KPR Institute of Engineering and Technology

Learn Beyond (Autonomous, NAAC "A")

Avinashi Road, Arasur, Coimbatore.

Great Place To Work. Certified MAR 2022 - MAR 2023 INDIA

B.Tech. – Artificial Intelligence and Data Science

Curriculum and Syllabi

Regulations - 2021

I. Vision and Mission of the Institute

Vision

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

Mission

- Commitment to offer value-based education and enhancement of practical skills.
- Continuous assessment of teaching and learning processes through scholarly activities.
- Enriching research and innovation activities in collaboration with industry and institutes of repute.
- Ensuring the academic processes to uphold culture, ethics and social responsibilities.

II. Vision and Mission of the Department

Vision

To be a department with global recognition through innovative teaching process, product development and research excellence in Artificial Intelligence and Data Science.

Mission

The Mission of the Department is to

- Provide the highest quality of teaching and learning opportunities to the students with a well-researched and carefully crafted curriculum.
- Enable the students to develop projects and products in latest technologies related to data science and artificial intelligence with the help of industrial collaboration.
- Develop a top notch research culture by empowering students and faculty in fundamentals and applications of data science and artificial intelligence.
- Educate the students to apply their skills in solving social challenges in an ethical manner.

III. Program Educational Objectives (PEOs)

The Program Educational Objectives (PEOs) of the Artificial Intelligence and Data Science (AD) represent major accomplishments that the graduates are expected to achieve after three to five years of graduation.

PEO 1: Acquire the expertise in artificial intelligence and data science essential for real-time problems.

PEO 2: Have the abilities to establish teams, exhibit leadership traits, and uphold moral principles that are crucial for operating ethically and professionally.

PEO 3: Develop the necessary competencies to become entrepreneurs, data scientists, and business owners in the field of artificial intelligence and data science

PEO 4: Continue to learn technological advancements through higher studies and research.

IV. Program Outcomes (POs)

Graduates of Artificial Intelligence and Data Science will be able to

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

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

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

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

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

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

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

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

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

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

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

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

V. Program Specific Outcomes (PSOs)

Graduates of Artificial Intelligence and Data Science will be able to

PSO1 Integrate the foundations of mathematical, analytical, programming and domain knowledge to build AI enabled systems for solving real world problems.

PSO2 Acquire skills to model the Data Science assisted systems and to analyse the data to solve business related problem.

VI. PEO/PO Mapping

Following three levels of correlation should be used:

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1: Low

2: Medium

3: High

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	3	3	3	3	2	2	2	2	2	3	3	2	3	3
PEO2	3	3	3	3	3	2	3	2	2	3	3	3	3	3
PEO3	3	3	3	3	3	2	2	2	3	3	3	3	3	3
PEO4	3	3	3	3	3	3	2	2	3	3	3	3	3	3

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VII. Mapping of Course Outcomes with Program Outcomes

SEM	Subject	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
SEM I	Calculus and Differential Equations	✓	✓	-	-	-	-	-	-	-	-	-	✓	-	-
	Basics of Electrical and Electronics Engineering	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-	-
	English for Technologist	-	-	-	-	-	-	-	✓	✓	✓	-	✓	-	-
	Engineering Physics	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	-
	Engineering Chemistry	✓	✓	-	-	-	-	✓	-	✓	-	-	✓	-	-
	Problem Solving and C Programming	✓	✓	✓	✓	-	✓	-	✓	✓	✓	-	✓	✓	✓
	Manufacturing Practices	✓	✓	✓	-	✓	-	✓	-	✓	✓	-	✓	-	-
SEM II	Applied Linear Algebra	✓	✓	-	-	-	-	-	-	-	-	-	✓	-	-
	Materials Science	✓	✓	-	-	-	✓	-	-	-	-	-	✓	-	-
	Personality Enhancement	-	-	-	-	-	-	-	✓	✓	✓	-	✓	-	-
	Statistical Analysis	✓	✓	-	-	-	-	-	-	-	-	-	✓	✓	✓
	Python Programming	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓
	Digital Electronics	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	✓	-
	Engineering Graphics	✓	✓	✓	-	✓	-	-	✓	-	✓	-	✓	-	-
SEM III	Probability Theory and Distributions	✓	✓	-	-	-	-	-	-	-	-	-	✓	-	-
	Ethics and Holistic Life	-	-	-	-	-	✓	✓	✓	✓	✓	-	✓	-	-
	Foundations of Data Science	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓
	Programming using Java	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	Data Structures Design	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	✓
	Fundamentals of Artificial Intelligence	✓	✓	✓	-	✓	-	-	-	-	✓	-	✓	✓	✓
	Data Science Laboratory	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓	-	✓

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	Java Lab	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
SEM IV	Discrete Mathematics	✓	✓	-	-	-	-	-	-	-	-	-	✓		
	Machine Learning - Essentials	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Database Design and Management	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Computing Essentials	✓	✓	✓	-	-	-	-	-	-	-	-	-	✓	-
	Networks and Communication	✓	✓	✓	-	✓	-	-	-	✓	✓	-	-	✓	-
	Machine Learning Laboratory	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	✓
	Database Laboratory	✓	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓	✓	✓
	Soft Skills – I	-	-	-	-	-	-	-	-	✓	✓	-	✓	-	-
SEM V	Deep Learning Principles and Practices	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	-
	Application Development	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Internet of Things and It's Applications	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓
	Deep Learning Laboratory	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	Soft Skills – II	-	-	-	-	-	-	-	-	✓	✓	-	-	-	-
SEM VI	Computer Vision and Image Processing	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Big Data Management	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	-	✓
	Generative AI	✓	✓	✓	✓	✓	-	-	-	-	-	-	-	-	✓
	Computer Vision and Image Processing Laboratory	✓	✓	✓	-	-	-	-	-	✓	✓	-	✓	✓	✓
	Soft Skills – III	-	-	-	-	-	-	-	✓	✓	✓	-	✓	-	-
SEM VII	Software Project Management	✓	✓	✓	✓	✓	-	✓	-	✓	✓	✓	✓	-	-
	Information Security	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	-	-
	Ethics of Artificial Intelligence	✓	✓	✓	-	✓	-	-	✓	-	-	-	✓	-	-
	Information Security Laboratory	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	-	-

	Project Work Phase – I	-	-	-	-	-	✓	✓	✓	✓	✓	✓	✓		-
SEM VII	Project Work Phase – II	-	-	-	-	-	✓	✓	✓	✓	✓	✓	✓	✓	-
VER I	Mathematical foundation for Data Science	✓	✓	✓	✓	✓	-	-	-	✓	-	-	✓	✓	✓
	Pattern Recognition	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	✓
	Speech Processing and Analytics	✓	✓	✓	-	-	✓	-	-	-	-	-	-	✓	✓
	Web Mining	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	-	✓
	Exploratory Data Analysis and Visualization	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓
	Predictive Analytics	✓	✓	✓	-	-	-	-	-	-	-	-	-	✓	✓
	Time Series Analysis and Forecasting	✓	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓
	Health Care Analytics	✓	✓	✓	-	✓	-	-	-	-	-	-	-	✓	✓
VER II	Knowledge Engineering	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	-
	Soft Computing	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	-
	Deep Neural Networks	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	✓
	Reinforcement Learning	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	✓
	Computer Vision	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	✓
	Feature Engineering	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	✓
	Object Detection & Facial Recognition	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	✓
	Text And Visual Analytics	✓	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	✓
VER III	Foundations of Cloud Computing	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	Data Storage and Management in Cloud	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Virtualization Techniques	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	Security and Privacy in Cloud	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	Data Analysis in Cloud Computing	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓
	Edge Computing	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	✓

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	Cloud Service Management	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	Big Data Integration and Processing	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
VER IV	Parallel and Distributed Computing	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	-	-
	Mobile Computing	✓	✓	-	-	-	-	-	-	-	-	-	✓	-	-
	Wireless Sensor Networks	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	-	-
	Software Defined Networks	✓	✓	✓	✓	✓	-	-	✓	-	-	-	✓	-	-
	Cyber Security	✓	✓	-	✓	✓	✓	-	-	-	-	-	✓	-	-
	Internet Security	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	-	-
	Ethical Hacking	✓	✓	✓	✓	✓	✓	-	✓	-	-	-	✓	-	-
	Digital Forensics	✓	✓	-	✓	✓	✓	-	✓	-	-	-	-	-	-
VER V	UI / UX Design	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓	-
	Python Web Development	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	App Development	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	JavaScript frameworks	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	Webservices and API Design	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	SOA and Microservices	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	Cloud Native Applications Development	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	Devops	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
VER VI	Next Generation Networks	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	-	-
	Game Development	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓	-
	Blockchain Technologies	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	-	-
	Augmented Reality /Virtual Reality	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	-	-
	Quantum Computing	✓	✓	✓	✓	✓	✓	-	✓	-	-	-	✓	-	-
	Graphics Processing Unit	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	-	-

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	Agile Methodologies	✓	✓	✓	✓	✓	✓	-	✓	✓	-	-	✓	-	-
	Software Testing Tools and Techniques	✓	✓	✓	✓	✓	✓	-	✓	-	-	-	✓	-	-
VER VII	Introduction to Innovation, IP Management and Entrepreneurship	✓	✓	-	✓	-	-	-	✓	-	-	✓	✓	-	-
	IT Project Management	✓	✓	-	-	-	-	-	-	✓	✓	✓	✓	-	-
	E – Business Management	✓	✓	✓	✓	✓	✓	-	✓	-	-	✓	✓	-	-
	Recommender Systems	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	-	-
	Industrial Psychology	✓	✓	-	✓	-	✓	-	-	-	-	✓	✓	-	-
	Marketing Research and Marketing Management	✓	✓	-	✓	-	✓	-	-	-	-	✓	✓	-	-
	Human Resource Management	✓	✓	-	✓	-	✓	-	-	-	-	✓	✓	-	-
	Financial Management	✓	✓	-	✓	✓	-	-	-	-	-	✓	✓	-	-

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B.TECH. ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

REGULATIONS – 2021

For the students admitted 2021 onwards

CHOICE BASED CREDIT SYSTEM

CURRICULUM FOR I - VIII SEMESTERS

SEMESTER I

Sl.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21MA101	Calculus and Differential Equations	BSC	3	1	0	0	4
2	U21EEG01	Basics of Electrical and Electronics Engineering	ESC	3	0	0	0	3
	THEORY COURSE WITH LABORATORY COMPONENT							
3	U21EN101	English for Technologists	HSMC	1	0	2	0	2
4	U21PH101	Engineering Physics	BSC	2	0	2	0	3
5	U21CY101	Engineering Chemistry	BSC	2	0	2	0	3
6	U21CSG01	Problem Solving and C Programming	ESC	2	0	2	0	3
	LABORATORY COURSES							
7	U21MEG02	Manufacturing Practices	ESC	0	0	4	0	2
	MANDATORY NON CREDIT COURSES							
8	U21MYC01	Induction program	MNC	Three Weeks				
			TOTAL	**13**	**1**	**12**	**0**	**20**

SEMESTER II

Sl.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21MA204	Applied Linear Algebra	BSC	3	0	0	0	3
2	U21PH201	Materials Science	BSC	2	0	0	0	2
	THEORY COURSE WITH LABORATORY COMPONENT							
3	U21EN201	Personality Enhancement	HSMC	1	0	2	0	2
4	U21MA205	Statistical Analysis	BSC	3	0	2	0	4
5	U21CSG02	Python Programming	ESC	2	0	2	0	3
6	U21ECG01	Digital Electronics	ESC	2	0	2	0	3
	LABORATORY COURSES							
7	U21MEG01	Engineering Graphics	ESC	0	0	4	0	2
	MANDATORY NON CREDIT COURSES							
8	U21MYC02	Environmental Sciences	MNC	1	0	0	0	0
			TOTAL	**14**	**0**	**12**	**0**	**19**

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SEMESTER III

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21MA301	Probability Theory and Distributions	BSC	3	1	0	0	4
2	U21AD301	Ethics and Holistic Life	HSMC	3	0	0	0	3
3	U21AD302	Foundations of Data Science	PCC	3	0	0	0	3
4	U21AD303	Programming using Java	PCC	3	0	0	0	3
	THEORY COURSE WITH LABORATORY COMPONENT							
5	U21AD304	Data Structures Design	PCC	2	0	2	0	3
6	U21AD305	Fundamentals of Artificial Intelligence	PCC	3	0	2	0	4
	LABORATORY COURSES / LABORATORY COURSE WITH PROJECT COMPONENT							
7	U21AD306	Data Science Laboratory	PCC	0	0	2	2	2
8	U21AD307	Java Laboratory	PCC	0	0	2	0	1
	MANDATORY NON CREDIT COURSES							
9	U21MYC03	Essence of Indian Traditional Knowledge	MNC	1	0	0	0	0
			TOTAL	18	1	8	2	23

SEMESTER IV

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21MAG02	Discrete Mathematics	BSC	3	1	0	0	4
2	U21AD401	Machine Learning - Essentials	PCC	3	0	0	0	3
3	U21AD402	Database Design and Management	PCC	3	0	0	0	3
4	U21AD403	Computing Essentials	ESC	3	0	0	0	3
5		Open Elective - I	OEC	3	0	0	0	3
	THEORY COURSE WITH LABORATORY COMPONENT							
6	U21AD404	Networks and Communication	ESC	2	0	2	0	3
	LABORATORY COURSES / LABORATORY COURSE WITH PROJECT COMPONENT							
7	U21AD405	Machine Learning Laboratory	PCC	0	0	2	2	2
8	U21AD406	Database Laboratory	PCC	0	0	2	2	2
9	U21SSG01	Soft Skills - I	HSMC	0	0	2	0	1
	MANDATORY NON CREDIT COURSES							
10	U21MYC04	Indian Constitution	MNC	1	0	0	0	0
			TOTAL	18	1	8	4	24

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SEMESTER V

Sl.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21AD501	Deep Learning Principles and Practices	PCC	3	1	0	0	4
2		Professional Elective - I	PEC	3	0	0	0	3
3		Professional Elective - II	PEC	3	0	0	0	3
4		Open Elective - II	OEC	3	0	0	0	3
	THEORY COURSE WITH LABORATORY COMPONENT / THEORY COURSE WITH PROJECT COMPONENT							
5	U21AD502	Application Development	PCC	3	0	2	0	4
6	U21ECG04	Internet of Things and It's Applications	PCC	2	0	2	0	3
	LABORATORY COURSES / LABORATORY COURSE WITH PROJECT COMPONENT							
7	U21AD503	Deep Learning Laboratory	PCC	0	0	2	2	2
8	U21SSG02	Soft Skills - II	HSMC	0	0	2	0	1
	MANDATORY NON CREDIT COURSES							
9	U21MYC05	Cyber Security Essentials	MNC	1	0	0	0	0
			TOTAL	18	1	8	2	23

SEMESTER VI

Sl.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21AD601	Computer Vision and Image Processing	PCC	3	0	0	0	3
2	U21AD602	Big Data Management	PCC	3	0	0	0	3
3		Professional Elective - III	PEC	3	0	0	0	3
4		Professional Elective - IV	PEC	3	0	0	0	3
5		Open Elective - III	OEC	3	0	0	0	3
	THEORY COURSE WITH LABORATORY COMPONENT							
6	U21AD603	Generative AI	PCC	3	0	2	0	4
	LABORATORY COURSES / LABORATORY COURSE WITH PROJECT COMPONENT							
7	U21AD604	Computer Vision and Image Processing Laboratory	PCC	0	0	2	2	2
8	U21SSG03	Soft Skills - III	HSMC	0	0	2	0	1
	MANDATORY NON CREDIT COURSES							
9	U21MYC06	Introduction to UNSDGs: An Integrative Approach	MNC	1	0	0	0	0
			TOTAL	19	0	6	2	22

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SEMESTER VII

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21IT701	Software Project Management	HSMC	3	0	0	0	3
2	U21ITG02	Information Security	PCC	3	0	0	0	3
3	U21AD701	Ethics of Artificial Intelligence	PCC	3	0	0	0	3
4		Professional Elective – V	PEC	3	0	0	0	3
5		Professional Elective - VI	PEC	3	0	0	0	3
6		Open Elective - IV	OEC	3	0	0	0	3
	LABORATORY COURSES / LABORATORY COURSE WITH PROJECT COMPONENT							
7	U21ITG03	Information Security Laboratory	PCC	0	0	4	0	2
8	U21AD702	Project Work Phase - I	EEC	0	0	0	4	2
			TOTAL	18	0	4	4	22

SEMESTER VIII

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21AD801	Project work Phase - II	EEC	0	0	0	20	10
			TOTAL	0	0	0	20	10

INDUSTRIAL TRAINING / INTERNSHIP

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21ADI01	Industrial Training / Internship *	EEC	0	0	0	0	2
			TOTAL	0	0	0	0	2

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

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NCC CREDIT COURSES:

Sl.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21NCC01	National Cadet Corps I	-	1	0	2	0	2
2	U21NCC02	National Cadet Corps II	-	1	0	2	0	2
3	U21NCC03	National Cadet Corps III	-	1	0	2	0	2
4	U21NCC04	National Cadet Corps IV	-	2	0	2	0	3
5	U21NCC05	National Cadet Corps V	-	1	0	2	0	2
6	U21NCC06	National Cadet Corps VI	-	2	0	2	0	3
				8	-	6	-	14

NCC Credit Course (Level 1 – Level 6) are offered for NCC students only. The grades earned by the students will be recorded in the mark sheet, however the same shall not be considered for the computation of CGPA.

TOTAL CREDITS: 165

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I Computational Analytics	Vertical II Artificial Intelligence and Machine Learning	Vertical III Cloud Computing and Data Storage Technologies	Vertical IV Networking and Cyber Security	Vertical V Full stack Development	Vertical VI IT and IT Enabled Services (ITeS)	Vertical VII Management and Marketing
Mathematical foundation for Data Science	Knowledge Engineering	Foundations of Cloud Computing	Parallel and Distributed Computing	UI / UX Design	Next Generation Networks	Introduction to Innovation, IP Management and Entrepreneurship
Pattern Recognition	Soft Computing	Data Storage and Management in Cloud	Mobile Computing	Python Web Development	Game Development	IT Project Management
Speech Processing and Analytics	Deep Neural Networks	Virtualization Techniques	Wireless Sensor Networks	App Development	Blockchain Technologies	E – Business Management
Web Mining	Reinforcement Learning	Security and Privacy in Cloud	Software Defined Networks	JavaScript frameworks	Augmented Reality /Virtual Reality	Recommender Systems
Exploratory Data Analysis and Visualization	Computer Vision	Data Analysis in Cloud Computing	Cyber Security	Webservices and API Design	Quantum Computing	Industrial Psychology
Predictive Analytics	Feature Engineering	Edge Computing	Internet Security	SOA and Microservices	Graphics Processing Unit	Marketing Research and Marketing Management
Time Series Analysis and Forecasting	Object Detection & Face Recognition	Cloud Service Management	Ethical Hacking	Cloud Native Applications Development	Agile Methodologies	Human Resource Management
Health Care Analytics	Text And Visual Analytics	Big Data Integration and Processing	Digital Forensics	Devops	Software Testing Tools and Techniques	Financial Management

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VERTICAL 1: COMPUTATIONAL ANALYTICS

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21ADP01	Mathematical foundation for Data Science	PEC	3	0	0	0	3
2	U21ADP02	Pattern Recognition	PEC	3	0	0	0	3
3	U21ADP03	Speech Processing and Analytics	PEC	3	0	0	0	3
4	U21ADP04	Web Mining	PEC	3	0	0	0	3
5	U21ADP05	Exploratory Data Analysis and Visualization	PEC	3	0	0	0	3
6	U21ADP06	Predictive Analytics	PEC	3	0	0	0	3
7	U21ADP07	Time series Analysis and Forecasting	PEC	3	0	0	0	3
8	U21ADP08	Health care Analytics	PEC	3	0	0	0	3

VERTICAL 2: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21AMP01	Knowledge Engineering	PEC	3	0	0	0	3
2	U21AMP02	Soft Computing	PEC	3	0	0	0	3
3	U21AMP03	Deep Neural Networks	PEC	3	0	0	0	3
4	U21AMP04	Reinforcement Learning	PEC	3	0	0	0	3
5	U21AMP05	Computer Vision	PEC	3	0	0	0	3
6	U21AMP06	Feature Engineering	PEC	3	0	0	0	3
7	U21AMP07	Object Detection & Face Recognition	PEC	3	0	0	0	3
8	U21AMP08	Text And Visual Analytics	PEC	3	0	0	0	3

VERTICAL 3: CLOUD COMPUTING AND DATA STORAGE TECHNOLOGIES

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CSP01	Foundations of Cloud Computing	PEC	3	0	0	0	3
2	U21CSP02	Data Storage and Management in Cloud	PEC	3	0	0	0	3
3	U21CSP03	Virtualization Techniques	PEC	3	0	0	0	3
4	U21CSP04	Security and Privacy in Cloud	PEC	3	0	0	0	3
5	U21CSP05	Data Analysis in Cloud Computing	PEC	3	0	0	0	3
6	U21CSP06	Edge Computing	PEC	3	0	0	0	3
7	U21CSP07	Cloud Service Management	PEC	3	0	0	0	3

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8	U21CSP08	Big Data Integration and Processing	PEC	3	0	0	0	3

VERTICAL 4: NETWORKING AND CYBER SECURITY

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21ITP01	Parallel and Distributed Computing	PEC	3	0	0	0	3
2	U21ITP02	Mobile Computing	PEC	3	0	0	0	3
3	U21ITP03	Wireless Sensor Networks	PEC	3	0	0	0	3
4	U21ITP04	Software Defined Networks	PEC	3	0	0	0	3
5	U21ITP05	Cyber Security	PEC	3	0	0	0	3
6	U21ITP06	Internet Security	PEC	3	0	0	0	3
7	U21ITP07	Ethical Hacking	PEC	3	0	0	0	3
8	U21ITP08	Digital Forensics	PEC	3	0	0	0	3

VERTICAL 5: FULL STACK DEVELOPMENT

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CSP09	UI / UX Design	PEC	3	0	0	0	3
2	U21CSP10	Python Web Development	PEC	3	0	0	0	3
3	U21CSP11	App Development	PEC	3	0	0	0	3
4	U21CSP12	JavaScript frameworks	PEC	3	0	0	0	3
5	U21CSP13	Webservices and API Design	PEC	3	0	0	0	3
6	U21CSP14	SOA and Microservices	PEC	3	0	0	0	3
7	U21CSP15	Cloud Native Applications Development	PEC	3	0	0	0	3
8	U21CSP16	Devops	PEC	3	0	0	0	3

VERTICAL 6: IT and IT ENABLED SERVICES (ITeS)

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21ITP09	Next Generation Networks	PEC	3	0	0	0	3
2	U21ITP10	Game Development	PEC	3	0	0	0	3
3	U21ITP11	Blockchain Technologies	PEC	3	0	0	0	3
4	U21ITP12	Augmented Reality /Virtual Reality	PEC	3	0	0	0	3
5	U21ITP13	Quantum Computing	PEC	3	0	0	0	3
6	U21ITP14	Graphics Processing Unit	PEC	3	0	0	0	3

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7	U21ITP15	Agile Methodologies	PEC	3	0	0	0	3
8	U21ITP16	Software Testing Tools and Techniques	PEC	3	0	0	0	3

VERTICAL 7: MANAGEMENT AND MARKETING

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CBP01	Introduction to Innovation, IP Management and Entrepreneurship	PEC	3	0	0	0	3
2	U21CBP02	IT Project Management	PEC	3	0	0	0	3
3	U21CBP03	E – Business Management	PEC	3	0	0	0	3
4	U21CBP04	Recommender Systems	PEC	3	0	0	0	3
5	U21CBP05	Industrial Psychology	PEC	3	0	0	0	3
6	U21CBP06	Marketing Research and Marketing Management	PEC	3	0	0	0	3
7	U21CBP07	Human Resource Management	PEC	3	0	0	0	3
8	U21CBP08	Financial Management	PEC	3	0	0	0	3

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OPEN ELECTIVES

(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories).

OPEN ELECTIVES – I (SEMESTER: IV)

SI.NO.	COURSE CODE	COURSETITLE	CATEGORY	L	T	P	J	C
1	U21ADX01	Data Visualization and Its Applications	OEC	3	0	0	0	3
2	U21ADX02	Fundamentals of Machine Learning	OEC	3	0	0	0	3

OPEN ELECTIVES – II (SEMESTER: V)

SI.NO.	COURSE CODE	COURSETITLE	CATEGORY	L	T	P	J	C
1	U21ADX03	Artificial Intelligence: Principles and Techniques	OEC	3	0	0	0	3
2	U21ADX04	Ethics and Data Science	OEC	3	0	0	0	3

OPEN ELECTIVES – III (SEMESTER: VI)

SI.NO.	COURSE CODE	COURSETITLE	CATEGORY	L	T	P	J	C
1	U21ADX05	Foundations of Data Analytics	OEC	3	0	0	0	3

OPEN ELECTIVES – IV (SEMESTER: VII)

SI.NO.	COURSE CODE	COURSETITLE	CATEGORY	L	T	P	J	C
1	U21ADX06	Introduction to Big Data	OEC	3	0	0	0	3
2	U21ADX07	Data Mining: Concepts and Techniques	OEC	3	0	0	0	3

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Scheme of Credit distribution – Summary

S.No	Stream	Credits/Semester								Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	Humanities and Social Sciences including Management (HSMC)	2	2	3	1	1	1	3	-	13
2.	Basic Science Courses (BSC)	10	9	4	4	-	-	-	-	27
3.	Engineering Science Courses (ESC)	8	8	-	6	-	-	-	-	22
4.	Professional Core Courses (PCC)	-	-	16	10	13	12	8	-	59
5.	Professional Elective Courses (PEC)	-	-	-	-	6	6	6	-	18
6.	Open Elective Courses (OEC)	-	-	-	3	3	3	3	-	12
7.	Employability Enhancement Courses (EEC)	-	-	-	-	-	-	2	10	12
8.	Industrial Training/ Internship	-	-	-	-	-	-	-	2	2
9.	Mandatory Non-Credit Course (MNC)	-	-	-	-	-	-	-	-	-
Total		**20**	**19**	**23**	**24**	**23**	**22**	**22**	**12**	**165**

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SEMESTER I

		Category: BSC				
U21MA101	CALCULUS AND DIFFERENTIAL EQUATIONS (Common to AD, BM, CE, CH, CS, CS(AIML), EC, IT, ME, MI)	L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1: Apply the knowledge of matrices with the concepts of eigenvalues to study their problems in core areas (Apply)

CO2: Apply the basic techniques and theorems of functions of several variables in other areas of mathematics (Apply)

CO3: Analyze the triple integrals techniques over a region in two dimensional and three dimensional geometry (Apply)

CO4: Apply basic concepts of integration to evaluate line, surface and volume integrals (Apply)

CO5: Solve basic application problems described by second and higher order linear differential equations with constant coefficients (Understand)

CO-PO MAPPING:

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

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

SYLLABUS:

UNIT I MATRICES **9 + 3**

Eigenvalues and eigenvectors – Properties (without proof) – Cayley Hamilton theorem (without proof) – Diagonalization using orthogonal transformation – Applications

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

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

UNIT III MULTIPLE INTEGRALS **9 + 3**

Double integrals – Change of order of integration – Triple integrals – Applications in area and volume

UNIT IV LINE AND SURFACE INTEGRALS **9 + 3**

Line integrals – Surface integrals – Green's theorem in a plane – Gauss divergence theorem – Stokes' theorem (excluding proofs)

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

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

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project: – Periods

Total: 60 Periods

TEXT BOOKS:

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

REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER I

		Category: ESC				
U21EEG01	**BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING** (Common to AD, AM,BM,CB, CS and IT)	**L**	**T**	**P**	**J**	**C**
		3	**0**	**0**	**0**	**3**

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To solve an electric network by applying basic laws
- To acquire the knowledge of operating principle, characteristics, starting, methods of DC and AC Machines
- To acquire the knowledge of construction, operating principle, characteristics of semiconductor devices and its applications

COURSE OUTCOMES:

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

CO1: Solve an electric network by applying basic laws (Apply)

CO2: Acquire the knowledge of operating principles, characteristics, starting, and speed control methods of DC motors (Understand)

CO3: Explain the operating principles of AC motor and characteristics, starting methods of induction motor (Understand)

CO4: Summarize the construction, principle and characteristics of semiconductor devices (Understand)

CO5: Interpret the applications of semiconductor devices (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I BASIC CONCEPTS OF ELECTRIC CIRCUITS 9

Active elements – Passive elements – Sources – Elements in series and parallel connections – Star and delta conversion – Ohm's law and Kirchhoff's laws – Mesh and Nodal analysis in DC Networks

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UNIT II DC MOTOR 9

DC motor – Construction, principle of operation, types, torque equation, characteristics and applications – Starters for DC motor: Two point – Three point – Speed control – Armature and field control (Qualitative Analysis only)

UNIT III TRANSFORMER AND AC MOTOR 9

Single phase transformer – Three phase induction motor – Construction, principle of operation, characteristics and applications – Starters – DOL, Star–delta. (Qualitative Analysis only).

UNIT IV SEMICONDUCTOR DEVICES 9

Construction, operation and characteristics: PN Junction, Zener Diode – BJT – FET

UNIT V APPLICATIONS OF SEMICONDUCTOR DEVICES 9

Rectifier– Half wave, Full wave – Filters – Voltage regulator – Series and shunt – CE, CB and CC Configuration

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", McGraw–Hill Education, New Delhi, 5th edition, Jul 2017.
2. R.K.Rajput, "Electrical Machines", Laxmi Publications, 6th edition, Jan 2016.
3. V.K Metha and Rohit Metha, "Principles of Electronics", S.Chand Publications, 12th edition, 2020.

REFERENCES:

1. J William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw–Hill Education, New Delhi, 8th edition, Aug 2013.
2. S.K. Bhattacharya, "Electrical Machines", McGraw–Hill Education, New Delhi, 4th edition, July 2017.
3. R.S..Sedha, "A text book of Applied Electronics", S.Chand Publications, Revised edition, Jul 2017.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER I

U21EN101	ENGLISH FOR TECHNOLOGISTS Common to AD, BM, CH, CE, CS, CS(AIML), EE, EC, ME, MI, IT	Category: HSMC					
		L	T	P	J	C	
		1	0	2	0	2	

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To infer and interpret the meaning of Technical, Business, Social and Academic contexts
- To enhance the listening skills and facilitate effective pronunciation
- To make effective presentation and conversation in technical and professional environment

COURSE OUTCOMES:

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

CO1: Comprehend language and learn strategies for error-free communication (Understand)

CO2: Improve speaking skills in academic and social contexts (Apply)

CO3: Enhance both reading and writing skills to excel in professional career (Analyse)

CO4: Evaluate different perspectives on a topic (Analyse)

CO5: Develop listening skills to understand complex business communication in a variety of global English accents through Personality Development (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I SUBJECTIVE INTROSPECTION 9

Module:1 Vocabulary Building

Activity: Word Puzzles, Snappy words, Word Sleuthing

Module:2 Introducing and Sharing Information

Activity: Get to know oneself, Introducing Peer Members

Module:3 Opinion Paragraph

Activity: Note making, analyzing and writing a review

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UNIT II CAREER ENHANCEMENT 9

Module:4 Reading Comprehension

Activity: Reading Newspaper articles/Blogs, Sentence completion

Module:5E-mail Communication

Activity: Drafting personal and professional emails

Module:6 Career Profiling

Activity: Resume Writing & Digital Profiling

UNIT III LANGUAGE ADEPTNESS 9

Module:7 Rewriting passages

Activity: Conversion of voices & Rephrasing Articles

Module:8 Enhancing Pronunciation skills

Activity: Listening to short technical Reels and reproducing it

Module:9 Making Conversations

Activity: Role play & Narrating Incidents

UNIT IV TECHNICAL WRITING 9

Module:10 Spotting Errors

Activity: Proof reading, Rewriting sentences

Module:11 Data interpretation

Activity: Interpretation of Graphics/Charts/Graphs

Module:12 Expository Writing

Activity: Picture inference, Captions for Posters& Products

UNIT V LANGUAGE UPSKILLING 9

Module:13 Listening for Specific Information

Activity: TED talks/Announcement/Documentaries

Module:14 Presentation

Activity: Extempore & Persuasive Speech

Module:15 Team Communication

Activity: Team building activities, Group Discussion

LIST OF EXERCISES

1. Introducing oneself
2. Role play
3. Listening to short technical Reels
4. Listening to TED Talks/ Announcements/ Documentaries
5. Presentation
6. Group Discussion

Contact Periods:

Lecture: 15 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 45 Periods

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TEXT BOOKS:

1. Ashraf Rizvi, "Effective Technical Communication", 2nd edition, Mc Graw – Hill. India 2017.
2. Rod Ellis, "English for Engineers & Technologists", Vol. II: (English for Engineers and Technologist: A Skills Approach). 2nd edition, Orient Black Swan, 1990.

REFERENCES:

1. Raymond Murphy, "Intermediate English Grammar", 2nd edition, Cambridge University Press, 2009.
2. Thomas L Means, "English and Communication for Colleges", 4th edition, Cengage 2017.
3. Using English: "A Coursebook for Undergraduate Engineers and Technologists", 1st edition, Orient Black Swan, 2017.

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th>End Semester Examinations</th></tr>
<tr><td colspan="2">Assessment I
(Theory)
(100 Marks)</td><td colspan="2">Assessment II
(Practical)
(100 Marks)</td><td rowspan="3">Practical Examinations

(Examinations will be conducted for 100 Marks)</td></tr>
<tr><td>Individual Assignment / Seminar / MCQ</td><td>Written Test</td><td>Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)</td><td>Test</td></tr>
<tr><td>40</td><td>60</td><td>75</td><td>25</td></tr>
<tr><td colspan="2">25</td><td colspan="2">25</td><td>50</td></tr>
<tr><td colspan="4">50</td><td>50</td></tr>
<tr><td colspan="5">Total: 100</td></tr>
</table>

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SEMESTER I

U21PH101	ENGINEERING PHYSICS (Common to all branches)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the fundamental principles of laser and fibre optics with their applications
- To acquire the knowledge of ultrasonic waves, thermal conductivity and properties of liquids
- To understand the concepts of crystals

COURSE OUTCOMES:

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

CO1: Demonstrate the types of laser for various industrial and medical applications (Understand)

CO2: Apply the concepts of fibre optics in engineering (Understand)

CO3: Understand the production methods of ultrasonic waves and uses in engineering and medicine (Understand)

CO4: Apply the concepts of thermal conductivity in hybrid vehicles and viscosity of liquids in engineering applications (Understand)

CO5: Explain the basic concepts of crystals and its growth techniques (Understand)

CO-PO MAPPING:

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

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

SYLLABUS:

UNIT I LASER 6

Laser characteristics – Spontaneous and stimulated emission – Pumping methods – CO_2 laser – Semiconductor laser – Material Processing – Selective laser Sintering – Hologram – Medical applications (Opthalmology)

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UNIT II FIBER OPTICS 6

Total internal reflection – Numerical aperture and acceptance angle – Classification of optical fibers (Materials, modes and refractive index profile) – Fiber optical communication system – Displacement and temperature sensor – Medical Endoscopy

UNIT III ULTRASONICS 6

Properties of ultrasonic waves – Piezoelecrtic generator – Acoustic grating – Applications of ultrasonics in industry – SONAR – NDT – Ultrasonic scanning methods – Fetal heart movement

UNIT IV THERMAL PHYSICS AND PROPERTIES OF FLUIDS 6

Modes of heat transfer – Thermal conductivity – Lee's disc method – Solar thermal power generation – Hybrid vehicles – Microwave oven – Surface tension and coefficient of viscosity – Poiseuille's flow experiment

UNIT V CRYSTAL PHYSICS 6

Unit cell – Bravais lattices – SC, BCC, FCC structures – Miller indices – D spacing in cubic lattice – Crystal growth from melt: Bridgeman Technique – Silicon ingots from Czochralski method – Silicon wafers from ingots and its applications.

LIST OF EXPERIMENTS

1. Determination of the wavelength of a given laser source
2. Determination of acceptance angle and numerical aperture of an optical fibre
3. Determination of velocity of sound and compressibility of a liquid using Ultrasonic interferometer
4. Determination of thermal conductivity of a bad conductor using Lee's disc method
5. Determination of viscosity of the given liquid using Poiseuille's flow method

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 60 Periods

TEXT BOOKS:

1. Bhattacharya D K and Poonam Tandon, "Engineering Physics", 2nd edition, Oxford University Press, Chennai, 2017
2. Marikani A, "Engineering Physics", 3rd edition, PHI publishers, Chennai, 2021

REFERENCES:

1. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", 2nd edition, Pearson India Education Services Private Limited, Chennai, 2018
2. Avadhanulu M N, Kshirsagar P G and Arun Murthy TVS, "A Text book of Engineering Physics", 2nd Edition, S Chand Publishing, New delhi, 2018
3. Thyagaran K, Ajoy Ghatak, "Lasers – Fundamantals and Applications", 2nd edition, Laxmi Publications Pvt Limited, New delhi, 2019
4. https://nptel.ac.in/downloads/104104085/
5. https://nptel.ac.in/courses/122107035/8/

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EVALUATION PATTERN:

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*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.

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SEMESTER I

U21CY101	ENGINEERING CHEMISTRY (Common to all BE./B.Tech. courses)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To inculcate the fundamentals of water technology and electrochemistry
- To gain basic knowledge of corrosion of metals and alloys
- To acquire knowledge about the properties of fuels and applications of polymers

COURSE OUTCOMES:

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

CO1: Apply the principles of water technology in treatment of industrial and domestic water and estimate the various constituents of industrial water (Apply)

CO2: Describe the principles and applications of electrochemical cells, fuel cells and solar cells (Understand)

CO3: Outline the different types of corrosion processes and preventive methods adopted in industries (Understand)

CO4: Explain the analysis and calorific value of different types of fuels (Understand)

CO5: Classify the polymers and their engineering applications (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I CHARACTERISTICS OF WATER AND ITS TREATMENT 6

Characteristics of water – Hardness – Types, Dissolved oxygen, Total dissolved solids, Disadvantages due to hard water in industries – (Scale, Sludge, Priming, Foaming and Caustic embrittlement), Water softening methods – Lime-soda, Zeolite, Ion exchange processes and reverse Osmosis and their applications. Specifications of domestic water (ICMR and WHO).

Water treatment for municipal supply – Sedimentation with coagulant – Sand Filtration – Chlorination, Disinfection methods – UV treatment, Ozonolysis, Electro dialysis

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UNIT II ELECTROCHEMISTRY AND ENERGY STORAGE SYSTEMS 6

Introduction, Electrodes – (Calomel electrode), Electrochemical series and its applications, Brief introduction to conventional primary and secondary batteries – (Pb acid, Lithium)

Fuel cells – Polymer membrane fuel cells, Solid-oxide fuel cells – Working principles, advantages, applications. Solar cells – Dye sensitized solar cells – Working principles, characteristics and applications

UNIT III CORROSION AND ITS CONTROL 6

Types – Dry – Chemical corrosion and Wet – Galvanic and differential aeration (Pitting, Crevice, pipeline) – Factors influencing rate of corrosion – Corrosion control methods – Sacrificial anode and impressed current method – Protective coating – Electroplating – Ni plating.

Alloys – Ferrous (stainless steel), Heat treatment – Non-ferrous alloys (Brass -Dutch metal, German Silver) – Composition, properties and uses

UNIT IV FUELS AND COMBUSTION 6

Fuels- Solid fuel: Coal - Analysis of coal (Proximate analysis only) – Liquid fuel – Manufacture of synthetic petrol (Bergius process) – Octane number, cetane number, Knocking in engines- Anti-knocking agents, Gasoline additives, Gaseous fuel: Compressed natural gas (CNG) – Liquefied petroleum gases (LPG) – Composition only.

Calorific value – Higher and lower calorific values – Flue gas analysis (ORSAT method). Measurement of calorific value using bomb calorimeter, Three-way catalytic converter – Selective catalytic reduction of NO_x

UNIT V POLYMERS 6

Introduction – Monomer, dimers, functionality, degree of polymerisation, transition glass temperature Classification of polymers, Difference between thermoplastics and thermosetting plastics, Engineering application of plastics – ABS, PVC, PTFE and Bakelite.

Types of compounding of plastics – Moulding, Injection moulding, Extrusion moulding, Compression moulding

Conducting polymers – Polypyrrole, Polyacetylene, Polyaniline – Structure and applications, Composites – FRP – Properties and applications

LIST OF EXPERIMENTS

1. Determination of total, permanent and temporary hardness of a given sample water by EDTA method
2. Estimation of ferrous ion by potentiometric titration
3. Estimation of Copper in Brass by EDTA method
4. Determination of percentage of moisture, volatile, ash and carbon content in a given sample of coal.
5. Determination of molecular weight and degree of polymerization of an oil sample by viscosity measurement (Ostwald's viscometer).
6. Determination of chloride content in the water sample
7. Determination of strength of HCl by pH metric method

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 60 Periods

TEXT BOOKS:

1. Jain P C and Monika Jain, "Engineering Chemistry", 16th edition, Dhanpat Rai Publishing Company, Pvt. Ltd., New Delhi, 2015
2. Vairam S, Kalyani P and Suba Ramesh, "Engineering Chemistry", 2nd edition, Wiley India Pvt. Ltd, New Delhi, 2014

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REFERENCES:

1. Friedrich Emich, "Engineering Chemistry", 2nd edition, Scientific International Pvt. Ltd, New Delhi, 2014
2. Prasanta Rath, "Engineering Chemistry", 1st edition, Cengage Learning India, Pvt. Ltd, Delhi, 2015
3. Shikha Agarwal, "Engineering Chemistry, Fundamentals and Applications", 1st edition, Cambridge University Press, 2015
4. https://nptel.ac.in/courses/113/104/113104008/

EVALUATION PATTERN:

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SEMESTER I

U21CSG01	PROBLEM SOLVING AND C PROGRAMMING (Common to All Branches)	Category: ESC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To provide exposure to problem-solving through programming
- To develop computational thinking perspective of one's own discipline
- To write, compile and debug programs using C language

COURSE OUTCOMES:

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

CO1: Formulate the algorithmic solutions for a given computational problem (Understand)

CO2: Describe modularization, structures and pointers in C language (Understand)

CO3: Design and implement algorithms for a given problem using C control structures (Apply)

CO4: Apply the C programming constructs for searching and sorting techniques (Apply)

CO5: Solve real time problems using suitable non-primitive data structures in C (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I COMPUTATIONAL THINKING 6

Computational Thinking – Modern Computer – Information based Problem solving – Real world information and Computable Data – Data types and data encoding – Number Systems – Introduction to programming languages – Basics of C programming – Variables– Data types – Keywords – C program structure – Simple programs in C

UNIT II ALGORITHMIC APPROACH 6

Logic – Boolean Logic – Applications of Propositional logic – Problem Definition – Logical Reasoning and Algorithmic thinking – Pseudo code and Flow chart – Constituents of algorithms – Sequence, Selection and Repetition – Problem understanding and analysis – Control structures in C – Algorithm design and implementation using control structures

UNIT III SEARCHING, SORTING, AND MODULARIZATION 6

Data Organization – Arrays – Introduction to Searching and Sorting – Linear Search, Binary Search – Basic sorting techniques – Two-dimensional arrays – Matrix manipulation – Modularization – Functions – Function prototype – Function definition – Function call – Built-in functions (string functions and math functions) – Recursion

UNIT IV STRUCTURES AND POINTERS 6

Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program – Sorting of names – Parameter passing – Pass by value – Pass by reference – Structure – Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Unions

UNIT V FILES 6

Files – Types of file processing – Sequential access – Random access – Sequential access file – Example Program – Finding average of numbers stored in sequential access file – Random access file – Example Program – Transaction processing using random access files – Command line arguments

LIST OF EXPERIMENTS

A. Lab Programs

1. Using IO Statements, get higher secondary marks of a student. Calculate and display the medical and engineering cut-off marks. [Assume the calculation formula]
2. Develop a C program to emulate the operations of an ATM using control structures. Authentication, Deposit, Withdrawal, and Balance check and pin change operations are to be supported.
3. Develop a calculator to perform the operations including addition, subtraction, multiplication, division and square of a number.
4. Given different prices of a vegetable which is varying through the day (from morning to evening), find out the best buy price and sell price for the maximum profit. Eg. For the prices [33, 35, 28, 36, 39, 25, 22, 31], best buy is at 28 and best sell is at 39.
5. Collect height and weight of 4 of your friends and calculate their body mass index. Use 2 dimensional array to store the values.
6. Weights of 10 students of your class who are standing in a line is given in a random order. Find out if there is a heavy person whose weight is the sum of previous two persons.
7. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
8. From a given paragraph perform the following using built-in functions:
    a) Find the total number of words.
    b) Capitalize the first word of each sentence.
9. Solve Towers of Hanoi using recursion.
10. Develop an expense manager which reads date, product, price and product category. The program should display the total expense amount based on product category or date as per user's selection. Use structures.
11. Develop a banking application to store details of accounts in a file. Count the number of account holders based on a search condition such as - whose balance is less than the minimum balance.

B. Mini Project (SAMPLE)

Create a Railway Reservation system with the following modules of Booking,

- Availability checking
- Cancellation
- Prepare chart

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 60 Periods

TEXT BOOKS:

1. David D. Railey and Kenny A.Hunt , "Computational Thinking for Modern problem Solver", 1st Edition, CRC Press, 2014
2. Brian W. Kernighan and Dennis Ritchie, " The C Programming Language" , 2nd Edition, Pearson, 2015

REFERENCES:

1. Paolo Ferragina and Fabrizio Luccio, "Computational Thinking First Algorithms, Then Code" ,1st Edition, Springer International Publishing, 2018
2. Reema Thareja, "Programming in C", 2nd Edition, Oxford University Press, 2016
3. Paul Deitel and Harvey Deitel, "C How to Program", 7th Edition, Pearson Publication
4. Juneja, B. L and Anita Seth, "Programming in C",1st Edition, Cengage Learning India Pvt. Ltd., 2011
5. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 1st Edition, Oxford University Press, 2009

EVALUATION PATTERN:

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SEMESTER I

U21MEG02	MANUFACTURING PRACTICES	Category: ESC				
		L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To provide exposure on workshop tools and additive manufacturing processes
- To provide hands on training experiences in sheet metal, carpentry welding and plumbing operations
- To provide hands on experience on soldering and simple electrical circuit wiring

COURSE OUTCOMES:

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

CO1: Identify the various tools and measuring equipment used for assembly and dismantling practice (Apply)

CO2: Develop simple components using 3D printer (Apply)

CO3: Fabricate products using sheet metal and carpentry (Apply)

CO4: Perform operations such as welding and plumbing (Apply)

CO5: Connect and test the electrical and electronics components for the given circuit diagram (Apply)

CO PO Mapping:

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

SYLLABUS:

UNIT I PRODUCT WORKSHOP **12**

Disassemble the product of sub assembly – Measure various dimensions using measuring instruments. Free hand rough sketch of the assembly and components – Name of the components and indicate the various materials used – Study the functioning of the assembly and parts – Study the assembly and components design for compactness – Processing – Ease of assembly and disassembly – Assemble the product or subassembly

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UNIT II ADDITIVE MANUFACTURING WORKSHOP 12

Study of 3 axis 3D printing machine – Methods of 3D printing – SLA and FDM methods – Pre – processing – Geometry creation – Support generation and slicing – Post Processing – Requirement and Techniques Support Removal – Sanding – Acetone treatment – Polishing

UNIT III SHEET METAL AND CARPENTRY WORKSHOP 12

Study of tools and equipment – Draw development drawing of simple objects on sheet metal (cone – Cylinder – Pyramid – Prism – Tray etc.) – Fabrication of components using small shearing and bending machines – Riveting practice – Study of carpentry process – Fabrication of wood joints like Lap – Tee – Dovetail and mortise & tenon joint

UNIT IV WELDING AND PLUMBING WORKSHOP 12

Study of tools and equipment – Study of various welding – Arc welding practice – Fitting – Square butt joint and lap joint – Plumbing tools – Make a piping joint to a simple piping layout (should include cutting – Threading and pipe fixing)

UNIT V ELECTRICAL AND ELECTRONICS ENGINEERING WORKSHOP 12

Study of tools and equipment – Study of basic electrical components and symbols – Simple Wiring – Staircase Wiring – Fluorescent wiring – Study of soldering tools and methods of soldering

Contact Periods:

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

LIST OF EXPERIMENTS

1. Study on measuring instruments used in workshop practices.
2. Dismantling, measuring and reassembling of centrifugal pump.
3. 3D prototyping of simple components using FDM method.
4. 3D Printing of simple geometric shapes using SLA printer.
5. Fabrication of sheet metal tray and funnel.
6. Fabrication of wood joints.
7. Preparation of MS plate for Lap, butt and Tee joints using arc welding
8. Installation of water lines for washbasin and showers faucets.
9. Preparation of wiring for tube light, staircase and electric fan.
10. Soldering of a simple circuit consists of THC and SMD components.

TEXT BOOKS:

1. Hajra Choudhury, "Elements of Mechanical Engineering", 11th edition, Media Promoters, 2010.
2. S.K. Hajra Choudhury, A.K. Hajra Choudhury, Nirjhar Roy the Elements of Workshop Technology – Vol I & II, 11th edition, Media Promoters and Publishers, Mumbai, 2001

REFERENCES:

1. Workshop manual prepared by Department of Mechanical Engineering

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EVALUATION PATTERN:

Continuous Internal Assessments		**End Semester Examinations**
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
60		40
100		

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SEMESTER II

		Category: BSC				
U21MA204	APPLIED LINEAR ALGEBRA (Common to AD, CS(AIML))	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge of decomposition of matrices
- To understand postulates of vector spaces and linear transformations
- To understand concepts of eigenvalues and eigenvectors of a matrix and inner product spaces

COURSE OUTCOMES:

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

CO1: Apply the concepts of the linear system of equations to solve core engineering problems (Apply)

CO2: Analyze the basic properties of vector spaces and subspaces and find basis and dimension of a vector space (Understand)

CO3: Compute linear transformations, kernel and range, and inverse linear transformations and find matrices of general linear transformations (Understand)

CO4: Compute inner products on a real vector space and compute angle and orthogonality in inner product spaces to solve application problems (Understand)

CO5: Find the eigen values and eigen vectors of the linear transformations for the simple real life problems (Understand)

CO-PO MAPPING:

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

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

SYLLABUS:

UNIT I LINEAR SYSTEMS **9**

Geometric interpretation of linear system in 2 and 3 unknowns – Row reduction and echelon forms – Vector equation – Matrix equation Ax=b-LU decomposition – Applications of linear systems

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UNIT II VECTOR SPACES 9

Vector spaces and subspaces – Linear combination, Span, linear independence and dependence – Null space, column space, and row space – Basis and dimension of a vector space – Rank and nullity – Applications to electrical network

UNIT III LINEAR TRANSFORMATION 9

General linear transformations – Kernel and range – Matrices of general linear transformation – Geometry linear operators – Change of basis

UNIT IV INNER PRODUCT SPACES 9

Inner product, length, angle and orthogonality – Orthogonal sets – Orthogonal projections – Inner product spaces – Orthonormal basis: Gram-Schmidt process

UNIT V EIGENVALUES AND EIGENVECTORS 9

Eigenvalues and eigenvectors – Singular value decomposition – Eigenvalues and linear transformations – Linear discrete dynamical systems – Direct Method

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Howard Anton and Chris Rorres, "Elementary Linear Algebra", 11th edition, John Wiley & Sons Inc, 2011.
2. David C. Lay, "Linear Algebra and its Applications", 5th edition, Pearson Education, 2015.

REFERENCES:

1. Gilbert Strang, "Linear Algebra and its Applications", 4th edition, Cengage India Pvt. Ltd., 2005.
2. Steven J. Leon, "Linear Algebra with Applications", 9th edition, Pearson College Division, 2014.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER II

U21PH201	MATERIALS SCIENCE (Common to all branches except BME)	Category: BSC				
		L	T	P	J	C
		2	0	0	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To gain the knowledge of conducting and semiconducting materials
- To understand the concepts of magnetic, dielectric and optical properties of materials
- To enhance the knowledge of new engineering materials

COURSE OUTCOMES:

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

CO1: Demonstrate the electrical characteristics of conducting materials (Understand)

CO2: Interpret the properties and types of semiconducting materials (Understand)

CO3: Compare various types of magnetic materials for engineering applications (Understand)

CO4: Explain the fundamental concepts of dielectric and optical materials (Understand)

CO5: Examine new engineering materials for industrial applications (Understand)

CO-PO MAPPING:

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

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

SYLLABUS:

UNIT I CONDUCTING MATERIALS 6

Classical free electron theory – Expression for electrical conductivity and thermal conductivity – Wiedemann – Franz law – Drawbacks – Fermi distribution function – Density of energy states in metals

UNIT II SEMICONDUCTING MATERIALS 6

Intrinsic and Extrinsic semiconductor – Carrier concentration in n-type semiconductor – P-type semiconductor(qualitative) – Applications of semiconductors – Solar cell – LED – Hall effect and its experimental determination

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UNIT III MAGNETIC MATERIALS 6

Origin of magnetism – Dia, para and ferro magnetic materials – Domain theory – Soft and hard magnetic materials – Magnetic bubble memories – GMR sensor

UNIT IV DIELECTRIC AND OPTICAL MATERIALS 6

Dielectrics – Types of polarisation – Electronic polarisation – Dielectric breakdown – Ferroelectrics – Applications of dielectrics – Classification of optical materials – Nonlinear optics – Applications

UNIT V NEW ENGINEERNG MATERIALS AND CHARACTERIZATION TECHNIQUES 6

SMA – SiC – GaN – Rheological materials – Nanomaterials – Synthesis (Ball milling and CVD) – Quantum dot, quantum wire and quantum well(qualitative) – Characterisation techniques – Powder XRD(qualitative) – SEM

Contact Periods:

Lecture: 30 Periods Tutorial: - Periods Practical: - Periods Project: - Periods

Total: 30 Periods

TEXT BOOKS:

1. Wahab M A, "Solid State Physics: Structure and Properties of Materials", 3rd edition, Narosa Publishing House, Chennai, 2018
2. Marikani A, "Materials Science", 1st edition, PHI publishers, Chennai, 2017

REFERENCES:

1. Pillai S O "Solid State Physics", 9th edition, New Age International Publishers, New Delhi, 2020
2. Bangwei Zhang, "Physical Fundamentals of Nanomaterials", Chemical Industry Press, China, 2018
3. Joginder Singh Galsin, "Solid State Physics – An Introduction to Theory", Academic Press, India, 2019
4. https://nptel.ac.in/courses/108/108/108108122/
5. https://nptel.ac.in/courses/113/105/113105081/

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
Individual Assignment / Seminar / Mini Project / MCQ	Written Test	Individual Assignment / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER II

U21EN201	PERSONALITY ENHANCEMENT (Common to AD, BM, CH , CE, CS, CS(AIML),EE,EC,ME,MI,IT)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop of personality traits that contributes in the professional environment
- To create a basic awareness about the significance of soft skills in professional and interpersonal communications
- To enhance the level of self-confidence that helps to excel in the leadership skills

COURSE OUTCOMES:

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

CO1: Nurture a deep understanding of personality development and interpersonal relationship for overall self-development (Understand)

CO2: Communicate proficiently in high-end interviews and in all social situations (Understand)

CO3: Synthesize complex concepts and present them in speech and writing (Analyse)

CO4: Negotiate and lead teams towards success (Understand)

CO5: Present ideas in an effective manner using web tools (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I LEXICAL REASONING 9

Module:1 Establishing Associations

Activity: Verbal Analogy, Logical Reasoning

Module:2 Lateral Thinking

Activity: Reasoning and Assertions

Module:3 Sentence Completion

Activity: Cloze Test, Single Word Substitutes

UNIT II SOCIAL CORRESPONDENCE 9

Module:4 Etiquettes

Activity: Brain storming & performing in actions

Module:5 Introspection

Activity: SWOT Analysis, Goal Setting

Module:6 Co-verbal Gesture

Activity: Body Language, Non verbal cues

UNIT III ART OF NETWORKING 9

Module:7 Addressing a Multitude

Activity: Welcome address, Vote of Thanks, Public Speaking

Module:8Persuasive Communication

Activity: Making Technical Presentation

Module:9 Career Oriented Communication

Activity: Face to face Conversation, Mock Interview

UNIT IV CRITICAL THINKING 9

Module:10 Organizing ideas

Activity: Mind Mapping

Module:11 Problem Solving Skills

Activity: Conflict management, Case Study

Module:12 Critical Review

Activity: Book/ Movie Review, Comparative Analysis

UNIT V CONTENT WRITING 9

Module:13 Reports

Activity: Writing Event Report, Project Report

Module:14 Writing for Digital platform

Activity: Writing Posts, Blogs

Module:15 Developing Content

Activity: Product Description, Writing Proposals

LIST OF EXERCISES

1.Listening to Inspirational Speech

2.Listening to Product Description

3.Book/Movie Review

4.Presentation

5.Mock Interview

6.Public Speaking

Contact Periods:

Lecture: 15 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 45 Periods

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TEXT BOOKS:

1. Meenakshi Raman & Sangeetha Sharma. "Professional English: for AKTU",1st edition, Oxford University Press. 2018.
2. Barun. K.Mitra. "Personality Development and Soft Skills", OUP India. 2nd edition, 2016.

REFERENCES:

1. Mathew Allen. "Smart Thinking: Skills for Critical Understanding and Writing", 2nd edition,OUP India, 2016.
2. Means, Thomas L, "English and Communication for Colleges", 4th edition, Cengage 2017
3. Using English: "A Coursebook for Undergraduate Engineers and Technologists", 1st edition,Orient Black Swan, 2017

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th>End Semester Examinations</th></tr>
<tr><td colspan="2">Assessment I
(Theory)
(100 Marks)</td><td colspan="2">Assessment II
(Practical)
(100 Marks)</td><td rowspan="3">Practical Examinations
(Examinations will be conducted for 100 Marks)</td></tr>
<tr><td>Individual Assignment / Seminar / MCQ</td><td>Written Test</td><td>Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)</td><td>Test</td></tr>
<tr><td>40</td><td>60</td><td>75</td><td>25</td></tr>
<tr><td colspan="2">25</td><td colspan="2">25</td><td>50</td></tr>
<tr><td colspan="4">50</td><td>50</td></tr>
<tr><td colspan="5">Total: 100</td></tr>
</table>

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SEMESTER II

U21MA205	STASTICAL ANALYSIS (for AD)	Category: BSC				
		L	T	P	J	C
		3	0	2	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of statistics in the field of engineering and technology
- To understand the concepts of testing of hypothesis for small and large samples
- To understand design of experiments in the field of engineering and technology

COURSE OUTCOMES:

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

CO1: Analyse statistical information given in descriptive form and interpret the data with the appropriate graphs (Understand)

CO2: Apply various sampling methods to solve core engineering problems (Apply)

CO3: Formulate and test a hypothesis, using critical values to draw conclusions and determining probability of making errors in hypothesis tests (Apply)

CO4: Analyse the correlation and regression techniques and explore variable relationships (Understand)

CO5: Compute and interpret the results of real time applications by performing ANOVA and F test (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I DESCRIPTIVE STATISTICS **9**

Overview of probability distribution – Frequency distribution – Bar graphs and Pie charts – Histogram – Ogive – Measures of central tenancy – Measures of variability

UNIT II SAMPLING **9**

Sample mean and variance – Sampling distributions – Statistical estimation of parameters, confidence intervals – Applications to statistical quality control and reliability analysis

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UNIT III TESTING OF HYPOTHESIS 9

Large sample test for single mean – Small sample test: t, F distributions – Tests for goodness of fit

UNIT IV CORRELATION AND REGRESSION 9

Estimation using the regression line – Correlation analysis – Limitations, errors, and caveats of using regression and correlation analyses

UNIT V DESIGN OF EXPERIMENTS 9

Analysis of variance – Completely randomized design, randomized block design

LIST OF EXPERIMENTS

1. Frequency Distribution
2. Graphical Representation of Data
3. Measures of central Tendency
4. Measures of Dispersion
5. Small Sample test – Single mean – t-test
6. Small Sample test – Difference of Mean – t-test
7. Small Sample test – Difference of Mean with Paired – t-test
8. Correlation, Rank correlation, Regression
9. One way ANOVA
10. Two way ANOVA

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 75 Periods

TEXT BOOKS:

1. Ronald E. Walpole, Raymond H. Meyers and Sharon L. Meyers, "Probability and Statistics for Engineers and Scientists", 9th edition, Pearson Education, 2013.
2. Jay L. Devore, "Probability and Statistics for Engineering and Sciences", 9th edition, Cengage India Pvt. Ltd., 2020.

REFERENCES:

1. Sheldon M.Ross, "Introduction to Probability Models", 12th edition, Elsevier, 2019.
2. Douglas C Montgomery and George C Runger, "Applied Statistics and Probability for Engineers", 6th edition, John Wiley & Sons, 2016.
3. Trivedi K.S., "Probability and Statistics with Reliability, Queuing and Computer Science Applications", 2nd edition, John Wiley & Sons, 2015.

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		**Assessment II (Practical) (100 Marks)**		**Theory Examinations (Examinations will be conducted for 100 Marks)**	**Practical Examinations (Examinations will be conducted for 100 Marks)**
Individual Assignment / Seminar / MCQ	Written Test	Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test		
40	**60**	**75**	**25**		
25		**25**		**35**	**15**
50				**50**	
Total: 100					

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SEMESTER II

U21CSG02	PYTHON PROGRAMMING (Common to All Branches)	Category: ESC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand syntax and semantics of python programming
- To implement programs using python data structures
- To gain expertise in using python libraries for solving real time problems

COURSE OUTCOMES:

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

CO1: Describe the basic operations of tokens in python (Understand)

CO2: Demonstrate the programs using control statements (Apply)

CO3: Develop programs using python data structures (Apply)

CO4: Implement the exceptions in file-handling concepts (Apply)

CO5: Apply the python libraries in real-world problems (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I LANGUAGE BASICS **6**

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

UNIT II CONTROL STATEMENTS, FUNCTIONS, AND MODULES **6**

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

UNIT III PYTHON DATA STRUCTURES 6

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

UNIT IV EXCEPTION AND FILE HANDLING 6

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

UNIT V NUMPY and PANDAS 6

Numpy – Introduction – Computations using NumPy functions – Computation on Arrays – Aggregation – Indexing and Sorting – Pandas – Introduction and Basic Pandas Concepts – Data frames – Data Handling

LIST OF EXPERIMENTS

1. Programs on selection and Iteration operations.
2. Get an integer input from a user. If the number is odd, then find the factorial of a number and find the number of digits in the factorial of the number. If the number is even, then check the given number is palindrome or not.
3. Strings and its operations.
4. Given two strings, PRINT (YES or NO) whether the second string can be obtained from the first by deletion of none, one or more characters.
5. List and its operations.
6. Programs for positive and negative indexing.
7. Program to check if the given list is in Ascending order or Not.
8. Tuples and its operations.
9. Python program to convert a tuple to a string.
10. Python program to reverse a tuple.
11. Sets and its operations.
12. Python program to check if a set is a subset of another set.
13. Dictionaries and its operations.
14. Python program to iterate over dictionaries using for loops.
15. Computations using NumPy functions.
16. NumPy program to convert a list of numeric value into a one-dimensional NumPy array.
17. NumPy program to convert a list and tuple into arrays.
18. Data manipulations using Pandas.
19. Program to convert a NumPy array and series to data frames.
20. Program to add, subtract, multiple and divide two Pandas Series.
21. Program to retrieve and manipulate data using dataframes.

Contact Periods:

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

TEXT BOOKS:

1. Reema Thareja, "Python programming: Using problem solving approach", 1st Edition, Oxford Press, 2017
2. William McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, Shroff/O'Reilly Publication, 2017

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REFERENCES:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. Ashok Namdev Kamthane and Amit Ashok Kamthane, "Programming and Problem Solving with Python", 2nd Edition, McGrawHill Education, 2018
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach",1st Edition, Pearson India Education Services Pvt. Ltd., 2016
4. https://python-iitk.vlabs.ac.in/List%20of%20experiments.html
5. http://greenteapress.com/wp/think-python/

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th colspan="2">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I
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(100 Marks)</th><th colspan="2">Assessment II
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(100 Marks)</th><th rowspan="2">Theory Examinations
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<tr><td colspan="4">50</td><td colspan="2">50</td></tr>
<tr><td colspan="6">Total: 100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER II

		Category: ESC				
		L	T	P	J	C
U21ECG01	DIGITAL ELECTRONICS (Common to EC, BM, CS, CSBS , AI & ML , IT and AD : For CS, CSBS , AI & ML , IT and AD, It is offered during II Semester and For EC and BM, It is offered during III Semester)	2	0	2	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the fundamentals of digital logic circuits
- To design the combinational logic circuits
- To design the synchronous and asynchronous sequential circuits

COURSE OUTCOMES:

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

CO1: Apply various reduction methods to simplify logic expressions (Apply)
CO2: Implement the combinational logic circuits using gates (Apply)
CO3: Examine the performances of latches and flip-flops (Analyze)
CO4: Construct sequential logic circuits using flip-flops (Apply)
CO5: Design hazard free circuit for asynchronous sequential circuit (Analyze)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I BOOLEAN THEOREMS AND LOGIC REDUCTION **6**

Number system – Complements – Boolean theorems – Codes – Logic gates – NAND and NOR gates – Representation of boolean expression – SOP, POS, canonical form – Simplification of logic functions using K-map, Quine McCluskey method

UNIT II COMBINATIONAL LOGIC DESIGN **6**

Adder-1 Bit adder/subtractor, parallel adder, 2's complement adder/subtractor – Implementation of combinational circuits – Multiplexers, decoders, encoders, demultiplexers – Code converters – Error detection and correction codes – Parity generator and checker

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UNIT III LATCHES AND FLIPFLOPS 6

Latches – NOR, NAND – Digital pulses – Clocked flip-flops – Master/Slave flip-flop – Asynchronous inputs – Flip-flop timing considerations – Conversion of flip-flop

UNIT IV SEQUENTIAL CIRCUITS 6

General model of sequential circuits – Mealy/Moore models, excitation table, state table, state diagram – Design of synchronous sequential circuits – Synchronous up/down counters, modulus counters – Asynchronous counter – Sequence detector

UNIT V REGISTERS AND HAZARDS 6

Shift registers – Ring counter, Johnson counter – Hazards and Essential Hazards in logic circuits – Design of Hazard free circuits

LIST OF EXPERIMENTS (INDICATIVE)

1. Characteristics of digital IC's
2. Implementation of combinational logic design using MUX IC's
3. Design and implementation of various data path elements (Adder/Subtractor)
4. Characteristics of flip-flop
5. Design and implementation of synchronous sequential circuit (Counters/ Shift registers)
6. Design and implementation of asynchronous mod counters

Contact Periods:

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

TEXT BOOKS:

1. M.Morris Mano, Michael D Ciletti, "Digital Design", 6th edition, Pearson, 2018
2. Charles H. Roth, Jr, Larry L. Kinney" Fundamentals of logic design",7th edition, Kluwer Academic Publishers,2014

REFERENCES:

1. Thomas L.Floyd, "Digital Fundamentals", 11th edition, Prentice Hall, 2015
2. A.Anand Kumar, "Fundamentals of Digital Circuits", 2nd edition, PHI Learning, 2013
3. Ronald J Tocci, Neal S Widmer, Gregory L Moss, "Digital Systems Principles and Applications", 10th edition, Pearson, 2009
4. D. Donald Givone, "Digital Principles and Design", 4th edition, Tata McGraw Hill, 2008

EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		Assessment II (Practical) (100 Marks)		Theory Examinations (Examinations will be conducted for 100 Marks)	Practical Examinations (Examinations will be conducted for 100 Marks)
Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test		
40	60	75	25		
25		25		25	25
50				50	
Total: 100					

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SEMESTER II

U21MEG01	ENGINEERING GRAPHICS	Category: ESC				
		L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To expose the standards and conventions followed in preparation of engineering drawings
- To develop graphic skills for communication of concepts, ideas and engineering drawings
- To expose on 2D & 3D drawings and its projections

COURSE OUTCOME:

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

CO1: Sketch the curves and orthographic projections of points as per BIS conventions (Apply)

CO2: Illustrate the orthographic projections of straight lines and plane surfaces (Apply)

CO3: Sketch the orthographic projections of solids, lateral surfaces of frustums, truncated solids and its development (Apply)

CO4: Develop the lateral surfaces of simple solids (Apply)

CO5: Interpret the orthographic and isometric views of simple components (Apply)

CO PO Mapping:

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

SYLLABUS:

BASICS OF ENGINEERING DRAWING AND CAD (Not for examination)

Introduction – Drawing instruments and its uses – Sheet layout – BIS conventions – Lines – Lettering and dimensioning practices – Lines – Co – Ordinate points – Axes – Poly lines – Square – Rectangle – Polygons – Splines – Circles – Ellipse – Text – Move – Copy – Off – Set – Mirror – Rotate – Trim – Extend – Break – Chamfer – Fillet – Curves – Constraints viz. agency – Parallelism – Inclination and perpendicularity

UNIT I CONICS, SPECIAL CURVES AND PROJECTION OF POINTS 12

Construction of parabola – Ellipse and hyperbola using eccentricity method – Construction of involutes for squares and circles – Construction of Tangent and normal to the above curves –

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Introduction – Method of projection – Planes of projection – Reference line and notations – Orthographic Projection of points – Points in all four quadrants

UNIT II PROJECTION OF STRAIGHT LINES AND SURFACES **12**

Projection of straight lines – Lines inclined to HP / VP plane – Inclined to both HP and VP planes (straight lines are assumed to be in first quadrant only) – Projection of planes – Projection of square – Rectangle – Pentagon – Hexagon and circular plane – Inclined to both the plane by change of position method

UNIT III PROJECTION OF SOLIDS **12**

Introduction – Projection of solids – Prisms – Pyramids – Cylinders and cones with axis inclined to both the planes (Solids resting on HP only)

UNIT IV DEVELOPMENT OF LATERAL SURFACES OF SOLIDS **12**

Introduction – Cutting plane – Sectional views of right regular solids resting with base on HP – Prisms – Pyramids – Cylinder and cone – True shapes of the sections – Development of lateral surfaces of right regular prisms – pyramids – Cylinders – Cones resting with base on HP only – Development of the frustums and truncations

UNIT V ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS **12**

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

Contact Periods:

Lecture: 60 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 60 Periods

TEXT BOOKS:

1. ND Bhat & VM Panchal, "Engineering Drawing", 51st edition, Charotar Publishing House, Gujarat, 2013.
2. Venugopal K. and Prabhu Raja V, "Engineering Graphics", 6th edition, New Age International (P) Limited,2019.

REFERENCE BOOKS:

1. Natrajan K.V., A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 21st edition 2017.
2. Sam Tickoo, AutoCAD 2013 for Engineers and Designers, Dream tech Press, 1st edition 2013.
3. M.H.Annaiah & Rajashekar Patil, Computer Aided Engineering Drawing, New Age International Publishers,4th edition,2012.
4. Basant Aggarwal, Engineering Drawing, Tata Mc Graw Hill Education Private Limited, 1st edition, 2010.
5. D.M.Kulkarni, A.P.Rastogi, A.K.Sarkar, "Engineering Graphics with AutoCAD", PHI Learning Private Limited, New Delhi, Revised edition.,2010.

EVALUATION PATTERN:

Continuous Internal Assessments		End Semester Examinations
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
60		40
100		

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SEMESTER III

U21MA301	PROBABILITY THEORY AND DISTRIBUTIONS (for AD)	Category: BSC				
		L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the mathematical concepts of probability, one and two dimensional random variables and distributions
- To understand the concepts of various distributions
- To understand the concepts of random processes which are widely used in IT fields

COURSE OUTCOMES:

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

CO1: Apply probability axioms and the moments of discrete and continuous random variables to core engineering problems (Apply)

CO2: Use discrete probability distributions including requirements, mean and variance for making decisions (Understand)

CO3: Use continuous probability distributions including requirements, mean and variance for making decisions (Understand)

CO4: Compare correlation and linear regression with respect to two dimensional random variables (Understand)

CO5: Analyze the simple classes of discrete random processes to model random arrivals (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I PROBABILITY AND RANDOM VARIABLES **9 + 3**

Axioms of probability – Conditional probability – Total probability – Bayes' theorem – Random variable – Distribution function – Properties – Probability mass function – Probability density function – Moments – Moment generating functions

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UNIT II DISCRETE DISTRIBUTIONS **9 + 3**

Bernoulli distribution – Binomial distribution – Poisson distribution – Geometric distribution – Moments – moment generating functions and properties for the above distributions

UNIT III CONTINUOUS DISTRIBUTIONS **9 + 3**

Exponential distribution – Uniform distribution – Gamma distribution – Normal distribution – Moments – Moment generating functions and properties for the above distributions

UNIT IV TWO DIMENSIONAL RANDOM VARIABLES **9 + 3**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Central limit theorem (without proof)

UNIT V RANDOM PROCESSES **9 + 3**

Definition and examples – Stationary process – Wide sense stationary – Markov chain – Bernoulli and Poisson processes

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project: – Periods

Total: 60 Periods

TEXT BOOKS:

1. Oliver C. Ibe, "Fundamentals of Applied probability and Random processes", 2nd edition, Elsevier, 2014.
2. Johnson R A, Miller I and Freund J, "Miller and Freund's Probability and Statistics for Engineers", 8th edition, Pearson Education, Asia, 2015.

REFERENCES:

1. Allen A. O, "Probability, Statistics and Queueing Theory with computer applications", 2nd edition, Elsevier, 2005.
2. Trivedi K. S, "Probability and Statistics with Reliability, Queueing and computer science Applications", 2nd edition, John Wiley and sons, 2012.
3. Gupta S C and Kapoor V K, "Fundamentals of Mathematical Statistics", 10th edition, Sultan Chand Publishers, 2014.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER III

		Category: HSMC				
U21AD301	ETHICS AND HOLISTIC LIFE	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To emphasize the meaning and nature of human values, ethics, and holistic life for leading a good, successful, and happy life through continuous examination of thoughts and conduct in day-to-day life
- To understand the status and responsible role of individual in order to develop a civilized and human society
- To view the place of Ethics and Human Values in the development of individual and society through identification and cross examination of life values and world view of his/her role models in society

COURSE OUTCOMES:

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

CO1: Explain the meaning of human values, importance of ethics at individual, local, global level for leading a successful, happy holistic life (Understand)
CO2: Realize his/her individual responsibility and develop their ability to create a civilized and human society (Understand)
CO3: Identify the personal, professional, and social values and integrate them in their personality after cross examination (Understand)
CO4: Develop positive habits of thought and conduct to work cohesively with fellow beings who have variety of strengths, experiences, shortcomings, and challenges, hence, to enable them to handle diverse type of personalities (Understand)
CO5: Explain the process of ethical decision making through critical assessment of incidents/cases of ethical dilemmas in personal, professional, and social life (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I HUMAN LIFE, ITS AIM AND SIGNIFICANCE 9

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

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UNIT II CREATIVE AND LEADERSHIP ABILITY AND THEIR DEVELOPMENT 9

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

UNIT III HARMONY IN PERSONAL AND SOCIAL 9

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

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

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

UNIT V DILEMMA BETWEEN MATERIALISTIC DEVELOPMENT AND HUMAN WELFARE 9

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

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

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

REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER III

U21AD302	FOUNDATIONS OF DATA SCIENCE	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CSG02 : Python Programming

COURSE OBJECTIVES:

- To learn basics of data science and statistical inference
- To understand the concept of data pre-processing and feature selection algorithms
- To visualize the processed data using visualization techniques

COURSE OUTCOMES:

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

CO1: Interpret data science basics, exploratory data analysis and its tools (Understand)

CO2: Demonstrate the usage of statistical inference and regression models (Apply)

CO3: Use the concept of linear algebra in principal component analysis (Understand)

CO4: Understand and apply the various data pre-processing methods, feature selection algorithms (Understand)

CO5: Implement the visualization of data using the visualization tools (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION **9**

Data Science – Need for data science – Benefits and uses – Facets of data – Data science process – Setting the research goal – Retrieving data – Cleansing, integrating, and transforming data – Exploratory data analysis – Build the models – Presenting and building applications

UNIT II DESCRIBING DATA - I **9**

Frequency distributions – Outliers – Relative frequency distributions – Cumulative frequency distributions – Frequency distributions for nominal data – Interpreting distributions – Graphs – Averages – Mode – Median – Mean – Averages for qualitative and ranked data – Describing variability – Range – Variance – Standard deviation – Degrees of freedom – Interquartile range – Variability for qualitative and ranked data

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UNIT III PYTHON FOR DATA HANDLING 9

Basics of NumPy arrays – Aggregations – Computations on arrays – Comparisons, Masks, Boolean logic – Fancy indexing – Structured arrays – Data manipulation with Pandas – Data indexing and selection – Operating on data – Missing data – Hierarchical indexing – Combining datasets – Aggregation and grouping – Pivot tables

UNIT IV DESCRIBING DATA - II 9

Normal distributions – Z scores – Normal curve problems – Finding proportions – Finding scores – More about z scores – 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 toward the mean

UNIT V PYTHON FOR DATA VISUALIZATION 9

Visualization with matplotlib – Line plots – Scatter plots – Visualizing errors – Density and contour plots – Histograms, binning, and density – Three-dimensional plotting – Geographic data – Data analysis using statmodels and seaborn – Graph plotting using Plotly – Interactive data visualization using Bokeh

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", 3rd edition, Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, "Statistics", 11th Edition, Wiley Publications, 2017.
3. Matt Harrison, "Learning the Pandas Library: Python Tools for Data Munging, Analysis, and Visualization, 2nd edition, O'Reilly, 2016.

REFERENCES:

1. Jiawei Han, Micheline Kamber and Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, ISBN 0123814790, (2011).
2. Joel Grus, "Data Science from Scratch: First Principles with Python", 1st edition, O'Reilly Media, 2015.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER III

U21AD303	PROGRAMMING USING JAVA	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CSG01 : Problem Solving and C programming

COURSE OBJECTIVES:

- To describe object oriented programming paradigm and its principles
- To implement programs with Core Java features
- To develop applications with Java Collections and database connectivity

COURSE OUTCOMES:

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

CO1: Explain the object oriented programming features through Java programs (Understand)

CO2: Implement the inheritance and interface concepts (Apply)

CO3: Demonstrate the working principles of exception handling and multithreading (Apply)

CO4: Develop Java programs with IO classes and Packages (Apply)

CO5: Exhibit the functions of Java collections and JDBC (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I OBJECT ORIENTED PROGRAMMING AND JAVA BASICS 9

Object Oriented Programming – Concepts – OOP in Java – Characteristics of Java – Java Environment – Structure – Compilation – Fundamental Programming Structures in Java – Tokens – Scanner class – Class and Object – Constructors – Methods – Static members – Control Flow – Arrays – Strings

UNIT II INHERITANCE AND INTERFACES 9

Inheritance: Super classes – Sub classes – Access modifiers – Types – Constructors in sub classes – Polymorphism – Method overloading and overriding – Object class – Abstract classes and methods

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Interfaces: defining an interface, implementing interface – Extending interfaces – Object cloning – Inner Classes and its types – Final – Super – Wrapper Class

UNIT III EXCEPTION HANDLING AND MULTITHREADING 9

Exceptions: Exception hierarchy – Throwing and catching exceptions – Checked and unchecked exceptions – Built in exceptions – Creating own exception – Chained exceptions – Stack Trace Elements.

Multithreaded Programming: The Java Thread Model – Creating multiple threads – Thread class – Runnable Interface – Thread Priorities – Synchronization and Interthread Communication.

UNIT IV PACKAGES AND I/O BASICS 9

Packages: Defining a Package – Packages and CLASSPATH – Package Example – Packages and Member Access – Importing Packages.

Input / Output Basics: Streams – Byte streams and Character streams – Reading from and Writing to Console – Reading and Writing Files – Programs

UNIT V COLLECTIONS AND JDBC 9

Collections: Overview – Framework: Iterable, Collection, List, Set, Queue, Map – Components: ArrayList, LinkedList, HashSet, TreeSet, PriorityQueue, HashMap, TreeMap – Hashcode and equals

JDBC : Basics of JDBC – Java program and MySQLConnectivity – Simple Application.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 12th edition, McGraw Hill Education, 2021.
2. Cay.S.Horstmann,"Core Java 2 Fundamentals", 11th edition, Pearson Education, 2018.

REFERENCES:

1. J.Nino and F.A. Hosch, "An Introduction to Programming and OO Design using Java", 4th edition, John wiley & Sons, 2018.
2. Paul Deitel, Harvey Deitel, "Java SE 8 for programmers", 3rd edition, Pearson, 2015.
3. E Balagurusamy, "Programming with Java", 6th edition, McGraw Hill Education, 2019.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER III

U21AD304	DATA STRUCTURES DESIGN	Category: PCC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- U21CSG01 : Problem Solving and C programming

COURSE OBJECTIVES:

- To understand the concepts of ADT and list operations
- To Learn linear data structures – stacks and queues
- To apply Tree and Graph structures

COURSE OUTCOMES:

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

CO1: Explain the fundamentals of data structure and abstract data types (Understand)

CO2: Demonstrate the operations of linear data structures such as stack and queue (Understand)

CO3: Implement various searching, sorting and hashing techniques (Apply)

CO4: Apply the various operations of tree structures (Apply)

CO5: Experiment with various problems using graph structures (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I ABSTRACT DATA TYPES **6**

Data Structure: Introduction – Importance – Types – Operations on Data Structure – Advantages – Introduction to analysis of algorithms – Asymptotic notations – Recursion – Analyzing recursive algorithms.

Abstract Data Types (ADTs): ADTs and classes – Classes in Python

UNIT II LINEAR DATA STRUCTURES **6**

List ADT – Array-based implementations – Linked list implementations: Singly, Doubly and circularly linked lists – Applications of lists

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Stack ADT: Operations – Applications – Evaluating arithmetic expressions – Conversion of Infix to postfix expression – Queue ADT: Operations – Applications – Circular Queue – Priority Queue – deQueue

UNIT III SEARCHING, SORTING AND HASHING TECHNIQUES 6

Introduction to Searching – Types of search – Linear Search – Binary Search. Sorting – Selection sort – Merge Sort – Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing

UNIT IV TREES 6

Tree ADT – Tree traversals – Binary Tree ADT – Expression trees – Implementation of expression tree – Applications of trees – Binary search tree ADT – Operations in binary search tree

UNIT V GRAPH STRUCTURES 6

Introduction to Graph – Types of graph – Representations of graph - Graph traversal – Breadth-first and Depth-first – DAG – Topological ordering – Minimum spanning tree algorithms – Shortest path algorithm – Dijkstra's algorithm

LIST OF EXPERIMENTS

1. Implement simple ADTs as Python classes
2. Implement recursive algorithms in Python
3. Implement List ADT using Python arrays
4. Linked list implementations using List
5. Implementation of Stack and Queue ADTs
6. Implementation of sorting and searching algorithms
7. Implementation of Hash tables
8. Implementation of single source shortest path algorithm

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 60 Periods

TEXT BOOKS:

1. Reema Thareja, "Data structures using C", 2nd Edition, Oxford University Press, 2018
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", 2nd Edition, University Press, 2017

REFERENCES:

1. R. Venkatesan, S. Lovelyn Rose, "Data Structures", 2nd Edition, Wiley, 2019.
2. Seymour Lipschutz, "Data structures with C", 4th Edition, McGraw Hill Education, 2017

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		**Assessment II (Practical) (100 Marks)**		**Theory Examinations (Examinations will be conducted for 100 Marks)**	**Practical Examinations (Examinations will be conducted for 100 Marks)**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test		
40	**60**	**75**	**25**		
25		**25**		**25**	**25**
50				**50**	
Total: 100					

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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KPRIET
Learn Beyond

SEMESTER III

U21AD305	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	Category: PCC				
		L	T	P	J	C
		3	0	2	0	4

PRE–REQUISITES:

- U21CSG02 : Python Programming

COURSE OBJECTIVES:

- To introduce the fundamentals of artificial intelligence and intelligent agents
- To learn the methods of knowledge representation and knowledge inference
- To understand the concepts of expert systems

COURSE OUTCOMES:

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

CO1: Exemplify the fundamentals of Artificial Intelligence and Intelligent agents (Understand)

CO2: Identify appropriate methods to solve AI problems (Understand)

CO3: Use different methodologies to represent and infer knowledge (Understand)

CO4: Apply pre-processing techniques on data (Apply)

CO5: Discuss the concepts of Expert Systems and its models (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTELLIGENT AGENTS 6

Introduction to AI – Agents and Environments – Concept of rationality – Nature of environments – Structure of agents Problem solving agents – Search algorithms – Uninformed search strategies

UNIT II PROBLEM-SOLVING METHODS 6

Heuristic search strategies – Heuristic functions – Local search and optimization problems – Local search in continuous space – Search with nondeterministic actions – Search in partially observable environments – Online search agents and unknown environments

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UNIT III GAME PLAYING AND CSP 6

Game theory – Optimal decisions in games – Alpha-beta search – Monte-carlo tree search – Stochastic games – Partially observable games – Constraint satisfaction problems – Constraint propagation – Backtracking search for CSP – Local search for CSP – Structure of CSP

UNIT IV LOGICAL AGENTS 6

Knowledge-based agents – Propositional logic – Propositional theorem proving – Propositional model checking – Agents based on propositional logic First-order logic – Syntax and semantics – Knowledge representation and engineering – Inferences in first-order logic – Forward chaining – Backward chaining – Resolution

UNIT V KNOWLEDGE REPRESENTATION AND PLANNING 6

Ontological engineering – Categories and objects – Events – Mental objects and modal logic – Reasoning systems for categories – Reasoning with default information Classical planning – Algorithms for classical planning – Heuristics for planning – Hierarchical planning – Non-deterministic domains – Time, Schedule, and Resources – Analysis

LIST OF EXPERIMENTS

1. Develop PEAS descriptions for given AI tasks
2. Implement basic search strategies for selected AI applications
3. Implement A* and memory bounded A* algorithms
4. Implement genetic algorithms for AI tasks
5. Implement simulated annealing algorithms for AI tasks
6. Implement alpha-beta tree search
7. Implement backtracking algorithms for CSP
8. Implement local search algorithms for CSP
9. Implement propositional logic inferences for AI tasks
10. Implement resolution based first order logic inferences for AI tasks
11. Implement classical planning algorithms
12. Mini Project

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 60 Periods

TEXT BOOKS:

1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", 5th edition, Mc Graw Hill- 2008.
2. Denis Rothman, "Artificial Intelligence by Example: Develop machine intelligence from scratch using real artificial intelligence use cases", 1st Edition, Packt, 2018
3. Dan W. Patterson, "Introduction to AI and ES", 1st Edition, Pearson Education, 2007.

REFERENCES:

1. Peter Jackson, "Introduction to Expert Systems", 3rd Edition, Pearson Education, 2007.
2. Stuart Russel and Peter Norvig "AI – A Modern Approach", 2nd Edition, Pearson Education 2007.
3. Deepak Khemani "A First Course in Artificial Intelligence", 1st Edition, Tata Mc Graw Hill Education 2013.

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		**Assessment II (Practical) (100 Marks)**		**Theory Examinations (Examinations will be conducted for 100 Marks)**	**Practical Examinations (Examinations will be conducted for 100 Marks)**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test		
40	60	75	25		
25		25		35	15
50				50	
Total: 100					

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER III

U21AD306	DATA SCIENCE LABORATORY	Category: PCC				
		L	T	P	J	C
		0	0	2	2	2

PRE–REQUISITES:

- U21CSG02 : Python Programming

COURSE OBJECTIVES:

- To familiarize with Jupyter Notebook, Pandas and SciPy for data analysis
- To implement linear regression and to validate the regression using various tests
- To perform visualization on different data sets

COURSE OUTCOMES:

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

CO1: Work with Jupyter Notebook, Pandas and SciPy for data analysis (Apply)

CO2: Apply statistical methods to hypotheses testing and inference problems (Apply)

CO3: Implement simple linear regression and to perform tests to validate the regression (Apply)

CO4: Implement the EDA using the principal component analysis technique (Apply)

CO5: Apply different visualization techniques on various massive datasets (Apply)

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. Working with Jupyter Notebook on fundamental Concepts.
2. Computations using NumPy functions – Computation on Arrays, Aggregation, Indexing and Sorting.
3. Data manipulations using Pandas – Handling of missing data and hierarchical indexing
4. Data Visualization using Matplotlib – Implementation of 2D plotting and 3D plotting
5. Case study to demonstrate Curve Fitting.
6. Implementation of Principle component analysis.

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7. Using Simple Linear Regression, calculate Gradient and Cost minimum, along with line of best fit.
8. Understand Linear Regression and other regression techniques using house prices prediction dataset.
9. Implement K-means Clustering to Find Natural Patterns in Data.
10. Data Handling Project Base.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 30 Periods

EVALUATION PATTERN:

<table>
<tr><th colspan="5">Continuous Internal Assessments</th><th>End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I (Practical) (100 Marks)</th><th colspan="3">Assessment II (Project) (100 Marks)</th><td rowspan="2">Practical Examinations
(Examinations will be conducted for 100 Marks)</td></tr>
<tr><td>Evaluation of Laboratory Observation, Record
(Rubrics Based Assessments)</td><td>Test</td><td>Review I</td><td>Review II</td><td>Review III</td></tr>
<tr><td>75</td><td>25</td><td>15</td><td>25</td><td>60</td><td></td></tr>
<tr><td colspan="2">25</td><td colspan="3">25</td><td>50</td></tr>
<tr><td colspan="5">50</td><td>50</td></tr>
<tr><td colspan="6">Total: 100</td></tr>
</table>

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SEMESTER III

U21AD307	JAVA LABORATORY	Category: PCC				
		L	T	P	J	C
		0	0	2	0	1

PRE–REQUISITES:

- U21CSG01 : Problem Solving and C programming

COURSE OBJECTIVES:

- To demonstrate object-oriented programming principles using Java programs
- To implement java programs for real time applications
- To develop java project using JDBC

COURSE OUTCOMES:

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

CO1: Implement the object oriented programming features such as class, object, method overloading and overriding (Apply)

CO2: Demonstrate the basic features of Java language (Apply)

CO3: Apply the principles of exception handling and multithreading for given problems (Apply)

CO4: Build programs for file handling, packages and collections (Apply)

CO5: Develop an application project using JDBC (Apply)

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. a. Write a Java program that determines the number of days in a month.

   b. Write a java program that arranges the given set of strings in alphabetical order. Supply the strings through command line arguments.

2. Develop a Java application to generate Electricity bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, and type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff:
   If the type of the EB connection is domestic, calculate the amount to be paid as follows:
   First 100 units - Free
   101-200 units - Rs. 2.50 per unit

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201 -500 units - Rs. 4 per unit
501 units - Rs. 6 per unit
If the type of the EB connection is commercial, calculate the amount to be paid as follows:
First 100 units - Free
101-200 units - Rs. 4.50 per unit
201 -500 units - Rs. 6 per unit
501 units - Rs. 7 per unit

3	Develop a Java program to implement constructor overloading and method overloading.
4	Develop a java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
5	Create an interface "CreditCardInterface" with methods to viewCreditAmount, viewPin, changePin and payBalance. Create a class Customer (name, card number, pin, creditAmount – initialized to 0). Implement all methods of the interface "CreditCardInterface" in Customer class. Create an array of customer objects and perform the following actions. Pay Balance Change Pin
6	Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape
7	Develop a Java program to demonstrate exception handling using the keywords try, catch, throw, throws & finally along with an own exception class.
8	Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.
9	Develop a java application to implement distance converter (meter to KM, miles to KM and vice versa) and time converter (hours to minutes, seconds and vice versa) using packages.
10	Develop a Java program to implement basic console IO and File IO.
11	Develop a Java program to store multiple objects in an Array List and to implement search and sort operations.
12	Develop a java to register students data using JDBC with MySQL Database
13	Mini Project: Develop a java application to register, search, modify and delete students data using JDBC and MySQL Database

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 30 Periods

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EVALUATION PATTERN:

Continuous Internal Assessments		End Semester Examinations
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
60		40
100		

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KPRIET
Learn Beyond

SEMESTER IV

		Category: BSC				
U21MAG02	DISCRETE MATHEMATICS (Common to AD, CS, CS(AIML), CSBS)	L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the basic concepts of propositions by various discrete structure techniques
- To understand the concepts in combinatorics techniques in solving the system by various methodology
- To understand the concepts of the different differential and integral techniques in solving the real time engineering problems

COURSE OUTCOMES:

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

CO1: Use the concepts of Boolean algebra for the analysis & design of various combinational & sequential logic circuits (Understand)

CO2: Use the mathematical concepts in abstract algebra with respect to characteristics of sets, group, ring and field (Understand)

CO3: Apply combinatorial principles and techniques to solve counting problems and linear recurrence relation (Understand)

CO4: Apply graph theory concepts to test and validate intuition and independent mathematical thinking in problem solving (Apply)

CO5: Analyze natural language arguments by means of symbolic propositional logic and proofs (Understand)

CO-PO MAPPING:

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

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

SYLLABUS:

UNIT I BOOLEAN ALGEBRA **9 + 3**

Boolean algebra – Truth table – Basic logic gate – Basic postulates of Boolean algebra – Principle of duality – Canonical form – Karnaugh map

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UNIT II ABSTRACT ALGEBRA **9 + 3**

Algebra of sets – The power set – Ordered pairs and Cartesian product – Relations on sets – Types of relations and their properties – Equivalence relations – Functions – Type of functions – Group – Semi group – Monoid – Abelian group – Sub group – Ring – Field

UNIT III COMBINATORICS **9 + 3**

Basics of counting – Pigeonhole principle – Permutations and combinations – Recurrence relations – Generating functions – Mathematical Induction

UNIT IV GRAPH THEORY **9 + 3**

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

UNIT V LOGIC **9 + 3**

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

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project: – Periods

Total: 60 Periods

TEXT BOOKS:

1. Herstein N, "Topics in Algebra", 2nd edition, John Wiley and Sons, 2006
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th edition, Tata McGraw Hill Pub. Co. Ltd, New Delhi, Special Indian Edition, 2016
3. Tremblay J. P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", 7th edition, Tata McGraw Hill Pub. Co. Ltd, New Delhi, 2011

REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER IV

U21AD401	MACHINE LEARNING - ESSENTIALS	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21AD302 : Foundations of Data Science

COURSE OBJECTIVES:

- To introduce students to the basic concepts and techniques of Machine Learning.
- To explore the Supervised and Unsupervised learning techniques
- To learn the various applications of Machine Learning

COURSE OUTCOMES:

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

CO1: Describe the fundamental concepts of machine learning (Understand)

CO2: Illustrate the classification and regressions (Understand)

CO3: Examine the concepts of neural networks and ensemble learning (Understand)

CO4: Illustrate the features of unsupervised learning (Understand)

CO5: Describe the applications of machine learning (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I MACHINE LEARNING LANDSCAPE 9

Machine learning – Need of machine learning – Machine Learning Applications – Types of Machine Learning systems – Challenges – Machine Learning Process – Data Collection, Exploration, Preparation, Training, Optimization – Performance Measures.

UNIT II SUPERVISED LEARNING - I 9

Classification and Regression Technique – Linear regression – Polynomial Regression, Logistic Regression – Generalization – Overfitting – Underfitting – Support Vector Machine – Kernels – KNN – Naïve bayes classifiers – Decision Tree.

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UNIT III SUPERVISED LEARNING - II 9

Random Forest – Ensemble Learning – Bagging – Boosting – Ada Boost – Gradient Boosting – Neural Networks – Biological Neurons – logical computations with neurons – ANN – Perceptron – MLPs and Backpropagation – Hyperparameter Optimization – Dimensionality Reduction.

UNIT IV UNSUPERVISED LEARNING 9

Clustering – Techniques – K-Means Clustering – AGNES – DIANA – Density Based Clustering (DBSCAN) – Grid based clustering – Gaussian Mixtures – Clustering High Dimensional Data – Outlier Analysis.

UNIT V MACHINE LEARNING APPLICATIONS 9

Dimensionality Reduction Applications – Factor Analysis – Model selection & evaluation – Optimization of turning parameters – Visualization of results – Contemporary Issues – Case Studies – Application of ML – Medical science, Fraud Detection, Traffic prediction, Personal Assistant, Stock Prediction.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Müller, Andreas C., and Sarah Guido. Introduction to machine learning with Python: a guide for data scientists. 3rd edition, O'Reilly Media, Inc.", 2016.
2. Géron, Aurélien. Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems. 1st edition, O'Reilly Media, 2019.

REFERENCES:

1. Himanshu Singh , Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python: With Case Studies and Applications from the Industry, 3rd edition, 2019
2. Leonardo De Marchi, Hands-On Neural Networks: Learn how to Build and Train Your First Neural Network Model Using Python Book, 1st edition, 2019
3. James Loy, Neural Network Projects with Python: The ultimate guide to using Python to explore the true power of neural networks through six projects 1st Edition, Kindle Edition, 2019

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER IV

U21AD402	DATABASE DESIGN AND MANAGEMENT	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the fundamentals of data models and database design
- To study SQL and relational database design using conceptual mapping and normalization
- To understand indexing and hashing techniques which helps in physical DB design
- To learn data model and querying in object-relational and No-SQL databases

COURSE OUTCOMES:

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

CO1: Illustrate the fundamentals of Database Management Systems and conceptual modeling (Understand)

CO2: Apply the conceptual-to-relational mapping and normalization techniques for database design (Apply)

CO3: Formulate solutions to real time problems using SQL (Apply)

CO4: Describe the concurrency control and recovery mechanisms in DBMS (Understand)

CO5: Discuss the data model and querying in No-SQL databases using MongoDB (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO DBMS 9

Introduction to DBMS: Purpose, Views of data, Database environment – Database system development lifecycle – Data Models, Database System Architecture – Relational databases – Relational Model – Keys – Relational Algebra – ER Model – Enhanced ER Model

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UNIT II DATABASE DESIGN 7

ER and EER-to-Relational mapping – Anomalies – Functional Dependencies – Inference rules – Minimal cover – Properties of relational decomposition – Normalization and its types – 1NF to BCNF.

UNIT III INTRODUCTION TO SQL AND PL/SQL 11

SQL Fundamentals – Types of SQL Commands – Integrity constraints – SQL Data manipulation – SQL Data definition – Views – SQL programming – PL/SQL Structure – Functions – Procedures – Exception Handling – Views – Cursors and its types

UNIT IV TRANSACTION CONCEPTS 9

Transaction Concepts – Life Cycle of a Transaction – Properties – Schedules – Serializability – Concurrency Control – Locking Protocols – Deadlock – Transaction Recovery – SQL for Concurrency and Recovery

UNIT V NOSQL DATABASE SYSTEM 9

Introduction and classification to NoSQL Database Systems: Graph Databases, Key-Value Stores, Document Stores – Columnar Databases – No-SQL: CAP theorem – NoSQL vs SQL – CRUD operations – MongoDB data model and CRUD operations

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Abraham Silberschatz, Henry F Korth, S Sudharshan, "Database System Concepts", 6th Edition, Tata Mc Graw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, 7th Edition, Pearson, 2017.

REFERENCES:

1. Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems:The Complete Book", 2nd edition, Pearson.
2. Raghu Ramakrishnan, "Database Management Systems", 4th Edition, Tata Mc Graw Hill, 2010.
3. Carlos Coronel, Steven Morris, and Peter Rob, Database Systems: Design, Implementation, and Management, 9th Edition, Cengage learning, 2012
4. https://www.tutorialspoint.com/plsql/

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER IV

		Category: ESC				
U21AD403	COMPUTING ESSENTIALS	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the architecture of the computer systems
- To interpret the I/O and Memory Interfacing circuits of the computer
- To learn the concepts and functions of operating systems in computer systems

COURSE OUTCOMES:

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

CO1: Describe the basic structure and operations of a digital computer (Understand)

CO2: Elaborate the memory and I/O in computer systems (Understand)

CO3: Discuss the role of operating systems and process management (Understand)

CO4: Exemplify the process synchronization and deadlock handling mechanisms (Understand)

CO5: Interpret various memory and storage management techniques (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I COMPUTER ORGANIZATION 9

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – Decision making – Addressing Modes – Processor Organization – Pipelining – Hazards

UNIT II MEMORY AND I/O ORGANIZATION 9

Characteristics of memory systems and memory hierarchy – Static and dynamic memory, Principles and operations: Cache memory – SSD – Flash memory – Magnetic disks – DMA operation – Bus Structure and its operations – Overview of programmed I/O and interrupt driven I/O techniques.

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UNIT III FUNDAMENTALS OF OPERATING SYSTEMS 9

Operating System types, Structure and Operations – System Calls, System Programs, OS Generation and System Boot. CPU Scheduling algorithms: Preemptive, Non preemptive scheduling, FCFS, SJF, SRTF, Priority, Round Robin – Inter Process Communications: Message Passing.

UNIT IV PROCESS SYNCHRONIZATION 9

Process Synchronization: The critical-section problem – Synchronization hardware – Semaphores – Classic problems of synchronization – Critical regions – Monitors. Deadlock: System model – Deadlock characterization – Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance – Deadlock detection – Recovery from deadlock. .

UNIT V STORAGE MANAGEMENT AND FILE SYSTEMS 9

Main Memory – swapping, Contiguous Memory Allocation, Paging, Segmentation, segmentation with Paging. Virtual Memory – Demand paging – Process creation – Page replacement – Allocation of frames File System structure – File concept – Access methods, Directory structure allocation methods – Free space management.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, "Computer Organization", 5th Edition, Tata McGraw Hill, 2002
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, 9th Edition, John Wiley and Sons Inc., 2012.

REFERENCES:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, 5th Edition, Morgan Kaufmann / Elsevier, 2014.
2. Ramaz Elmasri, A. Gil Carrick, David Levine, Operating Systems - A Spiral Approach, 1st edition, Tata McGraw Hill Edition, 2010.
3. William Stallings, "Operating Systems: Internals and Design Principles", 9th Edition, Pearson Education, 2018.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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Coimbatore - 641 407

SEMESTER IV

U21AD404	NETWORKS AND COMMUNICATION	Category: ESC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- U21AD303 : Programming using Java

COURSE OBJECTIVES:

- To understand the protocol layering and physical level communication
- To analyze the performance of a network
- To understand the various components required to build different networks
- To learn the functions of network layer and the various routing protocols

COURSE OUTCOMES:

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

CO1: Comprehend the basics of computer networks (Understand)

CO2: Illustrate the features of data link layer (Understand)

CO3: Discuss network layer protocols (Understand)

CO4: Describe various transport layer protocols (Understand)

CO5: Exemplify the application layer protocols (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION AND PHYSICAL LAYER 6

Networks – Network Types – Protocol Layering – OSI Model – TCP/IP Protocol suite – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

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UNIT II DATA-LINK LAYER & MEDIA ACCESS 6

Introduction – Link-Layer Addressing – DLC Services – Data-Link Layer Protocols – HDLC – PPP – Media Access Control – Wired LANs: Ethernet – Wireless LANs – Introduction – IEEE 802.11, Bluetooth – Connecting Devices

UNIT III NETWORK LAYER 6

Internet Protocol – Internetworking – IPv4 – Subnetting – IPv6 – Routing Techniques: Distance Vector routing – Link state routing – Basics of IP support protocols (ARP,RARP,DHCP,ICMP) – Network Address Translation

UNIT IV TRANSPORT LAYER 6

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol – Transmission Control Protocol – TCP Congestion Control – Congestion Avoidance Mechanism – Quality of Service – SCTP.

UNIT V APPLICATION LAYER 6

WWW and HTTP – FTP – Email – Telnet – SSH – DNS – SNMP.

LIST OF EXPERIMENTS

1. Learn to use commands like tcpdump, netstat, ifconfig, nslookup and traceroute. Capture ping and trace route PDUs using a network protocol analyzer and examine.
2. Simulation using Virtual Lab – IIT Bombay
   a) Fabrication of Cables
   b) Peer to Peer Topology and Star Topology
   c) IPV4 Addressing and Subnetting
3. Applications using TCP sockets like:
   a) Echo client and echo server
   b) Chat
   c) File Transfer
4. Simulation of DNS using UDP sockets.
5. Write a code simulating ARP /RARP protocols.
6. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.
7. Study of TCP/UDP performance using Simulation tool.

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 60 Periods

TEXT BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition TMH, 2013.
2. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, 5th Edition, Morgan Kaufmann Publishers Inc., 2012.

REFERENCES:

1. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", 7th Edition, Pearson Education, 2017.
2. William Stallings, Data and Computer Communications, 10th Edition, Pearson Education, 2013.
3. Nader F. Mir, Computer and Communication Networks, 2nd Edition, Prentice Hall, 2014.

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		Assessment II (Practical) (100 Marks)		Theory Examinations (Examinations will be conducted for 100 Marks)	Practical Examinations (Examinations will be conducted for 100 Marks)
Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test		
40	60	75	25		
25		25		25	25
50				50	
Total: 100					

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SEMESTER IV

		Category: PCC				
U21AD405	MACHINE LEARNING LABORATORY	L	T	P	J	C
		0	0	2	2	2

PRE–REQUISITES:

- U21CSG02 : Python Programming

COURSE OBJECTIVES:

- To apply the concepts of Machine Learning to solve real-world problems
- To implement basic algorithms in clustering & classification applied to text & numeric data
- To implement algorithms related to dimensionality reduction

COURSE OUTCOMES:

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

CO1: Use python to implement machine learning algorithms related to numeric data (Apply)

CO2: Implement machine learning algorithms involving text and image data (Apply)

CO3: Implement dimensionality reduction algorithms for image processing applications (Apply)

CO4: Use neural network algorithms for solving real-world problems (Apply)

CO5: Develop simple ML application (Apply)

CO-PO MAPPING:

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

LIST OF EXPERIMENTS (INDICATIVE)

1. Using MNIST dataset implement Linear Regression, calculate Gradient and Cost minimum, along with line of best fit.
2. Understand Linear Regression and other regression techniques using house prices prediction dataset.
3. Use IRIS dataset to illustrate Logistic Regression i.e., the most famous dataset that contains 150 IRIS flowers.
4. Train an SVM Classifier on MINIST dataset, Since SVM classifier are binary you need to use one versus the rest to classify all 10 digits. Tune the hyperparameters using small validation sets to speed up the process. Show what accuracy you reached?
5. Detecting Spam mails using Support vector machine.
6. Train and fine -tune a decision tree for MOONs Dataset by following these steps.

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(1) Use make-moons (n_samples= 1000 noise =0.4) to generate a moons dataset.
(2) Use train_test_split() to split the dataset into training and testing dataset.
(3) Use grid search with cross-validation to find good hyperparameter values for a Decision Tree Classifier. Hint: Try various values for Max_leaf_nodes.
(4) Show what accuracy you have reached.

7. Grow a forest by following these steps:
   (1) Generate 1000 subsets of MOONs Dataset each subset should contain 100 instances selected randomly. Hint: Use Scikit- ShuffleSplit class.
   (2) Evaluate these 1000 decision tree on the tests set. Since they were trained on smaller set, these Decision Trees will likely perform worse, Show the Accuracy.
   (3) Now comes the magic, For each test set instance, Generate the prediction of 1000 Decision Trees and keep only the most Frequent prediction use SciPy's Mode() function. This Approach gives you *Majority-vote prediction* over the test set.
   (4) Evaluate these predictions on the test set: show the accuracy.
8. Load MNIST Dataset and train various classifiers like, random forest, Extra tree classifiers , SVM and try to combine them on Ensemble that outperform each individual classifier on the validation set, using soft or hard voting. Classify how much better does it perform as compared to Individual classifier.
9. Use t-SNE to reduce the MNIST dataset down to 2-dimesions and plot the results using Matplotlib. You can use scatterplot using 10 different colors to represent each image target class. Alternatively, you can replace each dot in the scatterplot with the corresponding instance's class. Plot scaled-down version of digits images also. Do the same for other reduction algorithms such as PCA, LLE or MDS and compare the resulting visualization.
10. Load the classic OLLIVETTI faces dataset split the dataset into a training set, a validation set and test set. Since dataset is small, you probably want to use Stratified sampling to ensure that there are same number of images per person, Next cluster the images using K-Mean. Now use K-mean as Dimensionality reduction tool, train the classifier on reduced set. Search for the number of clusters that allows the classifier to get the best performance.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 30 Periods

EVALUATION PATTERN:

<table>
<tr><th colspan="5">Continuous Internal Assessments</th><th>End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I (Practical) (100 Marks)</th><th colspan="3">Assessment II (Project) (100 Marks)</th><td rowspan="3">Practical Examinations
(Examinations will be conducted for 100 Marks)</td></tr>
<tr><td>Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)</td><td>Test</td><td>Review I</td><td>Review II</td><td>Review III</td></tr>
<tr><td>75</td><td>25</td><td>15</td><td>25</td><td>60</td></tr>
<tr><td colspan="2">25</td><td colspan="3">25</td><td>50</td></tr>
<tr><td colspan="5">50</td><td>50</td></tr>
<tr><td colspan="6">Total: 100</td></tr>
</table>

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KPRIET Learn Beyond

SEMESTER IV

		Category: PCC				
U21AD406	DATABASE LABORATORY	L	T	P	J	C
		0	0	2	2	2

PRE–REQUISITES:

Nil

COURSE OBJECTIVES:

- To understand the database development life cycle
- To learn database design using conceptual modeling, Normalization
- To implement database using Data definition, Querying using SQL manipulation and SQL programming

COURSE OUTCOMES:

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

CO1: Understand the database development life cycle (Understand)

CO2: Design relational database using conceptual-to-relational mapping and Normalization (Apply)

CO3: Apply SQL for creation, manipulation and retrieval of data (Apply)

CO4: Implement various PL/SQL objects (Apply)

CO5: Develop a database application for real life scenario (Apply)

CO-PO MAPPING:

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

LIST OF EXPERIMENTS (INDICATIVE)

1. Database Development Life cycle: Student should decide a case study and formulate.
   - Problem statement, Problem definition and Requirement analysis.
   - Scope and Constraints.

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2. Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, represent attributes as columns, identifying keys) * Student is required to submit a document showing the database tables created from ER Model
3. Implement the database using SQL Data definition with Database Querying – Simple queries, Nested queries, Sub queries.
4. Query the database using SQL Manipulation Insert, Select, Update, Delete and Joins (Inner, Outer and Equip).
5. Querying/Managing the database using PL/SQL Programming

- Functions (COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping)
- Constraints and security using Triggers (creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger)

6. Managing the database using SQL stored procedures Creation of Stored Procedures, Execution of Procedure, and Modification of Procedure and Functions.
7. Develop a database application for real life scenario(Eg: Stock management system).

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 60 Periods Project: – Periods

Total: 60 Periods

EVALUATION PATTERN:

<table>
<tr><th colspan="5">Continuous Internal Assessments</th><th>End Semester Examinations</th></tr>
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(100 Marks)</td><td colspan="3">Assessment II
(Project)
(100 Marks)</td><td rowspan="2">Practical
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<tr><td>Evaluation of Laboratory Observation, Record
(Rubrics Based Assessments)</td><td>Test</td><td>Review I</td><td>Review II</td><td>Review III</td></tr>
<tr><td>75</td><td>25</td><td>15</td><td>25</td><td>60</td><td></td></tr>
<tr><td colspan="2">25</td><td colspan="3">25</td><td>50</td></tr>
<tr><td colspan="5">50</td><td>50</td></tr>
<tr><td colspan="6">Total: 100</td></tr>
</table>

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SEMESTER IV

U21SSG01	SOFT SKILLS – I	Category: HSMC				
		L	T	P	J	C
		0	0	2	0	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To inculcate potential skills and to work as a team effectively
- To develop confidence and enhance interpersonal skills

COURSE OUTCOMES:

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

CO1: Enhance decision making and negotiation skills (Analyse)

CO2: Maintain open, effective, and Professional Communication (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I VERBAL COMPETENCE **10**

Verbal Analogy – Spotting Errors – Ordering of Sentences – Cloze Test – Effective Listening – Reading Comprehension

UNIT II EFFECTIVE COMMUNICATION **10**

Overcoming Communication Barriers – Body Language and its Etiquettes – Contextual Communication – 7C's of Communication – Listening to Documentaries

UNIT III INTERPERSONAL SKILLS **10**

Group Decision Making – Paralanguage – Negotiation Skills – Preparation & Planning, Bargaining & Problem Solving –Self Grooming – SWOT Analysis

Contact Periods:

Lecture: - Periods Tutorial: - Periods Practical: 30 Periods Project: – Periods

Total: 30 Periods

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TEXT BOOKS:

1. Prashant Sharma,"Soft Skills: Personality Development for Life Success",1st edition, BPB Publications, 2022
2. Suresh Kumar E, Sreehari P and Savithri J, "Communication Skills and Soft Skills: An Integrated Approach", 1st edition, Dorling Kindersley, 2011.

REFERENCES:

1. Jeff Butterfield, "Problem Solving and Decision Making", 2nd edition, Course Technology, 2010.
2. Wushow Bill Chou, "Fast-Tracking your Career: Soft Skills for Engineering and IT Professionals", 1st edition, IEEE Press, 2013.

EVALUATION PATTERN:

Continuous Internal Assessments	Marks
Test - I	50
Test - II	50
Total	100

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SEMESTER V

		Category: PCC				
U21AD501	DEEP LEARNING PRINCIPLES AND PRACTICES	L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- U21AD401 : Machine Learning - Essentials

COURSE OBJECTIVES:

- To present theoretical foundations, algorithms, methodologies, and applications of neural networks and deep Learning
- To design and develop an application-specific deep learning model
- To apply the deep learning models in various real-world applications

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of Deep learning (Understand)

CO2: Optimize and regularize the deep learning algorithms (Apply)

CO3: Design and implement Convolutional Neural Networks (Apply)

CO4: Analyze and design Recurrent Neural Networks (Apply)

CO5: Develop deep learning models to encode the original data and reconstruct data (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I FUNDAMENTALS OF DEEP LEARNING **9+3**

Functions – Derivatives – Nested Functions – Chain Rule – Functions with Multiple Inputs – Derivatives of Functions with Multiple Inputs – Creating New Features – Derivatives of Functions – Computational Graph – The Backward Pass – Supervised Learning – Linear Regression – Training the Model – Assessing Our Model – Neural Networks from Scratch.

UNIT II BASICS OF NEURAL NETWORKS **9+3**

Deep Learning: A First Pass – Neural Networks: Operations, Layers, Building Blocks, Class – Trainer and Optimizer – Intuition – SoftMax Cross Entropy Loss Function – Experiments – Momentum – Learning Rate Decay – Weight Initialization – Dropout.

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UNIT III CONVOLUTIONAL NEURAL NETWORKS 9+3

Neural Networks and Representation Learning – Convolutional Layers – Implementing the Multichannel Convolution Operation – Train a CNN – Motivation – Pooling – Data Types.

UNIT IV RECURRENT NEURAL NETWORKS 9+3

Key Limitation: Handling Branching – Automatic Differentiation – Motivation – Recurrent Neural Networks – implementation of RNNs – RNN Nodes: Vanilla, GRU, LSTM.

UNIT V AUTO ENCODERS AND GENERATIVE MODELS 9+3

Regularized Autoencoders – Representational Power, Layer Size and Depth – Stochastic Encoders and Decoders – Denoising – Boltzmann Machines – Deep Belief Networks – Directed Generative Nets.

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project: – Periods

Total: 60 Periods

TEXTBOOKS:

1. Seth Weidman, "Deep Learning from Scratch", 1st edition, O'Reilly Media, 2019.
2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", 1st edition, MIT Press, 2017.

REFERENCES:

1. Francois Chollet, "Deep Learning with Python", 2nd edition, Manning Publications, 2018.
2. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", 1st edition, Apress, 2018.
3. Umberto Michelucci "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks", 1st edition, Apress, 2018.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER V

U21AD502	APPLICATION DEVELOPMENT	Category: PCC				
		L	T	P	J	C
		3	0	2	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the essential components of web and internet
- To use HTML, cascading style sheets (CSS) and Java script for website development
- To use modern web development technologies

COURSE OUTCOMES:

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

CO1: Describe the basic concepts of World Wide Web and HTML (Understand)

CO2: Develop static and dynamic web applications using Java script and CSS (Apply)

CO3: Develop server side applications using Node.js (Apply)

CO4: Implement web applications using React (Apply)

CO5: Develop data centric applications using Mongodb (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I WEB ESSENTIALS **9**

The Internet and World Wide Web – Basic Protocols – Web Essentials: Clients, Servers, and Communication – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML 5 Basic elements

UNIT II CSS AND CLIENT SIDE SCRIPTING **9**

Introduction to Cascading Style Sheets (CSS) – Basics elements – Inline, embedded and external style sheets – JavaScript Introduction – JavaScript DOM Model – Using Objects – Regular Expressions

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UNIT III APPLICATION DEVELOPMENT USING NODE JS 9

Introduction to Node.js – Installing Node.js – Asynchronous Programming – File System Operations – HTTP and Web Servers – NPM (Node Package Manager) – Managing dependencies, and using third-party packages in Node.js projects – working with events in Node.js – Security Considerations – Deployment

UNIT IV REACT JS 9

Introduction to React.js – Setting up React.js Environment – npm/yarn, create-react-app – JSX (JavaScript XML) – React components, their lifecycle – Props: Passing data and properties from parent components to child components – React's state management – Handling events – Forms and Controlled Components – Basics of React Hooks, React Router and Redux

UNIT V MONGO DB 9

Introduction to MongoDB – Installation and Setup – Documents – Collections – Subcollections – Database – Data Types – Dates – Arrays – Embedded Documents – CRUD Operations – Batch Insert – Insert Validation – Querying The Documents – Cursors – Indexing

LIST OF EXPERIMENTS

1. Develop a personal profile website using HTML and CSS
2. Develop a website with client side form validation
3. Develop an application for task management using Java Script.
4. Develop a basic web server with node.js
5. Build a simple login and registration application using react.js
6. Build a notes taking application with Mongo DB

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: 15 Periods Project: – Periods

Total: 60 Periods

TEXTBOOKS:

1. John Dean, "Web Programming with HTML5, CSS, and JavaScript Pap/Psc", 1st Edition, Jones and Bartlett Learning, 2019
2. Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native, Anthony Accomazzo, HousseinDjirdeh, Sophia Shoemaker, Devin Abbott, FullStack publishing, 2021

REFERENCES:

1. MongoDB in Action, Kyle Banker, Peter Bakkum, Shaun Verch, Douglas Garrett, Tim Hawkins, Manning Publication, Second edition, 2016.
2. Syed, Basarat Ali, and Martin Bean. Beginning Node.js. New York City: Apress, 2014.
3. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition.2017

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EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th colspan="2">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I
(Theory)
(100 Marks)</th><th colspan="2">Assessment II
(Practical)
(100 Marks)</th><th rowspan="2">Theory Examinations
(Examinations will be conducted for 100 Marks)</th><th rowspan="2">Practical Examinations
(Examinations will be conducted for 100 Marks)</th></tr>
<tr><td>Individual Assignment / Case Study / Seminar / Mini Project / MCQ</td><td>Written Test</td><td>Evaluation of Laboratory Observation, Record
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<tr><td>40</td><td>60</td><td>75</td><td>25</td><td></td><td></td></tr>
<tr><td colspan="2">25</td><td colspan="2">25</td><td>35</td><td>15</td></tr>
<tr><td colspan="4">50</td><td colspan="2">50</td></tr>
<tr><td colspan="6">Total: 100</td></tr>
</table>

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KPRIET
Learn Beyond

SEMESTER V

U21ECG04	INTERNET OF THINGS AND IT'S APPLICATIONS (Common to CS and AD)	Category: PCC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- U21CSG01: Problem Solving and C Programming

COURSE OBJECTIVES:

- To provide basic knowledge about embedded processor, its hardware and software
- To be acquainted with interfacing of sensors and actuators with microprocessor
- To apply Internet of Things techniques in the real time applications

COURSE OUTCOMES:

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

CO1: Outline the basics of embedded system and its components (Understand)

CO2: Explain the fundamentals of Arduino programming (Understand)

CO3: Implement the interfacing of different sensors and actuators to the development boards (Apply)

CO4: Apply the knowledge of IoT and Cloud interface for application development (Apply)

CO5: Develop simple projects using IoT platform (Analyze)

CO-PO MAPPING:

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

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

SYLLABUS:

UNIT I OVERVIEW OF EMBEDDED SYSTEMS 6

Embedded systems – Features, characteristics, model – Simple embedded system – Microprocessor Vs Microcontroller – Microcontroller unit – 8 bit MCU – Functional blocks of a mobile phone

UNIT II ARDUINO BOARDS AND PROGRAMMING CONCEPTS 6

Arduino families – Uno, Nano, Leonardo, Ethernet, Mega2560 – IDE tool – Variables and data types – Control structures – I/O functions

UNIT III INTERFACING SENSORS AND ACTUATORS 6

Programming and Interfacing with sensors – Temperature, humidity, water, MQ2, PIR and ultrasonic – Magnetic relay switches – Actuators – Servo motor – Stepper motor

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UNIT IV COMMUNICATION AND NETWORKING 6

ESP8266 characteristics – SPI protocol – I2C protocol – Wi-Fi communication – Blynk protocol – MQTT protocol – ThinkSpeak IoT platform

UNIT V IoT APPLICATIONS 6

IoT enabling technologies – Automatic water level controller – Smart irrigation system – Weather monitoring system – Home automation – Smart parking system

LIST OF EXPERIMENTS

1. Temperature monitoring system
2. Obstacle detection using ultrasonic sensor
3. Stepper motor control
4. IoT based Gas leakage monitoring system
5. IoT based Smart Lighting system using Blynk App.
6. IoT based weather monitoring using ThingSpeak

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 60 Periods

TEXT BOOKS:

1. James A. Langbridge, "Arduino Sketches: Tools and Techniques for Programming Wizardry", 1st edition, John Wiley & Sons, 2015
2. Lyla B. Das, " Embedded Systems: An Integrated Approach", 1st edition, Pearson Education, 2013

REFERENCES:

1. Raj Kamal, "Embedded Systems Architecture, Programming and Design", 3rd edition, McGraw-Hill Higher Education, 2017
2. Simon Monk, "Programming Arduino: Getting Started with Sketches", 2nd edition, Tata Mc Graw Hill, 2016
3. Massimo Banzi, Michael Shiloh, Make, "Getting Started with Arduino: The open source electronics prototyping platform", 3rd edition, LLC, 2015
4. Brock Craft, "Arduino Projects for Dummies", 2nd edition, John Wiley & Sons, 2013

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		**Assessment II (Practical) (100 Marks)**		**Theory Examinations (Examinations will be conducted for 100 Marks)**	**Practical Examinations (Examinations will be conducted for 100 Marks)**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test		
40	**60**	**75**	**25**		
25		**25**		**25**	**25**
50				**50**	
Total: 100					

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER V

U21AD503	DEEP LEARNING LABORATORY	Category: PCC				
		L	T	P	J	C
		0	0	2	2	2

PRE–REQUISITES:

- U21CSG02 : Python Programming
- U21AD401 : Machine Learning - Essentials

COURSE OBJECTIVES:

- To Identify and apply suitable deep learning approaches for given application
- To solve real world applications using Deep learning

COURSE OUTCOMES:

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

CO1: Build the Neural Network with various model (Apply)

CO2: Apply the Convolution Neural Network on computer vision problems (Apply)

CO3: Demonstrate the Deep Learning Models in the field of Natural Language Processing (Apply)

CO4: Exhibit the Auto encoder algorithms for encoding the real-world data (Apply)

CO5: Apply Generative Adversarial Networks for image generation (Apply)

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

1. a. Compute the derivatives of the functions with respect to any of the inputs.
   b. Build first neural network.
   c. Train the network using Trainer and Optimizer with models
   d. Train the model with learning rate decay.
2. Convolution Neural Network application using Tensorflow and Keras.
   a. Classification of Dataset using CNN
   b. Face recognition using CNN
3. Object detection using Transfer Learning of CNN architectures
4. Text processing, Language Modeling using RNN

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5. Time Series Prediction using RNN
6. Sentiment Analysis using LSTM
7. Image denoising (Fashion dataset) using Auto Encoders
8. Handling Color Image in Neural Network Aka Stacked Auto Encoders (Denoising)
9. Image generation using GAN
10. End to end application development using deep learning algorithm

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 30 Periods

REFERENCES:

1. Francois Chollet, "Deep Learning with Python", 2nd edition, Manning Publications, 2018.
2. Giancarlo Zaccone, Md. Rezaul Karim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", 1st edition, Packt Publisher, 2017.

EVALUATION PATTERN:

<table>
<tr><th colspan="5">Continuous Internal Assessments</th><th>End Semester Examinations</th></tr>
<tr><td colspan="2">Assessment I (Practical) (100 Marks)</td><td colspan="3">Assessment II (Project) (100 Marks)</td><td rowspan="2">Practical Examinations
(Examinations will be conducted for 100 Marks)</td></tr>
<tr><td>Evaluation of Laboratory Observation, Record
(Rubrics Based Assessments)</td><td>Test</td><td>Review I</td><td>Review II</td><td>Review III</td></tr>
<tr><td>75</td><td>25</td><td>15</td><td>25</td><td>60</td><td></td></tr>
<tr><td colspan="2">25</td><td colspan="3">25</td><td>50</td></tr>
<tr><td colspan="5">50</td><td>50</td></tr>
<tr><td colspan="6">Total: 100</td></tr>
</table>

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SEMESTER V

		Category: HSMC				
U21SSG02	SOFT SKILLS - II	L	T	P	J	C
		0	0	2	0	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the importance of communication and enhance self confidence
- To acquire employability skills

COURSE OUTCOMES:

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

CO1: Actively participate in Group Discussion (Analyze)

CO2: Enhance interview skills and make effective Presentation (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I PRESENTATION SKILLS **10**

Presentation Techniques – Time Management Techniques – Body language – Managerial Skills – Making Effective Presentation

UNIT II GROUP DISCUSSION AND PUBLIC SPEAKING **10**

Introduction to Group Discussion – Understanding Group Dynamics – Group Discussion Strategies– Activities to Improve GD Skills – Public Speaking Techniques – Public Speaking Activities

UNIT III INTERVIEW SKILLS **10**

Listening to Interviews – Preparation for the Interview – Interview Techniques and Etiquettes – Handling Stress Interview – Mock Interview – Online Interview Techniques

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 30 Periods

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TEXT BOOKS:

1. Prashant Sharma, "Soft Skills: Personality Development for Life Success", 1st edition, BPB Publications, 2022.
2. Leader Interpersonal and Influence Skills: The Soft Skills of Leadership." 1st edition, Routledge Publications, 2014.

REFERENCES:

1. Ghosh B N, "Managing Soft Skills for Personality Development", 1st edition,Tata McGraw-Hill, 2012.
2. Nitin Bhatnagar and Mamta Bhatnagar, "Effective Communication and Soft Skills Strategies for Success", 1st edition, Pearson Education, 2012.

EVALUATION PATTERN:

Continuous Internal Assessments	Marks
Test - I	50
Test - II	50
Total	100

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SEMESTER VI

U21AD601	COMPUTER VISION AND IMAGE PROCESSING	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21MA204 : Applied Linear Algebra

COURSE OBJECTIVES:

- To understand various image features and recognition techniques
- To review image processing techniques for computer vision
- Study real world applications of computer vision algorithms

COURSE OUTCOMES:

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

CO1: Explain low level processing of image and transformation techniques applied to images (Understand)

CO2: Explain the feature extraction, segmentation and object recognition methods (Understand)

CO3: Apply Histogram transform for detection of geometric shapes like line, ellipse and objects (Apply)

CO4: Execute 3D vision process and motion estimation techniques (Apply)

CO5: Apply vision techniques to real time applications (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I IMAGE PROCESSING FOUNDATIONS 8

Image processing techniques – Classical filtering operations – Thresholding techniques – Edge detection techniques – Corner and interest point detection – Mathematical morphology – Texture.

UNIT II IMAGE FORMATION AND PROCESSING 10

Overview and State-of-the-art – Fundamentals of Image Formation – Transformation: Orthogonal – Euclidean – Affine and Projective. Fourier Transform – Convolution and Filtering – Image Enhancement – Restoration – Histogram Processing.

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UNIT III FEATURE EXTRACTION **10**

Edges – Canny, LOG, DOG; Line detectors (Hough Transform) – Corners – Harris and Hessian Affine, Orientation Histogram – SIFT – SURF – HOG – GLOH – Scale-Space Analysis – Image Pyramids and Gaussian derivative filters – Gabor Filters and DWT.

UNIT IV IMAGE SEGMENTATION **8**

Region Growing – Edge Based approaches to segmentation – Graph-Cut – Mean-Shift – MRFs – Texture Segmentation –Object detection.

UNIT V PATTERN ANALYSIS **9**

Clustering: K-Means – K-Medoids – Mixture of Gaussians – Classification: Discriminant Function – Supervised – Un-supervised – Semi-supervised – Classifiers: Bayes – KNN – ANN models – Dimensionality Reduction: PCA – LDA – ICA – Non-parametric methods.

Contact Periods:

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

TEXT BOOKS:

1. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", 2nd Edition, Pearson Education, 2003.
2. Richard Szeliski, "Computer Vision: Algorithms and Applications", 2nd Edition, Springer Verlag London Limited, 2011

REFERENCES:

1. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, 1st edition, Cambridge University Press, 2012.
2. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, 3rd Edition, Academic Press, 2012.
3. E. R. Davies, (2012), "Computer & Machine Vision", 4th Edition, Academic Press.
4. ReinhardKlette, "Concise Computer Vision: An Introduction into Theory and Algorithms", 1st edition, Springer, 2014.

EVALUATION PATTERN:

<table>
<tr><td colspan="4">Continuous Internal Assessments</td><td rowspan="2">Total Internal Assessments</td><td rowspan="3">End Semester Examinations</td></tr>
<tr><td colspan="2">Assessment I (100 Marks)</td><td colspan="2">Assessment II (100 Marks)</td></tr>
<tr><td>Individual Assignment / Case Study / Seminar / Mini Project / MCQ</td><td>Written Test</td><td>Individual Assignment / Case Study / Seminar / Mini Project / MCQ</td><td>Written Test</td><td></td></tr>
<tr><td>40</td><td>60</td><td>40</td><td>60</td><td>200</td><td>100</td></tr>
<tr><td colspan="4" rowspan="2">Total</td><td>40</td><td>60</td></tr>
<tr><td colspan="2">100</td></tr>
</table>

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SEMESTER VI

U21AD602	BIG DATA MANAGEMENT	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand about big data
- To learn and use NoSQL big data management
- To learn map reduce analytics using Hadoop and related tools

COURSE OUTCOMES:

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

CO1: Describe big data and use cases from selected business domains (Understand)

CO2: Infer the features of NoSQL big data management (Understand)

CO3: Illustrate the configuration of Hadoop and HDFS (Understand)

CO4: Exemplify the map-reduce analytics using Hadoop (Understand)

CO5: Discuss Hadoop related tools for big data analytics (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I UNDERSTANDING BIG DATA 9

Introduction – distributed file system – Big Data and its importance, Five Vs, Drivers for Big data, Big data analytics, Big data applications – Big data and healthcare – big-data in medicine – Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

UNIT II NOSQL DATA MANAGEMENT 9

Introduction to NoSQL – Aggregate data models – Aggregates – Key-value and document data models – Relationships – Graph databases – Schema less databases – Materialized views – Distribution models – Sharing – Master-slave replication – Peer-peer replication – Sharing and

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replication – Consistency – Relaxing consistency – Version stamps – Map-Reduce – Partitioning and combining – Composing map-reduce calculations.

UNIT III BASICS OF HADOOP 9

Data format – analyzing data with Hadoop – Scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – Data flow – Hadoop I/O – Data integrity – Compression – Serialization – Avro – File-based data structures.

UNIT IV MAP REDUCE APPLICATIONS 9

Map Reduce workflows – Unit tests with MR Unit – Test data and local tests – Anatomy of Map Reduce job run – Classic Map-reduce – YARN – Failures in classic Map-reduce and YARN – Job scheduling – Shuffle and sort – Task execution – Map Reduce types – Input formats – Output formats.

UNIT V HADOOP RELATED TOOLS 9

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis. Cassandra – Cassandra data model – Cassandra examples – Cassandra clients – Hadoop integration. Pig – Grunt – Pig data model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", 1st edition, Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", 2nd edition, O'Reilley, 2012
3. Chris Eaton, Dirk deroos et al. , "Understanding Big data", 1st edition, McGraw Hill, 2012.

REFERENCES:

1. Vignesh Prajapati, "Big Data Analytics with R and Hadoop", 1st edition, Packet Publishing 2013.
2. JJ Geewax, "API Design Patterns", 1st Edition, Manning Publications, 2021.
3. Bogunuva Mohanram Balachandar, "Restful Java Web Services: A pragmatic guide to designing and building RESTful APIs using Java, 3rd Edition, Ingram Short Title, 2017.
4. Jy Liebowitz, "Big Data and Business analytics", 1st edition, CRC press, 2013.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER VI

		Category: PCC				
U21AD603	GENERATIVE AI	L	T	P	J	C
		3	0	2	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the fundamental concepts of generative AI
- To acquire the knowledge of encoders, decoders and autoregressive models
- To acquire the knowledge of various generative models for image generation, style transfer and text generation
- To learn to apply transformers, prompt engineering and APIs for real world problems
- To learn to implement develop application using chat GPTs and open API

COURSE OUTCOMES:

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

CO1: To understand the fundamental concepts of generative AI (Understand)

CO2: To understand the encoders, decoders and autoregressive models (Understand)

CO3: To apply various generative models for image generation, style transfer and text generation (Apply)

CO4: To apply transformers, prompt engineering and APIs for real world problems (Apply)

CO5: To develop application using chat GPTs and open API (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION 9

An Introduction to Generative AI – Applications of AI – The rules of probability – Why use generative models – Unique challenges of generative models

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UNIT II AUTOENCODERS AND AUTOREGRESSIVE MODELS 9

Autoencoders – Regularised autoencoders – Stochastic Encoders and Decoders – Autoregressive Models – Fully Visible Sigmoid Belief Network (FVSBN) – Neural Autoregressive Density Estimation (NADE) – Masked Autoencoder for Distribution Estimation (MADE)

UNIT III GENERATIVE ADVERSARIAL NETWORK 9

Generative Adversarial Networks – Vanilla GAN – Progressive GAN – Style transfer and image transformation – Image Generation with GANs – Style Transfer with GANs

UNIT IV TRANSFORMERS AND PROMPT ENGINEERING 9

Transformers – Large language models – MLM/NSP – Generative Pretrained Transformers (GPT) – Task-specific GPT Fine tuning – Prompt Engineering – Hugging face Pretrained Transformers – Huggingface APIs

UNIT V CHATGPTs AND OPENAPI 9

GPT3,3.5,4 – OpenAI APIs – Working with the OpenAI Playground – Applications and Use Cases: Content Filtering – Generating and Transforming Text – Classifying and Categorizing Text – Building a GPT-3-Powered Question-Answering App

LIST OF EXPERIMENTS

1. Prompt exercises using GPT based on explicit constraints
2. Content filtering exercises using GPT
3. Prompt exercises in Huggingface Transformer
4. Developing a real-time application using GPT3

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: 15 Periods Project: – Periods

Total: 60 Periods

REFERENCES:

1. Steve Tingiris, Exploring GPT-3, Packt Publishing Ltd. UK, 2021
2. Joseph Babcock Raghav Bali, Generative AI with Python and TensorFlow 2, Packt Publishing Ltd. UK, 2021
3. Sabit Ekin, Prompt Engineering For ChatGPT: A Quick Guide To Techniques, Tips, And Best Practices, DOI:10.36227/techrxiv.22683919.v2, 2023
4. https://huggingface.co/

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		**Assessment II (Practical) (100 Marks)**		**Theory Examinations (Examinations will be conducted for 100 Marks)**	**Practical Examinations (Examinations will be conducted for 100 Marks)**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test		
40	**60**	**75**	**25**		
25		**25**		**25**	**25**
50				**50**	
Total: 100					

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SEMESTER VI

		Category: PCC				
U21AD604	COMPUTER VISION AND IMAGE PROCESSING LABORATORY	L	T	P	J	C
		0	0	2	2	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To familiarize the basic concept and methodologies for digital image processing
- To implement algorithms for handling image data
- To implement computer vision techniques

COURSE OUTCOMES:

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

CO1: Use python to handle image data (Apply)

CO2: Apply image processing techniques to handle color images (Apply)

CO3: Implement filtering to eliminate high frequency components of image (Apply)

CO4: Apply different non-linear transforming techniques (Apply)

CO5: Perform segmentation of images (Apply)

CO-PO MAPPING:

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

LIST OF EXPERIMENTS (INDICATIVE)

1. Display of Gray scale Images.
   a. create a program to display grayscale image using read and write operation.
   b. create a vision program to convert a 2D array into a grayscale image.
   c. create a vision program to convert gray images into an array of numbers.
   d. create a program to rotate an image
2. Find histogram value and display histograph of a grayscale and color image.
3. Design a Non-linear Filter using edge detection.
4. Determine edge detection of an image using different operators.

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5. Discretize an image using Fourier transformation and perform Discrete cosine transform on an image.
6. Apply filtering in frequency domain to eliminate the high frequency components of an image
7. Display of colour images.
   a. create a color image and perform read and write operation
   b. create a vision program to convert a 2D array into a color image.
   c. create a vision program to convert colour images into an array of numbers.
8. Obtain the R, B, G colour values and resolved colour values from a colour box by choosing any colour.
9. Performs discrete wavelet transform on image.
10. Program for segmentation of an image using watershed transforms.
11. A mini project based on real time application. Say, medical image processing, object detection in road safety, object detection for visually impaired.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 30 Periods

REFERENCES:

1. Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, 1st edition, Cambridge University Press, 2012.
2. Mark Nixon and Alberto S. Aquado, Feature Extraction & Image Processing for Computer Vision, 3rd Edition, Academic Press, 2012.
3. E. R. Davies, (2012), "Computer & Machine Vision", 4th Edition, Academic Press.
4. ReinhardKlette, Concise Computer Vision: An Introduction into Theory and Algorithms, 1st edition, 2014

EVALUATION PATTERN:

<table>
<tr><th colspan="5">Continuous Internal Assessments</th><th>End Semester Examinations</th></tr>
<tr><td colspan="2">Assessment I (Practical)
(100 Marks)</td><td colspan="3">Assessment II
(Project)
(100 Marks)</td><td rowspan="2">Practical
Examinations
(Examinations will be conducted for 100 Marks)</td></tr>
<tr><td>Evaluation of Laboratory Observation, Record
(Rubrics Based Assessments)</td><td>Test</td><td>Review I</td><td>Review II</td><td>Review III</td></tr>
<tr><td>75</td><td>25</td><td>15</td><td>25</td><td>60</td><td></td></tr>
<tr><td colspan="2">25</td><td colspan="3">25</td><td>50</td></tr>
<tr><td colspan="5">50</td><td>50</td></tr>
<tr><td colspan="6">Total: 100</td></tr>
</table>

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KPRIET Learn Beyond

SEMESTER VI

		Category: HSMC				
U21SSG03	SOFT SKILLS – III	L	T	P	J	C
		0	0	2	0	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To improve language adeptness and to enhance fluency in language
- To Gain emotional intelligence and to manage stress

COURSE OUTCOMES:

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

CO1: Write reports and make reasoning and assertions (Apply)

CO2: Overcome stress and attain work-life balance (Analyse)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I LANGUAGE ADEPTNESS **10**

Sentence Completion – Report Writing – Logical Reasoning – Cause and Effect – Assertion and Reasoning – Digital Profiling – Creative Resume

UNIT II STRESS MANAGEMENT **10**

Factors Causing Stress – Positive and Negative Stress – Effects of Stress – Stress Overcoming Techniques – Context Based Tasks

UNIT III EMOTIONAL INTELLIGENCE **10**

Leadership effectiveness – Self-awareness – Self-management – Self-motivation – Empathy and Social Skills

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 30 Periods

TEXT BOOKS:

1. Daniel Goleman, "Emotional Intelligence: Why it Can Matter More Than IQ", 1st edition, Bloomsbury, 2009.
2. Alan Barker, "Improve Your Communication Skills : Present with Confidence; Write with Style; Learn Skills of Persuasion", 1st edition, Kogan Page, 2010.

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REFERENCES:

1. Jeremy Stranks, "Stress at Work: Management and Prevention", 1st edition, Butterworth-Heinemann, 2005.
2. Edward J Watson, "Emotional Intelligence: A Practical Guide on How to Control Your Emotions and Achieve Lifelong Social Success", 1st edition, Amazon Digital Services LLC, 2016.

EVALUATION PATTERN:

Continuous Internal Assessments	Marks
Test - I	50
Test - II	50
Total	100

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SEMESTER VII

U21IT701	SOFTWARE PROJECT MANAGEMENT (Common to IT and AD)	Category: HSMC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the Software Project Planning and Evaluation techniques.
- To plan and manage projects at each stage of the software development life cycle (SDLC)
- To learn about the activity planning and risk management principles.
- To manage software projects and control software deliverables.
- To develop skills to manage the various phases involved in project management and people management and to deliver successful software projects that support organization's strategic goals.

COURSE OUTCOMES:

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

CO1: Understand Project Management principles while developing software. (Understand)

CO2: Gain extensive knowledge about the basic project management concepts, framework, the software process models and software effort estimation techniques. (Understand)

CO3: Estimate the risks involved in various project activities. (Understand)

CO4: Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles. (Understand)

CO5: Learn staff selection process and the issues related to people management. (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I PROJECT EVALUATION AND PROJECT PLANNING 9

Importance of Software Project Management – Activities – Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

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UNIT II PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models – Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II – Parametric Productivity Model.

UNIT III ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning – Risk Management – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT IV PROJECT MANAGEMENT AND CONTROL 9

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

UNIT V STAFFING IN SOFTWARE PROJECTS 9

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOK:

1. Bob Hughes, Mike Cottereli and Rajib Mall, "Software Project Management", 5th Edition, Tata McGraw Hill, New Delhi, 2022.

REFERENCES:

1. Robert K. Wysocki, "Effective Software Project Management", Wiley Publication, 2011.
2. Walker Royce, "Software Project Management", Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, "Managing Global Software Projects", McGraw Hill Education, 14th Reprint 2013.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER VII

		Category: PCC				
U21ITG02	**INFORMATION SECURITY** (Common to IT and AD)	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21MA204 – Applied Linear Algebra

COURSE OBJECTIVES:

- To employ classical encryption techniques and symmetric key algorithms
- To apply hash functions and digital signature
- To construct key management and user authentication protocols

COURSE OUTCOMES:

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

CO1: Employ classical encryption techniques for providing confidentiality service (Apply)

CO2: Implement symmetric key algorithms and stream ciphers for encrypting text and multimedia data (Apply)

CO3: Apply number theory concepts to design asymmetric key algorithms for providing confidentiality and key exchange services (Apply)

CO4: Utilize hash function and digital signature for protecting digital documents (Understand)

CO5: Construct key management and user authentication protocols for providing key sharing and authentication services (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I CLASSICAL ENCRYPTION **8**

Basic concepts – Security attacks, services and mechanisms – Characteristics of good ciphers – Security Standards – Classical encryption techniques: Symmetric cipher model, Substitution techniques, and Transposition techniques

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UNIT II SYMMETRIC AND STREAM CIPHERS 10

Block cipher principles – Data Encryption Standard (DES) – Fields and finite field arithmetic – Advanced Encryption Standard (AES) – Block cipher modes of operation – Principles of random number generation – Random number generators, Stream ciphers, RC4

UNIT III ASYMMETRIC CIPHERS 9

Number theory concepts: Euclidean algorithm – Modular arithmetic – Prime numbers – Fermat's and Euler's theorem, Discrete logarithms, Principles of public–key cryptosystems, RSA algorithm, Diffie–Hellman key exchange, ElGamal cryptographic system

UNIT IV HASH FUNCTION AND DIGITAL SIGNATURE 9

Hash function: Applications, Requirements, Secure Hash Algorithm (SHA), Message authentication codes: Requirements, functions, Hash based Message Authentication Codes (HMAC) – Digital signature: Properties, ElGamal digital signature scheme, Digital Signature Standard (DSS)

UNIT V KEY MANAGEMENT AND USER AUTHENTICATION 9

Key management and distribution – X.509 certificate – Public key infrastructure – User authentication – Kerberos protocol

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOK:

1. William Stallings, "Cryptography and Network Security - Principles and Practices", Pearson Education, 6th Edition, 2014.
2. Douglas R Stinson, "Cryptography - Theory and Practice", Chapman and Hall / CRC Press, New York, 2013.

REFERENCES:

1. Behrouz A Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, New Delhi, 2011.
2. Atul Kahate, "Cryptography and Network Security", Tata Mcgraw Hill, New Delhi, 2013.
3. https://www.khanacademy.org/computing/computer-science/cryptography

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.

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SEMESTER VII

		Category: PCC				
U21AD701	ETHICS OF ARTIFICIAL INTELLIGENCE	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21AD305 : Fundamentals of Artificial Intelligence

COURSE OBJECTIVES:

- To understand ethical issues with the development of AI agents
- To apply the ethical considerations in different AI applications
- To overcome the risk for Human rights and other fundamental values

COURSE OUTCOMES:

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

CO1: Describe the basic concepts of ethics and discrimination in using AI (Understand)

CO2: Illustrate privacy violations and threats in AI applications with examples (Understand)

CO3: Exemplify the AI enabled manipulation with use cases (Understand)

CO4: Interpret the threats of AI to right to life, liberty and security of people (Understand)

CO5: Illustrate the conflict of AI with human dignity with case studies (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION **9**

The Ethics of Artificial Intelligence: An Introduction – Unfair and Illegal Discrimination – Cases of AI-Enabled Discrimination – Ethical Questions Concerning AI – Enabled Discrimination – AI Impact Assessment

UNIT II PRIVACY AND SURVEILLANCE CAPITALISM **9**

Privacy : Introduction – Cases of Privacy Violations Through AI – Case 1: Use of Personal Data by Authoritarian Regimes – Case 2: Genetic Privacy – Data Protection and Privacy Responses to AI – Related Privacy Threats Key Insights

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Surveillance Capitalism : Introduction – Cases of AI - Enabled Surveillance Capitalism – Case 1: Data Appropriation Manipulation and Right to Life, Liberty and Security of Persons

UNIT III MANIPULATION 9

Introduction Cases of AI – Enabled Manipulation – Case 1: Election Manipulation – Case 2: Pushing Sales During "Prime Vulnerability Moments" – The Ethics of Manipulation Responses to Manipulation

UNIT IV RIGHT TO LIFE, LIBERTY AND SECURITY OF PERSONS 9

Introduction – Cases of AI Adversely Affecting the Right to Life, Liberty – Security of Persons – Case 1: Fatal Crash Involving a Self-driving Car – Case 2: Smart Home Hubs Security Vulnerabilities – Case 3: Adversarial Attacks in Medical Diagnosis – Ethical - Responses

UNIT V DIGNITY 9

Introduction – Cases of AI in Potential Conflict with Human Dignity – Case 1: Unfair Dismissal - Case 2: Care Robots – Ethical Questions Concerning AI and Dignity

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Stahl, B.C., Schroeder, D., Rodrigues, R, "The Ethics of Artificial Intelligence: An Introduction. In: Ethics of Artificial Intelligence" Springer Briefs in Research and Innovation Governance. Springer, Cham. https://doi.org/10.1007/978-3-031-17040-9_1, 2023

REFERENCES:

1. Deepak Khemani, "A First Course in Artificial Intelligence", Mc Graw Hill Education, 1st Edition, 2014.
2. Dan W. Patterson "Introduction to AI and ES", Pearson Education, 1st Edition, 2007
3. Patrick Henry Winston, "Artificial Intelligence", Addison Wesley publishers, 3rd Edition, 1992.
4. Elaine Rich, Kevin Knight and Shivashankar, "Artificial Intelligence", McGraw Hill, 3rd Edition, 2017

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

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SEMESTER VII

U21ITG03	INFORMATION SECURITY LABORATORY (Common to IT and AD)	Category: PCC				
		L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- U21MA204 – Applied Linear Algebra

COURSE OBJECTIVES:

- To demonstrate the working of classical and symmetric encryption techniques
- To implement the random number generators and stream ciphers
- To implement public key cryptosystems, digital signature and authentication protocols

COURSE OUTCOMES:

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

CO1: Demonstrate the working of classical and symmetric encryption techniques for providing confidentiality service (Apply)

CO2: Implement random number generators and stream ciphers for encrypting data (Apply)

CO3: Develop public key cryptosystems using the number theory concepts (Apply)

CO4: Implement digital signature algorithm for secure data exchange (Apply)

CO5: Implement authentication protocols for secure data exchange (Apply)

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

The following experiments are to be implemented using Java/C/Python programming language.

1. Encrypt the message "the key is hidden under the door pad" with the encryption key is "information" using Play fair cipher. Also, decrypt the ciphertext to get back the plaintext message

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2. Employ column and row transposition techniques to encrypt the message "attack postponed until two am". The column transposition encryption key is 3 4 2 1 5 6 7 and row transposition key is 4 2 3 1. Find the decryption keys and decrypt the ciphertext to get back the plaintext message.
3. Encrypt and decrypt messages using the Data Encryption Standard and Advanced Encryption Standard algorithms using the built-in packages supported by Java language.
4. Generate random number generators using Blum Blum Shub and encrypt messages using bitwise XOR operation.
5. Generate five random keys using RC4 algorithm for the given inputs: State array S[4] = {2, 3, 4, 5} and Initial key K[4] = {4, 7, 3, 5}. Also perform encryption and decryption of messages using RC4 algorithm.
6. Encrypt the plaintext message M = 25 using RSA algorithm with the following inputs: p = 11, q = 17, and public key (e) = 7. Find the private key (d) using Extended Euclid's Algorithm and perform decryption to get back the plaintext message.
7. Find secret key shared by the users A and B using Diffie-Hellman key exchange algorithm. Given the following inputs: q=353, α=3, A's private = 97, and B's private = 233.
8. Implement SHA hash functions and HMAC function using the built-in packages supported by Java language.
9. Perform signing and verification of the signature created for a document with hash value H(M)=100 using ElGamal digital signature scheme. The value of global elements q=467, and α=2. The private key X_A = 127 and the random integer K=213.
10. Simulate the working model of Kerberos protocol to accomplish client/server authentication.

Contact Periods:

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

REFERENCES:

1. William Stallings, "Cryptography and Network Security - Principles and Practices", Pearson Education, 6th Edition, 2014.
2. Allan H. Robbins, Wilhelm C. Miller, "Circuits Analysis Theory and Practice", 5th edition, Behrouz A Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, New Delhi, 2011.
3. Atul Kahate, "Cryptography and Network Security", Tata Mcgraw Hill, New Delhi, 2013.
4. Douglas R Stinson, "Cryptography - Theory and Practice", Chapman and Hall / CRC Press, New York, 2013.
5. https://www.khanacademy.org/computing/computer-science/cryptography

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EVALUATION PATTERN:

Continuous Internal Assessments		End Semester Examinations
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
40		60
100		

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SEMESTER VII

		Category: EEC				
U21AD702	PROJECT WORK PHASE - I	L	T	P	J	C
		0	0	0	4	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To train the students to study and analyse a real world problem and choose appropriate technologies to solve the problem
- Collect detailed requirements and document them as per the available standards
- Build both high level and low level designs for the problem to model the proposed solution
- Document the detailed designs as per the standards

COURSE OUTCOMES:

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

CO1: Study and analyze a real-world problem and prepare software requirements specification document (Apply)

CO2: Design high-level and low-level designs based on the requirements (Apply)

CO3: Prepare detailed technical documents to illustrate the design and demonstrate it (Apply)

CO-PO MAPPING:

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

STRATEGY

To identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication or develop computer code. Demonstrate the novelty of the project through the results and outputs

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: – Periods Project: 60 Periods

Total: 60 Periods

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EVALUATION PATTERN:

Continuous Internal Assessments (60 Marks)			End semester Examinations (40 Marks)			
Review I	Review II	Review III	Project Report		Viva-Voce	
			Supervisor	External	Internal	External
10	20	30	10	10	10	10

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SEMESTER VIII

U21AD801	PROJECT WORK PHASE - II	Category: EEC				
		L	T	P	J	C
		0	0	0	20	10

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To implement the proposed solutions based on the design documents and deploy it in the targeted platform.
- To develop testing procedures to test and document the outcomes as per the standards.
- To prepare detailed project report and the presentation.

COURSE OUTCOMES:

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

CO1: Implement the solution as per the design document and coding standards (Apply)

CO2: Test the developed solution and document the outcomes (Apply)

CO3: Prepare detailed technical report, demonstrate and present the work (Apply)

CO-PO MAPPING:

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

STRATEGY

To identify a topic of interest in consultation with Faculty/Supervisor. Review the literature and gather information pertaining to the chosen topic. State the objectives and develop a methodology to achieve the objectives. Carryout the design / fabrication or develop computer code. Demonstrate the novelty of the project through the results and outputs

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: – Periods Project: 300 Periods

Total: 300 Periods

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EVALUATION PATTERN:

Continuous Internal Assessments (60 Marks)			End semester Examinations (40 Marks)			
Review I	Review II	Review III	Project Report		Viva-Voce	
			Supervisor	External	Internal	External
10	20	30	10	10	10	10

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VERTICAL 1: COMPUTATIONAL ANALYTICS

U21ADP01	MATHEMATICAL FOUNDATION FOR DATA SCIENCE	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To introduce the basic mathematical concepts relevant to data science
- To apply mathematical skills to solve real-time problems
- To introduce basic data science methods

COURSE OUTCOMES:

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

CO1: Describe the need of mathematical foundations for data science (Understand)

CO2: Illustrate linear algebra concepts required for data science (Understand).

CO3: Describe the basics of probability for data science (Understand)

CO4: Understand the basics of statistics for data science (Understand)

CO5: Describe the basics of optimization techniques for data science (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I BASICS OF DATA SCIENCE **9**

Introduction – Typology of problems – Importance of linear algebra, statistics and optimization from a data science perspective – Structured thinking for solving data science problems

UNIT II LINEAR ALGEBRA **9**

Solution of system of linear equations, Vector spaces – Linear dependence and independence – Bases and dimensions, Inner product space, Linear transformations – Range, kernel and problems – Eigenvalues and eigenvectors.

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UNIT III PROBABILITY 9

Probability – Axioms of Probability – Conditional probability – Baye's theorem. Discrete and Continuous random variables – Moments – Moment generating functions. Discrete and Continuous distributions: Binomial, Poisson, Geometric, Uniform, Exponential, and Normal distributions. Joint distributions: Marginal and conditional distributions – covariance – correlation and regression.

UNIT IV STATISTICS 9

Definition of Statistics – Basic objectives – Applications in various branches of science with examples.

Collection of Data: Primary and secondary data. Classification and tabulation of data – Frequency distribution – Bar graphs and Pie charts – Histogram – Measures of central tendency – Measures of Variability. Sampling: Sampling distributions – Statistical estimation of parameters-confidence intervals. Testing of hypothesis: large and small sample test. Design of Experiments: One way and two-way classifications.

UNIT V OPTIMIZATION: UNCONSTRAINED OPTIMIZATION 9

Necessary and sufficiency conditions for optima – Gradient descent methods – Constrained optimization – KKT conditions – Introduction to non-gradient techniques – Introduction to least squares optimization – Optimization view of machine learning

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. G. Strang . Introduction to Linear Algebra, Wellesley-Cambridge Press, 5th Edition, USA, 2016
2. Bendat, J. S. and A. G. Piersol. Random Data: Analysis and Measurement Procedures. 4th Edition. John Wiley & Sons, Inc.,NY, USA, 2010

REFERENCES:

1. Montgomery, D. C. and G. C. Runger. Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA, 2011
2. David G. Luenberger. Optimization by Vector Space Methods, John Wiley & Sons (NY), 1969
3. Cathy O'Neil and Rachel Schutt, Doing Data Science, O'Reilly Media, 2013

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Designer can choose any one / two components based on the nature of the course.

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U21ADP02	PATTERN RECOGNITION	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To introduce mathematical foundations of pattern recognition
- To describe different techniques involved in pattern recognition
- To familiarize various clustering techniques

COURSE OUTCOMES:

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

CO1: Describe pattern recognition and its mathematics fundamentals (Understand)

CO2: Understand the pattern recognition process (Understand)

CO3: Explain the pattern recognition models (Understand)

CO4: Describe non-parametric techniques in pattern recognition (Understand)

CO5: Illustrate unsupervised learning and clustering techniques (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION **9**

Pattern recognition system – Design cycle – Learning and adaptation – Mathematical foundations: Linear algebra – Conditional probability – Expectations, mean and covariance – Gaussian derivatives and integrals – Hypothesis testing

UNIT II BAYESIAN DECISION THEORY **9**

Continuous Features – Minimum-Error-Rate classification – Classifiers, discriminant functions and decision surfaces – Normal density – Discrete features – Missing and noisy features – Bayesian belief networks

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UNIT III MODELS 9

Maximum-Likelihood estimation – Bayesian parameter estimation – Principal component analysis – Expectation-Maximization – Hidden Markov models

UNIT IV NON-PARAMETRIC TECHNIQUES 9

Density estimation – Parzen windows – K-Nearest Neighbor estimation – Nearest neighbor rule – Fuzzy classification

UNIT V CLUSTERING TECHNIQUES 9

Unsupervised Bayesian learning – Criterion functions for clustering: Sum-of-Squared-Error – Related minimum variance – Hierarchical clustering: Agglomerative – Step-wise optimal

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Richard O. Duda, P. E. Hart, David G. Stork, "Pattern Classification", 2nd Edition, John Wiley, 2006

REFERENCES:

1. Andrew Webb, "Statistical Pattern Recognition", 2nd Edition, Arnold publishers, London, 1999
2. Bishop, Christopher M., "Pattern Recognition and Machine Learning", 1st Edition, Springer, 2009
3. S. Theodoridis, K. Koutroumbas, "Pattern Recognition", 4th Edition, Academic Press, 2009

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Designer can choose any one / two components based on the nature of the course.

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		Category: PEC				
U21ADP03	SPEECH PROCESSING AND ANALYTICS	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the need for morphological processing and their representation
- To know about the various techniques used for speech synthesis and recognition
- To appreciate the syntax analysis and parsing that is essential for natural language processing
- To learn about the various representations of semantics and discourse
- To have knowledge about the applications of natural language processing

COURSE OUTCOMES:

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

CO1: Identify the basic concepts of speech processing (Understand)

CO2: Describe the speech analysis process (Understand)

CO3: Illustrate speech modeling with examples (Understand)

CO4: Describe speech recognition techniques (Understand)

CO5: Illustrate speech synthesis with examples (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I SPEECH PROCESSING **9**

Phonetics – Articulatory Phonetics – Phonological Categories – Acoustic Phonetics and Signals – Speech Synthesis – Text Normalization – Phonetic and Acoustic Analysis – Diphone Waveform synthesis – Evaluation – Automatic Speech Recognition – Architecture – Hidden Markov Model to Speech – MFCC vectors – Acoustic Likelihood Computation – Evaluation. Triphones – Discriminative Training – Modeling Variation. Computational Phonology – Finite-State Phonology – Computational Optimality Theory – Syllabification – Learning Phonology and Morphology.

UNIT II SPEECH ANALYSIS **9**

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale,

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LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

UNIT III SPEECH MODELING 9

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, and Implementation issues.

UNIT IV SPEECH RECOGNITION 9

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary – continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

UNIT V SPEECH SYNTHESIS 9

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Jurafsky and Martin, "Speech and Language Processing", 2nd Edition, Pearson Prentice Hall, 2008.
2. Lawrence Rabinerand Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.

REFERENCES:

1. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", California Technical Publishing.
2. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", Pearson Education.
3. Claudio Becchetti and Lucio Prina Ricotti, "Speech Recognition", John Wiley and Sons, 1999.
4. Ben gold and Nelson Morgan, "Speech and audio signal processing", processing and perception of speech and music, Wiley- India Edition, 2006 Edition.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Designer can choose any one / two components based on the nature of the course.

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U21ADP04	WEB MINING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To describe web mining and understand the need for web mining
- To differentiate between Web mining and data mining
- To understand the different application areas for web mining
- To understand the different methods to introduce structure to web-based data

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of Web Mining and Data Mining concepts (Understand)

CO2: Apply the Supervised Learning algorithms and its application areas (Apply)

CO3: Formulate the application areas of Unsupervised Learning Algorithms (Apply)

CO4: Apply the information retrieval techniques and the requirements of Web Spamming (Understand)

CO5: Apply the concept of Basic Web crawler algorithms and overview of different web crawlers (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO WEB MINING 9

Introduction to Web Data Mining and Data Mining Foundations, Introduction — World Wide Web (WWW), A Brief History of the Web and the Internet, Web Data Mining — Data Mining Foundations – Association Rules and Sequential Patterns – Basic Concepts of Association Rules, Apriori Algorithm – Frequent Itemset Generation, Association Rule Generation, Data Formats for Association Rule Mining, Mining with multiple minimum supports – Mining Algorithm, Rule Generation, Mining Class Association Rules

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UNIT II SUPERVISED LEARNING 9

Supervised and Unsupervised Learning. Supervised Learning – Basic Concepts, Decision Tree Induction – Classifier Evaluation – Rule Induction – Classification Based on Associations, Naïve Bayesian Classification, Naïve Bayesian Text Classification – Probabilistic Framework, Naïve Bayesian Model – SVM – KNN Learning

UNIT III UNSUPERVISED LEARNING 9

K-Means Clustering – Representation of Clusters – Hierarchical Methods – Distance Functions – Data Standardization – Handling of Mixed Attributes – Cluster Evaluation

UNIT IV INFORMATION RETRIEVAL AND WEB SEARCH 9

Basic Concepts of Information Retrieval – Information Retrieval Models – Evaluation Measures – Text and Web Page Pre-Processing – Inverted Index and Its Compression – Latent Semantic Indexing – Web Spamming

UNIT V WEB CRAWLING 9

A Basic Crawler Algorithm – Universal Crawlers – Focused Crawlers – Topical Crawlers – Crawler ethics and conflicts – Wrapper Introduction – Wrapper Introduction

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data by Bing Liu (Springer Publications)

REFERENCES:

1. Data Mining: Concepts and Techniques, Second Edition Jiawei Han, Micheline Kamber (Elsevier Publications)
2. Web Mining : Applications and Techniques by Anthony Scime
3. Mining the Web: Discovering Knowledge from Hypertext Data by Soumen Chakrabarti

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Designer can choose any one / two components based on the nature of the course.

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U21ADP05	EXPLORATORY DATA ANALYSIS AND VISUALIZATION	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the purpose and concepts of data exploration
- To understand the basics of data visualization
- To explore the role of R language in data visualization

COURSE OUTCOMES:

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

CO1: Describe the basics of data explorations (Understand)

CO2: Illustrate Univariate and Multivariate Analysis for Data Exploration (Understand)

CO3: Describe the basics of Data visualization (Understand)

CO4: Illustrate data with graphs discrete and continuous probability distributions (Understand)

CO5: Explore the applications in data visualization (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO DATA EXPLORATORY 9

Introduction to Single variable: Distribution Variables – Numerical Summaries of Level and Spread – Scaling and Standardising – Inequality – Smoothing Time Series.

UNIT II INTRODUCING TWO VARIABLE AND THIRD VARIABLE 9

Relationships between Two Variables – Percentage Tables – Analysing Contingency Tables – Handling Several Batches – Scatterplots and Resistant Lines – Transformations – Introducing a Third Variable – Causal Explanations – Three-Variable Contingency Tables and Beyond – Longitudinal Data.

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UNIT III BASICS OF DATA VISUALIZATION 9

The Seven Stages of Visualizing Data – Getting Started with Processing – Mapping – Time Series – Connections and Correlations – Scatterplot Maps – Trees, Hierarchies, and Recursion – Networks and Graphs – Acquiring Data – Parsing Data

UNIT IV MISCELLANEOUS GRAPH 9

Basics of Histogram, Making Multiple Histograms from Grouped Data – Basics of Density Curve, Making Multiple Density Curves from Grouped Data – Frequency Polygon – Box Plot – Violin Plot – Multiple Dot Plots for Grouped Data – Density Plot of Two-Dimensional Data – Correlation Matrix – Network Graph – Heat Map – Three-Dimensional Scatter Plot – Dendrogram – QQ Plot an Empirical Cumulative Distribution Function – Mosaic Plot – MAP.

UNIT V APPLICATIONS OF DATA EXPLORATION AND VISUALIZATION 9

Real world applications of Data Visualization – The Basics of Data Exploration – Loading Data from Data sources – Transforming Data – Creating Tidy Data – Basic Data Exploration Techniques – Basic Data Visualization Techniques – Case Study – Students performance in theory and practical examinations

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Think Stats, "Exploratory Data Analysis", 2nd Edition: Allen B. Downey, Pages:226, ISBN 13:978-1-49190-733-7, 2014
2. Eric Pimpler, Data Visualization and Exploration with R, Geo Spatial Training service, 2017

REFERENCES:

1. Making Sense of Data II: A Practical Guide to Data Visualization, Advanced Data Mining Methods, and Applications, Glenn J. Myatt, and Wayne P. Johnson. Print ISBN:9780470222805 |Online ISBN:9780470417409 |DOI:10.1002/9780470417409.
2. Claus.O.Wlike, Fundamentals of Data Visualization, A primer on making informative and compelling Figures, O'Reily Publications, 2019.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Designer can choose any one / two components based on the nature of the course.

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U21ADP06	PREDICTIVE ANALYTICS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To explain terminology, technology and applications of predictive analysis
- To apply data preparation techniques and generate appropriate association rules
- To discuss various descriptive models, their merits, demerits and application
- To describe various predictive modelling methods
- To introduce the text mining tools, technologies and case study which is used in day-today analytics cycle

COURSE OUTCOMES:

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

CO1: Explain data understanding and data visualization (Understand)

CO2: Apply data preparation techniques to effectively interpret big data (Apply)

CO3: Discuss various descriptive models and cluster algorithms (Understand)

CO4 Describe principles of predictive analytics and apply them to achieve real, pragmatic solutions. (Apply)

CO5: Illustrate the features and applications of text mining (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO PREDICTIVE ANALYTICS 9

Overview of Predictive Analytics – Setting Up the Problem – Data Understanding – Single Variable – Data Visualization in One Dimension – Data Visualization, Two or Higher Dimensions – The Value of Statistical Significance – Pulling It All Together into a Data Audit

UNIT II DATA PREPARATION AND ASSOCIATION RULES 9

Data Preparation – Variable Cleaning – Feature Creation – Item sets and Association Rules – Terminology – Parameter Settings – How the Data Is Organized – Measures of Interesting Rules –

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Deploying Association Rules – Problems with Association Rules – Building Classification Rules from Association Rules

UNIT III MODELLING 9

Descriptive Modelling – Data Preparation Issues with Descriptive Modelling – Principal Component Analysis– Clustering Algorithms – Interpreting Descriptive Models– Standard Cluster Model Interpretation

UNIT IV PREDICTIVE MODELLING 9

Decision Trees – Logistic Regression – Neural Network Model – K-Nearest Neighbours – Naive Bayes – Regression Models – Linear Regression – Other Regression Algorithms

UNIT V TEXT MINING 9

Motivation for Text Mining – A Predictive Modelling Approach to Text Mining– Structured vs. Unstructured Data – Why Text Mining Is Hard– Data Preparation Steps – Text Mining Features – Modeling with Text Mining Features– Regular Expressions– Case Studies:– Survey Analysis

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Dean Abbott, "Applied Predictive Analytics-Principles and Techniques for the Professional Data Analyst", Wiley, 2014
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2012.

REFERENCES:

1. Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1st Edition, Que Publishing, 2012.
2. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014
3. Anasse Bari, Mohamed Chaouchi, Tommy Jung, Predictive Analytics for Dummies, 2nd Edition, Wiley, 2017.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Designer can choose any one / two components based on the nature of the course.

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U21ADP07	TIME SERIES ANALYSIS AND FORECASTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To equip students with various forecasting techniques
- To impart knowledge on modern statistical methods for analyzing time series data.

COURSE OUTCOMES:

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

CO1: Describe the concept of forecasting and regression analysis (Understand)

CO2: Illustrate multiple linear regression models (Understand)

CO3: Describe Time series regression and its features (Understand)

CO4: Classify non seasonal modeling techniques and forecasting (Understand)

CO5: Illustrate Box Jenkins Methods (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	P6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	-	1	1
CO2	3	2	2	1	-	-	-	-	-	-	-	-	1	1
CO3	3	2	2	1	-	-	-	-	-	-	-	-	1	1
CO4	3	2	2	1	-	-	-	-	-	-	-	-	1	1
CO5	3	2	2	1	-	-	-	-	-	-	-	-	1	1
CO	3	2	2	1	-	-	-	-	-	-	-	-	1	1
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION TO FORECASTING 9

Forecasting and Data – Forecasting Methods – Errors in Forecasting – Choosing a Forecasting Technique – An Overview of Quantitative Forecasting Techniques – REGRESSION ANALYSIS: The Simple Linear Regression Model – The Least Squares Point Estimates – Point Estimates and Point Predictions – Model Assumptions and the Standard Error– Testing the Significance of the Slope and y Intercept.

UNIT II MULTIPLE LINEAR REGRESSIONS 9

The Linear Regression Model – The Least Squares Estimates, and Point Estimation and Prediction – The Mean Square Error and the Standard Error – Model Utility: R2, Adjusted R2, and the Overall F Test – Model Building and Residual Analysis: Model Building and the Effects of Multicollinearity –

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Residual Analysis in Simple Regression – Residual Analysis in Multiple Regression – Diagnostics for Detecting Outlying and Influential Observations.

UNIT III TIME SERIES REGRESSION 9

Modelling Trend by Using Polynomial Functions – Detecting Autocorrelation – Types of Seasonal Variation – Modelling Seasonal Variation by Using Dummy Variables and Trigonometric Functions – Growth Curves – Handling First-Order Autocorrelation – Decomposition Methods: Multiplicative Decomposition – Additive Decomposition.

UNIT IV NON-SEASONAL BOX-JENKINS MODELLING AND THEIR TENTATIVE IDENTIFICATION 9

Stationary and Nonstationary Time Series – The Sample Autocorrelation and Partial Autocorrelation Functions: The SAC and SPAC – An Introduction to Non-seasonal Modelling and Forecasting – Tentative Identification of Non-seasonal Box-Jenkins Models – Estimation, Diagnostic Checking, and Forecasting for Non-seasonal Box-Jenkins Models: Estimation – Diagnostic Checking – Forecasting – A Case Study – Box-Jenkins Implementation of Exponential Smoothing.

UNIT V BOX-JENKINS METHODS 9

Transforming a Seasonal Time Series into a Stationary Time Series – Examples of Seasonal Modelling and Forecasting – Box-Jenkins Error Term Models in Time Series Regression – Advanced Box-Jenkins Modelling: The General Seasonal Model and Guidelines for Tentative Identification – Intervention Models.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Bruce L. Bowerman, Richard O'Connell, Anne Koehler, "Forecasting, Time Series, and Regression, 4th Edition", Cengage Unlimited Publishers.
2. Enders W. Applied Econometric Time Series. John Wiley & Sons, Inc., 1995.

REFERENCES:

1. Mills, T.C. The Econometric Modelling of Financial Time Series. Cambridge University Press, 1999.
2. Andrew C. Harvey. Time Series Models. Harvester wheatsheaf, 1993.
3. P. J. Brockwell, R. A. Davis, Introduction to Time Series and Forecasting. Springer, 1996.
4. 4. Cryer, Jonathan D.; Chan, Kung-sik, "Time series analysis: with applications in R", ed.: New York: Springer, cop. 2008.

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EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Designer can choose any one / two components based on the nature of the course.

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U21ADP08	HEALTH CARE ANALYTICS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To Understand the health data formats, health care policy and standards
- To Learn the significance and need of data analysis and data visualization
- To Understand the health data management frameworks
- To Learn the use of machine learning and deep learning algorithms in healthcare
- To Apply healthcare analytics for critical care applications

COURSE OUTCOMES:

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

CO1: Describe the basics of health care analytics (Understand)

CO2: Illustrate the machine learning fundamentals required for health care data analysis (Understand)

CO3: Illustrate the health care data management using IoT and associated techniques (Understand)

CO4: Describe the role of deep learning in health care analytics (Apply)

CO5: Discuss real time applications in health care analytics (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO HEALTHCARE ANALYTICS 9

Overview - History of Healthcare Analysis Parameters on medical care systems – Health care policy – Standardized code sets — Data Formats — Machine Learning Foundations: Tree Like reasoning, Probabilistic reasoning and Bayes Theorem, Weighted sum approach.

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UNIT II ANALYTICS ON MACHINE LEARNING 9

Machine Learning Pipeline – Pre-processing – Visualization – Feature Selection – Training model parameter – Evaluation model: Sensitivity, Specificity, PPV, NPV, FPR, Accuracy, ROC, Precision Recall Curves, Valued target variables

Python: Variables and types, Data Structures and containers, Pandas Data Frame: Operations – Scikit – Learn: Pre-processing, Feature Selection.

UNIT III HEALTH CARE MANAGEMENT 9

IOT- Smart Sensors – Migration of Healthcare Relational database to NoSQL Cloud Database – Decision Support System – Matrix block Cipher System – Semantic Framework Analysis – Histogram bin Shifting and Rc6 Encryption – Clinical Prediction Models – Visual Analytics for Healthcare.

UNIT IV HEALTHCARE AND DEEP LEARNING 9

Introduction on Deep Learning – DFF network CNN – RNN for Sequences – Biomedical Image and Signal Analysis – Natural Language Processing and Data Mining for Clinical Data – Mobile Imaging and Analytics – Clinical Decision Support System.

UNIT V CASE STUDIES 9

Predicting Mortality for cardiology Practice – Smart Ambulance System using IOT – Hospital Acquired Conditions (HAC) program – Healthcare and Emerging Technologies – ECG Data Analysis.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Vikas Kumar, "Health Care Analytics Made Simple", Packt Publishing, 2018.
2. Nilanjan Dey, Amira Ashour , Simon James Fong, Chintan Bhatl, "Health Care Data Analysis and Management", 1st Edition, Academic Press, 2018.

REFERENCES:

1. Hui Jang, Eva K.Lee, "HealthCare Analysis: From Data to Knowledge to Healthcare Improvement", 1st Edition, Wiley, 2016.
2. Kulkarni, Siarry, Singh, Abraham, Zhang, Zomaya, Baki, "Big Data Analytics in HealthCare", Springer, 2020.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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VERTICAL 2: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

U21AMP01	KNOWLEDGE ENGINEERING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the basics of Knowledge Engineering
- To discuss methodologies and modeling for Agent Design and Development
- To design and develop ontologies
- To apply reasoning with ontologies and rules
- To understand learning and rule learning

COURSE OUTCOMES:

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

CO1: Understand the basics of knowledge engineering (Understand)

CO2: Apply methodologies and modelling for agent design and development (Apply)

CO3: Design and develop ontologies (Apply)

CO4: Apply reasoning with ontologies and rules (Apply)

CO5: Differentiate the learning and rule learning in knowledge engineering (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I REASONING UNDER UNCERTAINTY 9

Introduction to reasoning – Abductive reasoning – Probabilistic reasoning: Enumerative probabilities – Subjective Bayesian view – Belief functions – Baconian probability – Fuzzy probability – Uncertainty methods – Evidence-based reasoning – Intelligent agent – Mixed-initiative reasoning – Knowledge engineering – Knowledge graphs

UNIT II METHODOLOGY AND MODELING 9

Conventional design and development – Development tools and reusable ontologies – Agent design and development using learning technology – Problem solving through analysis and synthesis – Inquiry-driven analysis and synthesis – Evidence-based assessment – Believability assessment – Drill-down analysis, Assumption-based reasoning, and What-if scenarios

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UNIT III ONTOLOGIES – DESIGN AND DEVELOPMENT 9

Concepts and instances – Generalization hierarchies – Object features – Defining features – Representation – Transitivity – Inheritance – Concepts as feature values – Ontology matching – Design and development methodologies – Steps in ontology development – Domain understanding and concept elicitation – Modelling-based ontology specification

UNIT IV REASONING WITH ONTOLOGIES AND RULES 9

Production system architecture – Complex ontology – Based concepts – Reduction and synthesis rules and the inference engine – Evidence-based hypothesis analysis – Rule and ontology matching – Partially learned knowledge – Reasoning with partially learned knowledge

UNIT V LEARNING AND RULE LEARNING 9

Machine learning concepts – Generalization and specialization rules, Types – Formal definition of generalization – Modelling, learning and problem solving – Rule learning and refinement – Rule generation and analysis – Hypothesis learning

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXTBOOKS:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum," Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning", 1st Edition, Cambridge University Press, 2016
2. Ela Kumar," Knowledge Engineering", 1st Edition, I K International Publisher House, 2018

REFERENCES:

1. Ronald J. Brachman, Hector J. Levesque, "Knowledge Representation and Reasoning", 1st Edition, Morgan Kaufmann, 2004
2. John F. Sowa, "Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole", 1st Edition, Thomson Learning, 2000
3. King, "Knowledge Management and Organizational Learning", 1st Edition Springer,2009
4. Jay Liebowitz," Knowledge Management Learning from Knowledge Engineering," 1st Edition, 2001

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose anyone / two components based on the nature of the course.

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U21AMP02	SOFT COMPUTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To introduce the concepts of neural networks and advanced neural networks
- To understand the fundamentals of fuzzy sets and fuzzy logic
- To establish basic knowledge about optimization techniques in soft computing
- To choose appropriate genetic operators for use in a genetic algorithm

COURSE OUTCOMES:

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

CO1: Understand the basic concepts of soft computing (Understand)

CO2: Explain the concepts of Artificial Neural Networks and its architecture (Understand)

CO3: Classify the fundamentals of fuzzy sets and fuzzy logic (Understand)

CO4: Implement the various evolutionary computing algorithms (Apply)

CO5: Apply ANN, genetic algorithm, and fuzzy logic for engineering problems (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO NEURAL NETWORKS 9

Introduction – Artificial Intelligence – Artificial Neural Networks (ANN) – History, Mathematical model of a neuron, ANN architectures, Learning rules – Paradigms – Perceptron network – Backpropagation network, Backpropagation learning and its applications

UNIT II ADVANCED NEURAL NETWORKS 9

Backpropagation Neural Networks – Associative memory: Autocorrelation, Hetero correlation, Exponential BAM – Applications – Adaptive Resonance Theory: Vector quantization, ART1, ART2, Applications

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UNIT III FUZZY SETS AND RELATIONS 9

Introduction – Uncertainty and imprecision – Chance vs ambiguity – Fuzzy sets – Fuzzy relations – Membership functions – Properties of membership functions – Fuzzification and defuzzification – Classical logic and Fuzzy logic – Fuzzy rule-based systems – Fuzzy decision making – Fuzzy classification

UNIT IV GENETIC ALGORITHMS 9

Introduction to evolutionary computation: Biological and artificial evolution – Evolutionary computation – Simple genetic algorithm – Search operators: Crossover, Mutation, Crossover and Mutation Rates – Selection schemes: Fitness proportional selection and Fitness scaling – Ranking – Tournament selection – Selection pressure and its impact on evolutionary search.

UNIT V HYBRID SYSTEMS 9

Hybrid systems – Optimization and decision support techniques – Swarm intelligence – Ant colony optimization – Particle swarm optimization – Applications

Contact Periods:

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

Total: 45 Periods

TEXTBOOKS:

1. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", 1st edition, PHI Learning Pvt. Ltd., 2017
2. Sivanandam S.N., Deepa S.N., "Principles of Soft Computing", 1st edition (Reprint), Wiley India Pvt. Ltd., 2012

REFERENCES:

1. Jang J.S.R., Sun C.T. and Mizutani E., "Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence", 1st edition, PHI Learning Private Limited, New Delhi, 2014
2. K. Sundareswaran, "A Learner's Guide to Fuzzy Logic Systems", 1st edition, Jaico Publishing House, 2006
3. Padhy N.P, "Artificial Intelligence and Intelligent System, 1st edition, Oxford University Press, 2005

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose anyone / two components based on the nature of the course.

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U21AMP03	DEEP NEURAL NETWORKS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature-based alignment and motion estimation
- To develop skills on 3D reconstruction and image-based rendering, recognition

COURSE OUTCOMES:

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

CO1: Understand the basic concepts of soft computing (Understand)

CO2: Implement the various image processing techniques (Apply)

CO3: Apply feature-based based image alignment, segmentation, and motion estimations (Apply)

CO4: Interpret 3D image reconstruction techniques (Apply)

CO5: Develop innovative image processing and computer vision applications (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO NEURAL NETWORKS 9

Introduction to artificial intelligence, Machine learning, Deep learning – Neural networks – Basics of CNN architecture: Convolution, Pooling, Activation functions – Convolutional layers: Filters, Strides, Padding – Pooling layers: Max pooling, Average pooling – Activation functions: ReLU, Sigmoid, Tanh – Loss Functions – Backpropagation in CNNs

UNIT II CNN ARCHITECTURES AND MEMORY COMPUTATION 9

Popular CNN architectures: LeNet, AlexNet, VGGNet, GoogLeNet, ResNet – Understanding memory computation in CNNs: Parameter sharing, Weight sharing, Receptive fields – Calculating the number of parameters in CNNs – Trade-offs between model complexity and memory requirements – Efficient architectures for memory – Constrained environments

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UNIT III TRAINING AND FINE-TUNING IN CNN 9

Loss functions for classification tasks: Cross-entropy loss, Softmax activation – Optimization algorithms: Stochastic Gradient Descent (SGD), Adam, RMSprop – Regularization techniques: Dropout, Weight decay – Transfer learning and fine-tuning: Using pretrained models, Freezing layers, Adapting to new tasks

UNIT IV EVALUATION PARAMETERS OF CNN 9

Performance evaluation metrics for classification tasks: Accuracy, Precision, Recall, F1 score – Confusion matrix and its interpretation – Receiver Operating Characteristic (ROC) curve and Area Under the Curve (AUC) – Evaluation metrics for object detection and localization tasks: Intersection over Union (IoU), Mean Average Precision – Handling class imbalance – Evaluation challenges

UNIT V ADVANCED CNN ARCHITECTURES 9

Convolutional layers with different receptive field sizes: Dilated convolutions, Atrous convolutions – Attention mechanisms in CNNs: Self-attention, Spatial attention – Advanced CNN architectures for specific tasks: Semantic segmentation, Instance segmentation and Image captioning

Contact Periods:

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

Total: 45 Periods

TEXTBOOKS:

1. Charu C. Aggarwal, "Neural Networks and Deep Learning A Textbook", 1st Edition, Springer International Publishing, 2018.
2. Hasmik Osipyan, Bosede Iyiade Edwards, Adrian David Cheok, "Deep Neural Network Applications", 1st Edition, CRC Press, 2022.
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", 1st Edition, MIT Press, 2016

REFERENCES:

1. Katy Warr, "Strengthening Deep Neural Networks Making AI Less Susceptible to Adversarial Trickery", 1st Edition, O'Reilly Media, 2019.
2. Information Resources Management Association, "Deep Learning and Neural Networks: Concepts, Methodologies, Tools, and Applications", 1st Edition, IGI Global, 2020.
3. Aston Zhang, Zack C. Lipton, Mu Li, and Alex J. Smola, "Dive into Deep Learning", 1st Edition, Cambridge University Press, 2023
4. Coursera Course: https://www.coursera.org/learn/neural-networks-deep-learning

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EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose anyone / two components based on the nature of the course.

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U21AMP04	REINFORCEMENT LEARNING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- Affords foundational ideas on modern reinforcement learning
- Develop an instinctive understanding on reinforcement learning
- Implementation and testing of complete decision-making systems

COURSE OUTCOMES:

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

CO1: Explain the knowledge of machine learning in reinforcement learning (Apply)

CO2: Classify the MDP models in reinforcement learning (Understand)

CO3: Experiment the value of a state or an action when similar circumstances occur (Apply)

CO4: Evaluate artificial neural networks that helps software agents to reach goals (Apply)

CO5: Examine the hierarchical reinforcement learning techniques (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO REINFORCEMENT LEARNING 9

Introduction to Reinforcement Learning (RL) – RL framework and application – Immediate Reinforcement Learning – Bandit algorithm: Introduction, Upper Confidence Bound (UCB), PAC algorithm, Bandit optimality – Value function – Based method – Policy gradient

UNIT II MDP MODELS 9

Full RL introduction – Return, Values function – Introduction to MDP model – Bellman equation – Optimization of bellman equation – Cauchy sequence and green equation – Banach fixed point theorem – Convergence proof

UNIT III FUNCTION APPROXIMATION 9

Approximation – Value prediction and control – Gradient Descent methods – Linear methods – Control with Function Approximation – Artificial Neural Network-based approximation – DQN and

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Fitted Q iterations – Policy Gradient Approach – Policy Gradient approach with function approximation

UNIT IV DEEP REINFORCEMENT LEARNING 9

Dynamic Programming – Monte Carlo – Components – Control in Monte Carlo – LPI convergence, Value iteration, Policy iteration – QLearning – QLearning with deep networks – Double QLearning – Replay memory – Deep Neural Network Architectures for RL

UNIT V HIERARCHICAL REINFORCEMENT LEARNING 9

Hierarchical reinforcement learning – Types of optimality – Semi MDP model – Options – Learning with options – Hierarchical abstract machines – Partially observable markov decision process

Contact Periods:

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

Total: 45 Periods

TEXTBOOKS:

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", 2nd Edition, The MIT Press, 2020
2. CsabaSzepesvári, "Algorithms for Reinforcement Learning", 1st Edition, Morgan & Claypool, 2013

REFERENCES:

1. Kevin Murphy, "Machine Learning - A Probabilistic Perspective", 1st Edition, MIT press, 2012
2. Christopher Bishop, "Pattern Recognition and Machine Learning", 1st Edition, Springer, 2006

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose anyone / two components based on the nature of the course.

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U21AMP05	COMPUTER VISION	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing
- To learn feature detection, matching, and detection
- To become familiar with feature-based alignment and motion estimation
- To develop skills in 3D reconstruction and image-based rendering, recognition

COURSE OUTCOMES:

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

CO1: Understand the basic concepts of computer vision in image processing (Understand)

CO2: Implement various image enhancement and filtering techniques (Apply)

CO3: Apply feature-based based image alignment, segmentation, and motion estimations (Apply)

CO4: Execute feature extraction and its matching techniques (Apply)

CO5: Develop innovative image processing and computer vision applications (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO COMPUTER VISION **9**

Overview of computer vision – Applications – Image representation – Digital image fundamentals – Image formation and acquisition – Image processing techniques for computer vision – Introduction to image processing libraries – OpenCV

UNIT II IMAGE ENHANCEMENT AND FILTERING **9**

Introduction to image enhancement techniques – Histogram equalization, Contrast stretching – Spatial domain filtering – Mean filter, Median filter – Frequency domain filtering – Fourier Transform, High pass filter, Low pass filter – Image denoising techniques – Gaussian filtering, Bilateral filtering

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UNIT III IMAGE SEGMENTATION AND OBJECT DETECTION 9

Introduction – Image segmentation algorithms – Thresholding, region-based segmentation – Edge detection techniques – Sobel, Canny – Contour detection and object representation – Introduction to object detection algorithms – Haar cascades, SSD, YOLO

UNIT IV HANDCRAFTED FEATURE EXTRACTION TECHNIQUES 9

Introduction – Feature Extraction – Feature extraction techniques – SIFT, SURF, ORB – Local feature descriptors – HoG, LBP – Feature matching algorithms – Brute-force matching, FLANN – Feature tracking and optical flow

UNIT V DEEP LEARNING FOR COMPUTER VISION 9

Introduction to deep learning and neural networks – Convolutional Neural Networks (CNNs) for image classification – Transfer learning and pre-trained models – Object detection using CNNs - Faster R-CNN, SSD – Semantic segmentation using CNNs - FCN, U-Net – Familiarity with popular libraries such as OpenCV and PyTorch

Contact Periods:

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

Total: 45 Periods

TEXTBOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer- Texts in Computer Science, 2nd edition, 2022
2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, 2nd edition, Pearson Education, 2015
3. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", 3rd edition, Pearson- 2017

REFERENCES:

1. E.R.Davies, "Computer and Machine Vision", 4th edition, Academic Press, 2012
2. Christopher M. Bishop, "Pattern Recognition and Machine Learning", 1st edition, Springer, 2006
3. Richard Hartley,Andrew Zisserman, "Multiple View Geometry in Computer Vision", 2nd edition, Cambridge University Press,2004
4. Adrian Kaehler, Gary Bradski, "Learning OpenCV 4: Computer Vision with Python", 3rd edition, O'Reilly Media ,2019
5. Adrian Rosebrock", "Deep Learning for Computer Vision with Python",1st edition, PyImageSearch, 2020

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose anyone / two components based on the nature of the course.

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U21AMP06	FEATURE ENGINEERING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To provide students with a comprehensive understanding of feature engineering principles
- To ensure data quality by scaling, normalizing, and transforming raw data before using it in a machine learning model
- To understand the techniques, and applications, equipping with the skills to effectively preprocess and engineer features for machine learning tasks

COURSE OUTCOMES:

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

CO1: Understand the basic concepts of feature engineering (Understand)

CO2: Learn techniques for handling the missing data (Understand)

CO3: Describe feature creation and transformation in feature engineering (Understand)

CO4: Execute the anomaly detection and outlier detection (Apply)

CO5: Implement feature selection and dimensionality reduction using feature engineering (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO FEATURE ENGINEERING **9**

Overview of feature engineering – Importance in machine learning – Types of features: Numerical, Categorical, Text – Feature representation and feature vectors – Evaluation metrics for feature engineering

UNIT II DATA PREPROCESSING AND HANDLING MISSING DATA **9**

Introduction to data preprocessing – Techniques for handling missing data: Deletion, Imputation, Interpolation – Strategies for dealing with different types of missing data – Handling noisy data: Smoothing filters, Denoising algorithms – Data scaling and normalization techniques

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UNIT III FEATURE CREATION AND TRANSFORMATION 9

Polynomial features and interaction terms – Binning and discretization techniques – Feature hashing and feature embedding – Logarithmic, Exponential, Power transformations

UNIT IV ANOMALY DETECTION AND OUTLIER DETECTION 9

Introduction to anomaly detection and outlier detection – Statistical methods for anomaly detection: Z-score, Mahalanobis distance – Density-based methods: Local Outlier Factor (LOF), Isolation Forest One-class SVM for outlier detection – Deep feature extraction: Visual Geometry Group (VGG), Residual Networks (ResNet)

UNIT V FEATURE SELECTION AND DIMENSIONALITY REDUCTION 9

Univariate feature selection methods: Chi-square test, ANOVA – Recursive Feature Elimination (RFE) – Feature importance using ensemble methods (e.g., Random Forest, XGBoost) – Principal Component Analysis (PCA) for dimensionality reduction

Contact Periods:

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

Total: 45 Periods

TEXTBOOKS:

1. Sinan Ozdemir, "Feature Engineering Bookcamp",1st edition Manning Publications, 2022
2. Alice Zheng and Amanda Casari, "Feature Engineering for Machine Learning: Principles and Techniques",1st edition, O'Reilly Media, 2018

REFERENCES:

1. Alice Zheng and Amanda Casari, "Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists", 1st edition, O'Reilly Media, 2018
2. Sinan Ozdemir and Divya Susarla, "Feature Engineering Made Easy: Identify Unique Features from Your Dataset in Just 30 Minutes",1st edition, Packt Publishing, 2018
3. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, "Introduction to Statistical Learning: With Applications in R", 1st edition, Springer,2013

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th rowspan="2">Total Internal Assessments</th><th rowspan="3">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I (100 Marks)</th><th colspan="2">Assessment II (100 Marks)</th></tr>
<tr><td>*Individual Assignment / Case Study / Seminar / Mini Project / MCQ</td><td>Written Test</td><td>*Individual Assignment / Case Study / Seminar / Mini Project / MCQ</td><td>Written Test</td><td></td></tr>
<tr><td>40</td><td>60</td><td>40</td><td>60</td><td>200</td><td>100</td></tr>
<tr><td colspan="4" rowspan="2">Total</td><td>40</td><td>60</td></tr>
<tr><td colspan="2">100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose anyone / two components based on the nature of the course.

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U21AMP07	OBJECT DETECTION & FACE RECOGNITION	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the basics of image processing techniques for computer vision
- To learn the techniques used for image pre-processing
- To discuss the various object detection techniques
- To understand the various face recognition mechanisms

COURSE OUTCOMES:

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

CO1: Understand the basics of image processing techniques for computer vision (Understand)

CO2: Explain the techniques used for image pre-processing (Understand)

CO3: Develop various object detection techniques (Apply)

CO4: Apply various face recognition mechanisms (Apply)

CO5: Implement algorithms for object detection and face recognition (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO OBJECT DETECTION 9

Computer Vision – Image representation and image analysis tasks – Image representations – digitization – properties – color images – Data structures for Image Analysis - Local pre-processing – Image smoothing – Edge detectors – Canny edge detection – Line detection by local pre-processing operators – Image restoration- Evaluation metrics for object detection systems

UNIT II ONE-STAGE & TWO STAGE DETECTORS 9

Introduction to one – stage object detectors (e.g., YOLO, SSD) – Single shot detection strategies for object localization and classification – Design principles and network architectures – Implementation and optimization techniques – Introduction to two-stage object detectors – RCNN, Fast RCNN, Faster RCNN) – Region proposal methods for generating candidate object regions

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UNIT III REGION-BASED CNN, FAST R-CNN & FASTER R-CNN 9

R-CNN architecture for object detection – Selective search algorithm for region proposals – Feature extraction using CNN – Training and inference processes of R-CNN – Fast R-CNN architecture: RoI pooling, Shared convolutional layers – Study of faster R-CNN framework – Region Proposal Network (RPN) for efficient region proposal generation – End to end training and inference in Faster R-CNN

UNIT IV FACE & FACIAL EXPRESSION RECOGNITION 9

Introduction – Face Recognition and challenges – Face detection using Haar cascades – Face alignment and normalization – Face representation using deep learning (e.g., FaceNet, ArcFace) facial expression recognition – Facial feature extraction methods (e.g., Geometric, Appearance-based) – Representation – Deep learning architectures for facial expression analysis – Realtime facial expression recognition and emotion detection

UNIT V BIOMETRIC RECOGNITION 9

Overview of biometric recognition- biometric modalities (e.g., face, fingerprint, iris, voice) – Challenges (e.g., variability, spoof attacks) – Biometric Verification and Identification-Evaluation metrics – Temporal Analysis in Biometrics: Handling temporal variations in biometric data – Feature extraction techniques for capturing temporal dynamics – Temporal modeling approaches

Contact Periods:

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

Total 45 Periods

TEXTBOOKS:

1. Vaibhav Verdhan, "Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras", 1st edition, Apress, 2021
2. Joseph Howse, Prateek Joshi ,"Object Detection and Recognition Using Deep Learning in OpenCV",1st edition, Packt Publishing, 2020
3. Rafael C. Gonzalez, David A. Forsyth, and Christopher R. Dance , "Deep Learning for Object Detection and Recognition",1st edition Cambridge University Press , 2019

REFERENCES:

1. Rajalingappaa Shanmugamani , "Deep Learning for Computer Vision: Expert Techniques to train advanced neural networks using TensorFlow and Keras",1st edition Packt Publishing, 2021
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th edition, Thomson Learning, 2014
3. E. R. Davies, "Computer & Machine Vision", 4th edition, Academic Press, 2012
4. Kelleher, John D., Tierney, Brian and Pacheco, Aoife, "Applied Machine Learning: From Classification to Object Detection Using Python", 1st edition, Springer, 2021

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EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose anyone / two components based on the nature of the course.

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U21AMP08	TEXT AND VISUAL ANALYTICS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To introduce students to the fundamentals of text and visual analytics
- To provide an overview of different techniques and tools for text and visual data analysis
- To perform text and visual analytics using programming languages and software tools
- To apply text and visual analytics techniques to real-world problems

COURSE OUTCOMES:

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

CO1: Understand the principles and concepts of text and visual analytics (Understand)

CO2: Analyze text data using sentiment analysis, topic modeling, and clustering (Apply)

CO3: Evaluate the effectiveness of different text and visual analytics techniques (Apply)

CO4: Apply text and visual analytics techniques to various real-world problems (Apply)

CO5: Use programming languages and software tools for text and visual analytics (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I NATURAL LANGUAGE BASICS **9**

Foundations of natural language processing – Language Syntax and structure – Text preprocessing and wrangling – Text tokenization – Stemming – Lemmatization – Removing stopwords – Feature Engineering for text representation – Bag of words model – Bag of N-Grams model – TF-IDF model

UNIT II TEXT CLASSIFICATION **9**

Vector semantics and embeddings – Word embeddings – Word2Vec model – Glove model – FastText model – Overview of deep learning models – RNN – Transformers – Overview of text summarization and Topic models

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UNIT III QUESTION ANSWERING AND DIALOGUE SYSTEMS 9

Information retrieval – IR-based question answering – Knowledge-based question answering – Language models for QA – Classic QA models – Chatbots – Design of dialogue systems – Evaluating dialogue systems

UNIT IV VISUAL ANALYTICS 9

Overview of visual analytics and its applications – Techniques for visualizing text data – Interactive visualizations for exploratory analysis – Evaluation of visual analytics models

UNIT V SENTIMENT ANALYSIS 9

Understanding sentiment analysis and its applications – Techniques for sentiment analysis: Rule-based, Machine Learning and Deep Learning – Sentiment lexicons and resources – Evaluation of sentiment analysis models

Contact Periods:

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

Total: 45 Periods

TEXTBOOKS:

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 3rd Edition, Pearson Prentice Hall, 2022
2. Nan Cao, Weiwei Cui, "Introduction to Text Visualization", 1st Edition, Atlantis Press, 2016

REFERENCES:

1. Steven Struhl, "Practical Text Analytics: Interpreting Text and Unstructured Data for Business Intelligence", 1st Edition, Kogan Page Limited, 2016
2. Bing Liu, "Sentiment Analysis: Mining Opinions, Sentiments, and Emotions", 1st Edition, Cambridge University Press, 2020
3. Tamara Munzner, "Visualization Analysis and Design", 1st Edition, CRC press, 2015.
4. Dan Jurafsky and James H. Martin, "Speech and Language Processing", 1st Edition, Prentice Hall, 2009
5. Li Bai, Alfred Kobsa, and Jinah Park,"Visual Analytics and Interactive Technologies: Data, Text and Web Mining Applications", 1st Edition, IGI Global, 2011

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose anyone / two components based on the nature of the course.

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VERTICAL 3: CLOUD COMPUTING AND DATA STORAGE TECHNOLOGIES

		Category: PEC				
U21CSP01	FOUNDATIONS OF CLOUD COMPUTING	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the architecture and features of different cloud models
- To acquire basic knowledge on virtualization, cloud applications and cloud storage
- To learn security issues and cloud computing platforms

COURSE OUTCOMES:

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

CO1: Describe the types of cloud models and services (Understand)

CO2: Analyze the types of virtualization techniques and Opensource Platforms (Analyze)

CO3: Interpret the best features to move to the cloud and categorize the cloud storage types (Apply)

CO4: Identify the cloud security concerns (Apply)

CO5: Utilize various cloud computing platforms (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I CLOUD COMPUTING BASICS **9**

Introduction to Cloud computing – Evolution of Cloud Computing – Cloud Types – Cloud Characteristics – NIST Reference Cloud Architecture – Architectural Design Challenges – Cloud Computing Stack – Deployment models – Service Models – Benefits of Cloud Computing

UNIT II VIRTUALIZATION AND PLATFORMS **9**

Abstraction and Virtualization – Virtualization Structures and Mechanisms – Virtualization of CPU – Memory and I/O Devices – Types of CPU Virtualization – Virtualization Support and Disaster Recovery – Cloud Platforms – Features of Cloud Platforms – Overview of Open–source Platforms – Eucalyptus and OpenNebula – An Insight into OpenStack Architecture and Components

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UNIT III CLOUD STORAGE AND CONTAINERS 9

Introduction to Cloud Storage – Digital Universe – Provisioning Cloud Storage – Unmanaged and Managed Cloud Storage – Creating Cloud Storage Systems – Cloud Backup Types and Features – Cloud Attached Backup and solutions – Cloud Storage Interoperability, CDMI, OCCI – Introduction to Containers – Kubernetes – Heroku and Docker Containers

UNIT IV CLOUD SECURITY 9

Cloud Security Defense Strategies – Securing the Cloud & Data – Distributed Intrusion and Anomaly Detection – Data and Software Protection Techniques – Data Security in the Cloud – Current State and Future Trends in the Cloud – Cloud Security Risks – The Cloud, Digital Identity, and Data Security Standards – Establishing Identity and Presence in Cloud

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Hadoop – Map Reduce – Google App Engine (GAE) – Programming Environment for GAE – Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation – Introduction to Fog Computing – Introduction to Edge Computing

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Dac–Nhuong Le, Raghvendra Kumar, Gia Nhu Nguyen, Jyotir Moy Chatterjee, "Cloud Computing and Virtualizaton", 2nd Edition, Wiley Publishers, 2018
2. Nick, Gillam, Lee, "Cloud Computing – Principles, Systems and Applications", 2nd Edition, Springer, 2017

REFERENCES:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering the Cloud Computing", Morgan Kaufmann,2013
2. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation "Management, and Security", CRC Press, 2016.
3. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
4. Barrie Sosinsky, "Cloud Computing Bible", 1st Edition, Wiley Publishing, 2015

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EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CSP02	DATA STORAGE AND MANAGEMENT IN CLOUD	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the Importance of Data and Storage
- To gain knowledge on storage services and network connectivity
- To understand the concepts of securing and managing storage infrastructure

COURSE OUTCOMES:

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

CO1: Elucidate the concepts of data storage system and network connectivity (Understand)

CO2: Illustrate the storage services and network security ideas (Understand)

CO3: Explain the challenges and techniques for storage security (Understand)

CO4: Identify tools for storage management and communication (Apply)

CO5: Analyze the concepts for securing and managing storage infrastructure (Analyze)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I STORAGE SYSTEM 9

Importance of Data and Storage – Business Issues and IT Challenges – Server and Storage I/O Fundamentals – Virtualization and Storage Services – Data and Storge Access – Infrastructure and Resource Management – Data Movement and Migration – I/O Connectivity and Networking Fundamentals

UNIT II STORAGE SERVICES AND NETWORK CONNECTIVITY

Storage Services and Functionalities – Storage Reliability – Availability and Serviceability – Storage System Architectures – Storage Virtualization and Virtual Storage – Server Virtualization – Networking Challenges – Converged and Unified Networking – Local Networking – Enabling MANs and WANs – Configuring Networks

UNIT III DATA STORAGE SECURITY 9

Data Protection Challenges – Protect, Preserve and Serve Information Services – SLO and SLAs – Virtual, Physical and Cloud Data Protection – Modernizing Data Protection and Backup – Checklist

– Data Footprint Reduction Techniques – Compression and Compaction – Data De–duplication – DFR and RAID Configurations

UNIT IV MANAGEMENT TOOLS 9

Data Management in Libraries – Airtable – Google Sheets– Data Visualization in Cloud – Tableau – Cloud Tools for Project Management – Trello – Asana – Communication in Cloud – Microsoft Teams – Library Management Systems in Cloud – FOLIO

UNIT V SECURING AND MANAGING STORAGE INFRASTRUCTURE 9

Securing the storage infrastructure framework – Risk triad – Domains – Security implementations for FC – SAN, IP SAN and NAS environments – Security in virtualized and cloud environments Managing the storage infrastructure – Monitoring – Management activities – Challenges – Information lifecycle management – Storage tiering

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Greg Schulz ,"Cloud and Virtual Data Storage Networking", First Edition, CRC Press, 2011
2. Kayla Kipps, Allison Kaiser Jones, "Collection Management in the Cloud,A Guide for Using Cloud Computing Technologies in Libraries", First Edition, 2022

REFERENCES:

1. Somasundaram Gnanasundaram, Alok Shrivastava, "Information Storage and Management: Storing, Managing and Protecting Digital Information in classic, Virtualized and Cloud Environments", Second Edition, EMC Educations Services, Wiley, 2012
2. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, Osborne, 2003
3. Ulf Troppens, Rainer Erkens, Wolfgang Mueller–Friedt, Rainer Wolafka, Nils Haustei, "Storage Networks Explained: Basics and Application of Fibre Channel SAN, NAS, iSCSI, InfiniBand and FCoE", 2nd Edition, Wiley, 2011

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CSP03	VIRTUALIZATION TECHNIQUES	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the virtualization concepts and its types
- To learn WAN 0026 VLAN architecture and its virtualization
- To acquire knowledge on virtualization technologies

COURSE OUTCOMES:

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

CO1: Illustrate a virtual machine and virtual network (Understand)

CO2: Describe various virtual machine products (Understand)

CO3: Perform server virtualization (Apply)

CO4: Implement the concept of network virtualization (Apply)

CO5: Carryout various tasks in storage virtualization (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I VIRTUALIZATION CONCEPTS 9

System Architectures – Virtual Machine Basics – Process Virtual Machines – System Virtual Machines – Taxonomy of Virtual Machines – Emulation: Basic Interpretation – Binary Translation – Full and Para – Virtualization – Types of Hypervisor – Types of Virtualization

UNIT II SERVER VIRTUALIZATION 9

Server Virtualization – Partitioning Techniques – Hardware Virtualization – Virtual Hardware – Types of Server Virtualization – Business Cases for Server Virtualization – Uses of Virtual Server Consolidation – Selecting Server Virtualization Platform

UNIT III NETWORK VIRTUALIZATION 9

Design of Scalable Enterprise Networks – Virtualizing the Campus – WAN Design – WAN Architecture – WAN virtualization – Virtual Enterprise Transport Virtualization – VLANs and Scalability – Theory Network Device Virtualization Layer 2 – VFIs Virtual Firewall Contexts

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UNIT IV STORAGE VIRTUALIZATION 9

Hardware Devices – SCSI – SCSI Communication – Using SCSI Buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI SAN Backup & Recovery Techniques – RAID – Classic Storage Model – SNIA

UNIT V APPLYING VIRTUALIZATION 9

Comparison of Virtualization Technologies: Shared Kernel – Enterprise Solutions: VMware Server First Edition – ESXi – Citrix XenServer – Microsoft Virtual PC – Microsoft Hyper–V – Virtual Box – Case study: Migration to Open–source based messaging service (Exim, Dovecot and SOGo)

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Second Edition, Elsevier/Morgan Kaufmann Publishers, 2015.
2. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", 2nd Edition, Berkeley, Apress, 2016.
3. Gerardus Blokdyk, "Virtualization Technology A Complete Guide", Emer2020.

REFERENCES:

1. William von Hagen, "Professional Xen Virtualization", 1st Edition, Wrox Publications, 2014
2. Matthew Portnoy, "Virtualization Essentials", 2nd Edition, Wiley, 2015.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", 6th Edition, Addison–Wesley, Publications, 2012

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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KPRIET Learn Beyond

U21CSP04	SECURITY AND PRIVACY IN CLOUD	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge on cloud security and privacy foundations
- To learn threat model and security techniques of cloud computing
- To understand vulnerability, network Security, Strategies and Management of cloud

COURSE OUTCOMES:

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

CO1: Outline the cloud security and privacy foundations (Understand)

CO2: Identify threat model and security techniques (Apply)

CO3: Apply the cloud infrastructure management and security (Apply)

CO4: Identify the need for vulnerability management and network security (Apply)

CO5: Analyze the strategies and practices related to cloud security (Analyze)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I CLOUD COMPUTING , SECURITY AND PRIVACY FOUNDATIONS **9**

Cloud Computing services – Deployment Models – Cloud Security Goals – Concepts – Security Standards – NIST Cloud Reference Model – Cloud Security Issues – Security Requirements for Privacy – Privacy issues in Cloud – Key privacy Concerns

UNIT II THREAT MODEL AND SECURITY TECHNIQUES **9**

Threat Model – Attack Types – Taxonomy of Attacks – Intrusion Detection – Classification– Intrusion Detection Techniques – Attack Tools–Security Tools – Virtual Machine Introspection – Hypervisor Introspection – Threat Model in Containerized Environment

UNIT III CLOUD INFRASTRUCTURE MANAGEMENT AND SECURITY **9**

Data Asset Management – Tagging Cloud Resources – Protecting Data in Cloud – Cloud Asset Types – Asset Management Pipeline – Procurement Leaks – Identity and Access Management – Lifecycle – Authentication – Authorization – Revalidate

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UNIT IV VULNERABILITY MANAGEMENT AND NETWORK SECURITY 9

Vulnerable Areas – Finding and Fixing Vulnerabilities – Agentless, Agent Based Configuration Management – Vulnerability Management Metrics – Network Security features – VPCs – Address Translation – Encryption in Motion – Firewalls and Network Segmentation – Administrative Access

UNIT V STRATEGIES AND PRACTICES 9

Strategies and best practices Security Controls – Limits, Best Practices, Monitoring Security Criteria – Assessing Risk Factors in Clouds – SaaS, PaaS, IaaS Availability Management Security as a Service – Trust Management for Security – Governance and Administration Patterns

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Preeti Mishra, Emmanuel S Pilli, RC Joshi,"Cloud Security–Attacks, Techniques, Tools, and Challenges", 1st Edition, CRC Press,2022
2. Chris Dotson, "Practical Cloud Security – A Guide for Secure Design and Deployment", 1st Edition, Oreilly, 2019

REFERENCES:

1. Vic (J.R.) Winkler," Securing the Cloud: Cloud Computer Security Techniques and Tactics", 1st Edition, Elseiver 2011
2. Riyan Ko,Kim–Kwang Raymond Choo , "The Cloud Security Ecosystem, Technical, Legal, Business and Management Issues", 1st Edition, Elseiver,2015
3. Tim Mather, Subra Kumaraswamy, and Shahed Latif , " Cloud Security and Privcy", 1st Edition, Oreilly, 2009

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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KPRIET
Learn Beyond

U21CS05	DATA ANALYSIS IN CLOUD COMPUTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the basic concepts of data mining
- To acquire basic knowledge on cloud based data analysis, scalable data analytics
- To learn security of sensitive data in cloud and research trends

COURSE OUTCOMES:

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

CO1: Describe the basic concepts of data mining (Understand)

CO2: Examine the techniques for cloud based data analysis (Apply)

CO3: Utilize the idea of scalable data analytics (Apply)

CO4: Integrate the concept of securing sensitive data in cloud (Apply)

CO5: Employ various research trends related to data analytics in cloud (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I DATA MINING **9**

Data Mining Concepts – Classification – Clustering–Association Rules – Parallel and Distributed Data Mining – machine Learning Approach to Data Analysis – Data Formats – Data Cleaning – Data Visualization – Problem Solving Approach

UNIT II CLOUD BASED DATA ANALYSIS **9**

Mathematical and Parallel Techniques – MapReduce for Data Analysis – MapReduce Paradigm – MapReduce Frameworks – MapReduce Algorithms and Applications – Data Analysis Work Flows – Work Flow Programming – Work Flow Management System – Work Flow Management System for Cloud – NoSQL Models for Data Analysis

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UNIT III SCALABLE DATA ANALYTICS 9

Data Analysis System for Clouds – Amazon Athena – Amazon FinSpace – Swift – Spark – BigML – Mahout– Microsoft Azure Machine Learning – Design of Scalable Data Analysis Framework in Cloud – Work Flow based Data Analysis

UNIT IV SECURITY OF SENSITIVE DATA IN CLOUD 9

Data in Cloud – Data Lie Cycle – Security Challenges in Cloud Computing for Data – Protection of Data – Tighter IAM Controls – Classical Cryptography for Cloud Computing – Homomorphic Crypto System

UNIT V RESEARCH TRENDS 9

Data – Intensive Exascale Computing – Massive Social Network Analysis – Key Research Areas – Data Analysis Case Studies – Trajectory Mining Workflow using VL4Cloud – Ensemble Learning workflow using JS4 Cloud – Parallel Classification using Swift

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Domenico Talia, Paolo Trunfio, Fabrizio Marozzo, "Data Analysis in the cloud, Models, Techniques and Applications", Elsevier 2016.
2. Sachi Nandhan Mohanty, Jyotir Moy Chtterjee, Monika mangla, Suneetha Sathpathy,Sirisha Potluri, 'Machine Learning Approach for Cloud Data Analytics in IoT', Wiley , 2021

REFERENCES:

1. Nick, Gillam, Lee, "Cloud Computing – Principles, Systems and Applications", 2nd Edition, Springer, 2017
2. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering the Cloud Computing", Morgan Kaufmann,2013
3. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation "Management, and Security", CRC Press, 2016.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CSP06	EDGE COMPUTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge on Cloud Computing and enabling technologies.
- To explore the need for Edge Computation.
- To impart the knowledge to log the sensor data and to perform further data analytics.

COURSE OUTCOMES:

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

CO1: Illustrate the principles and architectures of fog computing (Understand)

CO2: Interpret the communication and management of edge computing (Understand)

CO3: Analyze the storage and computation of fogs (Analyze)

CO4: Examine the performance of the applications developed using fog architecture (Apply)

CO5: Identify the security and privacy issues of edge computing (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I EDGE COMPUTING PARADIGMS **9**

Introduction to Edge Computing scenarios and Use cases Eg. Healthcare – Edge Computing hardware and architectures – Edge platforms, Edge vs Fog Computing, Communication Models – Edge, Fog and M2M Fog and Edge Computing completing the cloud – Hierarchy of Fog and Edge computing – Business models – Opportunities and challenges

UNIT II CHALLENGES IN FEDERATING EDGE RESOURCES **9**

Introduction – Methodology – Integrated C2F2T Literature by modeling technique – Integrated C2F2T Literature by Use–case Scenarios – Integrated C2F2T Literature by metrics – Resources – deployment of edge nodes, Public usability of edge nodes, Modelling – mobility modeling, Network resource modeling

UNIT III MANAGEMENT OF NETWORK **9**

Introduction – Background – Network slicing – Network slicing in software – Defined Clouds – Network slicing management in Edge – Internet of Vehicles: Architecture, Protocol and Security – Seven

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layered model architecture for the Internet of Vehicles – IoV: Network models, challenges and future aspects.

UNIT IV MIDDLEWARE FOR EDGE COMPUTING: DESIGN ISSUES 9

Need for Edge Computing Middleware – Design Goals – State–of–the–Art Middleware Infrastructures – System Model – Middleware for Edge Cloud Architecture – Data Management for Fog Computing – Predictive analysis to support Fog Application Deployment.

UNIT V APPLICATIONS AND ISSUES 9

Exploiting Fog Computing in Health Monitoring – Surveillance Video Stream Processing at the Edge for Real–Time Human Objects Tracking – Fog Computing Model for Evolving Smart Transportation Applications – Testing Perspectives of Fog – Based IoT Applications – Legal Aspects of Operating IoT Applications in the Fog

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Buyya, Rajkumar, and Satish Narayana Srirama, eds, Fog and edge computing: principles and paradigms, 1st edition, John Wiley & Sons, 2019. John Mutumba
2. Bilay, Peter Gutsche, Mandy Krimmel and Volker Stiehl ,SAP Cloud Platform Integration: The Comprehensive Guide, 2nd edition, Rheinwerg publishing, 2019

REFERENCES:

1. Bahga, Arshdeep, and Vijay Madisetti. Cloud computing: A hands–on approach, 1st edition, CreateSpace Independent Publishing Platform, 2013.
2. Ovidiu Vermesan, Peter Friess, Internet of Things – From Research and Innovation to Market Deployment, 1st edition,River Publishers, 2014
3. Michael Missbach, Thorsten Staerk, Cameron Gardiner, Joshua McCloud, Robert Madl, Mark Tempes, George Anderson, SAP on Cloud, 1st edition, Springer, 2016

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CSP07	CLOUD SERVICE MANAGEMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge on cloud Enabling Technologies and Architecture
- To learn Cloud Service Models
- To understand Resource Management and Security Management

COURSE OUTCOMES:

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

CO1: Describe the cloud enabling technologies and architecture (Understand)

CO2: Outline the concepts related to Infrastructure as a Service Management (Understand)

CO3: Utilize Platform as a Service models and its management (Apply)

CO4: Analyze the working model of Software as a Service Model and its service providers (Analyze)

CO5: Examine the cloud security management and administrative techniques (Analyze)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I CLOUD ENABLING TECHNOLOGIES AND ARCHITECTURE **9**

Cloud Enabling Technologies – Cloud Fundamentals – Architecture – Applications – Deployment Models – Service Models – Scalability – Virtualization – Issues – architectures – Internals of Virtual Machine Monitors/Hypervisors – Interfaces for Virtualization Management

UNIT II INFRASTRUCTURE AS A SERVICE MANAGEMENT **9**

Infrastructure as a Service – Cloud Native Infrastructure–Applications – Designing Infrastructure Applications– Testing Cloud Native Infrastructure – Managing Cloud native Applications – Implementing Cloud Native Infrastructure

UNIT III PLATFORM AS A SERVICE MANAGEMENT **9**

Platform as a Service(PaaS) – Common Features – On–Premises PaaS – Development WorkFlow – Architecture – Automated Testing – Creating Sample and Advanced Applications– PaaS Providers – PaaS Software Tools

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UNIT IV SOFTWARE AS A SERVICE MANAGEMENT 9

SaaS – Advantages – Multiple Facets of the SaaS Model – Functional – Operational – Security and Financial –Working Model of SaaS Business – Transition to SaaS – Functional Blocks – SaaS Providers – Applications of SaaS – Management of SaaS

UNIT V CLOUD SECURITY MANAGEMNT 9

Vulnerable Areas – Finding and Fixing Vulnerabilities – Agentless, Agent Based Configuration Management – Vulnerability Management Metrics – Network Security features – VPCs– Address Translation – Encryption in Motion – Firewalls and Network Segmentation – Administrative Access and Techniques

Contact Periods:

Lecture: 45 Periods Tutorial – Periods : Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing Principles and Paradigms", 2nd Edition, Wiley Publishers, 2015
2. Justin Garrison & Kris Nova, "Cloud Native Infrastructure Patterns for Scalable Infrastructure and Applications in a Dynamic Environment" 1st Edition, Orielly, ,2017

REFERENCES:

1. Michael P McGarth, " Understanding PaaS", 1st Edition, Orielly, 2012
2. Robert Michon, "The Complete Guide to Software as a Service Everything You Need to Know About Saas", 1st Edition, CreateSpace Independent Publishing Platform, 2017.
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", 1st Edition, O'Reilly, 2010

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th rowspan="3">Total Internal Assessments</th><th rowspan="3">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I (100 Marks)</th><th colspan="2">Assessment II (100 Marks)</th></tr>
<tr><th>*Individual Assignment / Case Study / Seminar / Mini Project / MCQ</th><th>Written Test</th><th>*Individual Assignment / Case Study / Seminar / Mini Project / MCQ</th><th>Written Test</th></tr>
<tr><td>40</td><td>60</td><td>40</td><td>60</td><td>200</td><td>100</td></tr>
<tr><td colspan="4" rowspan="2">Total</td><td>40</td><td>60</td></tr>
<tr><td colspan="2">100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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KPRIET Learn Beyond

U21CSP08	BIG DATA INTEGRATION AND PROCESSING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the basics concepts of Managing Big data in cloud storage
- To acquire basic knowledge on retrieving Big data
- To learn big data integration and processing, analytics

COURSE OUTCOMES:

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

CO1: Describe the basic concepts for managing Big data in cloud storage (Understand)

CO2: Implement the techniques for retrieving Big data (Apply)

CO3: Integrate the knowledge on Big Data into cloud storage (Apply)

CO4: Apply processing techniques of Big Data (Apply)

CO5: Perform the process of Big Data analytics using Spark (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I MANAGING BIG DATA IN CLOUD STORAGE 9

Big Data Modelling and Management – Orientation of data in clusters and cloud storage – Browsing Tables in Metastore – Browsing Files in HDFS – S3 – Apache Hive and Apache Impala Interoperability – Loading Data into Cloud Storage – Storage Engines

UNIT II RETRIEVING BIG DATA 9

Significance of Big Data Processing – Retrieving Big Data – Querying JSON Data with MongoDB – Aggregation Function – Querying Aerospike

UNIT III BIG DATA INTEGRATION 9

Overview of Information Integration – Data Integration Scenario – Integration for Multi-Channel Analytics – Industry Examples for Big data integration and Management – Big data management and processing using Splunk and Diameter

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UNIT IV PROCESSING BIG DATA 9

Big Data Processing Pipelines – High level processing operations – Aggregation Operations in Big Data Pipelines – Typical analytical operations in Big data pipelines – Over view of Big Data Processing Systems – Work Flow Management – Integration and processing Layer Pipe Line and Tools

UNIT V BIG DATA ANALYTICS 9

Big Data Analytics using Spark – Programming in Spark using RDDS in Pipelines – Spark Core Transformations– Spark Eco System – Spark SQL – Streaming – Spark MLLib – Data Processing Spark–Use case–Analyzing sensor data with Spark streaming

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Xin Luna Dong, Divesh Srivastava, "Big data Integration and Management in Cloud", 1st Edition,Morgan & Claypool Publishers, 2015
2. Course Era, "Big Data Integration and Processing", University of California San Diego

REFERENCES:

1. Judith Hurwitz, Alan Nugent, Dr. Fern Halper"Big Data for Dummies" , 1st Edition, John Wiley & Sons ,2013
2. Pelin Yildirim Taser, "Emerging Trends in IoT and Integration with Data Science, Cloud Computing, and Big Data Analytics", IGI Global, 2021

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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VERTICAL 4: NETWORKING AND CYBER SECURITY

U21ITP01	PARALLEL AND DISTRIBUTED COMPUTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the technologies, system architecture, and communication architecture that propelled the growth of parallel and distributed computing systems
- To understand the basics of communication and communication modes in parallel and distributed systems
- To understand the basics ofconsistency control in parallel and distributed systems

COURSE OUTCOMES:

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

CO1: Explain the foundational principles behind parallel programming and distributed systems (Understand)

CO2: Apply the various design principles of parallel algorithms (Apply)

CO3: Recognise the effectiveness of parallel algorithms in considering elements like scalability, load balancing, and synchronisation (Understand)

CO4: Illustrate the techniques for designing scalable and high-performance distributed systems (Understand)

CO5: Comprehend the importance of distributed systems' communication, consistency control, fault tolerance, and recovery procedures. (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I MESSAGE PASSING INTERFACE **9**

Functional parallelism: The Single Program Multiple Data (SPMD) model, Processor identification - Parallel computer memory architectures – Parallel Programming Models

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UNIT II DESIGNING PARALLEL ALGORITHMS 9

Methodical design – Partitioning, Domain decomposition, Functional decomposition, Partitioning design checklist – Communication, local and global communication, Unstructured and dynamic communication – Asynchronous communication, Agglomeration – Mapping, Load-balancing algorithms, Task-scheduling algorithms

UNIT III COMMUNICATION MODES AND COMMUNICATORS 9

Communication modes: Persistent, Partitioned, Synchronous and asynchronous, local and nonlocal operations, Buffered communication – Communicators: Basic communicators, Duplicating communicator, Sub communicators, Splitting a communicator, Communicator and groups, Inter communicators.

UNIT IV DISTRIBUTED SYSTEMS 9

Types of distributed systems – Architectures, System architecture and styles, Middleware organization – Processes, Threads, Client and server – Distributed file systems: Scalable performance, Load balancing, and Availability.

UNIT V COMMUNICATION AND CONSISTENCY CONTROL 9

Inter process communication – Remote invocation – Indirect communication –Consistency control: Data centric consistency – Client centric consistency – Replica management – Consistency protocols – Fault tolerance and recovery – Cast study : CORBA, Google spanner

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Vick Eijkhout, "Parallel Programming in MPI and OpenMP",2nd Edition, McGraw-Hill Education, 2022
2. Ian Foster,"Designing and Building Parallel Programs – Concepts and tools for Parallel Software Engineering", ,1st Edition, Pearson, 2019
3. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, "Distributed Systems: Concepts and Design",5th Edition, Pearson Education, 2017

REFERENCES:

1. FokkinkW, "Distributed Algorithms: an Intuitive Approach", 2nd Edition, MIT Press, 2018
2. Peter Pacheco, "An Introduction to Parallel Programming", Illustrated Edition, Morgan Kaufmann, 2011

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EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.

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U21ITP02	MOBILE COMPUTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- Nil

COURSE OBJECTIVES:

- To understand the fundamentals of mobile computing
- To describe the various protocols used in MANETs
- To explore the operating systems used in mobile computing and e-commerce

COURSE OUTCOMES:

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

CO1: Explain the basic concepts and technologies used in mobile communication (Understand)

CO2: Outline the importance of MAC, Mobile Internet Protocol and DHCP in MANETs (Understand)

CO3: Illustrate the working of transport layer and databases in mobile computing (Understand)

CO4: Describe the basics of Mobile Adhoc networks and the various possible security issues in MANETs (Understand)

CO5: Demonstrate suitable operating systems for mobile computing and the basic principles of mobile commerce (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I COMMUNICATION TECHNOLOGIES 9

Mobile handsets, Wireless communications, and server applications – Cell phone system – Types of telecommunication networks – LAN architectures – Components of a wireless communication systems – Architecture of a mobile telecommunication system – Wireless networking standards – WLANs – Bluetooth technology – Mobile computing – Mobile computing applications – Structure of mobile computing application – Cellular mobile communication – GSM – GPRS – UMTS – Mobile phone and human boy

UNIT II MAC AND MOBILE IP 9

Properties of MAC protocols – Issues in wireless MAC protocols – Taxonomy of MAC protocols – Fixed assignment schemes – Random assignment schemes – Reservation-based schemes – The802.11 MAC Standard – MAC protocols for Ad hoc networks – Mobile Internet Protocol: Mobile

IP terminologies – Packet delivery – Features of mobile IP – Key mechanism in mobile IP – Route optimization – Dynamic Host Configuration Protocol(DHCP)

UNIT III MOBILE TRANSPORT LAYER AND DATABASES 9

TCP/IP – Architecture of TCP/IP – Operation of TCP – Application layer protocols of TCP – TCP/IP versus ISO/OSI Model – Adaptation of TCP window – Improvement in TCP performance – Issues in transaction processing –Transaction processing environment – Data dissemination–Transaction processing in mobile environment – Data replication – Mobile transaction models – Rollback process –Two-phase commit protocol – Query processing–Recovery

UNIT IV MOBILE ADHOC NETWORKS 9

Characteristics of MANETs – Applications of MANETs – MANET design issues – Routing – Essentials of traditional routing protocols – Routing in MANETs: MANET routing protocols – Vehicular Ad Hoc Networks (VANETs) – MANET vs. VANET – Security issues in a MANET – Attacks on Ad Hoc networks – Security attack countermeasures

UNIT V OPERATING SYSTEMS FOR MOBILE COMPUTING AND MOBILE COMMERCE 9

Mobile operating systems – Constraints and requirements of mobile operating systems – Commercial mobile operating systems – Operating systems for sensor networks – Applications of M-Commerce – Business-to-Consumer (B2C) Applications – Business-to-Business (B2B) Applications–Structure of mobile commerce – Pros and Cons of M-Commerce–Mobile payment systems – Security issues

Contact Periods:

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

Total: 45 Periods

TEXT BOOK:

1. Prasant Kumar Pattnaik, RajibMall,"Fundamentals of Mobile Computing", 1st Edition, PHI Learning, 2019

REFERENCES:

1. Schiller J, "Mobile Communication", 2nd Edition, Pearson Education, 2023
2. Raj Kamal, "Mobile Computing", 3rd Edition, Oxford University press Inc, 2019
3. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, "Mobile Computing Technology, Applications and Service Creation", 2nd Edition , McGraw Hill, 2018
4. Martin Sauter, "From GSM to LTE, An Introduction to Mobile Networks and Mobile Broadband",1st Edition, Wiley, 2014

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.

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U21ITP03	WIRELESS SENSOR NETWORKS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- Nil

COURSE OBJECTIVES:

- Understand the basic concepts and functionalities of MAC and routing algorithms in sensor network
- Choose appropriate solutions for network management and Middleware services.
- Describe the various applications of WSN

COURSE OUTCOMES:

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

CO1: Explain the concepts of sensor network using WSN architecture (Understand)

CO2: Describe the concepts of physical and MAC layer protocols for WSN (Understand)

CO3: Elucidate the functionalities of routing algorithms in sensor networks (Understand)

CO4: Use appropriate solutions for network management and middleware services in WAN (Apply)

CO5: Demonstrate various applications in wireless sensor networks (Apply)

CO-PO MAPPING:

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

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

SYLLABUS:

UNIT I WSN ARCHITECTURES **9**

Single-node architecture – Hardware components – Energy consumption of sensor nodes – Operating systems and execution environments – Sensor network scenarios – Optimization goals – Design principles for WSNs – Service interfaces of WSNs–Gateway concepts

UNIT II MEDIUM ACCESS CONTROL PROTOCOLS **9**

Wireless channel and communication fundamentals – Physical layer and transceiver design considerations in WSNs – Fundamentals of wireless MAC protocols – Low duty cycle protocols and wakeup concepts – Contention-based protocols – Schedule-based protocols – Random Access-based Protocols – Case study: Sensor – MAC IEEE 802.15.4 LR-WPANs Standard

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UNIT III ROUTING AND DATA GATHERING PROTOCOLS 9

Routing challenges and design issues in wireless sensor networks – Routing strategies in wireless sensor networks – Data-centric networking – Data-centric routing – Data aggregation – Data-centric storage

UNIT IV NETWORK MANAGEMENT 9

Middleware principle, Middleware architecture – Existing middleware – Network management requirements, Traditional network management models – Network management design issues, Operating system design issues – WSN design issues – Performance modelling of WSN, Case study: Computation of the system life span

UNIT V APPLICATIONS 9

Home control – Building automation – Industrial automation – Medical applications – Reconfigurable sensor networks – Highway monitoring – Military applications – Civil and environmental engineering applications – Wildfire instrumentation – Habitat monitoring – Nanoscopic sensor applications – Case study: Target detection and tracking – Contour/edge detection

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. KazemSohraby, Daniel Minoli, TaiebZnati, "Wireless Sensor Networks Technology, Protocols, and Applications", 2nd Edition, Wiley, 2016
2. Abbas Jamalipour,J unZheng,"Wireless Sensor Networks: A Networking Perspective", 1stEdition, Wiley, 2014
3. Hossam Mahmoud Ahmad Fahmy, "Wireless Sensor Networks: Concepts, Applications, Experimentation and Analysis", 1stEdition, Springer, 2018

REFERENCES:

1. Zhao, Feng,Guibas, Leonidas,"Wireless Sensor networks : An information processing approach", 2nd Edition, Elsevier, 2016
2. Mohammad Ilyas,"The Handbook of Ad Hoc Wireless Networks", 1st Edition, CRC Press, 2017
3. ImadMahgoub,MohammadIlyas, "Sensor Network Protocols", 1st Edition, CRC Press, 2018

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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KPRIET Learn Beyond

U21ITP04	SOFTWARE DEFINED NETWORKS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- Nil

COURSE OBJECTIVES:

- Utilize the concepts of open flow and SDN controllers to provide services
- Identify and build SDN framework to model and deploy services for data centres
- Explain SDN applications using open SDN controllers

COURSE OUTCOMES:

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

CO1: Explain the evolution of software defined networking to understand network programmability (Understand)

CO2: Outline the concepts of open flow and SDN controllers to provide services for realizing a distributed control plane (Understand)

CO3: Identify SDN solutions for data centers using different kinds of SDN controllers (Apply)

CO4: Build the SDN Frameworks to model and deploy services for ensuring syntactic and semantic correctness (Apply)

CO5: Build SDN applications using open SDN controllers for different environments (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION 9

History of Software Defined Networking (SDN) – Modern data center – Traditional switch architecture – Purpose of SDN – Evolution of SDN – Working of SDN – Control plane and data plane

UNIT II OPEN FLOW AND SDN CONTROLLERS 9

Open flow specification – Drawbacks of open SDN - SDN via APIs–SDN via Hypervisor based overlays – SDN via Networking device – SDN controllers: VMware, Nicira, OpenFlow related

UNIT III DATA CENTERS 9

Multitenant and virtualized multitenant data center – SDN solutions for the data centernetwork – Virtual Local Area Network VLANs – Ethernet VPN – Virtual extensible LAN – Network Virtualization using Generic Routing Encapsulation

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UNIT IV SDN FRAMEWORK 9

SDN Frameworks – Open daylight controller – Floodlight controller – Bandwidth calendaring – Data centerorchestration.

UNIT V SDN APPLICATIONS AND OPEN SOURCE 9

SDN in other environments – SDN applications – SDN open source: open source environment, OpenFlowsource code, Network virtualization, Simulation, Testing, and Tools, Open source cloud software

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Thomas DNadeau, Ken Gray,"SDN: Software Defined Networks",1stEdition,O'Reilly Media, 2013
2. Paul Goransson, Chuck Black,"Software Defined Networks: A Comprehensive Approach", 2ndEdition,Morgan Kaufmann,2016

REFERENCES:

1. SiamakAzodolmolky,"Software Defined Networking with Open Flow", 2nd Edition, Packet Publishing, 2017
2. VivekTiwari,"SDN and Open Flow for Beginner",1st Edition, M.M. D.D. Multimedia LLC, 2013
3. Fei Hu, "Network Innovation through Open Flow and SDN: Principles and Design", 1st Edition, CRC Press, 2014

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21ITP05	CYBER SECURITY	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To discuss cyber security evolution, policy and law
- To describe the cyber security metrics and issues
- To explore the attacking and defencing techniques

COURSE OUTCOMES:

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

CO1: Elucidate the cyber security evolution and its policy to handle cyber threats (Understand)

CO2: Describe the cybersecurity metrics and guidance for management of cyber issues (Understand)

CO3: Explain the cybersecurityissues faced by decision makers for understanding cyber security (Understand)

CO4: Illustrate the attacking techniques and exploitation to detect cyber-attacks (Understand)

CO5: Identify the different category of malicious code to defend cyber attacks (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION **9**

Cyber security – Cyber security policy – Domain of cyber security policy: Laws and regulations, Enterprisepolicy, Technology operations, Technology configuration - Strategy versus policy – IT Act – Cyber security evolution: Productivity, Internet,E-commerce, Counter measures, Challenges

UNIT II CYBERSECURITY OBJECTIVES AND GUIDANCE **9**

Cyber security metrics – Security management goals – Counting vulnerabilities – Security frameworks: E-commerce systems, Industrial control systems, Personal mobile devices – Security policy objectives – Guidance for decision makers - Cyber security management – Catalog approach

UNIT III CYBERSECURITY ISSUES **9**

Cyber governance issues: Net neutrality, Internet names, and numbers, Copyright and trademarks, Email and messaging - Cyber user issues: Malvertising, Impersonation, Appropriate use, Cybercrime,

Geolocation, Privacy – Cyber conflict issues: Intellectual, Property theft, Cyber espionage, Cybersabotage, Cyber welfare

UNIT IV ATTACKER TECHNIQUES AND EXPLOITATION 9

Antiforensics, Tunneling techniques, Fraud techniques, Threat infrastructure – Techniques to gain a foothold, Misdirection, Reconnaissance, and Disruption methods

UNIT V MALICIOUS CODE AND DEFENSE 9

Self - replicating malicious code, Evading detection and elevating privileges , Stealing information and exploitation – Defense and analysis techniques

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Jennifer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs , Jeffrey Schmidt, Joseph Weiss, "Cyber Security Policy Guidebook", 1st Edition, John Wiley & Sons, 2012
2. James Graham, Rick Howard, Ryan Olson, "Cyber Security Essentials", 1st Edition, CRC Press, 2016

REFERENCES:

1. "National Cyber Crime Reference – Handbook-I", National Cyber Safety and Security Standards, India, 2014
2. "National Cyber Defence Reference – Handbook-II", National Cyber Safety and Security Standards, India, 2016
3. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics", 2nd Edition, Tata McGraw -Hill, 2006
4. https://www.sans.org/white-papers

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21ITP06	INTERNET SECURITY	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- Nil

COURSE OBJECTIVES:

- To describe intrusion detection techniques, IP security and Web security protocols
- To study e-mail security and wireless security protocols
- To acquire the security services needed in cloud environment

COURSE OUTCOMES:

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

CO1: Describe intrusion detection techniques and firewalls for preventing security attacks (Understand)

CO2: Explore IP security and web security protocols for providing data security services (Apply)

CO3: Demonstrate the use of security protocols for securing e-mail services (Apply)

CO4: Illustrate the various wireless security protocols for protecting data in a wireless environment (Understand)

CO5: Infer the security services needed in cloud environment for secure data sharing (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION **9**

Threats in networks – Network security controls – Intruders – Intrusion detection – Password management – Malicious software – Firewalls: Characteristics – Types – Firewall basing – Firewall location and configurations

UNIT II IP AND WEB SECURITY **9**

IP security: IP security policy, Encapsulating security payload – Web security: Secure socket layer, Transport layer security – HTTPS – Secure shell (SSH)

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UNIT III ELECTRONIC MAIL SECURITY 9

Store and forward – Security services – Source authentication – Message integrity – Non - repudiation – Proof of submission and delivery – Pretty Good Privacy (PGP) – Secure/Multipurpose Internet Mail Extension (S/MIME).

UNIT IV WIRELESS NETWORK SECURITY 9

IEEE 802.11 wireless LAN overview – IEEE 802.11i wireless LAN security – Wireless application protocol – Wireless transport layer security – WAP end-to-end security

UNIT V CLOUD SECURITY 9

Cloud information security objectives – Cloud security services – Cloud security design principles – Penetration testing tools and techniques – Cloud computing risk issues: CIA triad, privacy and compliance risks – Threats to infrastructure – data, and access control – Cloud service provider risks.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. William Stallings, "Cryptography and Network Security – Principles and Practice", Pearson Education, 7th Edition, 2017
2. Ronald L Krutz and Russell Dean Vines, "Cloud Security- A Comprehensive Guide to Secure Cloud Computing", 1st Edition, Wiley, 2016

REFERENCES:

1. J Bernard Menezes, "Network Security and Cryptography",2nd Edition,Cengage Learning, 2014
2. Chalie Kaufman, Radia Perlman, Mike Speciner, "Network Security: Private Communication in a Public World", 2nd Edition, Pearson Education, 2022
3. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms and Source Code in C", 20th Anniversary Edition, John Wiley and Sons, 2015
4. https://training.apnic.net/wp-content/uploads/sites/2/2016/12/TSEC01.pdf

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21ITP07	ETHICAL HACKING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To demonstrate penetration and port scanning tools
- To understand vulnerability assessment and network sniffing attacks
- To explore remote exploitation, wireless and web hackings

COURSE OUTCOMES:

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

CO1: Explain the concepts of penetration testing methodologies and tools to identifycyber threats (Understand)

CO2: Demonstrate port scanning tolls to detect vulnerable ports (Apply)

CO3: Explain vulnerability assessment and network sniffing tools to predict cyber threats (Understand)

CO4: Describe possible remote exploitation using network protocols and servers (Understand)

CO5: Experiment wireless and web hacking to detect cyber threats and attacks (Apply)

CO-PO MAPPING:

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

SYLLABUS

UNIT I PENETRATION TESTING 9

Important terminologies – Penetration testing: Methodologies – Categories of penetration test – Penetration testing report – Information gathering techniques: Active information gathering – Passive information gathering – Sources of information gathering – NeoTrace – Cheops-ng – Intercepting a Response – WhatWeb – Netcraft

UNIT II PORT SCANNING TECHNIQUES 9

Scanning for open ports and services – Types of port scanning – TCP flags – Port status types – TCP SYN scan – TCP connect scan – UDP port scan – IDLE scan – Scanning for a vulnerable host – Performing an IDLE scan with NMAP – OS fingerprinting

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UNIT III VULNERABILITY ASSESSMENT AND NETWORK SNIFFING 9

Vulnerability scanners – Vulnerability assessment with Nmap – Nessus vulnerability scanner – Types of sniffing – MITM attacks – ARP protocol – ARP attacks – Denial of service attacks, Dsnif – Sniffing the traffic with Dsnif – Sniffing with wireshark – Using ARP spoof to perform MITM Attacks – Hijacking session with MITM attack – Sniffing Session Cookies with Wireshark – DNS spoofing – DHCP spoofing

UNIT IV REMOTE EXPLOITATION 9

Network protocols – Server protocols – Attacking network remote services – Common target protocols – Cracking services with hydra – OpenSSH username discovery bug – Cracking SSH with Medusa – Attacking SQL servers – Metasploit: commands – reconnaissance – port scanning – Metasploit databases – Useful scans with Metasploit

UNIT V WIRELESSHACKING AND WEB HACKING 9

Aircrack-ng – Uncovering hidden SSIDs – Monitoring beacon frames on Wireshark – Determining the target with Airodump-ng – Cracking a WPA/WPA2 wireless network using Aircrack-ng – Capturing packets– Attacking the authentication – Brute force and dictionary attacks SQL injection attacks – Testing for SQL injection

Contact Periods:

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

Total: 45 Periods

TEXT BOOK:

1. Baloch, R, "Ethical Hacking and Penetration Testing Guide", 1st Edition, CRC Press, 2015

REFERENCES:

1. SagarRahalkar, "Quick Start Guide to Penetration Testing with NMAP, OpenVAS and Metasploit", Apress, 1st Edition, 2019
2. Alan T Norman, "Kali Linux and Wireless Hacking Ultimate Guide with Security and Penetration Testing Tools, Practical Step by Step Computer Hacking Book", 1st Edition,CB-India, 2018

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21ITP08	DIGITAL FORENSICS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- Describe the knowledge requirement for computer forensics and documenting the evidence
- Understand the proccess of online investigations
- Explore the different category of cyber forensics

COURSE OUTCOMES:

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

CO1: Explain the scope for computer forensics and file system for digital crime investigations (Understand)

CO2: Describe the process of acquiring and documenting computer forensic evidence for investigation (Understand)

CO3: Illustrate the proccess of online intestigations to resolve security disputes (Understand)

CO4: Perform network and mobile forensics in the field of digital communication (Apply)

CO5: Perform digital photographic forensics to resolve crime disputes(Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION 9

Scope of computer forensics: Introduction – Types of evidence – Investigator skills – Importance, – History of computer forensics – Law enforcement training– Physical and logical storage – Boot process – Windows registry

UNIT II ACQUIRING EVIDENCE AND DOCUMENTATION 9

Hard disk – Cloning hard disk – Removable memory – Lab Requirements – Private sector computer forensics laboratories – Computer forensics laboratory requirements – Extracting evidence from a device – Documenting the investigation

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UNIT III ONLINE INVESTIGATIONS 9

Working undercover – Website evidence – Background searches on a suspect – Online crime – Capturing online communications

UNIT IV NETWORK AND MOBILE FORENSICS 9

Tools, Networking devices – Understanding the OSI model – Advanced persistent threats – Investigating a network attack – Cellular network – Handset specifications – Mobile operating systems – Handling handset evidence – Handset forensics.

UNIT V MAC AND PHOTOGRAPHFORENSICS 9

Macintosh file systems – Forensic examination of a MAC – Mac operating systems – Apple mobile devices, Digital photography – Examining picture files – Evidence admissibility – Case studies.

Contact Periods:

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

Total: 45 Periods

TEXT BOOK:

1. Darren R. Hayes, "A Practical Guide to Digital Forensics Investigations", 2nd Edition, Pearson, 2020

REFERENCES:

1. "National Cyber Crime Reference – Handbook-I", National Cyber Safety and Security Standards, India, 2014.
2. "National Cyber Defence Reference – Handbook – II", National Cyber Safety and Security Standards, India, 2016.
3. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations", 6th Edition, Cengage learning, 2020.
4. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics", 2nd Edition, BCS, The chartered institute for IT, 2018.
5. https://www.sans.org/white-papers

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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VERTICAL 5: FULL STACK DEVELOPMENT

U21CSP09	UI/UX DESIGN	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the fundamental concepts of UI/UX Design
- To understand prototyping, analyzing and testing an application
- To learn to develop real time applications

COURSE OUTCOMES:

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

CO1: Interpret the concepts of UI/UX Design (Understand)

CO2: Discover different methods for organizing the contents (Understand)

CO3: Describe the knowledge on different heuristics and design interaction for an application (Understand)

CO4: Elucidate the process of prototyping, analyzing and testing an application (Understand)

CO5: Apply real time product designing using design thinking (Apply)

CO–PO MAPPING:

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

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

SYLLABUS:

UNIT I INTRODUCTION 9

Fundamentals of graphics design, principles of visual design – Mental Model – Cognitive Model in UX – Means to an End – Basics of User Research– Patterns– Project Ecosystem – Project Objectives and approach – Four Tenets of UX Strategy – user research – Personas

UNIT II ORGANIZING THE CONTENT 9

Information Architecture and Application Structure: Big Picture – Content Patterns – Picture Manager – Dashboard – Canvas Plus Palette – Wizard – Settings Editor – Alternative Views – Many Workspaces– Multi–Level Help.

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UNIT III HEURISTICS AND INTERACTION DESIGN 9

Navigational Models – Defining to designing – Design Principles – Site maps and Task Flows – Wireframes and Annotations – Interaction Patterns – Core Responsive Design.

UNIT IV PROTOTYPING, ANALYSING AND TESTING 9

Prototyping – Paper Prototyping – Digital Prototyping – Wireframe vs. Realistic Prototypes – HTML vs. WYSIWYG Editors– Additional Tools for Prototyping – Prototype Examples– Conducting Competitive Analysis – Design Testing with Users – Usability Evaluation – Heuristic Evaluation.

UNIT V PRODUCT DESIGN 9

Design Thinking Life Cycle– Types of products & solutions– Design Psychology for e–commerce sites – Design and testing of social media site and online shopping site.

Contact Periods:

Lecture: 45 Periods Tutorial – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Jaime Levy, UX Strategy, O'Reilly, 1st Edition, 2015.
2. Russer Unger, Carolyn Chandler, A Project Guide to UX Design, 2nd Edition, New Riders

REFERENCES:

1. Wiiliam Redwell, Kritina Holden, Jill Butler, "Universal Principles of Design", Rockport, 2010
2. Jesse James Garrett, "The Elements of User Experience: User–Centered Design for the Web and Beyond – Voices That Matter", AIGA NEW RIDERS, 2010
3. Marcin Treder , "UX Design for startups", UXpin, 2013

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CSP10	PYTHON WEB DEVELOPMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the object oriented structure and user interface programming through Python
- To gain knowledge of web development using Flask Framework
- To learn to deploy the software in Linux and Windows platforms

COURSE OUTCOMES:

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

CO1: Describe the object–oriented concepts in Python (Understand)

CO2: Identify the UI applications in Python (Apply)

CO3: Utilize the use of flask framework for web development (Apply)

CO4: Develop real time web applications using flask and MangoDB (Apply)

CO5: Implement the steps to deploy the developed web applications (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I OBJECT ORIENTED APPROACH IN PYTHON 9

Classes – Class Coding Basics: Instances – Behavior Methods – Operator Overloading – Customizing Behavior Methods – Constructors – Polymorphism – Inheritance

UNIT II USER INTERFACE APPLICATIONS IN PYTHON 9

Wxpython installation – Menus and Toolbars – Layout Management – Wxpython Events – Wxpython Dialogs – Widgets – Graphics

UNIT III FLASK FRAMEWORK FOR WEB DEVELOPMENT 9

Flask Basics – Routes – Templates – Control Flow – Inheritance – Forms – Modules – Connection with Databases – Relational Database versus NoSQL – Modeling – Mapping Classes to Mongodb – Building Data Layer with Mongo Engine

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UNIT IV REAL TIME DEVELOPMENT OF WEB APPLICATION 9

Develop Web Applications with Flask and MongoDB – Example Applications – Blogs – Forums – Social media applications – Twitter clone – Instagram clone – Auto Evaluation of Student Assignments

UNIT V DEPLOYMENT OF APPLICATIONS 9

Collaborative Version Control Systems – Git Commands – Real Time Usage of Git Commands – Deployment Using AWS, Google Cloud and Heroku

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Mark Lutz, "Learning Python", 5th Edition, O' Reilly 2013.
2. Miguel Grinberg, "Flask Web Development Developing Web Applications with Python", OReilly, 2014.

REFERENCES:

1. Karl Seguin, "The Little Mongo DB Book", https://github.com/karlseguin/the–little–mongodb–book.
2. Gareth Dwyer, "Flask by Example", Packt Publishers, 2016.
3. https://aws.amazon.com/education/awseducate/
4. http://packaging.ubuntu.com/html/packaging–new–software.html
5. Scott Chacon and Ben Straub, "Pro Git", Free e–book under Creative commons, 2nd Edition, Apress, 2016.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CSP11	APP DEVELOPMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn development of native applications with basic GUI Components
- To develop applications with location and data storage capabilities
- To implement cross platform applications with basic GUI and event handling

COURSE OUTCOMES:

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

CO1: Describe the Native applications with GUI Components (Understand)

CO2: Examine hybrid applications with basic event handling (Apply)

CO3: Integrate the cross–platform applications with location and data storage capabilities (Apply)

CO4: Employ the cross–platform applications with basic GUI and event handling (Apply)

CO5: Identify the web applications with cloud database access (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT 9

Basics of Web and Mobile application development – Native App – Hybrid App – Cross–platform App – What is Progressive Web App – Responsive Web design

UNIT II NATIVE APP DEVELOPMENT USING JAVA 9

What is Native Web App – Benefits of Native App – Scenarios to create Native App – Tools for creating Native App – Cons of Native App – Popular Native App Development Frameworks – Java & Kotlin for Android – Swift & Objective–C for iOS – Basics of React Native – Native Components – JSX, State, Props

UNIT III HYBRID APP DEVELOPMENT 9

What is Hybrid Web App – Benefits of Hybrid App – Criteria for creating Native App – Tools for creating Hybrid App – Cons of Hybrid App – Popular Hybrid App Development Frameworks – Ionic – Apache Cordova

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UNIT IV CROSS–PLATFORM APP DEVELOPMENT USING REACT–NATIVE 9

What is Cross-platform App – Benefits of Cross-platform App – Criteria for creating Cross-platform App – Tools for creating Cross-platform App – Cons of Cross-platform App – Popular Cross-platform App Development Frameworks – Flutter – Xamarin -- React–Native – Basics of React Native – Native Components – JSX, State, Props

UNIT V NON–FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS 9

Comparison of different App frameworks – Build Performance – App Performance – Debugging capabilities – Time to Market – Maintainability – Ease of Development – UI/UX, Reusability

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Dawn Griffiths, "Head First Android Development", O'Reilly, 1st edition
2. Anthony Accomazzo, HousseinDjirdeh, Sophia Shoemaker, Devin Abbott, "Full Stack React Native: Create beautiful mobile apps with JavaScript and React Native", FullStack publishing

REFERENCES:

1. Android Programming for Beginners, John Horton, Packt Publishing, 2nd Edition
2. Apache Cordova 4 Programming, John M Wargo, 2015
3. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition
4. Apache Cordova in Action, Raymond K. Camden, Manning. 2015

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CSP12	JAVASCRIPT FRAMEWORKS	PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the various components of full stack development
- To learn the basics of java script frameworks
- To learn application development using MongoDB

COURSE OUTCOMES:

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

CO1: Describe the various stacks available for web application development (Understand)

CO2: Utilize the use of Node.js for application development (Apply)

CO3: Implement the function of MongoDB (Apply)

CO4: Employ the role of Angular and Express for web development (Apply)

CO5: Illustrate the features of React (Understand)

CO–PO MAPPING:

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

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

SYLLABUS:

UNIT I BASICS OF FULL STACK 9

Understanding the Basic Web Development Framework – User – Browser – Webserver – Backend Services – MVC Architecture – Understanding the different stacks –The role of Express – Angular – Node – Mongo DB – React

UNIT II NODE JS 9

Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers – Callbacks – Handling Data I/O – Implementing HTTP services in Node.js

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UNIT III MONGO DB 9

Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications

UNIT IV EXPRESS AND ANGULAR 9

Implementing Express in Node.js – Configuring routes – Using Request and Response objects – Angular – Typescript – Angular Components – Expressions – Data binding – Built in directives

UNIT V REACT 9

MERN STACK – Basic React applications – React Components – React State – Express REST APIs – Modularization and Webpack – Routing with React Router – Server–side rendering

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Node.js, MongoDB and Angular Web Development, Brad Dayley, Brendan Dayley, Caleb Dayley, 2nd Edition, Pearson Education, Inc., 2018
2. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, Apress, 2017

REFERENCES:

1. Chris Northwood, "The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer", Apress; 1st edition (19 November 2018).
2. Kirupa Chinnathambi , "Learning React: A Hands–On Guide to Building Web Applications Using React and Redux", 2nd edition, Addison–Wesley Professional, (26 April 2018).
3. Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, "MongoDB: The Definitive Guide: Powerful and Scalable Data Storage", 3rd Edition, O'Reilly publication, December 31, 2019.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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KPRIET Learn Beyond

U21CSP13	WEB SERVICES AND API DESIGN	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the types of web services, resources, APIs and their architectures
- To develop, deploy RESTful web service APIs in JAVA
- To understand the security concerns of web services

COURSE OUTCOMES:

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

CO1: Describe Web Services architectural pattern for a given design problem (Understand)

CO2: Examine the types of resources and suitable design patterns for development (Apply)

CO3: Adopt Restful API Design Patterns (Apply)

CO4: Utilize RESTful API web services (Apply)

CO5: Evaluate the performance and security aspects of web services (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION **9**

Web Services – Building Blocks, Types; Service Oriented architectures – resource oriented architectures, API architectures, Micro services and architectures, HATEOAS, REST, URI, Code on Demand

UNIT II RESOURCES AND DESIGN PATTERNS **9**

Resources – Identification, Resource Relations, Representations, Parameters, types, methods, Requirements for APIs, Architectural Patterns. Basic and Advanced RESTful API patterns

UNIT III RESTFUL API DESIGN PRINCIPLES **9**

API front End Design, API back end Design, Identifier Design, Interaction Design with HTTP, Metadata Design, Representation Design, URI design, REST constraints, Best Practices

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UNIT IV DEVELOPMENT AND DEPOLYMENT 9

Frameworks, Standard Languages, API Description Languages, Handover points, Development and Deployment of RESTful web service applications in Java, microservice API, Best Practices

UNIT V PERFORMANCE AND SECURITY 9

Performance and availability – caching – Traffic shaping – Evolution and versioning, Security concerns – Mechanisms, Authentication, Validation, Access Control, Token Based Authentication, Authorization

Contact Periods:

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

TEXT BOOKS:

1. Matthias Biehl, "RESTful API Design, API University Series, 1st Edition, CreateSpace Independent Publishing Platform, 2016.
2. "RESTful web APIs", Packt Publishing, 2019.

REFERENCES:

1. JJ Geewax, "API Design Patterns", 1st Edition, Manning Publications, 2021.
2. Bogunuva Mohanram Balachandar, "Restful Java Web Services: A pragmatic guide to designing and building RESTful APIs using Java, 3rd Edition, Ingram Short Title, 2017.
3. Mark Masse, "REST API Design Rulebook: Designing Consistent RESTful Web Service Interfaces", 1st Edition, O' Reilly, 2011.
4. Harihara Subramanian, Pethuru Raj, "Hands–On RESTful API Design Patterns and Best Practices: Design, develop, and deploy highly adaptable, scalable, and secure", Packt publication, 2019

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CSP14	SOA & MICRO SERVICES	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand service–oriented architecture and microservices
- To learn the basics of DevOps practices
- To integrate DevOps with Cloud

COURSE OUTCOMES:

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

CO1: Describe SOA and micro services architecture (Understand)

CO2: Elucidate the Implementation of micro services applications (Understand)

CO3: Outline the features of SOA (Understand)

CO4: Integrate various elements of Cloud and Devops (Apply)

CO5: Execute the ways to work with third party APIs (Apply)

CO–PO MAPPING:

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

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

SYLLABUS:

UNIT I SOA AND MICROSERVICE ARCHITECTURE BASICS **9**

Need for Software Architecture – Architecting process for software applications – Software applications in enterprises – Platforms – Cloud computing platforms – SOA and MSA – Basics – Evolution of SOA & MSA – Drivers for SOA – Dimensions, Standards and Guidelines for SOA – Emergence of MSA

UNIT II MICROSERVICE BASED APPLICATIONS **9**

Implementing Microservices with Python – Microservice Discovery Framework – Coding, Testing & Documenting Microservices – Interacting with Other Services – Monitoring and Securing the Services – Containerized Services – Deploying on Cloud

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UNIT III SERVICE ORIENTED ARCHITECTURE 9

Enterprise–wide SOA – Service oriented applications – Service oriented analysis and design – Technologies for SOA – SOA Implementation and Governance

UNIT IV CLOUD AND DEVOPS 9

Origin of DevOps – The developers versus operations dilemma – Key characteristics of a DevOps culture – Deploying a Web Application – Creating and configuring an account – Creating a web server – Managing infrastructure with Cloud Formation – Adding a configuration management system

UNIT V WORKING WITH APIs 9

Working with Third Party APIs: Overview of interconnectivity in cloud ecosystems. Working with Twitter API, Flickr API, Google Maps API. Advanced use of JSON and REST

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Shankar Kambhampaty, "Service–oriented Architecture &Microservice Architecture: For Enterprise, Cloud, Big Data and Mobile", 3rd Edition, Wiley, 2018.
2. Tarek Ziadé , "Python Microservices Development", O'REILLY publication, 2017.

REFERENCES:

1. Len Bass, Ingo Weber and Liming Zhu, "DevOps: A Software Architect"s Perspective", Pearson Education, 2016
2. Nathaniel Felsen, "Effective DevOps with AWS", Packt Publishing, [ISBN:9781786466815], 2017
3. Jim Webber, SavasParastatidis, Ian Robinson, "REST in Practice" O'Reilly Media; 1st edition, [ISBN: 978–0596805821] 2010.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CSP15	CLOUD NATIVE APPLICATIONS DEVELOPMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To Introduce Cloud Environments and cloud native fundamentals
- To introduce the Docker environment
- To understand container orchestration and continuous integration and development

COURSE OUTCOMES:

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

CO1: Define the characteristics of various cloud environments (Understand)

CO2: Describe the concepts of cloud native fundamentals (Understand)

CO3: Employ Docker for cloud native development (Apply)

CO4: Implement container orchestration techniques (Apply)

CO5: Practice the features of continuous integration and development (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I CLOUD ENVIRONMENTS 9

Cloud Service Providers, AWS, Azure, CP, Cloud Technology Ecosystems, Procurement in the Cloud, Cloud Marketplaces Application Virtualization, Virtual clusters and Resource Management, Containers vs. Virtual Machines

UNIT II CLOUD NATIVE FUNDAMENTALS 9

Basics of the cloud native ecosystem – CNCF (Cloud Native Computing Foundation) – cloud native tooling – Choosing monolith or microservice based–architecture for an application – Evaluating the involved trade–offs for monoliths and microservices

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UNIT III DOCKER 9

Introduction to Docker, Docker Components, Docker Container, Docker Images and Repositories. Cloud Native application design, Containers, Data Management in Cloud, Web–Queue–Worker, Serverless Computing

UNIT IV CONTAINER ORCHESTRATION 9

Using Docker to package an application and distribute it via DockerHub – Bootstrap a Kubernetes cluster using k3s – Explore Kubernetes resources for an application deployment – Differentiate between declarative and imperative Kubernetes management techniques

UNIT V CONTINUOUS INTEGRATION AND DEVELOPMENT 9

Continuous Integration fundamentals using GitHub – Continuous Delivery fundamentals using ArgoCD – Basics of Helm, as a configuration template manager – Kubernetes basics – Deploying an application using ArgoCD and a Helm chart

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS

1. Michael J Kavis, "Architecting the Cloud – Design Decisions for Cloud Computing", Wiley publication
2. Tom Laszewski, Kamal Arora, Eric Farr, Piyum Zanooz, "Cloud Native Architectures: Design high–availability and cost–effective applications for the cloud", Packt publishing

REFERENCE BOOKS

1. Bill Wilder, Cloud Architecture Patterns: Using Microsoft Azure, O'Reilly Media
2. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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		Category: PEC				
U21CSP16	DEVOPS	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration / Continuous Testing / Continuous Deployment

COURSE OUTCOMES:

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

CO1: Explain different actions performed through Version control tools like Git (Understand)

CO2: Describe Automated Continuous Deployment (Understand)

CO3: Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle (Apply)

CO4: Illustrate configuration management using Ansible (Understand)

CO5: Use Cloud–based DevOps tools (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO DEVOPS 9

Devops Essentials – Introduction To AWS, GCP, Azure – Version control systems: Git and Github.

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle

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UNIT III CONTINUOUS INTEGRATION USING JENKINS 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT V BUILDING DEVOPS PIPELINES USING AZURE 9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure–pipelines.yaml file

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Roberto Vormittag, "A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step–By–Step Exercises", 2nd Edition, Kindle Edition, 2016.
2. Jason Cannon, —Linux for Beginners: An Introduction to the Linux Operating System and Command Linell, Kindle Edition, 2014

REFERENCES:

1. Mitesh Soni, "Hands–On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure" (English Edition) Paperback – 1 January 2020
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humansll", 1st Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOpsll", 2nd Edition, 2016.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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VERTICAL 6: IT and IT ENABLED SERVICES (ITeS)

U21ITP09	NEXT GENERATION NETWORKS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concept of small cells in 5G mobile networks
- To learn the mobile clouds and security issues in 5G networks
- To understand the role of cognitive radios in 5G networks

COURSE OUTCOMES:

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

CO1: Compare the 5G network with older generations of networks (Understand)
CO2: Identify suitable small cells for different applications of 5G networks (Understand)
CO3: Describe the importance of MAC protocol in wireless network (Understand)
CO4: Demonstrate an applications with 5G network support and mobile cloud (Apply)
CO5: Analyze the security risks in 5G networks (Analyze)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I PERVASIVE CONNECTED WORLD AND 5G INTERNET **9**

Historical trend of wireless communications – Evolution of LTE technology to beyond 4G – 5G roadmap – Ten pillars of 5G – Internet of things and context awareness – Networking reconfiguration and virtualization support – Mobility – Quality of service control – Emerging approach for resource over provisioning

UNIT II SMALL CELLS FOR 5G MOBILE NETWORKS **9**

Small cells – Capacity limits and achievable gains with densification – Mobile data demand – Demand vs. capacity – Small cell challenges

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UNIT III COOPERATION FOR NEXT GENERATION WIRELESS NETWORKS 9

Cooperative diversity and relaying strategies: Cooperation and network coding – Cooperative ARQ MAC protocols – PHY layer impact on MAC protocol analysis: Impact of fast Fading and shadowing on packet reception for QoS guarantee – Impact of shadowing spatial correlation – Study: NCCARQ, PHY layer impact.

UNIT IV MOBILE CLOUDS AND COGNITIVE RADIO 9

The mobile cloud – Mobile cloud enablers – Network coding – Overview of cognitive radio technology in 5G wireless – Spectrum optimization using cognitive radio – Relevant spectrum optimization literature in 5G – Cognitive radio and carrier aggregation – Energy efficient cognitive radio technology

UNIT V SECURITY AND SELF ORGANISING NETWORKS 9

5G communications system architecture – Security issues and challenges in 5G communications systems – Self organising networks: Introduction – Self organising networks in UMTS and LTE – The need for self organising networks in 5G – Evolution towards small cell dominant HetNets.

Contact Periods:

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

Total : 45 Periods

TEXT BOOK:

1. Jonathan Rodriguez, "Fundamentals of 5G Mobile Networks", 1st Edition, Wiley, 2015

REFERENCES:

1. Yin Zhang, Min Chen, "Cloud Based 5G Wireless Networks – Springer Briefs in Computer Science", 1st Edition Springer, 2016
2. Athanasios G. Kanatas, Konstantina S. Nikita, Panagiotis (Takis) Mathiopoulos, "New Directions in Wireless Communications Systems: From Mobile to 5G", 1st Edition, CRC Press, 2017

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21ITP10	GAME DEVELOPMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- Introduce the notion of a game, its solutions concepts, and other basic notions and tools of game theory
- Formalize the notion of strategic thinking and rational choice by using the tools of game theory
- Draw the connections between game theory, computer science, and economics, emphasizing the computational issues

COURSE OUTCOMES:

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

CO1: Discuss the notion of a strategic game, equilibria and characteristics of main applications (Understand)

CO2: Explain the use of nash equilibrium for various games (Understand)

CO3: Identify the key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation (Apply)

CO4: Apply bayesian games for suitable gaming applications (Apply)

CO5: Implement a typical virtual business scenario using game theory (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION 9

Basics of games – Strategy – Preferences – Payoffs – Mathematical basics – Game theory –Rational choice – Basic solution concepts – Non-cooperative games – Cooperative games – Basic computational issues – Finding equilibria and learning in games

UNIT II GAMES WITH PERFECT INFORMATION 9

Strategic games – Prisoner's dilemma, Matching pennies – Nash equilibria – Theory and illustrations – Cournot's and Bertrand's models of oligopoly – Auctions – Mixed strategy equilibrium – Zero-sum games – Extensive games with perfect information – Repeated games (prisoner's dilemma)

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UNIT III GAMES WITH IMPERFECT INFORMATION 9

Bayesian games – Motivational examples – General definitions – Information aspects – Illustrations – Extensive games with imperfect – Information – Strategies – Nash equilibrium – Beliefs and sequential equilibrium – Illustrations – Repeated games – Prisoner's dilemma – Bargaining

UNIT IV NON-COOPERATIVE GAME THEORY 9

Self-interested agents – Games in normal form – Analyzing games: from optimality to equilibrium – Computing solution concepts of Normal-Form games – Computing nash equilibria of two-player – zero-sum games – Computing nash equilibria of two player, general-sum games – Identifying dominated strategies

UNIT V MECHANISM DESIGN 9

Aggregating preferences – Social choice – Formal model – Voting – Existence of social functions – Ranking systems – Protocols for strategic agents: Mechanism design – Unrestricted preferences-Efficient mechanisms – Vickrey and VCG mechanisms - Applications of mechanism design – Computer science – eBay auctions – K-armed bandits

Contact Periods:

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

Total: 45 Periods

TEXT BOOK:

1. N. Nisan, T. Roughgarden, E. Tardos, and V. V. Vazirani , "Algorithmic Game Theory" 1st Edition(Revised), Cambridge University Press, 2011

REFERENCES:

1. M. Machler, E. Solan, S. Zamir, "Game Theory", 1st Edition, ,Cambridge University Press, 2020
2. A.Dixit and S. Skeath, "Games of Strategy", 2nd Edition, W W Norton & Co Inc, 2015
3. YoavShoham, Kevin Leyton-Brown, "Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations", 4th Edition, Cambridge University Press, 2008
4. Zhu Han, DusitNiyato, WalidSaad, Tamer Basar and Hjorungnes, "Game Theory in Wireless and Communication Networks", 1st Edition, Cambridge University Press, 2012

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21ITP11	BLOCKCHAIN TECHNOLOGIES	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- Nil

COURSE OBJECTIVES:

- To understand the importance of decentralization
- To know the concepts of currency and smart contracts in ethereum network
- To become familiar with the model of alternative blockchain technology and its challenges

COURSE OUTCOMES:

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

CO1: Describe the significance of decentralization using blockchain (Understand)

CO2: Distinguish the concepts of crypto currency and Bitcoin (Understand)

CO3: Recognise the importance of the Ethereum framework's components and tools (Understand)

CO4: Describe the concept of distributed ledger using hyperledger fabric for a web3 application (Understand)

CO5: Identify the challenges and trends using various blockchain projects (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I FUNDAMENTALS OF BLOCKCHAIN 9

History of blockchain – Types of blockchain – Consensus – Decentralization using blockchain – Methods of decentralization – Blockchain and full ecosystem decentralization – Platforms for decentralization - Decentralized autonomous organization

UNIT II CRYPTO CURRENCY AND SMART CONTRACTS 9

Private key vs Public key – Hash function – Secure hash algorithms - Bitcoin – Digital keys and addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative coins – Theoretical limitations – Bitcoin limitations– Smart contracts – Ricardian contracts.

UNIT III ETHEREUM 9

The Ethereum Network – Components of ethereum ecosystem – Ethereum development tools and frameworks– Solidity language

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UNIT IV WEB3 AND HYPERLEDGER 9

Web3 – Contract deployment – POST requests – Development frameworks – Hyperledger as a protocol – The reference architecture – Hyperledger fabric – Distributed ledger.

UNIT V ALTERNATIVE BLOCKCHAINS AND CHALLENGES 9

Kadena – Ripple – Rootstock – Quorum – Multichain – Scalability – Privacy – Emerging trends – Other challenges – Blockchain research – Case Study: Supply chain management.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Elad Elrom, "The Blockchain Developer: A Practical Guide for Designing, Implementing, Publishing, Testing, and Securing Distributed Blockchain-based Projects", 1st Edition, Apress, 2019
2. Chandramouli Subramanian, Asha A George, Abhilash K A "Blockchain Technology", 1st Edition, Universities Press, 2020

REFERENCES:

1. Joseph Bonneau , "SoK: Research Perspectives and Challenges for Bitcoin and Cryptocurrency", IEEE Symposium on Security and Privacy, 2015
2. Imran Bashir, "Mastering Blockchain", 2nd Edition, Pactz, 2018

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21ITP12	AUGMENTED REALITY / VIRTUAL REALITY	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To describe the fundamentals of XR, virtual reality architecture and modeling.
- To develop virtual reality applications
- To understand the design principles of augmented reality applications

COURSE OUTCOMES:

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

CO1: Describe the fundamentals of extended reality (XR) with example applications (Understand)

CO2: Outline the virtual reality architecture and modeling for real time applications (Understand)

CO3: Develop the virtual reality applications by using appropriate tools (Apply)

CO4: Explain the basics of augmented reality with real time examples (Understand)

CO5: Apply the design principles and practices of augmented reality for industrial sectors (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I XR OVERVIEW 9

Introduction – XR spectrum – Definitions - Augmented reality – Virtual reality – Mixed reality – History – Challenges – XR and business – Applications: Retail, Training, Education, Healthcare, Entertainment, Sports, Manufacturing, Military.

UNIT II VR IO, MODELING 9

VR definition, Input devices: Trackers, navigation and gesture interfaces, Output devices: Graphics, Three dimensional sound and Haptic displays, Computer architecture for VR, Modelling.

UNIT III VR APPLICATION ENVIRONMENT 9

Enabling VR Environment, Building: Steam VR, Oculus rift, Windows gear VR, Oculus Go, Google VR, Setting up for android devices - 3D walkthrough, Object grabbing, Transformation, Hand avatar manipulation, World space menu creation

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UNIT IV AR PRINCIPLES 9

AR Definition, Displays: Multimodal displays, Spatial display model, Visual displays, Tracking, Calibration and registration - Mobile sensors - Computer vision for AR

UNIT V AR APPLICATION DEVELOPMENT 9

Mobile application for image tracking, Image dataset generation, Setting up AR environment, Animation and transformation (Scale, Move, Rotate, Transform), Build generation for iOS and Android. Case study: Picture puzzle

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Berbard Marr, " Extended Reality in Practice: Augmented, Virtual and Mixed Reality Explored", 1st Edition, Wiley, 2021
2. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", 2nd Edition, John Wiley & Son, 2014
3. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles and Practice", 1st Edition, Addison-Wesley, 2017

REFERENCES:

1. Steve Aukstakalnis, "Practical Augmented Reality: A Guide to the Technology Applications, and Human Factors for AR and VR", 1st Edition, Addison-Wesley, 2016
2. Robert Scoble, Shel Israel, "The Fourth Transformation: How Augmented Reality & Artificial Intelligence Will Change Everything", 1st Edition, Patrick Brewster Press, 2016
3. Jesse Glover, Jonathan Linowes, "Complete Virtual Reality and Augmented Reality Development with Unity",1st Edition, Packt, 2019

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21ITP13	QUANTUM COMPUTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the fundamentals of quantum information science
- To become familiar with 1-qubit and 2-qubit gate operations and gain the ability to build simple quantum circuits
- To familiar with quantum algorithms and their analysis

COURSE OUTCOMES:

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

CO1: Explain the fundamentals of quantum information science (Understand)

CO2: Distinguish the concepts of quantum bits and classical bits (Understand)

CO3: Illustrate the basic quantum logical operations and algorithms for processing quantum information (Understand)

CO4: Implement simple quantum algorithms and information channels in the quantum circuit model (Apply)

CO5: Employ the basic error correction methods and tools in quantum computing (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I SINGLE AND MULTIPLE QUBIT QUANTUM SYSTEMS 9

Quantum building blocks, Single qubit systems: Quantum mechanics of photon polarization – Single qubit measurement – Quantum key distribution protocol – The state space of single qubit system – Multiple qubit systems: Tensor products – State space of n – qubit system – Entangled States – Quantum key distribution using entangled states.

UNIT II MEASUREMENT OF MULTIPLE– QUBIT STATES AND QUANTUM STATE TRANSFORMATIONS 9

Dirac's Bra/Ket Notation – Projection operators for measurement – Hermitian operator formalism for measurement – EPR paradox and Bell's theorem – Quantum state transformations: Unitary transformations – Simple quantum gate – Applications of simple gates – Realizing unitary transformations as quantum circuits.

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UNIT III CLASSICAL COMPUTATIONS AND ALGORITHMS 9

From reversible classical computations to quantum computations – Reversible implementations of classical circuits – Language for quantum implementations – Example programs for arithmetic operations. Introduction to quantum algorithms: computing with superpositions – Notions of complexity – Deutsch's problem – Quantum subroutines – Few simple quantum algorithms.

UNIT IV SHOR'S FACTORING ALGORITHM AND GENERALIZATION 9

Classical reduction to period– finding – Shor's factoring algorithm – The efficiency of Shor's algorithm, Generalizations: The discrete logarithm problem – Hidden subgroup problems

UNIT V ERROR CORRECTION AND TOOLS 9

Quantum code that corrects single bit – Flip errors – Code for single – Qubit phase - flip errors – Code for all single - qubite errors – QISKit – AWS Braket – QCSim

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Ray LaPierre, "Introduction to Quantum Computing", 1st Edition, Springer, 2021
2. Eleanor Rieffel, Wolfgang Polak, "Quantum Computing: A Gentle Introduction",1st Edition, MIT Press, 2011
3. Bernhardt, Chris, "Quantum Computing for Everyone" 1st Edition, MIT Press, 2019

REFERENCES:

1. David J Griffiths, "Introduction to Quantum Mechanics", 1st Edition, Cambridge, 2016
2. Scott Aaronson, **"Quantum Computing Since Democritus"**, Cambridge University Press, 1st Edition, 2013
3. Michael A. Nielsen, Isaac L. Chuang , "Quantum Computation and Quantum Information", 10th Anniversary Edition, Cambridge University Press, 2011

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21ITP14	GRAPHICS PROCESSING UNIT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- Nil

COURSE OBJECTIVES:

- To understand the organization of threads computation
- To describe the performance of computations efficiently
- To describe the use of available hardware resources effectively to improve the system performance

COURSE OUTCOMES:

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

CO1: Describe the common GPU architectures and programming models (Understand)

CO2: Implement efficient algorithms for common application kernels (Apply)

CO3: Make use of synchronization and functions to develop an efficient parallel algorithm for solving real world problems (Apply)

CO4: Develop an efficient and correct code to solve it, analyze its performance (Understand)

CO5: Apply the advanced techniques used in parallel computing for image processing (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION **9**

GPU Architecture – Clock speeds – CPU / GPU comparisons – Heterogeneity – Accelerators – Parallel Programming – CUDA OpenCL / OpenACC – Kernels Launch parameters – Thread hierarchy – Warps / Wavefronts – Threadblocks / Workgroups – Streaming multiprocessors – 1D / 2D / 3D thread mapping – Device properties, Simple Programs

UNIT II MEMORY **9**

Memory hierarchy – DRAM / global, local / shared, private / local, textures – Constant Memory – Pointers – Parameter passing – Arrays and dynamic memory – Multi-dimensional arrays – Memory allocation – Memory copying across devices – Programs with matrices – Performance evaluation with different memories

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UNIT III SYNCHRONIZATION AND FUNCTIONS 9

Synchronization: Memory consistency – Barriers (local versus global) – Atomics – Memory fence – Prefix sum – Reduction – Programs for concurrent data structures such as Worklists, Linked-lists – Synchronization across CPU and GPU Functions: Device functions – Host functions – Kernels functions – Using libraries (such as Thrust), and developing libraries.

UNIT IV SUPPORT AND STREAMS 9

Support: Debugging GPU programs – Profiling, Profile tools – Performance aspects streams: Asynchronous processing, tasks – Task-dependence – Overlapped data transfers – Default stream – Synchronization with streams – Events, Event-based synchronization – Overlapping data transfer and kernel execution – Pitfalls

UNIT V PARALLELISM 9

Dynamic parallelism – Unified virtual memory – Multi-GPU processing – Peer access – Heterogeneous processing – Case study: Image processing

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. David Kirk, Wen-mei Hwu, "Programming Massively Parallel Processors: A Hands-On Approach", 2nd Edition, Morgan Kaufman, 2013
2. Shane Cook, "CUDA Programming: A Developer's Guide to Parallel Computing with GPUs", 1st Edition, Elsevier, 2013

REFERENCES:

1. Avimanyu Bandyopadhyay, "Hands on GPU Computing with Python", 1st Edition, Packt, 2019
2. Brian Tuomanen, "Hands-On GPU Programming with Python and CUDA", 1st Edition, Packt, 2018

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course coordinator can choose any one / two components based on the nature of the course.

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KPRIET Learn Beyond

U21ITP15	AGILE METHODOLOGIES	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- Nil

COURSE OBJECTIVES:

- To understand agile development processes and the principles behind the agile manifesto
- To understand the business value of adopting agile approaches
- To apply design principles and refactoring to achieve agility

COURSE OUTCOMES:

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

CO1: Elucidate agile software development and related methodologies (Understand)
CO2: Describe the importance of interacting with business stakeholders in determining the requirements for a software system (Understand)
CO3: Recognize the agile process and requirement management in industry (Understand)
CO4: Implement test driven development to increase quality in agile process (Apply)
CO5: Apply the impact of social aspects on software development success (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I AGILE METHODOLOGY 9

Theories for agile management – Agile software development – Traditional model vs. agile model - Classification of agile methods – Agile manifesto and principles – Agile project management – Agile team interactions – Ethics in agile teams - Agility in design – testing – Agile documentations – Agile drivers – Capabilities and values.

UNIT II AGILE PROCESSES 9

Lean production – SCRUM, Crystal – Feature Driven Development – Adaptive software development – Extreme Programming: Method overview – Lifecycle – Work products, Roles and practices

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UNIT III AGILITY AND KNOWLEDGE MANAGEMENT 9

Agile information systems – Agile decision making - Earl_s schools of KM – Institutional knowledge evolution cycle – Development, Acquisition, Refinement, Distribution, Deployment, Leveraging – KM in software engineering – Managing software knowledge – Challenges of migrating to agile methodologies – Agile knowledge sharing – Role of story-cards – Story-card Maturity Model (SMM).

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING 9

Impact of agile processes in RE – Current agile practices – Variance – Overview of RE using agile – Managing unstable requirements – Requirements elicitation – Agile requirements abstraction model – Requirements management in agile environment – Agile requirements prioritization – Agile requirements modelling and generation – Concurrency in agile requirements generation.

UNIT V AGILITY AND QUALITY ASSURANCE 9

Agile Interaction Design – Agile product development – Agile metrics – Feature driven development (FDD) – Financial and production metrics in FDD – Agile approach to quality assurance - Test driven development – Pair programming: issues and challenges – Agile approach to global software development.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. John C.pasture, "Project Management the Agile Way Making It Work in the Enterprise", 2nd Edition, Cengage Learning, 2016
2. Orit Hazzan, Yael Dubinsky, "Agile Software Engineering", 2nd Edition, Springer, 2014

REFERENCES:

1. Dingsoyr, Torgeir, Dyba, Tore, Moe, Nils Brede (Eds.), "Agile Software Development, Current Research and Future Directionsll",1st Edition, Springer, 2010
2. Karl Weigers, John Beatty, "Software Requirement", 3rd Edition, Microsoft Press US,2013

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21ITP16	SOTWARE TESTING TOOLS AND TECHNIQUES	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- Nil

COURSE OBJECTIVES:

- To understand the fundamentals of software testing and developing test cases for real time problems
- To describe the various testing strategies to improve the quality
- To explore the selenium tool for building test cases

COURSE OUTCOMES:

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

CO1: Explain the testing levels for various test cases using graph theory and basics of discrete mathematics (Understand)
CO2: Describe the variants of unit testing with the help of case studies (Understand)
CO3: Describe the importance of waterfall, agile and integration tesing strategies (Understand)
CO4: Demonstrate the functionalities of selenium tool for software testing (Apply)
CO5: Apply the selenium tool for real time test cases (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION **9**

Basic definitions – Test cases – Insights from a venn diagram – Identifying test cases – Fault taxonomies – Levels of Testing – Discrete math for testers – set theory – Functions – Relations – Propositional logic – Graph theory for testers – Graphs – Directed graphs – Graphs for testing.

UNIT II UNIT TESTING **9**

Boundary value testing – Robust boundary value testing – special value testing – Examples – Random testing – Equivalence class testing – Equivalence classes – Traditional equivalence class testing – Improved equivalence class testing – Decision table based testing – Decision tables – Decision table techniques – Case study: Triangle problem and NextDate function.

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UNIT III TESTING STRATEGIES 9

Life cycle based testing – Traditional waterfall testing – Testing in iterative lifecycles – Agile testing – Integration testing: Decomposition based integration – Call graph-based integration – Path based integration – Model based integration testing

UNIT IV AUTOMATION TESTING 9

Automation testing, Advantages and disadvantages, History of selenium, Why selenium - Difference between selenium and other tools - Components - Variables and datatypes - Control statements - Arrays - Strings and functions - Classes and objects - Inheritance and polymorphism - Exception handling – Collections and File Handling

UNIT V IFRAMES IN WEB DEVELOPMENT 9

Generating scripts - Wait commands - Validation commands - Store commands - Limitations - Sample program - Navigation - Radio buttons and checkbox - Drop down list - File upload - Drag and drop - Error and alert messages - Multiple windows - Iframes - Web table and calendar - types and use of framework - Execution of programs - Checking reports - Implementing listeners - Run group test cases

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Paul C.Jorgensen, Byron Devries, "Software Testing: A craftsman's Approach", 5th Edition, CRC Press, 2021
2. Navneesh Garg, "Test Automation using Selenium WebDriver with Java: Step by Step Guide" 1st Edition, AdactIn Group, 2014

REFERENCES:

1. Ralf Bierig, Stephen brown, Edgar Galvan, Joe Timoney, "Essentials of Software Testing", 1st Edition, Cambridge University Press, 2022
2. Gerard O'Regan, "Concise Guide to Software testing", 1st Edition, Springer Nature, 2019
3. William E.Lewis, David D.Dobbs, Gunasekaran Veerapillai, "Software Testing and Continuous Quality Improvement",3rd Edition, CRC press, 2017

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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Vertical 7: Management and Marketing

U21CBP01	INTRODUCTION TO INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop and strengthen innovation, IP management and entrepreneurial quality
- To motivate in and to impart basic skills
- To understanding to run a business efficiently and effectively

COURSE OUTCOMES:

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

CO1: Outline the current and emerging trends in innovation. (Understand)

CO2: Exemplify the importance of IPR in patents, copyrights, and geographical indications (Understand)

CO3: Apply legal and regulatory requirements for the registration of IPRs (Apply)

CO4: Analyze various types of entrepreneurs and analyze their motivations (Apply)

CO5: Develop a comprehensive small business plan integrating feasibility and financial strategies (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO INNOVATION **9**

Adoption of Innovations, Exploring Innovations, Idea generation, Developing innovative culture, Executing innovations, Innovation attributes and their adoption rate, Measuring and evaluation of innovation, Exploiting and renewing innovations, Managing innovations in organizations, Innovation and intellectual property rights, Innovation portfolio

UNIT II INTRODUCTION TO IPR **9**

Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature

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of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR

UNIT III REGISTRATION OF IPRs 9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad, Agreements and Legislations

UNIT IV ENTREPRENEURSHIP 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur, Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management

UNIT V BUSINESS AND FINANCING 9

Small Enterprises – Characteristics, Ownership Structures – Steps involved in setting up a Business – Identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project 100 Appraisal –Sources of Finance, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. V. Scople Vinod, "Managing Intellectual Property : The Strategic Imperative", 5th Edition,Prentice Hall of India pvt Ltd, 2012
2. Donald F Kuratko, "Entreprenuership – Theory, Process and Practice", 9th Edition, Cengage Learning, 2014.

REFERENCES:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, 3rd Edition, 2012.
2. Oliver Gassmann, Martin A. Bader, Mark James Thompson, "Patent Management Protecting Intellectual Property and Innovation", 1st Edition, Springer, 2020.
3. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.

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EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CBP02	IT PROJECT MANAGEMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the concepts of managing IT projects
- To understand about planning, budgeting, resource allocation and scheduling
- To learn software quality management

COURSE OUTCOMES:

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

CO1: Describe the project management principles to manage business situations effectively (Understand)

CO2: Illustrate the planning, budgeting, and scheduling skills to create effective project plans (Understand)

CO3: Optimize resource utilization and time management to ensure project success (Apply)

CO4: Analyze and control resource allocation for successful project completion (Analyze)

CO5: Implement software quality management techniques to ensure high-quality project deliverables (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO PROJECT MANAGEMENT 9

Project Management – Definition – Goal - Lifecycles. Project Selection Methods. Project Portfolio Process – Project Formulation. Project Manager – Roles - Responsibilities and Selection – Project Teams, Project support activities, Types of project organizations

UNIT II PLANNING AND BUDGETING 9

The Planning Process – Work Break down Structure – Role of Multidisciplinary teams, Critical path analysis. Budget the Project – Methods. Cost Estimating and Improvement. Budget uncertainty and risk management

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UNIT III SCHEDULING & RESOURCE ALLOCATION 9

PERT & CPM Networks - Crashing – Project Uncertainty and Risk Management – Simulation – Gantt Charts – Expediting a project – Resource loading and leveling. Allocating scarce resources – Goldratt"s Critical Chain

UNIT IV CONTROL AND COMPLETION 9

The Plan-Monitor-Control cycle – Data Collecting and reporting – Project Control – Designing the control system. Project Evaluation, Earned Value Analysis, Auditing and Termination, Risk Management – Conflict – Origin & Consequences. Managing conflict – Team methods for resolving conflict

UNIT V SOFTWARE QUALITY MANAGEMENT 9

Product quality and software quality – Quality management systems, principles and features – System quality specification and measurement – Process and product quality approaches – Quality assurance and quality control, project audit and quality audit, Methods of enhancing quality: the different types of testing, inspections, reviews, standards – Management and control of testing

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Hughes B, "IT-related Projects" , 2nd Edition, BCS Publications, 2012
2. Greg Horine, "Project Management Absolute Beginner's Guide", 4th Edition, Pearson Education, 2017.
3. John M. Nicholas, "Business and Technology - Principles and Practice ", 2nd Edition, Pearson Education, 2006.

REFERENCES:

1. Gido and Clements, Successful Project Management, 2nd Edition, Thomson Learning, 2003.

2. Harvey Maylor, Project Management, 3rd Edition, Pearson Education, 2006.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CBP03	E – BUSINESS MANAGEMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the practices and technology to start an online business
- To learn e-business payment and security
- To understand legal and privacy issues

COURSE OUTCOMES:

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

CO1: Infer the need for e-business (Understand)

CO2: Identify the technology infrastructure required for e-business (Understand)

CO3: Apply the knowledge of consumer-oriented e-business models (Apply)

CO4: Employ the e-business payment and security protocols (Apply)

CO5: Apply the ethical, legal, privacy issues and encryption policies for e-business (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO e-BUSINESS 9

e-business, e-business vs e-commerce, Economic forces – advantages – myths – e-business models, design, develop and manage e-business, Web 2.0 and Social Networking, Mobile Commerce's-commerce

UNIT II TECHNOLOGY INFRASTRUCTURE 9

Internet and World Wide Web, internet protocols – FTP, intranet and extranet, information publishing technology – Basics of web server hardware and software

UNIT III BUSINESS APPLICATIONS 9

Consumer oriented e-business – e-tailing and models - Marketing on web – advertising, e-mail marketing, affiliated programs – e-CRM; online services, Business oriented e-business, e-governance, EDI on the internet, Delivery management system, Web Auctions, Virtual communities and Web portals – social media marketing

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UNIT IV E-BUSINESS PAYMENTS AND SECURITY 9

E-payments – Characteristics of payment of systems, protocols, e-cash, e-cheque and Micro payment systems- internet security – Cryptography – Security protocols – Network security

UNIT V LEGAL AND PRIVACY ISSUES 9

Legal, Ethics and privacy issues – Protection needs and methodology – consumer protection, cyber laws, contracts and warranties, Taxation and encryption policies

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Lee, I. "Electronic Commerce Management for Business Activities and Global Enterprises: Competitive Advantages", 2nd Edition ,Business Science Reference, 2012.
2. Lee, I., "Encyclopedia of E-Commerce Development, Implementation, and Management", IGI Global, 2016.
3. Martínez-López, F. J., Jelassi, T, "Strategies for E-Business: Concepts and Cases on Value Creation and Digital Business Transformation", 4th, Springer International Publishing, 2020.

REFERENCES:

1. Harvey M.Deitel, Paul J.Deitel, Kate Steinbuhler, "e-business and e-commerce for managers",1st edition, Pearson, 2011.
2. Efraim Turban, Jae K. Lee, David King, Ting Peng Liang, Deborrah Turban, "Electronic Commerce –A managerial perspective", 8th Edition, Pearson Education Asia, 2015.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CBP04	RECOMMENDER SYSTEMS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the foundations and significance of machine learning and data mining algorithms for Recommender systems
- To gain the design and implementation of a recommender system using collaborative filtering
- To acquire a comprehensive understanding of collaborative filtering techniques

COURSE OUTCOMES:

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

CO1: Elucidate different recommender systems and their effective construction using data mining methods (Understand)

CO2: Illustrate the content-based recommendation systems through user and item profile learning (Understand)

CO3: Evaluate user and item-based collaborative filtering techniques for building recommendation systems (Apply)

CO4: Apply strategies to detect and protect recommender systems from attacks (Apply)

CO5: Employ appropriate evaluation paradigms and metrics to assess the recommender systems (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION 9

Introduction and basic taxonomy of recommender systems – Traditional and non-personalized Recommender Systems – Overview of data mining methods for recommender systems - similarity measures – Dimensionality reduction – Singular Value Decomposition (SVD), Applications of recommendation systems, Issues with recommender system

UNIT II CONTENT-BASED RECOMMENDATION SYSTEMS 9

High-level architecture of content-based systems – Advantages and drawbacks of content based filtering, Item profiles – Representing item profiles – Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

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UNIT III COLLABORATIVE FILTERING 9

A systematic approach – Nearest-neighbour collaborative filtering (CF) – User-based and item-based CF – Components of neighbourhood methods (rating normalization, similarity weight computation, and neighbourhood selection

UNIT IV ATTACK-RESISTANT RECOMMENDER SYSTEMS 9

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms

UNIT V EVALUATING RECOMMENDER SYSTEMS 9

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Error metrics, Decision-Support metrics, User-Centred metrics, and Design Issues – Accuracy metrics – Limitations of Evaluation measures

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Charu C. Aggarwal, "Recommender Systems: The Textbook, Springer ",2nd Edition,Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , "Recommender Systems: An Introduction, Cambridge University Press" , 1st Edition, 2011.
3. Francesco Ricci ,LiorRokach , Bracha Shapira , "Recommender Sytems Handbook", 1st Edition, Springer 2011,
4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, "Mining of massive datasets", 3rd edition, Cambridge University Press, 2020.

REFERENCES:

1. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender "Systems Handbook, Springer" , 1st Edition, 2011.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer",1st Edition, 2013.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CBP05	INDUSTRIAL PSYCHOLOGY	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To introduce students to industrial psychology and its applications in organizational settings
- To understand key topics such as employment law, job analysis, recruitment, selection, training, performance appraisal, motivation, and workplace safety
- To emphasize an applied approach to prepare students for their roles as employees and managers

COURSE OUTCOMES:

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

CO1: Elucidate the I/O psychology research methods for job analysis, evaluation, compensation, and recruitment (Understand)

CO2: Illustrate the employee performance measurement and evaluation methods (Understand)

CO3: Analyze theories of employee motivation, satisfaction, commitment, diversity, and leadership for organizational development (Apply)

CO4: Apply the knowledge of organizational culture, cultural fit, cross-cultural issues, and work behavior (Apply)

CO5: Employ stress management strategies to mitigate stress-inducing factors (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION 9

I/O Psychology-definition. Research Methods, Statistics, and Evidence-based Practice – Introduction & Legal Context of Industrial Psychology – Job Analysis & Competency Modelling – Job Evaluation &Compensation – Job Design & Employee Well-Being – Recruitment

UNIT II EMPLOYEES PERFORMANCE AND EVALUATION 9

Identifying Criteria & Validating Tests and Measures, Screening Methods, Intensive Methods, Performance Goals and Feedback, Performance Coaching and Evaluation, Evaluating Employee Performance

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UNIT III LEADERSHIP AND ORGANISATIONAL DEVELOPMENT 9

Employee Motivation – Satisfaction and Commitment – Fairness and Diversity, Leadership, Leadership vs Management – Leadership Theories – Organizational Climate, Culture, and Development – Emerging issues in Leadership

UNIT IV ORGANIZATIONAL CULTURE 9

Organizational Climate and Culture – Functions of organizational culture – Organizational Socialization, Assessing Cultural Values and Fit – Cross Cultural issues Teams in Organizations – The Organization of Work Behaviour

UNIT V STRESS MANAGEMENT 9

Source of Stress – Consequences of stress – Managing Stress, Stress Reduction Interventions Related to Life/Work Issues – Measuring Stress – Demands of Life and Work

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Jeffrey M. Conte, Frank J. Landy."Work in the 21st Century: An Introduction to Industrial and Organizational Psychology",6th Edition,Wiley, 2019.
2. Aamodt, M. G. "Industrial/Organizational Psychology: An Applied Approach" , 1st Edition, Cengage Learning, 2022

REFERENCES:

1. Ashwathappa, K. "Human Resource Management: Text & Cases, McGraw Hill Education ", 8th Edition, 2017.
2. Donald M. Truxillo, Talya N. Bauer, Berrin Erdogan," Psychology and Work An Introduction to Industrial and Organizational Psychology",2nd Edition, Taylor & Francis, 2021.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CBP06	MARKETING RESEARCH AND MARKETING MANAGEMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the changing business environment and the fundamental premise underlying market driven strategies
- To analyse the nature of consumer buying behaviour
- To understanding the marketing research and new trends in the arena of marketing

COURSE OUTCOMES:

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

CO1: Explain contemporary marketing theories to practical business and management situations (Understand)

CO2: Illustrate the marketing strategies for consumer and industrial markets (Understand)

CO3: Select and manage appropriate marketing mix elements and integrated marketing channels for a given product or service. (Apply)

CO4: Evaluate the factors influencing consumer buying behavior (Apply)

CO5: Analyze emerging marketing trends and recommend strategies for adaptation. (Analyze)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO MARKETING RESEARCH AND MARKETING MANAGEMENT 9

Defining Marketing – Core concepts in Marketing – Evolution of Marketing – Marketing Planning Process – Scanning Business environment: Internal and External – Value chain – Core Competencies – PESTEL – SWOT Analysis – Marketing interface with other functional areas – Production – Finance Human Relations Management – Information System – Marketing in global environment – International Marketing – Rural Marketing – Prospects and Challenges.

UNIT II MARKETING STRATEGY 9

Marketing strategy formulations – Key Drivers of Marketing Strategies – Strategies for Industrial Marketing – Consumer Marketing – Services marketing – Competition Analysis – Analysis of

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consumer and industrial markets – Influence of Economic and Behavioral Factors – Strategic Marketing Mix components.

UNIT III MARKETING MIX DECISIONS 9

Product planning and development – Product life cycle – New product Development and Management – Defining Market Segmentation – Targeting and Positioning – Brand Positioning and Differentiation – Channel Management – Managing Integrated Marketing Channels – Managing Retailing, Wholesaling and Logistics – Advertising and Sales Promotions – Pricing Objectives, Policies and Methods

UNIT IV BUYER BEHAVIOUR 9

Understanding Industrial and Consumer Buyer Behaviour – Influencing factors – Buyer Behaviour Models – Online buyer behaviour – Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection – Creating Long Term Loyalty Relationships.

UNIT V MARKETING RESEARCH & TRENDS IN MARKETING 9

Marketing Information System – Marketing Research Process – Concepts and applications: Product – Advertising – Promotion – Consumer Behaviour – Retail research – Customer driven organizations - Cause related marketing – Ethics in marketing – Online marketing trends - social media and digital marketing.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Philip T. Kotler and Kevin Lane Keller, Marketing Management, 15th Edition, Prentice Hall India, 2017.
2. KS Chandrasekar, "Marketing management-Text and Cases", 1st Edition ,Tata McGraw Hill Education, 2012

REFERENCES:

1. Paul Baines, Chris Fill, Kelly Page, Marketing, Asian edition,5th Edition , Oxford University Press, 2019.
2. Philip Kotler , Gay Armstrong, Prafulla Agnihotri, "Principles of marketing",7th Edition , 2018.

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EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CBP07	HUMAN RESOURCE MANAGEMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the fundamental concepts and theories of HRM
- To practice the ethical values in achieving stakeholders welfare
- To involve stakeholders and team members in executing decisions

COURSE OUTCOMES:

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

CO1: Explain the concepts of human resource management (Understand)

CO2: Illustrate the recruitment and selection strategies for an organization (Understand)

CO3: Utilize training programs to enhance employee performance and appraisal (Apply)

CO4: Manage wage and salary programs aligned with the industry standards (Apply)

CO5: Apply legal and ethical principles to manage employee relations and promote workplace safety. (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO HRM **9**

Meaning and Definition – Characteristics of HRM – Evolution of HRM – Organization and Policies of Personnel Department – Scope of HRM – Functions of HRM– Objectives of HRM– Qualities of HR Manager– Important Trends in HR Management

UNIT II HR PLANNING, RECRUITMENT AND SELECTION **9**

Importance of HR Planning – Job Analysis-Job description and job specification – Recruitment Sources of Recruitment – Selection- Importance of careful selection – Process of selection – Types of Tests for selection – Interview- Methods of Selection Interview – Induction Process

UNIT III TRAINING AND DEVELOPMENT & PERFORMANCE APPRAISAL **9**

Training and Development: Objectives of training – Identification of Training needs – Concepts of Training – Training methods – Orientation and Placement – Management development – Purposes

and Principles of promotion – Bases and types for promotion – Transfer – Separation Performance Appraisal: Introduction – Identification of issues in performance appraisal – Uses of Performance Appraisal – limitations of Performance Appraisal – Performance Management – Career Management Basics – Talent Management – Methods of appraisal

UNIT IV WAGE AND SALARY ADMINISTRATION 9

Meaning and Definition – Job Evaluation – Basic Factors in Determining Pay Rates – Establishing Pay Rates – Competency-Based Pay – Money and Motivation: An Introduction – Insurance Benefits – Retirement Benefits – Personal Services and Family-Friendly Benefits – Flexible Benefits Programs

UNIT V INDUSTRIAL RELATION, HEALTH AND SAFETY 9

Industrial Relation– Health and safety measures Industrial Relations – Meaning & Characteristics, Industrial Relations – Parties to Industrial relations – Nature of Trade Unions – Problems of Trade–Union – Measures to Strengthen Trade Union Movement in India – Causes for Industrial Disputes-Settlement of Industrial Disputes – Occupational Security and Safety : Accidents – Workplace Health Hazards: Problems and Remedies

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. Gary Dessler, BijuVarkkey,"Human Resource Management", 15th Edition, Pearson Education, 2018.
2. Denisi, Griffin, Sarkar, "Human Resource Management", 2nd Edition Cengage Learning ,2016.
3. George W.Bchlander, Scott A.Snell," Principles of Human Resource Management", 16th Edition, Cengage Learning, 2014.

REFERENCES:

1. Denisi, Griffin, Sarkar, "Human Resource Management", 2nd Edition Cengage Learning ,2016.
2. Aswathappa K, " Human Resource Management: Text and Cases ", 17th Edition, Tata McGraw-Hill, 2013.
3. Armstrong Michael," A Handbook of Human Resource Management", 13th Edition, Kogan Page, 2014.
4. Peter J. Dowling, Marion Festing, Allen D Engle, Sr, "International Human Resource Management", 6th Edition, Cengage Learning, 2013.

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EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21CBP08	FINANCIAL MANAGEMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- Understand the operational nuances of a Finance Manager
- Comprehend the technique of making decisions related to finance functions

COURSE OUTCOMES:

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

CO1: Elucidate the concepts of financial decision of an organisation (Understand)

CO2: Illustrate the capital budgeting principles and techniques (Understand)

CO3: Apply EBIT-EPS analysis, capital structure theories, and dividend decisions to understand the impact on business (Apply)

CO4: Apply the principles of working capital management (Apply)

CO5: Assess the short-term and long-term sources of finance (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO FINANCE **9**

Introduction to finance – Financial Management – Nature, scope and functions of Finance, organization of financial functions, objectives of Financial management, Major financial decisions – Time value of money – features and valuation of shares and bonds – Concept of risk and return – single asset and of a portfolio

UNIT II INVESTMENT DECISIONS **9**

Capital Budgeting: Principles and techniques – Nature of capital budgeting- Identifying relevant cash flows – Evaluation Techniques: Payback, Accounting rate of return, Net Present Value, Internal Rate of Return, Profitability Index – Comparison of DCF techniques – Concept and measurement of cost of capital – Specific cost and overall cost of capital

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UNIT III FINANCING AND DIVIDEND DECISION 9

Leverages – Operating and Financial leverage – Measurement of leverages – Degree of Operating &Financial leverage – Combined leverage, EBIT – EPS Analysis- Indifference point. Capital structure – Theories – Net Income Approach, Net Operating Income Approach, MM Approach – Determinants of Capital structure. Dividend decision- Issues in dividend decisions, Importance, Relevance & Irrelevance theoriesWalter"s – Model, Gordon"s model and MM model. – Factors determining dividend policy – Types of dividend policies – Forms of dividend

UNIT IV WORKING CAPITAL MANAGEMENT 9

Principles of working capital: Concepts, Needs, Determinants, issues and estimation of working capital- Receivables Management – Inventory management – Cash management – Working capital finance: Commercial paper, Company deposit, Trade credit, Bank finance

UNIT V LONG TERM SOURCES OF FINANCE 9

Indian capital market – New issues market – Secondary market – Long term finance: Shares, debentures and term loans, lease, hire purchase, venture capital financing, Private Equity

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXT BOOKS:

1. 1. I M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd., 11th edition, 2018
2. James C. Van Horne, Sanjay Dhamija, Financial Management and Policy, 12th Edition, Pearson Education, 2012.
3. Eugene F Brigham, Michael C. Ehrhardt, Financial Management Theory and Practice, 14th Edition, Cengage Learning, 2014.

REFERENCES:

1. 1. M.Y. Khan and P.K.Jain Financial management, Text, Problems and cases Tata McGraw Hill, 8th edition, 2017.
2. James C. Vanhorne –Fundamentals of Financial Management– PHI Learning,13th Edition, 2014.
3. Prasanna Chandra, "Financial Management", 9th Edition, Tata McGraw Hill, 2017.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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U21ADP09	COMPREHENSION I	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21MA101 : Calculus and Differential Equations
- U21MA204 : Applied Linear Algebra
- U21MA205 : Statistical Analysis
- U21MA301 : Probability Theory and Distributions

COURSE OBJECTIVES:

- To understand the concepts of probability and statistics in the field of engineering and technology
- To understand the concepts of various distributions
- To understand the concepts of decomposition of matrices

COURSE OUTCOMES:

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

CO1: Implement the functions of a single variable and optimization (Apply)

CO2: Apply probability axioms of discrete and continuous random variables, distributions to core engineering problems (Apply)

CO3: Formulate and test a hypothesis, using critical values to draw conclusions and determining probability of making errors in hypothesis tests (Apply)

CO4: Implement correlation and linear regression with respect to two dimensional random variables (Apply)

CO5: Implement the various matrix techniques in solving the system of linear equations (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I CALCULUS 9

Functions of a single variable, limit, continuity and differentiability, Taylor series, maxima and minima, optimization involving a single variable.

UNIT II PROBABILITY, RANDOM VARIABLES AND DISTRIBUTIONS 9

Axioms of probability – Conditional probability – Total probability – Bayes' theorem – Random variable – Distribution function – Properties – Probability mass function – Probability density function,

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Discrete – Bernoulli distribution, binomial distribution, Poisson distribution; Continuous – exponential distribution, normal distribution, standard normal distribution, t-distribution, chi-squared distributions

UNIT III DESCRIPTIVE STATISTICS AND SAMPLING AND TESTING OF HYPOTHESIS 9

Measures of central tenancy – Measures of variability, Sample mean and variance – Sampling distributions – Statistical estimation of parameters, confidence intervals – z-test, t-test, chi-squared test

UNIT IV TWO DIMENSIONAL RANDOM VARIABLES 9

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Central limit theorem (without proof)

UNIT V MATRICES AND VECTOR SPACES 9

Vector space, subspaces, linear dependence and independence of vectors, matrices, projection matrix, orthogonal matrix, idempotent matrix, partition matrix and their properties, quadratic forms, systems of linear equations and solutions – Gaussian elimination, eigenvalues and eigenvectors, determinant, rank, nullity, projections, LU decomposition, singular value decomposition.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXT BOOKS:

1. Ronald E. Walpole, Raymond H. Meyers and Sharon L. Meyers, "Probability and Statistics for Engineers and Scientists", 9th edition, Pearson Education, 2013.
2. Jay L. Devore, "Probability and Statistics for Engineering and Sciences", 9th edition, Cengage India Pvt. Ltd., 2020.
3. Howard Anton and Chris Rorres, "Elementary Linear Algebra – Applications version", 9th edition, John Wiley & Sons, 2005.

REFERENCES:

1. Allen A. O, "Probability, Statistics and Queueing Theory with computer applications", 2nd edition, Elsevier, 2005.
2. Johnson R A, Miller I and Freund J, "Miller and Freund's Probability and Statistics for Engineers", 8th edition, Pearson Education, Asia, 2015.
3. Steven J. Leon, "Linear Algebra with Applications", 9th edition, Pearson College Division, 2014.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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U21ADP10	COMPREHENSION II	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CSG02 : Python Programming
- U21AD304 : Data Structures Design
- U21AD305 : Fundamentals of Artificial Intelligence
- U21AD401 : Machine Learning – Essentials
- U21AD402 : Database Design and Management

COURSE OBJECTIVES:

- To learn the implementation techniques of data structures and algorithms using python.
- To understand the use of data base management systems and data warehousing.
- To learn the core concepts of Artificial Intelligence and Machine learning.

COURSE OUTCOMES:

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

CO1: Implement major concepts in data structures and algorithms using python (Apply)

CO2: Design relational database using conceptual-to-relational mapping and Normalization (Apply)

CO3: Formulate supervised learning with the help of regression and classification problems and suitable algorithms. (Apply)

CO4: Formulate unsupervised learning with the help of clustering problems and suitable algorithms. (Apply)

CO5: Implement appropriate methods to solve AI problems (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I PROGRAMMING, DATA STRUCTURES AND ALGORITHMS 9

Programming in Python – Basic data structures: stacks, queues, linked lists, trees, hash tables – Search algorithms: linear search and binary search – Basic sorting algorithms: selection sort, bubble sort and insertion sort – Divide and conquer: mergesort, quicksort – Introduction to graph theory – Basic graph algorithms: traversals and shortest path

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UNIT II DATABASE MANAGEMENT AND WAREHOUSING 9

ER-model – Relational model: relational algebra, tuple calculus, SQL, integrity constraints, normal form, file organization, indexing, data types, data transformation such as normalization, discretization, sampling, compression – Data warehouse modelling: schema for multidimensional data models, concept hierarchies – Measures: categorization and computations

UNIT III SUPERVISED LEARNING 9

Regression and classification problems: Simple linear regression, multiple linear regression, ridge regression, logistic regression, k-nearest neighbour, naïve Bayes classifier, linear discriminant analysis, support vector machine, decision trees, bias-variance trade-off, cross-validation methods such as leave-one-out (LOO) cross-validation, k-folds cross-validation, multi-layer perceptron, feed-forward neural network

UNIT IV UNSUPERVISED LEARNING 9

Clustering algorithms, k-means/k-medoid, hierarchical clustering, top-down, bottom-up: single-linkage, multiple-linkage, dimensionality reduction, principal component analysis

UNIT V ARTIFICIAL INTELLIGENCE 9

Search: informed, uninformed, adversarial – Logic, propositional, predicate; reasoning under uncertainty topics – Conditional independence representation, exact inference through variable elimination, and approximate inference through sampling

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

REFERENCES:

1. Mark Lutz, "Learning Python", 5th Edition, O'Reilly Media, 2013
2. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill Education, 2014
3. Parteek Bhatia, "Data Mining and Data Warehousing: Principles and Practical Techniques", Cambridge University Press, 2019
4. Chris Sebastian, "Machine Learning for Absolute Beginners Guide, Learn Machine Learning and Artificial Intelligence from Scratch", Kindle Edition, 2018
5. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", 4th edition, Pearson Education, 2022

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
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				100	

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