPERACCESS -Ad hoc wireless networks: Introduction and issues - MAC protocols: Design issues - Goals and classification - MACAW: A media access protocol for wireless LANsDistributed packet reservation multiple access protocol-Distributed priority scheduling and Medium access in Ad hoc networks.

ROUTING PROTOCOLS **10 Hours**

Design issues – Classification – Wireless routing protocol - Location aided routing- Zone routing protocol - Hierarchical state routing protocol - Power aware routing protocol – Operation of multicast routing protocols - Classification of multicast routing protocols – Application-Dependent multicast routing.

SECURITY IN AD HOC NETWORKS **9 Hours**

Security in ad hoc wireless networks – Network security requirements - Issues and challenges in security provisioning – Network security attacks – key management – secure routing in Ad hoc networks.

WIRELESS SENSOR NETWORKS **7 Hours**

Sensors and Actuators -Types of sensors- Multimedia sensors -Architecture - Data dissemination - Date gathering - MAC protocols - Location discovery - Quality of sensor networks - Case study

SENSOR NETWORK DATABASE **10 Hours**

Sensor database challenges – Querying the physical environment – Query interfaces - High level database organization – In-Network aggregation – Temporal data – Emerging Applications

Case Study of Ad Hoc and sensor network applications:

Proficiently analyze ad hoc and sensor network protocols using simulation tool (NS3/SUMO/OPNET..).

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Siva Ram Murthy. C and Manoj B.S, “Ad hoc Wireless Networks: Architectures And Protocols”, Prentice Hall PTR, 2004
2. Toh C.K., “Ad hoc Mobile Wireless Networks: Protocols And Systems”, Prentice Hall PTR, First edition 2001.
3. Mohammad Ilyas, “The Handbook Of Ad hoc Wireless Networks”, CRC press, 2002
4. Charles E. Perkins, “Ad hoc Networking, Addison”, Wesley,2000
5. Stefano Basagni , et al, “Mobile Ad hoc Networking”, Wiley –IEEE press,2004
6. Zhao, Guibas “Wireless Sensor Networks”, ,Morgan Kaufmann Publications,2004

ONLINE COURSES AND VIDEO LECTURES:

1. https://nptel.ac.in/courses/106105160/

U18CSE0006 SOFTWARE DEFINED NETWORKS

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

- **CO1:** Categorize SDN Controllers and the evolution of SDN. [K4]
- **CO2:** Choose the relevant data center for SDN. [K3].
- **CO3:** Make use of SDN solutions in networking scenarios. [K3]
- **CO4:** Experiment with SDN Programming. [K3]
- **CO5:** Develop various applications of SDN. [K3]

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S									M		M			
CO2	S	M								M		M			
CO3		M	M							M		M			M
CO4		M								M		M			
CO5			M							M		M	M		M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Open book test; Cooperative learning report, Assignment; Journal paper review, Group Presentation, Project report, Poster preparation, Prototype or Product Demonstration etc (as applicable) 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION 9 Hours

History of Software Defined Networking (SDN) – Modern Data Center – Traditional Switch Architecture – Why SDN – Evolution of SDN – How SDN Works – Centralized and Distributed Control and Date Planes

OPEN FLOW AND SDN CONTROLLERS 9 Hours

Open Flow Specification – Drawbacks of Open SDN, SDN via APIs, SDN via Hypervisor-Based Overlays – SDN via Opening up the Device – SDN Controllers – General Concepts.

DATA CENTRES **9 Hours**

Multitenant and Virtualized Multitenant Data Center – SDN Solutions for the Data Center Network – VLANs – EVPN – VxLAN – NVGRE

SDN PROGRAMMING **9 Hours**

Programming SDNs: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs – Network Functions Virtualization (NFV) and Software Defined Networks: Concepts, Implementation and Applications

SDN **9 Hours**

Juniper SDN Framework - IETF SDN Framework - Open Daylight Controller - Floodlight Controller - Bandwidth Calendaring - Data Centre Orchestration.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Paul Goransson and Chuck Black, ―Software Defined Networks: A Comprehensive Approach, First Edition, Morgan Kaufmann, 2014.
2. Thomas D. Nadeau, Ken Gray, ―SDN: Software Defined Networks, O'Reilly Media, 2013.
3. Siamak Azodolmolky, ―Software Defined Networking with Open Flow, Packet Publishing, 2013
4. Vivek Tiwari, ―SDN and Open Flow for Beginners‖, Amazon Digital Services, Inc., 2013
5. Fei Hu, Editor, ―Network Innovation through Open Flow and SDN: Principles and Design, CRC Press, 2014.

U18CSE0007 CRYPTOGRAPHY AND NETWORK SECURITY

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

- **CO1:** Analyze various security attacks and select appropriate security mechanisms for designing various security services K4
- **CO2:** Construct cryptographic algorithms from hard problems in mathematics K3
- **CO3:** Identify appropriate algorithms for assuring message integrity and authentication K3
- **CO4:** Discover how cryptographic algorithms are used to build network security protocols K4
- **CO5:** Identify appropriate mechanisms for providing system security K3

Pre-requisite: U18CSI5201-Computer Networks

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	S	M	S					M	M			M	M	S
CO2	S	M													
CO3	S													S	
CO4	S		M												
CO5	S	M							M	M				S	S

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignments / Mini Projects / Group Presentations/ Case Studies, involving analysis of security of any information system / domain, and using security mechanisms to deliver security services 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY CONTENTS

INTRODUCTION **10 Hours**

Security Attacks, Mechanisms and Services, Classical Encryption Techniques – Block Ciphers, DES, Finite Fields and AES, Block Cipher Operation, Stream Cipher – RC4.

PUBLIC KEY CRYPTOGRAPHY **9 Hours**

Introduction to Number Theory, Factorization problem and RSA, Discrete Log problem and Diffie Hellman Key Exchange, Elliptic curve cryptography

HASH FUNCTION AND MESSAGE AUTHENTICATION **9 Hours**

Requirements and Security of Cryptographic Hash Functions, SHA, Message Authentication Requirements – Message Authentication Functions – Requirements and Security of Message Authentication Codes–HMAC, Digital Signatures – NIST Digital Signature Algorithm, Key Management and Distribution

NETWORK SECURITY **9 Hours**

Remote User Authentication Principles, Kerberos –Electronic Mail Security–PGP–S/MIME-IP Security–Transport Layer Security, 802.11 wireless security

SYSTEM LEVEL SECURITY **8 Hours**

Intruders, Intrusion Detection, Password Management, Malicious Software: Types, Viruses and Worms, Countermeasures for Viruses and Worms, DDoS Attacks, Firewalls: Needs, Characteristics, Types, Basing, Location and Configuration of Firewalls

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. William Stallings, "Network Security Essentials: Applications and Standards", Pearson Education India; 4 edition (2011)
2. William Stallings, "Cryptography and Network Security – Principles and Practices", Pearson Education; Seventh edition, 2017
3. AtulKahate, "Cryptography and Network Security", 2nd Edition, Tata McGraw Hill, 2008
4. Bruce Schneier, "Applied Cryptography", JohnWiley& Sons Inc, 2001.
5. Charles P fleeger and Shari Lawrence P fleeger, "Security in Computing", Fourth edition, PearsonEducation,2015.

Online Courses

1. Cryptography I – Stanford University Course by Dan Boneh available at Coursera Link: https://www.coursera.org/learn/crypto or at Stanford Online: https://online.stanford.edu/courses/soe-y0001-cryptography-i
2. Applied Cryptography – Udacity Course by Dave Evans available at: https://in.udacity.com/course/applied-cryptography--cs387
3. Cryptography and Network Security – NPTEL Course by Prof. S. Mukhopadhyay available at https://onlinecourses.nptel.ac.in/noc18_cs07/preview

U18CSE0012 **BLOCKCHAIN TECHNOLOGY AND APPLICATIONS**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1:	Understand emerging abstract models for Blockchain Technology (K2)
CO2:	Discover the secure and efficient transactions with crypto-currencies (K4)
CO3:	Experiment with cryptocurrency trading and crypto exchanges (K3)
CO4:	Develop private blockchain environment and develop a smart contract on ethereum (K3,S2)
CO5:	Build the hyperledger architecture and the consensus mechanism applied in the hyperledger (K5,S2)

Pre-requisite : Nil

CO/PO MAPPING

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M		M						M		M			
CO2	S					M				M		M	M		
CO3	S	M	M		M	M				M		M	M		M
CO4	M	S	S		M							M			
CO5	M	S	S		M							M			

COURSE ASSESSMENT METHODS

DIRECT

1. Continuous Assessment Test I, II
2. Assignment, Project
3. End Semester Examination

INDIRECT

1. Course-end survey

THEORY COMPONENT CONTENTS

BLOCKCHAIN REVOLUTION AND DESIGN PRINCIPLES (10 hours)

Blockchain- An Introduction, Distinction between databases and blockchain, Centralized Registries vs. Distributed Ledgers, Public vs. Private Ledgers, Bitcoin & Blockchain, Blockchain Structure and operations, Consensus Algorithms & Types- Proof of work, proof of stake, Byzantine Fault Tolerance. Distributed networks- Distributed Applications (DApps) – Web 3.0 - DApps Ecosystems. Working - Permissioned and permission-less Blockchain – Cross Chain Technologies. – IOT & Blockchain - Digital Disruption in Industries – Banking, Insurance,

Supply Chain, Governments, IP rights, Creation of trustless Ecosystems – Block chain as a Service – Open Source Block chains.

CRYPTO AND CRYPTOCURRENCIES (8 HOURS)

Crypto Currencies - Anonymity and Pseudonymity in Cryptocurrencies , Cryptographic Hash Functions, Hash Pointers and Data Structures, Digital Signatures, Public Keys as Identities, Centralization vs. Decentralization, Distributed Consensus, Consensus without Identity, Incentives and Proof of work, Regulations on Crypto Currencies & exchanges – Downside of non-regulated currencies – crypto Scams – Exchange hacks.

BITCOIN (9 HOURS)

Bitcoin blockchain, the challenges, and solutions, Bitcoin Scripts, Applications of Bitcoin Scripts, Bitcoin Blocks, The Bitcoin Network, Limitations & Improvements, How to Store and Use Bitcoins, Hot and Cold Storage, Splitting and Sharing Keys, Online Wallets and Exchanges, Payment Services, Transaction Fees, Currency Exchange Markets.

ETHEREUM (9 HOURS)

The Ethereum ecosystem, Smart Contract Basics, Processing and deploying smart contracts in Remix IDE, Solidity: contract classes, Data Types & Statements , operators, Data structures, functions, Inheritance, functions, abstract contracts, libraries, Types & optimization of Ether- Global variables- Debugging, Viewing Information about blocks in Blockchain- Developing smart contract on private Blockchain.

HYPERLEDGER (9 HOURS)

Hyperledger fabric, components of Hyperledger Fabric Technology, Develop Hyperledger Blockchain Applications using Composer Framework, Model the Blockchain Applications using Composer modeling language, Intro: Alternative Decentralized Solutions, Interplanetary File System, Hashgraph.

Theory: 45	Tutorial: 0	Practical: 0	Project: 0	Total: 45 Hours

REFERENCES

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos 2018
2. Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations-2016
3. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

E BOOKS AND ONLINE LEARNING MATERIALS

1. https://www.coursera.org/learn/blockchain-basics#syllabus
2. https://www.coursera.org/learn/cryptocurrency#syllabus
3. https://www.coursera.org/learn/smarter-contracts#syllabus
4. https://www.udemy.com/course/hyperledger

5. https://www.coursera.org/learn/blockchain-platforms
6. https://bitcoinbook.cs.princeton.edu/

U18CSE0008 PRINCIPLES OF COMPILER DESIGN

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Interpret the different phases of the compiler and experiment the scanner using Lex tool (K3).

CO2: Construct various parser and execute the same using tools. (K5).

CO3: Break down the given expression into intermediate code (K4).

CO4: Translate given intermediate code to target code.(K3)

CO5: Identify various types of optimizations that can be applied to an intermediate code (K3)

Pre-requisite:U18CST4003/Theory of Computation

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S		S		S							M	M		
CO2	M	M										M	M		
CO3	S	S										M	M		
CO4												M	M		
CO5	S	S										M	M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignment; Group Presentation 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION **9 Hours**

Introduction: Language Processors- The Structure of a Compiler

Lexical Analysis: The Role of the Lexical Analyzer- Input Buffering- Specification of Tokens- Recognition of Tokens- The Lexical-Analyzer Generator: LEX

SYNTAX ANALYZER **9 Hours** The Role of the Parser- Error-Recovery Strategies- Top Down Parsing- Bottom-Up Parsing: SLR, CLR, LALR- The Parser Generator YACC

INTERMEDIATE CODE GENERATION **9 Hours**
Variants of syntax trees- Three address codes – Types and Declarations – Translation of expression- Type checking - Control flow-Back patching-Switch statements-Intermediate code for procedures

CODE GENERATION **9 Hours**
Issues in the design of code generation – Target language-Addresses in target code- Basic Blocks and Flow Graphs- Optimization of Basic Blocks – A simple Code generator – Peephole optimization

CODE OPTIMIZATION AND RUN-TIME ENVIRONMENTS **9 Hours**
Machine-Independent Optimizations: The Principal Sources of Optimization - Loops in Flow Graphs
Run-Time Environments: Storage organization- Stack allocation space- Access to non-local data on the stack-Heap management
Optimizing for Parallelism-Basic Concepts.

Simple exercises using LEX and YACC tools

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Alfred V. Aho et al “Compilers Principles, Techniques and Tools”, Second Edition, Pearson Education, 2007.
2. Allen I. Holub, “Compiler Design in C”, Prentice Hall of India, 2003.
3. Fischer C.N. and LeBlanc R.J. “Crafting a Compiler with C”, Benjamin Cummings, 2003.
4. Bennet J.P. “Introduction to Compiler Techniques”, Second Edition, Tata McGraw-Hill, 2003.
5. HenkAlblas and Albert Nymeyer, “Practice and Principles of Compiler Building with C”, PHI, 2001.
6. Kenneth C. Louden, “Compiler Construction: Principles and Practice”, Thompson Learning, 2003.

U18CSE0009 **GRAPHICS AND MULTIMEDIA**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1: Illustrate graphics input and output primitives.[K3]
CO2: Construct 2D and 3D geometric transformations on objects.[K5]
CO3: Summarize the graphics modeling process.[K3]
CO4: Apply the techniques of multimedia, compression, communication and authoring.[K3]
CO5: Design a simple application with animation.[K5]

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													CO/PSO Mapping		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S									M		M			
CO2	S	S								M		M			
CO3	S									M		M			
CO4	S									M		M			
CO5	S	S			S	S			M	M	S	M	M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignment 3. Mini Project 4. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

2D PRIMITIVES 9 Hours

Elements of pictures created in Computer Graphics – Graphics input primitives and devices – Output Primitives – Line, Circle and Ellipse drawing Algorithms – Attributes of output primitives

2D GEOMETRIC TRANSFORMATIONS 9 Hours

Two Dimensional Geometric Transformations – 2D Viewing – Window-Viewport Transformations – Line, Polygon, Curve and Text Clipping algorithms – 2D Geometric Transformations-Case study

3D CONCEPTS **9 Hours**

Three Dimensional Object Representation – Polygons, Curved Lines, Splines, Quadric Surfaces - 3D affine transformations - Parallel and perspective projections – Visualization of data sets – Viewing – Visible Surface Identification - Color Models- Case study

MULTIMEDIA BASICS AND 3D MODELLING **9 Hours**

Introduction and Definitions – Applications – Elements – Animations –Definition of Modelling - Surface Modelling- Object cloning-Object Editing-3D Procedural Modelling- Modelling with Polygons-Building Simple scenes-Building complex scenes- Modelling with NURBS

MULTIMEDIA APPLICATION DESIGN **9 Hours**

Types of Multimedia systems - Virtual Reality Design - Components of Multimedia system - Distributed Application Design Issues - Multimedia Authoring and User Interface - Hypermedia Messaging - Distributed Multimedia Systems

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45Hours**

REFERENCES

1. Donald Hearn, M. Pauline Baker, "Computer Graphics", Prentice Hall, 1998
2. Donald Hearn, M. Pauline Baker, "Computer Graphics(C version)" Second edition , Prentice Hall ,2002
3. Donald Hearn, M. Pauline Baker and Warren Caritthers, "Computer Graphics with OpenGL", Fourth edition, Prentice Hall, 2010.
4. Ze-Nian Li and Mark S. Drew, "Fundamentals of Multimedia", First Edition, Pearson Education, 2004.
5. PrabhatK.Andleigh, KiranThakrar ,"Multimedia Systems Design", PHI, 2013.
6. Ralf Steinmetz and Klara, "Multimedia Computing, Communications and Applications", Pearson Education, 2012.
7. F.S. Hill, "Computer Graphics using OpenGL", Third Edition, Pearson Education, 2006.

Tools:

https://en.wikibooks.org/wiki/GIMP
https://docs.gimp.org/2.8/en/gimp-tools.html
https://www-uxsup.csx.cam.ac.uk/pub/doc/suse/suse9.0/userguide-9.0/ch23s02.html
https://en.wikipedia.org/wiki/Hypermedia#Development_tools

Other References:

1. http://ocw.mit.edu/courses/electrical-engineering-and-computerscience/6-837-computer-graphics-fall-2003/
2. https://nptel.ac.in/courses/106106090/

U18CSE0010 **INFORMATION SECURITY**

L	T	P	J	C
3	0	0	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

- **CO1:** Select the appropriate security techniques to prevent and detect security breaches (K3)
- **CO2:** Analyze the threats, attacks and understand legal professional and ethical issues (K4)
- **CO3:** Utilize the Big data security analytics tools to detect security breaches (K3,S2)
- **CO4:** Select the appropriate security technology for risk control (K5)
- **CO5:** Choose the appropriate operational security technologies to prevent security breach (K5)

Pre-requisite: Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	M		M								M	M		
CO2	S		M			M				M		M			
CO3	S	M								M		M		M	M
CO4	M	S										M			
CO5	M	S	S		S	M						M	M		

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II 2. Assignment, Project 3. End Semester Examination
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

SECURITY REQUIREMENTS AND SECURE SDLC **9 Hours**

History - What is Information Security? - CIA requirements- security model - Components of an information system - Securing the components - Balancing security and access - The SDLC - Security in SDLC.

THREATS, ATTACKS AND ISSUES **9 Hours**

Need for security - Business needs - Threats – Attacks – Legal - Ethical and professional issues.

RISK MANAGEMENT BASED SECURITY **9 Hours**

Planning for Security, Risk management: Identifying and assessing risk - Assessing and controlling risk.

SECURITY TECHNOLOGIES **9 Hours**

Security Technology: Access Control, Firewalls, and VPNs, Intrusion Detection and Prevention Systems, Honeypots, Honeynets and Padded Cell Systems, Scanning and Analysis Tools, Introduction to Big Data Security Analytics and Security Breaches

PHYSICAL, PERSONNEL AND OPERATIONAL SECURITY **9 Hours**

Physical Security: Physical Access Controls, Fire Security and Safety, Failure of Supporting Utilities and and Structural Collapse, Interception of Data, Securing Mobile and Portable Systems, Special Considerations, - Security and personnel – Information Security Maintenance- Real time case studies.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. Michael E Whitman and Herbert J Mattord, “Principles of Information Security”, Sixth Edition, Cengage Learning, 2017.
2. Micki Krause, Harold F. Tipton, “Handbook of Information Security Management”, Vol 1-3 CRC Press LLC, 2004.
3. Stuart McClure, et al., “Hacking Exposed”, Tata McGraw- Hill, Sixth edition2009. 4. Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002.

E BOOKS AND ONLINE LEARNING MATERIALS

1. https://www.lovemytool.com/files/vulnerabilities-threats-and-attacks-chapter-one-7.pdf
2. https://www.nisc.go.jp/security-site/campaign/files/aj-sec/handbook-all_eng.pdf

U18CSE0011 **DECLARATIVE DEVELOPMENT OF CUSTOMIZED APPLICATIONS**

L	T	P	J	C
2	0	0	2	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1:	Design and manage the correct data model based on business requirements.
CO2:	Define business logic and configure application security.
CO3:	Visualize the process automation declaratively.
CO4:	Define and Design an appropriate deployment plan.
CO5:	Develop customized applications using Lightning Components.

Pre-requisites : U18CSI3204/Database Management Systems

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak													**CO/PSO MAPPING**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	M		M											M	
CO2		M	M												
CO3					S										
CO4			M		S									M	
CO5			M		M								M		

COURSE ASSESSMENT METHODS

DIRECT
1. Online Assessment 2. Quiz
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION TO DATA MODEL

6+3 Hours

Introduction to Salesforce- Salesforce Architecture-Declarative vs. Programmatic Customizations - Salesforce CRM-Data Modeling-Custom and Standard Objects- Object Relationships- Data Management-Determining an Appropriate Data Model - Building Data Model

BUSINESS LOGIC AND APPLICATION SECURITY 6+3 Hours

Constructing business logic – Salesforce Social Features-Lightning Vs Classic UI- - UI Design Best Practices.-Customization Options- Custom Buttons, Links, and Actions- List Views- Record Types- - Constructing business logic - Formula Fields - Roll-up Summary Fields - Validation Rules - Restricting and Extending Object, Record, and Field Access

AUTOMATING BUSINESS PROCESSES 6+3Hours

Business Value of Process Builder-Workflow Vs Process Builder-Converting Workflow into Process Best Practices-Lightning Process Builder- Workflows and Approvals- Automating Business Processes- Custom Lightning Components

DEPLOYING YOUR APP 6+3Hours

Application Lifecycle Management-Change Management Process- Sandboxes-Application Lifecycle Models- Change Sets - Unmanaged and Managed Packages - Determining an Appropriate Deployment Plan

DESIGNING ADVANCED USER INTERFACE COMPONENTS 6+3 Hours

Declarative Customizations- Limits of Declarative tools - Creating Reports – Report Types – Dashboards – Declarative Options for Incorporating Lightning Components – AppExchange Apps

Theory: 30	**Tutorial: 0**	**Practical: 0**	**Project: 15**	**Total: 60 Hours**
Completion of Project : 15 Hours				

REFERENCES

1. https://www.edureka.co/blog/what-is-salesforce/
2. https://www.j2interactive.com/blog/brief-history-salesforce/
3. https://www.salesforce.com/blog/2017/08/salesforce-forbes-most-innovative-2017.html
4. https://trailhead.salesforce.com/en/academy/classes/dex402-build-platform-apps-using-declarative-development-in-lightning-experience/
5. https://trailhead.salesforce.com/en/users/strailhead/trailmixes/prepare-for-your-salesforce-platform-app-builder-credential
6. https://trailhead.salesforce.com/en/users/dnadimi/trailmixes/dex-402-kick-off
7. https://trailhead.salesforce.com/content/learn/trails/platform-app-builder-certification-prep
8. https://trailhead.salesforce.com/modules/data_security
9. https://trailhead.salesforce.com/modules/reports_dashboards
10. https://trailhead.salesforce.com/modules/lex_customization

U18CSE0013 PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP

L	T	P	J	C
0	0	6	0	3

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS SHOULD BE ABLE TO

CO1:	Upskill in emerging technologies and apply to real industry-level use cases.	K3, S2
CO2:	Understand agile development process.	K2
CO3:	Develop career readiness competencies, Team Skills / Leadership qualities	K2
CO4:	Develop Time management, Project management skills and Communication Skills.	K2
CO5:	Use Critical Thinking for Innovative Problem Solving	K4, S2
CO6:	Develop entrepreneurship skills to independently work on products.	K2

Pre-requisites :Nil

CO/PO MAPPING (S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak												**CO/PSO Mapping**		
COs	**PROGRAMME OUTCOMES (POs)**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	S	M	S	S	S				M			M	S		
CO2	S		M										M		
CO3									S			M			
CO4									M	S	S	S			
CO5	M	M	S	S									S		
CO6			M			S	M	M	S				M		

COURSE ASSESSMENT METHODS

DIRECT
Continuous Project Based Assessment
INDIRECT
Course-end survey

TABLE 1: ACTIVITIES

Activity Name	Activity Description	Time (weeks)
Choosing a Project	Selecting a project from the list of projects categorized various technologies & business domains	2
Team Formation	Students shall form a team of 4 Members before enrolling to a project. Team members shall distribute the project activities among themselves.	1
Hands on Training	Students will be provided with hands-on training on selected technology in which they are going to develop the project.	2
Project Development	Project shall be developed in agile mode. The status of the project shall be updated to the mentors via appropriate platform	6
Code submission, Project Doc and Demo	Project deliverables must include the working code, project document and demonstration video. All the project deliverables are to be uploaded to cloud-based repository such as GitHub.	3
Mentor Review and Approval	Mentor will be reviewing the project deliverables as per the milestone schedule and the feedback will be provided to the team.	1
Evaluation and scoring	Evaluators will be assigned to the team to evaluate the project deliverables, and the scoring will be provided based on the evaluation metrics	1
TOTAL		**16 WEEKS**

Essentially, it involves 15 weeks of learning and doing, and one week for evaluation. The evaluation will be carried out to assess technical and soft skills as given in Table 2.

TABLE 2: EVALUATION SCHEMA

PROFESSIONAL READINESS FOR INNOVATION, EMPLOYABILITY AND ENTREPRENEURSHIP			
Technical Skills		**Soft Skills**	
Criteria	**Weightage**	**Criteria**	**Weightage**
Project Design using Design Thinking	10	Teamwork	5

Innovation & Problem Solving	10	Time Management	10
Requirements Analysis using Critical Thinking	10	Attendance and Punctuality	5
Project Planning using Agile Methodologies	5	Project Documentation	5
Technology Stack (APIs, tools, Platforms)	5	Project Demonstration	5
Coding & Solutioning	15		
User Acceptance Testing	5		
Performance of Product / Application	5		
Technical Training & Assignments	5		
Total	**70**	**Total**	**30**
Total Weightage			**100**
Passing Requirement			**50**
Continuous Assessment Only			

Theory: 0	**Tutorial: 0**	**Practical: 100**	**Project: 0**	**Total: 100 Hours**

Mandatory Courses (MC)

U18CHT4000 **ENVIRONMENTAL SCIENCE AND ENGINEERING**
(Common to All branches) (Mandatory Course)

L	T	P	J	C
3	0	0	0	0

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS WOULD BE ABLE TO

CO 1: Analyze the impact of engineering solutions in a global and societal context.
CO 2: Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems.
CO 3: Highlight the importance of ecosystem and biodiversity.
CO 4: Consider issues of environment and sustainable development in his/her personal and professional undertakings.
CO 5: Paraphrase the importance of conservation of resources.
CO 6: Play an important role in transferring a healthy environment for future generations.

Pre-requisite : Nil

CO/PO Mapping
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes (POs)											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1		M					S		M			
CO 2						M				M		
CO 3							M					
CO 4						M	S					
CO 5							S					
CO 6			W				S					M

COURSE ASSESSMENT METHODS

DIRECT
1. Continuous Assessment Test I, II (Theory component) 2. Assignment 3. Group presentation
INDIRECT
1. Course-end survey

THEORY COMPONENT CONTENTS

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES — 14 Hours

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies – Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and overutilization of surface and ground water, conflicts over water, dams – benefits and problems – Water conservation, rain water harvesting, watershed management.
Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, case studies.
Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources, case studies.
Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification, Wasteland reclamation – Role of an individual in conservation of natural resources.

ECOSYSTEMS AND BIODIVERSITY **9 Hours**

ECOSYSTEM: Concept of an ecosystem – Structure and function of an ecosystem: Producers, consumers and decomposers, Food chain, Food web, Energy flow in the ecosystem and Ecological pyramids – Ecological succession – Introduction, types, characteristic features, structure and function of the (a) Forest ecosystem (b) Grassland ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).
BIODIVERSITY: Introduction to Biodiversity – Definition: genetic, species and ecosystem diversity – Bio geographical classification of India – Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic values – India as a mega-diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

ENVIRONMENTAL POLLUTION **8 Hours**

Definition – Causes, effects and control measures of: (a) Air pollution – Organic and inorganic pollution – cyclone separator, electrostatic precipitator (b) Water pollution (c) Heavy metal pollution (d) Noise pollution (e) Thermal pollution (f) Nuclear hazards – Role of an individual in prevention of pollution – Pollution case studies – Solid waste and hazardous Management: Causes, effects and control measures from factories, small scale and large scale industries – Waste minimization – Disaster management: floods, earthquake, cyclone and landslides.

SOCIAL ISSUES AND THE ENVIRONMENT **7 Hours**

From Unsustainable to Sustainable development – Urban problems related to energy – Resettlement and rehabilitation of people; its problems and concerns, case studies – Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion – Environment Production Act – Air (Prevention and Control of Pollution) Act – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Human Rights.

HUMAN POPULATION AND THE ENVIRONMENT **7 Hours**

Population growth and explosion – Welfare Program – Environment and human health – Communicable disease – Role of Information Technology in Environment and human health – Case studies.

Theory: 45	**Tutorial: 0**	**Practical: 0**	**Project: 0**	**Total: 45 Hours**

REFERENCES

1. G. Tyler Miller and Scott Spoolman, 'Environmental Science', Fourteenth Edition, Brooks Cole, 2012.
2. Gilbert M. Masters and Wendell P. Ela, 'Introduction to Environmental Engineering and Science', Third Edition, Pearson Education, 2013.
3. Bharucha Erach, 'The Biodiversity of India', Mapin Publishing Pvt. Ltd., Ahmedabad, 2002.
4. Trivedi R.K and P.K.Goel, 'Introduction to Air Pollution', Techno-Science Publications, 2003.
5. Trivedi R.K., 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media, 1996.
6. Cunningham, W.P.Cooper and T.H.Gorhani, 'Environmental Encyclopedia', Jaico Publication House, Mumbai, 2001.
7. Wager K.D., 'Environmental Management', W.B. Saunders Co., Philadelphia, USA, 1998.
8. Colin R. Townsend, Michael Begon and John L. Harper, 'Essentials of Ecology', Third Edition, Blackwell Publishing, 2008.

U18INT5000 **CONSTITUTION OF INDIA**
(Mandatory course)

L	T	P	J	C
2	0	0	0	0

COURSE OUTCOMES

AFTER SUCCESSFUL COMPLETION OF THIS COURSE, THE STUDENTS WILL BE ABLE TO:

CO 1: Gain Knowledge about the Constitutional Law of India
CO 2: Understand the Fundamental Rights and Duties of a citizen
CO 3: Apply the concept of Federal structure of Indian Government
CO 4: Analyze the Amendments and Emergency provisions in the Constitution
CO 5: Develop a holistic approach in their life as a Citizen of India

Pre-requisites : NIL

CO/PO MAPPING
(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	PROGRAMME OUTCOMES (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						M			W			S
CO2						S		S				M
CO3									M	S		W
CO4								W	M			M
CO5						M		M				S
CO6												

COURSE ASSESSMENT METHODS

Direct

1. Group Activity / Quiz/ Debate / Case studies
2. Class test / Assignment

Indirect

1. Course End Survey

THEORY COMPONENT CONTENTS:

Module.1: Introduction to Indian Constitution **4 Hours**

Meaning of the constitution law and constitutionalism - Historical perspective of the Constitutio and characteristics of the Constitution of India

Module.2: Fundamental Rights **8 Hours**

Scheme of the fundamental rights - Right to Equality - Fundamental Right under Article 19 - Scope of the Right to Life and Liberty - Fundamental Duties and its legal status - Directive Principles of State Policy – Its importance and implementation

Module.3: Federal Structure **8 Hours**

Federal structure and distribution of legislative and financial powers between the Union and the States - Parliamentary Form of Government in India - The constitutional powers and status of the President of India

Module.4: Amendment to Constitution **6 Hours**

Amendment of the Constitutional Powers and Procedure - The historical perspectives of the constitutional amendments in India

Module.5: Emergency Provisions **4 Hours**

National Emergency, President Rule, Financial Emergency Local Self Government – Constitutional Scheme in India

REFERENCES

1. Constitution of India - Ministry of Law & Justice – PDF format
   awmin.nic.in/coi/coiason29july08.pdf
2. Introduction to the Constitution of India by Durgadas Basu
3. The Constitution of India – Google free material -
www.constitution.org/cons/india/const.html
4. Parliament of India – PDF format
   download.nos.org/srsec317newE/317EL11.pdf
5. The Role of the President of India – By Prof.Balkrishna
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