

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 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 become a potential innovation cluster in Information Technology for offering quality education, research and professional skills to meet the global requirements.

Mission

- Empower students with innovative teaching learning processes that meets the dynamic requirements of the industries.
- Encourage collaborative research and industry-institute interactions to cater the global Needs
- Create ethically strong and socially responsible professionals with high competency

III. Programme Educational Objectives (PEOs)

The graduates of Information Technology (IT) will

- PEO1: Excel in their professional roles and higher studies by implementing the knowledge acquired IT with lifelong learning
- PEO2: Design and implement IT based solutions and services to solve the industrial and societal problems
- PEO3: Exhibit communication skills, leadership virtues, professional and ethical values in professional domains

IV. Program Outcomes (POs)

Graduates of Information Technology department will be able to

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

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

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

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

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations

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

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

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

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

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

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

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

V. Programme Specific Outcomes (PSOs)

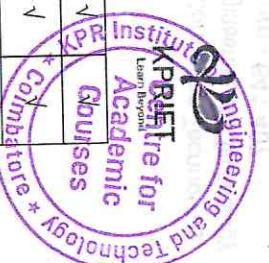
- PSO1: Identify and apply appropriate IT integrated tools and techniques to build projects and services in networking, computing and data security
- PSO2: Design and develop IT enabled solutions and services for catering the broader societal needs

**VI. PEO – PO Mapping**

POs PEOs \	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	2			2	2	1	1	2		3	3
PEO2	3	3	3	2	2	3	2		2		2	2
PEO3						1	1	2	3	3	1	3

A blue ink signature of "Dr. S. Venkatesan" in cursive script.

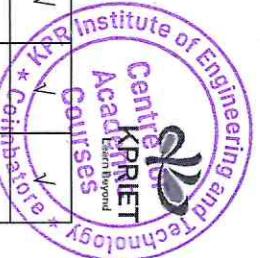
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Coimbatore - 641 407

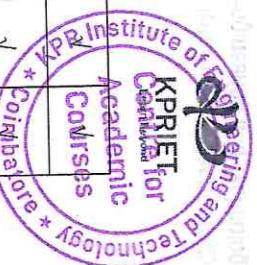


U21CSP09	UI/UX Design	✓	✓	✓	-	-	-	-	✓	-	✓	-	✓
U21CSP10	Python Web Development	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	✓
U21CSP11	App Development	✓	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓
U21CSP12	Java Script Frameworks	✓	✓	✓	✓	✓	-	-	-	✓	✓	✓	✓
U21CSP13	Webservices and API Design	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
U21CSP14	SOA and Microservices	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
U21CSP15	Cloud Native Applications Development	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
U21CSP16	DevOps	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
U21TP09	Next Generation Networks	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
U21TP10	Game Development	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
U21TP11	Blockchain Technologies	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
U21TP12	Augmented Reality	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
U21TP13	Quantum Computing	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
U21TP14	Graphics Processing Unit	✓	✓	✓	✓	✓	-	-	-	-	✓	✓	✓
U21TP15	Agile Methodologies	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	✓	✓
U21TP16	Software Testing Tools and Techniques	✓	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓

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Vertical III CLOUD COMPUTING AND DATA STORAGE TECHNOLOGIES	U21CSP01	Foundations of Cloud Computing	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓
	U21CSP02	Data Storage and Management in Cloud	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓
U21CSP03	Virtualization Techniques	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓
U21CSP04	Security and Privacy in Cloud	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓
U21CSP05	Data Analysis in Cloud Computing	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓
U21CSP06	Edge Computing	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓
U21CSP07	Cloud Service Management	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓
U21CSP08	Big Data Integration and Processing	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓
U21ITP01	Parallel and Distributed Computing	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓
U21ITP02	Mobile Computing	✓	✓	-	-	-	-	-	-	-	-	-	✓	✓
U21ITP03	Wireless Sensor Networks	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓
U21ITP04	Software Defined Networks	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓
U21ITP05	Cyber Security	✓	✓	-	✓	✓	✓	-	✓	-	-	-	✓	✓
U21ITP06	Internet Security	✓	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓
U21ITP07	Ethical Hacking	✓	✓	✓	✓	✓	✓	-	✓	-	-	-	✓	✓
U21ITP08	Digital Forensics	✓	✓	✓	✓	✓	✓	-	✓	-	-	-	✓	✓

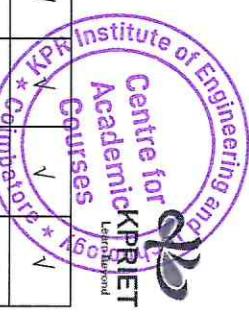




VIII	U21IT801	Project Work Phase – II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Vertical I COMPUTATIONAL ANALYTICS	U21ADP01	Mathematical Foundation for Data Science	✓	✓	✓	✓	✓	-	-	✓	-	-	✓	✓
	U21ADP02	Pattern Recognition	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓
	U21ADP03	Speech Processing and Analytics	✓	✓	✓	-	-	✓	-	-	-	-	✓	✓
	U21ADP04	Web Mining	✓	✓	✓	✓	✓	✓	✓	-	-	-	✓	✓
	U21ADP05	Exploratory Data Analysis and Visualization	✓	✓	✓	✓	✓	✓	✓	-	-	-	✓	✓
	U21ADP06	Predictive Analytics	✓	✓	✓	-	-	-	-	-	-	-	✓	✓
	U21ADP07	Time Series Analysis and Forecasting	✓	✓	✓	✓	-	-	-	-	-	-	✓	✓
	U21ADP08	Healthcare Analytics	✓	✓	✓	-	✓	-	-	-	-	-	✓	✓
Vertical II ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	U21AMP01	Knowledge Engineering	✓	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓
	U21AMP02	Soft Computing	✓	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓
	U21AMP03	Deep Neural Networks	✓	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓
	U21AMP04	Reinforcement Learning	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓	✓
	U21AMP05	Computer Vision	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓	✓
	U21AMP06	Feature Engineering	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓	✓
	U21AMP07	Object Detection & Face Recognition	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓	✓
	U21AMP08	Text and Visual Analytics	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓	✓

B.Tech. – IT – R2021 – CBCS

	U21ITG01	Software Engineering	✓	✓	✓	✓	✓	✓	-	-	✓	-	✓	✓	✓	✓	* ✓	* ✓	* ✓	
	U21ITG02	Information Security	✓	✓	✓	✓	✓	✓	✓	-	-	✓	-	-	✓	✓	✓	✓	✓	
V	U21CB502	Formal Languages and Automata Theory	✓	✓	✓	✓	✓	✓	-	-	-	-	✓	-	✓	✓	✓	-	-	
	U21CSG05	Computer Networks	✓	✓	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	-	✓	-	-	
	U21SSG02	Soft Skills – II	-	-	-	-	-	-	-	-	-	✓	✓	-	-	-	-	-	-	
	U21ITG03	Information Security Laboratory	✓	✓	✓	✓	✓	✓	-	-	✓	✓	-	-	✓	-	-	✓	-	
	U21IT501	Proto Studio – I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-	
	U21IT601	Machine Learning Techniques	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	U21ECG06	Embedded Systems and IoT	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	U21SSG03	Soft Skills – III	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
VII	U21IT602	Machine Learning Techniques	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	-	✓	-	✓	✓	✓	
	U21ECG07	Embedded Systems and IoT Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	U21IT603	Proto Studio – II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	-	-	
	U21IT701	Software Project Management	✓	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	✓	✓	✓	
	U21IT702	Cloud Computing	✓	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓	✓	✓	
	U21IT703	Design Patterns	✓	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	-	✓	✓	✓	
VII	U21IT704	Cloud Computing Laboratory	✓	✓	✓	✓	✓	✓	-	-	✓	-	-	✓	-	✓	✓	✓	✓	
	U21IT705	Project Work Phase – I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	



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	U21AD301	Ethics and Holistic Life	-	-	-	-	-	✓	✓	✓	✓	✓	-	✓	-	-
	U21MAG02	Discrete Mathematics	✓	✓	-	-	-	-	-	-	-	-	✓	✓	✓	✓
	U21IT301	Computer Graphics and Visualization	✓	✓	✓	-	-	✓	-	-	-	-	✓	✓	-	-
III	U21CS301	Computer Organization and Architecture	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	✓	-
	U21AD303	Programming using Java	✓	✓	✓	-	-	-	-	-	-	-	✓	-	✓	✓
	U21CSG03	Data Structures	✓	✓	✓	✓	✓	-	✓	-	✓	✓	-	✓	✓	✓
	U21AD307	Java Laboratory	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	-	✓
	U21IT302	Design Studio – I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	U21MA403	Probability and Queuing Theory	✓	✓	-	-	-	-	-	-	-	-	-	✓	✓	-
	U21CS401	Design and Analysis of Algorithms	✓	✓	✓	✓	-	✓	✓	✓	-	-	-	✓	✓	✓
	U21AD402	Database Design and Management	✓	✓	✓	✓	✓	-	✓	✓	-	-	-	✓	✓	✓
	U21CS403	Operating Systems	✓	✓	✓	✓	-	-	-	-	-	-	-	✓	✓	✓
IV	U21IT401	Internet Programming	✓	✓	✓	✓	✓	✓	-	-	-	-	-	✓	✓	✓
	U21SSG01	Soft Skills – I	-	-	-	-	-	-	-	-	-	-	✓	-	✓	-
	U21CS404	Operating Systems Laboratory	✓	✓	✓	✓	✓	✓	-	-	✓	✓	✓	-	✓	-
	U21AD406	Database Laboratory	✓	✓	✓	✓	✓	-	-	✓	✓	✓	✓	✓	✓	✓
	U21IT402	Design Studio – II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓



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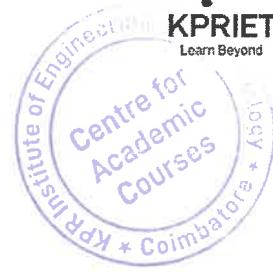
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VII. Mapping of Course Outcomes with Program Outcomes

SEM	SUBJECT CODE	SUBJECT NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
	U21GEG01	Heritage of Tamils	-	-	-	-	-	-	✓	✓	-	✓	-	✓	-	-
	U21MA101	Calculus and Differential Equations	✓	✓	-	-	-	-	-	-	-	-	-	✓	-	✓
I	U21EEG01	Basics of Electrical and Electronics Engineering	✓	✓	✓	-	-	-	-	-	-	-	-	✓	✓	-
	U21EN101	English for Technologists	-	-	-	-	-	-	-	✓	✓	✓	-	✓	-	-
	U21PH101	Engineering Physics	✓	✓	✓	-	-	-	-	-	-	-	-	-	-	-
	U21CY101	Engineering Chemistry	✓	✓	-	-	-	-	-	✓	-	-	-	✓	-	-
	U21CSG01	Problem Solving and C Programming	✓	✓	✓	✓	-	✓	-	✓	✓	✓	-	✓	-	-
	U21MEG01	Engineering Graphics	✓	✓	✓	-	✓	-	✓	-	✓	-	-	✓	-	-
	U21GEG02	Tamils and Technology	-	-	-	-	-	-	✓	✓	-	✓	-	✓	-	-
	U21MA208	Linear Algebra	✓	✓	✓	✓	-	✓	-	-	-	-	✓	✓	-	✓
	U21PH201	Materials Science	✓	✓	-	-	-	✓	-	-	-	-	-	✓	-	✓
II	U21IT201	Principles of Data Communication	✓	✓	✓	✓	-	-	-	-	-	-	-	-	✓	-
	U21EN201	Personality Enhancement	-	-	-	-	-	-	✓	✓	✓	-	✓	-	-	-
	U21CSG02	Python Programming	✓	✓	✓	✓	✓	✓	-	✓	✓	✓	-	✓	✓	✓
	U21ECG01	Digital Electronics	✓	✓	✓	✓	-	-	-	✓	✓	✓	-	✓	✓	-
	U21ECG03	Engineering Studio	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	✓



B.Tech. INFORMATION TECHNOLOGY
REGULATIONS - 2021 (Revised)
For the students admitted 2022 onwards
CHOICE-BASED CREDIT SYSTEM
CURRICULUM FOR I - VIII Semesters
SEMESTER I



SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
THEORY COURSES								
1.	U21GEG01	Heritage of Tamils	HSMC	1	0	0	0	1
2.	U21MA101	Calculus and Differential Equations	BSC	3	1	0	0	4
3.	U21EEG01	Basics of Electrical and Electronics Engineering	ESC	3	0	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
4.	U21EN101	English for Technologists	HSMC	1	0	2	0	2
5.	U21PH101	Engineering Physics	BSC	2	0	2	0	3
6.	U21CY101	Engineering Chemistry	BSC	2	0	2	0	3
7.	U21CSG01	Problem Solving and C Programming	ESC	2	0	2	0	3
LABORATORY COURSE								
8.	U21MEG01	Engineering Graphics	ESC	0	0	4	0	2
MANDATORY NON CREDIT COURSE								
9.	U21MYC01	Induction Program	MNC	Three Weeks				
		TOTAL	14	1	12	0	21	

SEMESTER II

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
THEORY COURSES								
1.	U21GEG02	Tamils and Technology	HSMC	1	0	0	0	1
2.	U21MA208	Linear Algebra	BSC	3	1	0	0	4
3.	U21PH201	Materials Science	BSC	2	0	0	0	2
4.	U21IT201	Principles of Data Communication	PCC	3	0	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
5.	U21EN201	Personality Enhancement	HSMC	1	0	2	0	2
6.	U21CSG02	Python Programming	ESC	2	0	2	0	3
7.	U21ECG01	Digital Electronics	ESC	2	0	2	0	3
LABORATORY COURSE								
8.	U21ECG03	Engineering Studio	ESC	0	0	4	0	2
MANDATORY NON CREDIT COURSE								
9.	U21MYC02	Environmental Science	MNC	1	0	0	0	0
		TOTAL	15	1	10	0	20	

SEMESTER III

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
THEORY COURSES								
1.	U21AD301	Ethics and Holistic Life	HSMC	3	0	0	0	3
2.	U21MAG02	Discrete Mathematics	BSC	3	1	0	0	4
3.	U21IT301	Computer Graphics and Visualization	PCC	3	1	0	0	4
4.	U21CS301	Computer Organization and Architecture	PCC	3	0	0	0	3
5.	U21AD303	Programming using Java	PCC	3	0	0	0	3
THEORY COURSE WITH LABORATORY COMPONENT / PROJECT COMPONENT								
6.	U21CSG03	Data Structures	PCC	2	0	2	0	3
LABORATORY COURSE / LABORATORY COURSE WITH PROJECT COMPONENT								
7.	U21AD307	Java Laboratory	PCC	0	0	2	0	1
8.	U21IT302	Design Studio - I	EEC	0	0	0	2	1
MANDATORY NON CREDIT COURSE								
9.	U21MYC03	Essence of Indian Traditional Knowledge	MNC	1	0	0	0	0
		TOTAL	18	2	4	2	22	

SEMESTER IV

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
THEORY COURSES								
1.	U21MA403	Probability and Queuing Theory	BSC	3	0	0	0	3
2.	U21CS401	Design and Analysis of Algorithms	PCC	3	0	0	0	3
3.	U21AD402	Database Design and Management	PCC	3	0	0	0	3
4.	U21CS403	Operating Systems	PCC	3	0	0	0	3
5.		Open Elective - I	OEC	3	0	0	0	3
THEORY COURSE WITH LABORATORY COMPONENT								
6.	U21IT401	Internet Programming	PCC	2	0	2	0	3
LABORATORY COURSES / LABORATORY COURSE WITH PROJECT COMPONENT								
7.	U21SSG01	Soft Skills - I	HSMC	0	0	2	0	1
8.	U21CS404	Operating Systems Laboratory	PCC	0	0	2	0	1
9.	U21AD406	Database Laboratory	PCC	0	0	2	2	2
10.	U21IT402	Design Studio - II	EEC	0	0	0	2	1
MANDATORY NON CREDIT COURSE								
11.	U21MYC04	Indian Constitution	MNC	1	0	0	0	0
		TOTAL	18	0	8	4	23	

SEMESTER V

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
THEORY COURSES								
1.	U21ITG01	Software Engineering	PCC	3	0	0	0	3
2.	U21ITG02	Information Security	PCC	3	0	0	0	3
3.	U21CB502	Formal Languages and Automata Theory	PCC	3	0	0	0	3
4.		Professional Elective - I	PEC	3	0	0	0	3
5.		Professional Elective - II	PEC	3	0	0	0	3
6.		Open Elective - II	OEC	3	0	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
7.	U21CSG05	Computer Networks	PCC	2	0	2	0	3
LABORATORY COURSES								
8.	U21SSG02	Soft Skills - II	HSMC	0	0	2	0	1
9.	U21ITG03	Information Security Laboratory	PCC	0	0	4	0	2
10.	U21IT501	Proto Studio - I	EEC	0	0	0	2	1
MANDATORY NON CREDIT COURSE								
11.	U21MYC05	Cyber Security Essentials	MNC	1	0	0	0	0
TOTAL								
21 0 8 2 25								

SEMESTER VI

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
THEORY COURSES								
1.	U21IT601	Machine Learning Techniques	PCC	3	0	0	0	3
2.	U21ECG05	Embedded Systems and IoT	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
LABORATORY COURSES / LABORATORY COURSE WITH PROJECT COMPONENT								
6.	U21SSG03	Soft Skills - III	HSMC	0	0	2	0	1
7.	U21IT602	Machine Learning Techniques Laboratory	PCC	0	0	4	0	2
8.	U21ECG06	Embedded Systems and IoT Laboratory	PCC	0	0	2	2	2
9.	U21IT603	Proto Studio - II	EEC	0	0	0	2	1
MANDATORY NON CREDIT COURSE								
10.	U21MYC06	Introduction to UNSDGs: An Integrative Approach	MNC	1	0	0	0	0
TOTAL								
16 0 8 4 21								



SEMESTER VII

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
THEORY COURSES								
1.	U21IT701	Software Project Management	PCC	3	0	0	0	3
2.	U21IT702	Cloud Computing	PCC	3	0	0	0	3
3.	U21IT703	Design Patterns	PCC	3	1	0	0	4
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 COURSE / LABORATORY COURSE WITH PROJECT COMPONENT								
7.	U21IT704	Cloud Computing Laboratory	PCC	0	0	4	0	2
8.	U21IT705	Project Work Phase - I	EEC	0	0	0	4	2
TOTAL				18	1	4	4	23

SEMESTER VIII

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C	
1.	U21IT801	Project Work Phase - II	EEC	0	0	0	16	8	
TOTAL					0	0	0	16	8

INDUSTRIAL TRAINING / INTERNSHIP

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C	
1.	U21ITI01	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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PROFESSIONAL ELECTIVES COURSES: VERTICALS

Vertical I – COMPUTATIONAL ANALYTICS

Sl. 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	Healthcare Analytics	PEC	3	0	0	0	3

Vertical II - ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Sl. 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 and Face Recognition	PEC	3	0	0	0	3
8.	U21AMP08	Text and Visual Analytics	PEC	3	0	0	0	3

Vertical III - CLOUD COMPUTING AND DATA STORAGE TECHNOLOGIES

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

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Vertical IV - NETWORKING AND CYBER SECURITY

Sl. 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 V - FULL STACK DEVELOPMENT

Sl. 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	Java Script 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 VI - IT AND IT ENABLED SERVICES (ITES)

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



NCC CREDIT COURSES

SI.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
TOTAL				8	-	12	-	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 ELECTIVES COURSES (PEC)

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)
U21ADP01 - Mathematical Foundation for Data Science	U21AMP01 - Knowledge Engineering	U21CSP01-Foundations of Cloud Computing	U21ITP01- Parallel and Distributed Computing	U21CSP09-JUI / UX Design	U21ITP09-Next Generation Networks
U21ADP02 - Pattern Recognition	U21AMP02 - Soft Computing	U21CSP02-Data Storage and Management in Cloud	U21ITP02- Mobile Computing	U21CSP10-Python Web Development	U21ITP10-Game Development
U21ADP03 - Speech Processing and Analytics	U21AMP03 - Deep Neural Networks	U21CSP03-Virtualization Techniques	U21ITP03 - Wireless Sensor Networks	U21CSP11-App Development	U21ITP11-Blockchain Technologies
U21ADP04 - Web Mining	U21AMP04 - Reinforcement Learning	U21CSP04-Security and Privacy in Cloud	U21ITP04 - Software Defined Networks	U21CSP12-JavaScript Frameworks	U21ITP12-Augmented Reality /Virtual Reality
U21ADP05 - Exploratory Data Analysis and Visualization	U21AMP05 - Computer Vision	U21CSP05-Data Analysis in Cloud Computing	U21ITP05 - Cyber Security	U21CSP13-Webservices and API Design	U21ITP13-Quantum Computing
U21ADP06 - Predictive Analytics	U21AMP06 - Feature Engineering	U21CSP06-Edge Computing	U21ITP06 - Internet Security	U21CSP14-SOA and Microservices	U21ITP14-Graphics Processing Unit
U21ADP07 - Time Series Analysis and Forecasting	U21AMP07 - Object Detection & Face Recognition	U21CSP07-Cloud Service Management	U21ITP07 - Ethical Hacking	U21CSP15-Cloud Native Applications Development	U21ITP15-Agile Methodologies
U21ADP08 -Healthcare Analytics	U21AMP08 - Text and Visual Analytics	U21CSP08-Big Data Integration and Processing	U21ITP08 - Digital Forensics	U21CSP16-Devops	U21ITP16-Software Testing Tools and Techniques

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in semesters V to VII. These courses are listed in groups called verticals that represent a particular area of specialization/diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals.

The registration of courses for B.E. / B.Tech (Honours) or Minor degree shall be done from semesters V to VII.


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**OPEN ELECTIVES****OPEN ELECTIVES – I (SEMESTER: IV)**

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21ITX01	Information Technology Essentials	OEC	3	0	0	0	3
2	U21ITX02	Introduction to Cyber Security	OEC	3	0	0	0	3

OPEN ELECTIVES – II (SEMESTER: V)

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21ITX03	Digital Transformation	OEC	3	0	0	0	3
2	U21ITX04	Human Resource Management	OEC	3	0	0	0	3

OPEN ELECTIVES – III (SEMESTER: VI)

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21ITX05	Social Media Security	OEC	3	0	0	0	3
2	U21ITX06	Enterprise Resource Planning	OEC	3	0	0	0	3

OPEN ELECTIVES – IV (SEMESTER: VII)

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21ITX07	Introduction to Computer Forensics	OEC	3	0	0	0	3
2	U21ITX08	User Interface Design	OEC	3	0	0	0	3

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Scheme of Credit distribution – Summary

Sl. No.	Stream	Credits / Semester								Credits
		I	II	III	IV	V	VI	VII	VIII	
1.	Humanities and Sciences Including Management (HSMC)	3	3	3	1	1	1			12
2.	Basic Science Courses (BSC)	10	6	4	3					23
3.	Engineering Science Courses (ESC)	8	8							16
4.	Professional Core Courses (PCC)		3	14	15	14	10	12		68
5.	Professional Elective Courses (PEC)					6	6	6		18
6.	Open Elective Courses (OEC)				3	3	3	3		12
7.	Employability Enhancement Courses (EEC)			1	1	1	1	2	8	
8.	Industrial Training/Internship (EEC)								2	16
Total		21	20	22	23	25	21	23	10	165
Total Credits										165

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Head

Centre for Academic Courses
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SEMESTER I

U21GEG01	HERITAGE OF TAMILS (Common to all Programmes)	Category: HSMC				
L	T	P	J	C		
1	0	0	0	1		

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

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

- To learn the extensive literature of classical tamil
- To review the fine arts heritage of tamil culture
- To realize the contribution of tamils in Indian freedom struggle

COURSE OUTCOMES:

CO1: Understand the extensive literature of tamil and its classical nature (Understand)

CO2: Understand the heritage of sculpture, painting and musical instruments of ancient people (Understand)

CO3: Review on folk and martial arts of tamil people (Understand)

CO4: Realization of thinai concepts, trade and victory of chozha dynasty (Understand)

CO5: Understand the contribution of tamils in Indian freedom struggle, self-esteem movement and siddha medicine (Understand)

CO-PO MAPPING:

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

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

SYLLABUS:

UNIT I LANGUAGE AND LITERATURE

3

Language Families in India-Dravidian Languages - Tamil as a Classical Language-Classical Literature in Tamil - Secular Nature of Sangam Literature - Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry – Development of Modern literature in Tamil - Contribution of Bharathiyan and Bharathidhasan.

UNIT II HERITAGE-ROCK ART PAINTINGS TO MODERN ART-SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple carmaking - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance-Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Ahamand Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India - Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine - Inscriptions & Manuscripts - Print History of Tamil Books.

Contact Periods:

Lecture:15 Periods	Tutorial:-Periods	Practical:-Periods	Project: –Periods
			Total: 15 Periods

TEXT-CUM-REFERENCE BOOKS

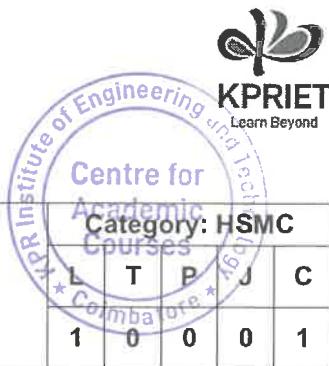
1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல. சுந்தரம் (விகடன் பிரசரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்க காலநகர நாகரிகம் (தொல்லியல்துறை வெளியீடு)
4. பொருநெ - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies)
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

EVALUATION PATTERN:

Continuous Internal Assessment	Total
	100



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SEMESTER I

U21GEG01	தமிழர்மரபு (அனைத்து துறைகளுக்கும் பொதுவனது)	
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முன்கூட்டிய துறைசார் அறிவு: தேவையில்லை

பாடத்தின் நோக்கங்கள்:

- தமிழ்மொழியின் இலக்கியச் செறிவைக் கற்றுணர்தல்
- தமிழர்பண்பாட்டின் நுண்கலைகள் பற்றிய ஒரு மீன் பார்வை
- இந்திய தேசிய இயக்கத்தில் தமிழர்களின் பங்கினை அறிதல்

பாடம் கற்றுதின் விளைவுகள்:

CO1: தமிழ்மொழியின் செந்தன்மை மற்றும் இலக்கியங்கள் குறித்த தெரிதல் (புரிதல்)

CO2: தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக்கருவிகள் குறித்த தெளிவு (புரிதல்)

CO3: தமிழர்களின் நாட்டுப்புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த அறிமுகம் (புரிதல்)

CO4: தமிழர்களின் திணைக்கோட்பாடுகள், சங்க காலவணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள் (புரிதல்)

CO5: இந்திய தேசியஇயக்கம், சுயமரியாதை இயக்கம் மற்றும் சித்தமருத்துவம் பற்றியபுரிதல் (புரிதல்)

CO-PO MAPPING:

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

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

பாடத்திட்டங்கள்:

அலகு 1 மொழி மற்றும் இலக்கியம்

3

இந்தியமொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச்சார்பற்றதன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க்காப்பியங்கள் – தமிழகத்தில் சமண, பெளத்தசமயங்களின் தாக்கம் – பக்கு இலக்கியம் – ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின்வளர்ச்சி – தமிழ் இலக்கியவளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின்பங்களிப்பு.

Chairman.

அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை

3

நடுகல் முதல் நவீனசிற்பங்கள் வரை – ஜம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள், பொம்மைகள் – தேர்செய்யும்கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர்சிலை – இசைக்கருவிகள்-மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக, பொருளாதார வாழ்வில் கோவில்களின் பங்கு

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீரவினையாட்டுகள்

3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஓயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின்வினையாட்டுகள்

அலகு IV தமிழர்களின் திணைக்கோட்பாடுகள்

3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக்கோட்பாடுகள் – தமிழர்கள்போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் எழுத்தறிவும், கல்வியும் – சங்ககாலநகரங்களும், துறைமுகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி

அலகு V இந்திய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு

3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு-இந்தியாவின் பிறபகுதிகளில் தமிழ்ப்பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு

Contact Periods:

Lecture: 15 Periods	Tutorial: - Periods	Practical: – Periods	Project: – Periods
Total: 15 Periods			

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம் (தொல்லியல்துறைவெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies)
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)



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9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

மதிப்பீட்டு முறை:

தொடர்ச்சியான உள்மதிப்பீடு	மொத்தம்
	100



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SEMESTER I

U21MA101	CALCULUS AND DIFFERENTIAL EQUATIONS (Common to AD, BM, CE, CH, CS, AM, EC, IT, ME, MI)	Category: BSC				
		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 eigen values 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	-	2	
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	2
CO3	2	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.

UNIT II FUNCTIONS OF SEVERAL VARIABLES

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

UNIT III MULTIPLE INTEGRALS

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

UNIT IV LINE AND SURFACE INTEGRALS

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

UNIT V ORDINARY DIFFERENTIAL EQUATIONS

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

SEMESTER I

U21EEG01	Basics of Electrical and Electronics Engineering (Common to AD, AM, BM, CB, CS and IT)	Category: ESC				
		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: Exemplify 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	1	-
CO2	3	2	1	-	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	-	-	-	-	-	-	-	-	1	1	-
CO4	3	2	1	-	-	-	-	-	-	-	-	1	1	-
CO5	3	2	1	-	-	-	-	-	-	-	-	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.

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", 5th edition, McGraw-Hill Education, New Delhi, 2017.
2. R.K.Rajput, "Electrical Machines", 6th edition, Laxmi Publications, 2016.
3. V.K Metha and RohitMetha, "Principles of Electronics", 12th edition, S.Chand Publications, 2020.

REFERENCES:

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

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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SEMESTER I

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

UNIT II CAREER ENHANCEMENT

9

Module:4 Reading Comprehension

Activity: Reading Newspaper articles/Blogs, Sentence completion

Module:5 E-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			

TEXT BOOKS:

1. Ashraf Rizvi, "Effective Technical Communication", 2nd edition, McGraw – 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 Course book for Undergraduate Engineers and Technologists", 1st edition, Orient Black Swan, 2017.

EVALUATION PATTERN:

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

U21PH101	ENGINEERING PHYSICS (Common to all Programmes)	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 fiber 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	-	-	-	-	-	-	-	-	-	2	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	2	-
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 – CO₂ laser – Semiconductor laser – Material Processing – Selective laser Sintering – Hologram – Medical applications (Ophthalmology).

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 – Piezoelectric generator – Acoustic grating – Applications of ultrasonics in industry– SONAR – NDT – Ultrasonic scanning methods – Fetal heart movement.

Course content 1 year
Effective from academic session 2021-22
YOM Reg - 2021-22

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 fiber
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 PoonamTandon, "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, Arun Murthy TVS, "A Text book of Engineering Physics", 2nd Edition, S Chand Publishing, New Delhi, 2018.
3. Thyagarajan K, AjoyGhatak, "Lasers – Fundamentals and Applications", 2nd Edition, Laxmi Publications Pvt Limited, New Delhi, 2019.

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		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.



SEMESTER I

U21CY101	ENGINEERING CHEMISTRY (Common to all BE./B.Tech. courses)	Category: BSC <table border="1" style="margin-left: auto; margin-right: 0;"> <tr> <td>L</td><td>T</td><td>P</td><td>J</td><td>C</td></tr> <tr> <td>2</td><td>0</td><td>2</td><td>0</td><td>3</td></tr> </table>	L	T	P	J	C	2	0	2	0	3
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 electro chemical 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 Total	– Periods 60 Periods
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TEXT BOOKS:

1. Jain P C and Monika Jain, "Engineering Chemistry", 16th edition, DhanpatRai 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.

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:

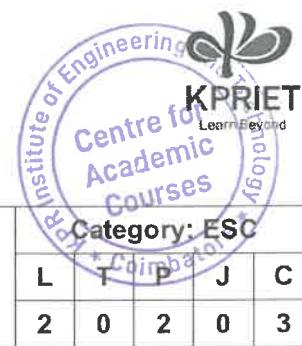
Continuous Internal Assessments				End Semester Examinations	
Assessment I (Theory) (100 Marks)		Assessment II (Practical) (100 Marks)		Theory Examinations (Examinations will be conducted for 100 Marks)	Practical Examinations (Examinations will be conducted for 100 Marks)
*Individual Assignment / Case 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 I



U21CSG01	PROBLEM SOLVING AND C PROGRAMMING (Common to all Programmes)	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 \ 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	2	-
CO2	2	1	1	2	-	-	-	1	2	2	-	2	1	-
CO3	3	2	2	2	-	2	-	1	2	2	-	2	2	-
CO4	3	2	2	2	-	-	-	1	2	2	-	2	2	-
CO5	3	2	2	2	-	-	-	1	2	2	-	2	2	-
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 arrays 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 FabrizioLuccio, "Computational Thinking First Algorithms", Then Code", 1st Edition, Springer International Publishing, 2018.
2. ReemaThareja, "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. PradipDey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 1st Edition, Oxford University Press, 2009.

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 I

U21MEG01	ENGINEERING GRAPHICS (Common to all Programmes)	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 OUTCOMES:

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)**

12

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

TEXT BOOKS:

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

REFERENCES:

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

*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.



SEMESTER II

U21GEG02	TAMILS AND TECHNOLOGY (Common to all Programmes)	Category: HSMC				
L	T	P	J	C		
1	0	0	0	1		

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

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

- To learn weaving, ceramic and construction technology of Tamils
- To understand the agriculture, irrigation and manufacturing technology of Tamils
- To realize the development of scientific tamil and tamil computing

COURSE OUTCOMES:

CO1: Understand the weaving and ceramic technology of ancient tamil people nature
(Understand)

CO2: Understand the construction technology, building materials in sangam period and case studies (Understand)

CO3: Infer the metal process, coin and beads manufacturing with relevant archeological evidence
(Understand)

CO4: Realize the agriculture methods, irrigation technology and pearl diving (Understand)

CO5: Apply the knowledge of scientific tamil and tamil computing (Apply)

CO-PO MAPPING:

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

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

SYLLABUS:

UNIT I WEAVING AND CERAMIC TECHNOLOGY

3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY

3

Designing and Structural construction House & Designs in household materials during Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple) –

Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY
3

Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold – Coins as source of history – Minting of Coins – Beads making – Industries Stone beads – Glass beads – Terracotta beads – Shell beads/ bone beads – Archeological evidences – Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY
3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING
3

Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

Contact Periods:

Lecture: 15 Periods	Tutorial: - Periods	Practical: – Periods	Project: – Periods
Total: 15 Periods			

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித்தமிழ் - முனைவர். இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies)
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D.Thirunavukkarasu) (Published by: International Institute of Tamil Studies)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

EVALUATION PATTERN:

Continuous Internal Assessment	Total
	100



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SEMESTER II

U21GEG02	தமிழரும் தொழில்நுட்பமும் (அனைத்து துறைகளுக்கும் பொதுவனது)	Category: HSMC				
L	T	P	J	C		
1	0	0	0	1		

முன்கூட்டிய துறைசார் அறிவு: தேவையில்லை

பாடத்தின் நோக்கங்கள்:

- தமிழர்களின் சங்ககால நெசவு, பானை வணைதல் மற்றும் கட்டட தொழில்நுட்பம் குறித்து அறிதல்
- தமிழர்களின் சங்ககால வேளாண்மை, நீர்ப்பாசனம் மற்றும் உற்பத்தி முறைகள் குறித்த கற்றல்
- நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிதல்

பாடம்கற்றுதின் விளைவுகள்:

CO1: சங்ககாலத் தமிழர்களின் நெசவு மற்றும் பானை வணைதல் குறித்த கற்றுணர்தல் (புரிதல்)

CO2: சங்ககாலத் தமிழர்களின் கட்டட தொழில்நுட்பம், கட்டுமானப் பொருட்கள் மற்றும் அவற்றை விளக்கும் தளங்கள் குறித்த அறிவு (புரிதல்)

CO3: சங்ககாலத் தமிழர்களின் உலோகத்தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு (புரிதல்)

CO4: சங்ககாலத் தமிழர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு (புரிதல்)

CO5: நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிந்துகொள்ளலும் மற்றும் பயன்படுத்துதலும் (பயன்படுத்தல்)

CO-PO MAPPING:

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

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

பாடத்திட்டங்கள்:

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்

3

சங்ககாலத்தில் நெசவுத்தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்

3

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் மற்றும் சங்ககாலத்தில் வீட்டுப்பொருட்களின் வடிவமைப்பு – சங்ககாலத்தில் கட்டுமானப்பொருட்களும்

நடுகல்லும்-சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள்-மாமல்லபுரச் சிறபங்களும் கோவில்களும் - சோழர்காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக்கோயில்கள்-மாதிரி கட்டமைப்புகள் பற்றி அறிதல்-மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலைநாயக்கர் மஹால் - செட்டிநாடு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக்கலை.

அலகு III உற்பத்தித்தொழில்நுட்பம்
3

கப்பல்கட்டும்கலை-உலோகவியல் - இரும்புத் தொழிற்சாலை-இரும்பை உருகுதல், எக்கு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்கநாணயங்கள் - நாணயங்கள் அச்சடித்தல்-மணிஉருவாக்கும்தொழிற்சாலைகள் - கல் மணிகள் - கண்ணாடி மணிகள்-சுடுமண் மணிகள் - சங்கு மணிகள்-எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம்
3

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குழிழித்தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார்அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல்-பெருங்கடல் குறித்த பண்டையஅறிவு - அறிவிசார்சலுகம்.

அலகு V அறிவியல்தமிழ்மற்றும்கணினித்தமிழ்
3

அறிவியல் தமிழின் வளர்ச்சி - கணினித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின் பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின்நாலகம்-இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

Contact Periods:

Lecture: 15 Periods	Tutorial: - Periods	Practical: – Periods	Project – Periods	Total 15 Periods
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TEXT-CUM-REFERENCE BOOKS

1. தமிழகவரலாறு - மக்களும்பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு:தமிழ்நாடுபாடநால்மற்றும்கல்வியியல்பணிகள்கழகம்)
2. கணினித்தமிழ் - முனைவர். இல. சுந்தரம் (விகடன்பிரசரம்)
3. கீழடி - வைகைநதிக்கரையில்சங்ககாலநகரநாகரிகம் (தொல்லியல்துறைவெளியீடு)
4. பொருநை - ஆற்றங்கரைநாகரிகம் (தொல்லியல்துறைவெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book

மதிப்பீட்டுமுறை:

தொடர்ச்சியான உள்மதிப்பீடு	மொத்தம்
	100



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U21MA208	LINEAR ALGEBRA (Common to CB & IT)	Category: BSC				
		L	T	P	J	C
		3	1	0	0	4

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of decomposition of matrices
- To understand the concepts of independence, basis and dimensions in vector spaces
- To understand the concepts of inner product spaces and orthogonality

COURSE OUTCOMES:

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

- CO1:** Implement the various matrix techniques in solving the system of linear equations (Understand)
- CO2:** Use the concept of vector spaces to predict an orthonormal basis (Understand)
- CO3:** Attribute a set of vectors in an inner product space using Gram-Schmidt orthogonalisation and decompose a given matrix using QR decomposition (Understand)
- CO4:** Find the Eigen values and Eigen vectors of the linear transformations for the simple real life problems (Understand)
- CO5:** Apply the Singular value decomposition and Principal component analysis technique to real world datasets for performing the dimensional reduction on the given data (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	-	2
CO2	3	2	1	1	-	1	-	-	-	-	1	2	-	1
CO3	3	2	1	1	-	1	-	-	-	-	1	2	-	1
CO4	3	2	2	1	-	1	-	-	-	-	1	2	-	2
CO5	3	2	2	1	-	1	-	-	-	-	1	2	-	2
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:**UNIT I MATRICES** **9 + 3**

Vectors and Linear combinations – Rank of a matrix – Solution of system of linear equations by Gaussian elimination, Gauss Jordan and LU decomposition methods.

UNIT II VECTOR SPACE **9 + 3**

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear dependence and independence – Bases and dimensions.

UNIT III INNER PRODUCT SPACE
9 + 3

Introduction to linear transformation – Inner product – Norm – Angle - Orthogonality: definition and simple problems – Projections – Gram Schmidt orthogonalization and QR decomposition.

UNIT IV EIGENVALUE PROBLEMS
9 + 3

Linear transformations – Range, kernel and problems – Eigenvalues and eigenvectors – Hermitian and unitary matrices (simple problems).

UNIT V PRINCIPAL COMPONENT ANALYSIS
9 + 3

Positive definite matrices – Cayley-Hamilton theorem – Singular value decomposition and principal component analysis using the covariance method – Introduction to their applications in image processing and machine learning (problems not included).

Contact Periods:

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

TEXT BOOKS:

- Howard Anton and Chris Rorres, "Elementary Linear Algebra – Applications version", 9th edition, John Wiley & Sons, 2005.
- David C. Lay, "Linear Algebra and its Applications", 5th edition, Pearson College Division, 2014.

REFERENCES:

- Steven J. Leon, "Linear Algebra with Applications", 9th edition, Pearson College Division, 2014.
- Gilbert Strang, "Introduction to Linear Algebra", 5th edition, Wellesley Publishers, 2016.
- Gonzalez R C and Woods R E, "Digital Image Processing", 4th edition, Pearson Education, 2018.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / 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 based on the nature of the courses. Course Coordinator can choose any one / two components based on the nature of the course.



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U21PH201	MATERIALS SCIENCE (Common to all Programmes 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	-	1
CO2	3	2	-	-	-	1	-	-	-	-	-	1	-	-
CO3	3	2	-	-	-	1	-	-	-	-	-	1	-	1
CO4	3	2	-	-	-	1	-	-	-	-	-	1	-	1
CO5	3	2	-	-	-	1	-	-	-	-	-	1	-	2
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.

UNIT III MAGNETIC MATERIALS

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

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

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:

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

REFERENCES:

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

EVALUATION PATTERN:

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

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



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U21IT201	PRINCIPLES OF DATA COMMUNICATION	Category: PCC				
L	T	P	J	C		
3	0	0	0	3		

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- Understand the concepts of electronic communication systems
- Gain knowledge on analog and digital communication transmission systems
- Understand the concepts of data communication

COURSE OUTCOMES:

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

CO1: Illustrate the basic concepts and elements of communication systems (Understand)

CO2: Explain the amplitude modulation techniques (Understand)

CO3: Summarize the concepts of angle modulation (Understand)

CO4: Illustrate the digital modulation techniques (Understand)

CO5: Explain the concepts of data communication and perform error detection and correction across channels using error control coding schemes (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	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO4	3	2	1	1	-	-	-	-	-	-	-	-	1	-
CO5	3	2	1	1	-	-	-	-	-	-	-	-	2	-

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

SYLLABUS:**UNIT I INTRODUCTION**

9

Elements of communication system – Bandwidth – Communication channels – Classification of communication – Types of communication – Modulation process – Analog and digital communication – Fundamental limitations of communication systems – Applications of electronic communication.

UNIT II AMPLITUDE MODULATION

9

Multiplexing: Frequency and Time Division Multiplexing – Principles of AM – Spectrum of AM wave – Modulation index and percentage modulation – Power content in AM wave – Low and high level AM – Low level modulated AM transmitter- Basic super heterodyne receiver.

UNIT III ANGLE MODULATION

9

Concept – Types of Angle modulation –Relationship between Phase Modulation and Frequency Modulation – FM and PM waves – Types of frequency modulation – Comparison of FM and AM systems – Direct and indirect methods of FM generation.

UNIT IV DIGITAL MODULATION

9

Information capacity – Bits- Bit rate – Baud – M-ary coding – Amplitude Shift Keying – Frequency Shift Keying – Phase Shift Keying - Differential Phase Shift Keying – Probability of error and bit error rate.

UNIT V DATA COMMUNICATION

9

Codes: ASCII, Bar codes - Error control – Error detection – Error correction – Data communication hardware – RS232 serial interface – Data communication circuits – Data communication modems.

Contact Periods:

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

TEXT BOOKS:

1. Sanjay Sharma, "Principles of Communication", 8th Edition, S.K.Kataria & Sons, 2014.
2. Wayne Tomasi, "Electronic Communication Systems: Fundamentals through Advanced", 5th Edition, Pearson Education, 2012.

REFERENCES:

1. Louis E Frenzel, "Principles of Electronic Communication Systems", 4th Edition, Tata Mc-Graw Hill, 2015.
2. Michael P Fitz, "Fundamentals of Electronic Communication Systems", Tata Mc-Graw Hill, 2008.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*Individual Assignment / MCQ	Written Test	*Individual Assignment / 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 based on the nature of the courses. Course Coordinator can choose any one / two components based on the nature of the course.



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SEMESTER II

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop 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:8 Persuasive 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", 2nd edition, OUP India, 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:

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

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



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SEMESTER II

U21CSG02	PYTHON PROGRAMMING (Common to all Programmes)	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	-	-
CO2	2	1	1	2	-	-	-	1	2	2	-	2	1	-
CO3	3	2	2	2	-	-	-	1	2	2	-	2	2	-
CO4	3	2	2	2	-	-	-	1	2	2	-	2	2	-
CO5	3	2	2	2	1	-	-	1	2	2	-	2	2	2
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:**UNIT I LANGUAGE BASICS** 6

Python interpreter and interactive mode – Tokens – Datatypes – 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

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

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

UNIT V NUMPY AND PANDAS

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.

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 NamdevKamthane 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:

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 II

U21ECG01	DIGITAL ELECTRONICS (Common to EC, BM, CS, CB, AM, IT and AD: For CS, CB, AM, IT and AD, it is offered during II Semester and for EC and BM, it is offered during III Semester)	Category: ESC				
		L	T	P	J	C
		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	PSQ1	PSO2
CO1	3	2	-	2	-	-	-	2	2	2	-	2	1	-
CO2	3	2	-	2	-	-	-	2	2	2	-	2	1	-
CO3	3	3	2	2	-	-	-	2	2	2	-	2	2	-
CO4	3	2	-	2	-	-	-	2	2	2	-	2	2	-
CO5	3	3	2	2	-	-	-	2	2	2	-	2	1	-

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, QuineMcCluskey 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.

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.

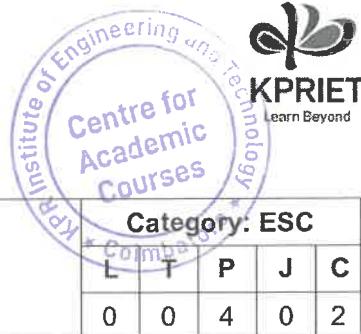
EVALUATION PATTERN:

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					

*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

U21ECG03	ENGINEERING STUDIO (Common to all Programmes)	Category: ESC				
L	T	P	J	C		
0	0	4	0	2		

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To enable the students understand the functioning of simple to complex devices and systems
- To help the students design and build simple applications on their own
- To create an immersive environment in the engineering lab

COURSE OUTCOMES:

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

CO1: Understand basics of electronics (Understand)

CO2: Use basic electronic components and Arduino for prototyping (Apply)

CO3: Create simple real time use cases (Create)

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

Basics of Electronics

1. Breadboard Basics – LED glowing, Ohm's Law
Series and Parallel Circuits
2. Controlling the circuit response using Potentiometer
Capacitor Charging and Discharging
3. Water level Indicator using transistor
Touch sensor using transistor
4. Automatic night light- (LDR –transistor) circuit
Fire alarm Circuit
5. IR Sensor-Obstacle detecting circuit
Doorbell using 555 Timer circuit
6. LED Chaser circuit using Counter IC
Shadow detector using IC741
7. Regulated output using Regulator IC
Logic gate Realization

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Basics of IoT (With Arduino)

1. Basics of ARDUINO and IoT
 - Working with LEDs
2. Working with digital switch
 - Adjusting voltage using potentiometer
3. Measuring the presence / absence of light using LDR
 - Finding the distance of an object using ultrasonic sensor
4. Finding the Temperature and Humidity in the surroundings
 - Detecting the motion of human using PIR
5. Working with Servo motor
 - Establish communication using Bluetooth

Contact Periods:

Lecture: – Periods

Tutorial: – Periods

Practical: 60 Periods

Project: – Periods

Total: 60 Periods

EVALUATION PATTERN:

Continuous Internal Assessments	
Evaluation of course workbook, Tasks (Rubrics based)	
100	
100	



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SEMESTER III

U21AD301	ETHICS AND HOLISTIC LIFE (Common to AD & IT)	Category: HSMC				
		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 that 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	-	1
CO2	-	-	-	-	-	3	3	3	3	-	-	3	-	2
CO3	-	-	-	-	-	3	3	3	3	-	-	3	-	2
CO4	-	-	-	-	-	3	3	3	3	3	-	3	-	2
CO5	-	-	-	-	-	2	2	2	2	3	-	3	-	2

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.

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

SEMESTER III

U21MAG02	DISCRETE MATHEMATICS (Common to AD, CS, AM, IT, CB)	Category: BSC				
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	1
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	1
CO3	3	2	-	-	-	-	-	-	-	-	-	-	1	1
CO4	3	2	-	-	-	-	-	-	-	-	-	-	1	1
CO5	3	3	-	-	-	-	-	-	-	-	-	-	1	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

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				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*Individual Assignment / Seminar / MCQ	Written Test	*Individual Assignment / Seminar / 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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U21IT301	COMPUTER GRAPHICS AND VISUALIZATION	Category: PCC					
		L	T	P	J	C	
		3	1	0	0	4	

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- Fundamental concepts and theory of computer graphics.
- Importance of drawing algorithm, polygon fitting, clipping and 2D transformation curves and an introduction to 3D transformation.
- Demonstrate the significant of these mathematical and computational tools and visualization algorithms in visual computing and relevant areas.

COURSE OUTCOMES:

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

- CO1:** Comprehend the concepts related to basics of computer graphics and visualization (Understand)
- CO2:** Demonstrate various graphics primitives and 2-D, 3-D geometric transformations and clipping techniques (Apply)
- CO3:** Understand the foundations of the visualization processes, from basic building blocks to taxonomies and frameworks (Understand)
- CO4:** Explain and understand fundamental concepts within information visualization and scientific visualization (Understand)
- CO5:** Apply and implement the concepts of computer graphics and Visualization in applications (Apply)

CO-PO MAPPING:

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

SYLLABUS:**UNIT I INTRODUCTION TO GRAPHICS**

9+3

Introduction to Raster Scan displays, Pixels, Frame buffer, Vector & Character generation, Random Scan systems, Display devices, Scan Conversion techniques, Line Drawing algorithms: simple DDA, Bresenham's Algorithm, Circle Drawing Algorithms: Midpoint Circle drawing and Bresenham's Algorithm, Polygon fill algorithm: Boundary-fill and Flood-fill algorithms.

UNIT II 2-D TRANSFORMATIONS**9+3**

Translation, Rotation, Scaling, Shearing, Reflection. Inverse Transformation, Homogeneous coordinate system, Matrices Transformation, Composite Transformation. Windowing & Clipping: World Coordinate System, Screen Coordinate System, Viewing Transformation, Line Clipping & Polygon Clipping Algorithms.

UNIT III 3-D TRANSFORMATIONS**9+3**

Translation, Rotation and Scaling. Parallel & Perspective Projection: Types of Parallel & Perspective Projection, Hidden Surface elimination: Depth comparison, Back face detection algorithm, Painter's Algorithm, Z-Buffer Algorithm. Curve generation, Bezier and B-spline methods. Basic Illumination Model: Diffuse reflection, Specular reflection, Phong Shading, Gouraud shading, Ray Tracing, Color models like RGB, YIQ, CMY, HSV.

UNIT IV BASIC RENDERING**9+3**

Rendering in nature, Polygonal representation, Affine and coordinate system transformations, Visibility and occlusion, depth buffering, Painter's algorithm, ray tracing, forward and backward rendering equations, Phong Shading per pixel per vertex Shading.

UNIT V VISUALIZATION**9+3**

Visualization of 2D/3D scalar fields: color mapping, ISO surfaces. Direct volume data rendering: ray-casting, transfer functions, segmentation. Visualization of Vector fields and flow data, Time-varying data, High-dimensional data: dimension reduction, parallel coordinates, Non-spatial data: multi-variate, tree/graph structured, text Perceptual and cognitive foundations, Evaluation of visualization methods, Applications of visualization, Basic Animation Techniques like traditional, key framing.

Contact Periods:

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

TEXT BOOKS:

- Donald D Hearn, M. Pauline Baker, Computer Graphics C version, Pearson Education, 2016.
- Dave Shreiner, Mason Woo, Jackie Neider, Tom Davis, OpenGL Programming Guide: The Official Guide to Learning OpenGL, Addison-Wesley, 2016.

REFERENCES:

- F. S. Hill Jr. and S. M. Kelley, Computer Graphics using OpenGL, 4th Edition, Prentice Hall, 2019.
- James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes, Computer Graphics: Principles & Practice in C, Addison Wesley Longman, 3rd edition, 2013.



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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 / 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 III

U21CS301	COMPUTER ORGANIZATION AND ARCHITECTURE (Common to CS, CB, AM, IT)	Category: PCC				
L	T	P	J	C		
3	0	0	0	3		

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To learn the basic structure and operations of a computer
- To learn the arithmetic and logic unit and implementation of fixed-point and floating point arithmetic unit
- To learn the basic of pipelined execution
- To understand the memory hierarchies, cache memories and virtual memories
- To learn the different ways of communication with I/O devices

COURSE OUTCOMES:

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

- CO1:** Describe the various parts of modern computer functional units, bus structure, addressing modes and Computer arithmetic (Understand)
- CO2:** Identify the process involved in executing an instruction (Understand)
- CO3:** Design the hardwired and micro programmed control (Apply)
- CO4:** Describe the memory hierarchy and memory system (Understand)
- CO5:** Explain pipelined execution and instruction scheduling (Understand)

CO-PO MAPPING:

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

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

SYLLABUS:**UNIT I INTRODUCTION**

9

Evolution of computers – Structure of computers – Basic Operational Concepts – GPR based and stack based organization – Bus Structures, Performance Measurement – Processor Clock, Basic Performance Equation, Clock Rate – Machine Instructions and Programs – Memory Location and Addresses, Memory Operation – Instructions and Instruction Sequencing – Addressing Modes.

UNIT II DATA PATH AND CONTROL

9

Fetching and Storing words – Register Transfer – Execution of instruction – Instruction codes – computer registers – computer instructions – timing & control – instruction cycle – memory

reference instructions – Hard-wired Control – Micro programmed Control – Micro instruction – Microprogram sequencing.

UNIT III PIPELINING 9

Basic concepts of pipelining – the instruction pipeline – pipeline hazards – instruction level parallelism – reduced instruction set – Computer principles – RISC versus CISC.

UNIT IV MEMORY SYSTEM 9

Basic Concepts– Semiconductor RAM Memories– Read Only Memories– Speed, Size, and Cost– Cache Memories – Mapping Functions– Replacement Algorithms– page mode access– interleaved access– Performance Considerations– Virtual Memories– Secondary Storage.

UNIT V INPUT/OUTPUT ORGANIZATION 9

Accessing I/O Devices – Interrupts – Interrupt Hardware – Enabling and Disabling Interrupts – Handling Multiple Devices – Controlling Device Requests – Exceptions – Direct Memory Access – Buses – Interface Circuits – Standard I/O Interfaces – PCI Bus – SCSI Bus, Bus – Arbitration schemes – USB.

Contact Periods:

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

TEXT BOOKS:

1. David A Patterson, John L Hennessy, "Computer Organization and Design", (The Hardware/Software Interface), 5th Edition, Morgan Kaufmann, 2014.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, "Computer Organization", 5th Edition, Tata McGraw Hill, 2002.

REFERENCES:

1. William Stallings, "Computer Organization and Architecture Designing for Performance", 10th Edition, Pearson, 2016.
2. Nicholas P Carter, "Computer Architecture & Organisation", O'Reilly Publishing, 2014.

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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**SEMESTER III**

U21AD303	PROGRAMMING USING JAVA (Common to AD and IT)	Category: PCC <table border="1" style="margin-left: auto; margin-right: 0;"> <tr> <th>L</th><th>T</th><th>P</th><th>J</th><th>C</th></tr> <tr> <td>3</td><td>0</td><td>0</td><td>0</td><td>3</td></tr> </table>	L	T	P	J	C	3	0	0	0	3
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 \ POs COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	2	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO3	2	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO4	2	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO5	2	2	2	-	-	-	-	-	-	-	-	-	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.

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 MySQL Connectivity – Simple Application.

Contact Periods:

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

TEXT BOOKS:

- Herbert Schildt, "Java: The Complete Reference", 12th edition, McGraw Hill Education, 2022.
- Cay.S.Horstmann, "Core Java 2 Fundamentals", 11th edition, Pearson Education, 2018.

REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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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U21CSG03	DATA STRUCTURES (Common to AM, BM, CB, CS, EC, EE, IT)	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 concept of linear and non linear data structures (Understand)

CO2: Demonstrate stack and queue with suitable applications (Apply)

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

CO4: Analyze non linear data structures – trees (Apply)

CO5: Implement various problems in graph data structures (Apply)

CO-PO MAPPING:

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

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

SYLLABUS:**UNIT I LINEAR DATA STRUCTURES – LIST**

6

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list based implementation – Singly linked lists – Circularly linked lists – Doubly-linked lists – Applications of linked list.

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES

6

Stack ADT – Operations – Applications – Evaluating arithmetic expressions – Conversion of infix to postfix expression – Queue ADT – Operations – Circular queue – Priority queue – deQueue – Applications of queues.

UNIT III SEARCHING, SORTING AND HASHING TECHNIQUES

6

Introduction to searching – Types of search – Linear search – Binary search – Sorting – Bubble sort



– Selection sort – Insertion sort – Shell sort – Hashing – Hash functions – Separate chaining – Open addressing – Rehashing.

UNIT IV NON LINEAR DATA STRUCTURES – 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 – Introduction to heap – Properties.

UNIT V NON LINEAR DATA STRUCTURES - GRAPHS

6

Introduction to graph – Types of graph – Graph traversal – Breadth-first traversal – Depth-first traversal – Topological sort – Minimum spanning tree algorithms – Shortest path algorithm – Dijkstra's algorithm.

LIST OF EXPERIMENT (INDICATIVE)

1. Write a function program to perform the following operations on a singly linked list

- i. Create a list cube.
- ii. Insert an element to the list
- iii. Delete the maximum element from the list
- iv. Arrange the list as sorted order
- v. Display the elements of the list

Write a main method to demonstrate the above functionalities.

2. Creation of Array and linked list implementation of Stack and Queue ADTs

3. Implementation of quick, heap and shell sort

4. Program to sort the elements in ascending order using selection sort and bubble sort

5. Implementation of hashing technique

6. Develop a program to perform linear and binary search

7. Program to construct an expression tree for a given expression and perform various tree traversal methods.

8. Implement Prims algorithm with the following functionalities

- i. Read a set of vertices minimum of six from the keyboard
- ii. Get the number of edges and form the graph
- iii. Find the value of each edge by using distance formula for two points.

iv. Develop a Minimum Spanning Tree for the graph

v. Find the total length of all edges. Write a main method to execute the above functionalities

9. Choose an appropriate data structure and create a token system for banking service (withdrawal, deposit and money transfer).

10. Create a food delivering system which allocates the path for delivery of food using appropriate data structures

11. Create a book rack allocation system in a library, which allocates appropriate space for the books based on category using appropriate data structures

Contact Periods:

Lecture: 30 Periods

Tutorial: – Periods

Practical: 30 Periods

Project: – Periods

Total: 60 Periods

TEXT BOOKS:

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



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REFERENCES:

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

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 III

U21AD307	JAVA LABORATORY (Common to AD and IT)	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
CO2	1	1	2	-	-	-	-	-	-	-	-	1	-	1
CO3	1	1	2	-	-	-	-	-	-	-	-	1	-	1
CO4	1	1	2	-	-	-	-	-	-	-	-	1	-	1
CO5	1	2	2	-	-	-	-	-	-	-	-	2	-	2

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

LIST OF EXPERIMENTS

- a. Write a Java program that determines the number of days in a month.
- 1 b. Write a java program that arranges the given set of strings in alphabetical order. Supply the strings through command line arguments.

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:

- 2 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

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.
- 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.
- 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
- 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.
- 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

EVALUATION PATTERN:

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

SEMESTER III

U21IT302	DESIGN STUDIO I	Category: PCC				
		L	T	P	J	C
		0	0	0	2	1

PRE-REQUISITES:

- U21ECG03 - Engineering Studio

COURSE OBJECTIVES:

- To inculcate the problem-solving & Innovation mindset
- To provide a platform for self-learning, experimenting, solving the real-world problems and to develop a product
- To enable hands-on experience for active learning

COURSE OUTCOMES:

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

CO1: Understand design thinking, system thinking, mapping the problem statements to UNSDG (Understand)

CO2: Apply the design thinking steps “Empathize, Define, ideate and prototype” (Apply)

CO3: Create experimental proof of concept (TRL 3) (Understand)

CO4: Demonstrate teamwork, project management, technical report writing and presentation skills (Apply)

CO-PO MAPPING:

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

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

Course conduction:

- The students will be divided into batches (maximum 4 students / batch). They will be provided the space, time, resources, and a mentor.
- With the guidance of assigned mentor, the students will find & validate a problem statement, map to UNSDG, identify the skills required for the project and self-learn.
- Applying the design thinking concept, the students will provide a solution and produce the version 1 of prototype.
- The student will learn teamwork, project management, technical report writing and presentation skills through this course.

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

Total: 30 Periods

EVALUATION PATTERN:

Review 0 (Within 10 days of commencement of semester)	Review 1 (Between 35 th to 40 th working day)	Review 2 (Between 80 th to 90 th working day)	Total
0	40	60	100

SEMESTER IV

U21MA403	PROBABILITY AND QUEUEING THEORY (Common to CS and IT)	Category: BSC				
		T	P	J	C	
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

- CO1:** Apply probability theory and random variable as a need for the analysis of random experiment (Apply)
- CO2:** Use discrete and continuous probability distributions including requirements, mean and variance for making decisions (Understand)
- CO3:** Distinguish correlation and linear regression in two dimensional random variable (Understand)
- CO4:** Apply various Processes in low pass and band pass noise models (Apply)
- CO5:** Compute the traffic intensity, blocked traffic and the utilization of some queuing systems (Apply)

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	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	1	-
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)			3: Substantial (High)						

SYLLABUS:**UNIT I PROBABILITY** 9

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

UNIT II DISTRIBUTION FUNCTIONS 9

Binomial distribution – Poisson distribution – Exponential distribution – Uniform distribution – Normal distribution – Applications.

UNIT III TWO – DIMENSIONAL RANDOM VARIABLES 9

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

UNIT IV RANDOM PROCESSES 9

Classification – Stationary process – Markov chain – Bernoulli and Poisson Process.

UNIT V QUEUEING MODELS 9

Markovian queues – Birth and death processes – Single and multiple server queueing models – Little's formulas with finite waiting rooms.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

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

REFERENCES:

- Allen A. O. "Probability, Statistics and Queueing Theory with computer applications", 2nd edition, Elsevier, 2005.
- Taha H. A, "Operations Research", 9th edition, Pearson Education, Asia, 2014.
- Trivedi K. S, "Probability and Statistics with Reliability, Queueing and computer science applications", 2nd edition, John Wiley & sons, 2012.
- Narayanan S, Manicavachagom Pillay T. K and Ramanaiah G, "Advanced Mathematics for Engineering Students", Vol. II & III, 2nd edition, S. Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

EVALUATION PATTERN:

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

SEMESTER IV

U21CS401	DESIGN AND ANALYSIS OF ALGORITHMS (Common to CS, CB, IT)	Category: PCC				
L	T	P	J	C		
3	0	0	0	3		

PRE–REQUISITE:

- U21CSG03- Data Structures

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

- CO1:** Apply the fundamental concepts of algorithmic problem-solving types (Apply)
- CO2:** Analyze the fundamentals of the algorithm efficiency for real world problems (Analyze)
- CO3:** Examine the searching and sorting techniques in the analysis of algorithms (Apply)
- CO4:** Implement the graph algorithms with dynamic programming (Apply)
- CO5:** Apply the algorithm design techniques for P and NP 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	2	-	-	-	-	-	-	-	-	2	2	1
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	2	1
CO3	3	2	1	2	-	-	-	-	-	-	-	-	3	2	1
CO4	3	2	1	2	-	-	-	-	-	-	-	-	2	3	1
CO5	3	2	1	3	-	1	1	1	-	-	-	-	2	2	1

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

SYLLABUS:**UNIT I PROBLEM SOLVING**

9

Introduction — Fundamentals of algorithmic problem Solving—Important problem types — Sorting problem — Searching problems — Combinatorial problems — Geometric Problems — Fundamental data structures — Trees and graphs.

UNIT II FUNDAMENTALS OF ANALYSIS OF ALGORITHM EFFICIENCY

9

Analysis framework — Asymptotic notations - Basic efficiency classes — Mathematical analysis of non-recursive algorithm — Mathematical analysis of recursive algorithm — Fibonacci numbers — Empirical analysis of algorithms.

UNIT III ANALYSIS OF SORTING AND SEARCHING ALGORITHMS

9

Brute force strategy – Selection sort and bubble sort – Sequential search and brute-force string matching – Closest pair and convex hull problem – Divide and conquer – Quick sort – Random quick sort –Binary search.

UNIT IV ANALYSIS OF GRAPH ALGORITHMS

9

Balanced search trees – AVL trees – Dynamic programming – Warshalls and Floyd algorithm – Greedy technique – Prims algorithm – Kruskals algorithm – Dijkstra algorithm.

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

9

Limitations of algorithm power — P, NP and NP complete problems — Coping with limitation of algorithm power — Backtracking — N-Queens problem — Hamiltonian circuit problem — Approximation algorithms for NP hard problems.

Contact Periods:

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

TEXT BOOKS:

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

REFERENCES:

1. T.H. Cormen, C.E. Leiserson, R.L. Rivest and C. Stein, "Introduction to Algorithms", 3rd Edition, PHI Pvt. Ltd., 2015.
2. Sara Baase and Allen Van Gelder, "Computer Algorithms Introduction to Design and Analysis", 1st Edition, Pearson Education Asia, 2016.
3. A.V.Aho, J.E. Hopcroft and J.D.Ullman, "The Design and Analysis of Computer Algorithms", 1st Edition, Pearson Education Asia, 2013.

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	200	100
40	60	40	60	40	60
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.

SEMESTER IV

U21AD402	DATABASE DESIGN AND MANAGEMENT (Common to AD & IT)	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
CO2	3	3	2	2	-	-	-	-	-	-	-	-	1	2
CO3	3	3	3	3	1	-	-	-	-	-	-	-	2	2
CO4	3	2	2	2	-	-	-	-	-	-	-	-	2	1
CO5	3	1	1	1	1	-	-	-	-	-	-	-	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.

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.

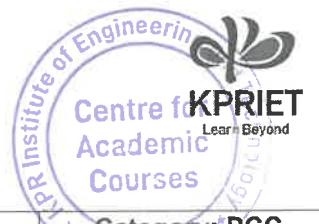
REFERENCES:

1. Hector Garcia-Molina, Jeffrey D Ullman, Jennifer Widom, "Database Systems:The Complete Book", 2nd Edition, Pearson, 2008.
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.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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.



U21CS403	OPERATING SYSTEMS (Common to CB, CS, IT)	Category: PCC				
L	T	P	J	C		
3	0	0	0	3		

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1: Describe the important computer system resources and the role of operating system

(Understand)

CO2: Explain the various CPU scheduling algorithms and synchronization (Understand)

CO3: Exemplify with handling deadlock mechanisms (Understand)

CO4: Evaluate various page replacement algorithms (Apply)

CO5: Exhibit file system structure and disk scheduling algorithms (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
CO2	2	1	-	-	-	-	-	-	-	-	-	1	2	1
CO3	2	1	-	-	-	-	-	-	-	-	-	2	2	1
CO4	3	2	1	-	-	-	-	-	-	-	-	2	2	2
CO5	3	2	1	-	-	-	-	-	-	-	-	2	2	2

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

SYLLABUS:**UNIT I OPERATING SYSTEM OVERVIEW**

9

Computer system overview – Memory hierarchy – Cache memory – Interrupts – Operating system overview – Objectives and functions – System calls – System programs – System boot.

UNIT II PROCESS MANAGEMENT

9

Process concepts – Process scheduling: short term, long term, medium term – CPU scheduling algorithms: Preemptive, Non preemptive scheduling, FCFS, SJF, SRTF, Priority, Round Robin – Inter process communications: Message passing, Shared memory, Critical sections, Mutual exclusion and synchronization: Classical problems for synchronization, Peterson's solution, Semaphore, Mutex.

UNIT III DEADLOCK MANAGEMENT 9

Principles of deadlock – Necessary conditions – Deadlock detection – Resource allocation graph – Deadlock avoidance – Banker's algorithm – Deadlock prevention – Deadlock recovery.

UNIT IV MEMORY MANAGEMENT 9

Main memory – Contiguous allocation – Fixed partitioning – Virtual memory – Paging – Segmentation – Swapping – Demand paging – Page replacement algorithms.

UNIT V STORAGE MANAGEMENT 9

File system structure – Allocation methods – Free space management – Disk structure – Disk scheduling algorithms – Swap space management – Case study – Linux system.

Contact Periods:

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

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.
2. William Stallings, "Operating Systems: Internals and Design Principles", 9th Edition, Pearson Education 2018.

REFERENCES:

1. Maurice J Bach, "The Design of the Unix Operating System", 3rd Edition, Pearson Education, 2017.
2. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems: A Spiral Approach", 1st Edition, Tata McGraw Hill Edition, 2010.
3. Achyut S.Godbole, Atul Kahate, "Operating Systems", 3rd Edition, Mc Graw Hill Education, 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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U21IT401	INTERNET PROGRAMMING	Category: PCC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITE:

- U21AD303 - Programming using Java

COURSE OBJECTIVES:

- To understand the basic structure and design of webpage using HTML and CSS
- To comprehend the client-side and server-side scripting using Java Script and PHP
- To develop database driven web applications using MySQL

COURSE OUTCOMES:

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

CO1: Illustrate web technology concepts and web page designing using HTML tags for structuring the documents on the web (Apply)

CO2: Develop web pages and apply styles using CSS to control the presentation of the web (Apply)

CO3: Design dynamic pages using JavaScript used to enhance client-side scripting (Apply)

CO4: Apply PHP programming concepts to develop dynamic web pages in server-side scripting (Apply)

CO5: Develop web applications with database connectivity to interact with databases (Apply)

CO-PO MAPPING:

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

SYLLABUS:**UNIT I HYPERTEXT MARKUP LANGUAGE 6 + 6**

Understanding elements – Describing data types –Formatting text with HTML elements – Arranging text – Displaying lists – Exploring hyperlinks and URL – Creating tables – Inserting Images, Exploring colors and canvas – Working with forms.

UNIT II CASCADING STYLE SHEETS 6 + 6

Evolution and syntax – Exploring selectors – Inserting CSS in HTML – Background and color properties – Font and text properties – Creating boxes and columns.



UNIT III DYNAMIC HTML AND JAVASCRIPTS
6 + 6

Features of Javascript – Usage in HTML document – Programming fundamentals – Functions and events – Built-in objects – Document object model – Form validation.

UNIT IV PHP
6 + 6

PHP - MySQL- Deciding on a Web application platform – PHP syntax- Comments – Variables – Types in PHP - Simple datatypes – Output statements. Control structures and functions: Boolean Expressions - Branching: - Looping – Functions and variables scope – Passing information with PHP – Arrays.

UNIT V MySQL
6 + 6

Databases and MySQL – PHP supported databases – Integrating PHP and MySQL performing Database queries: HTML Tables and database tables - Complex mappings - Creating the sample tables - Integrating web forms and databases: HTML Forms - Basic form submission to a database - Self-submission – Editing data with HTML form.

List of Experiments

1. Develop a static web page for an education institution using HTML
2. Design a web page using table formatting and images
3. Develop a web page using form control elements
4. Design a dynamic web page using inline, internal and external cascading style sheets
5. Construct a multicolumn layout web page using CSS with a responsive design
6. Write a JavaScript to validate form content of a webpage
7. Using DOM, add various elements and change the attributes of the web page dynamically using mouse events
8. Write a PHP program using arrays and user-defined functions
9. Develop SQL queries to manipulate a simple table containing student details in MySQL
10. Write a PHP code with MySQL connectivity for library management system

Contact Periods:

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

TEXT BOOKS:

1. DT Editorial Services, "HTML5 Black Book Covers CSS3, Javascript, HTML, XHTML, AJAX, PHP and JQuery, 2nd Edition, DreamTech Press, 2020.
2. Suehring Steve, Converse Tim, Park Joyce, "PHP 6 and MySQL6 Bible", 1st Edition, Wiley Publications, 2017.

REFERENCES:

1. Welling Luke, Thomson Laura, "PHP and MySQL Web Development", 5th Edition, Pearson Education, 2020.
2. Nixon Robin, "Learning PHP MySQL and Javascript with Jquery CSS and HTML5", 4th Edition, Shroff Publishers and Distributors Pvt Ltd., 2019

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 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 motivate the students 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.

CO2: Maintain open, effective, and Professional Communication.

CO-PO MAPPING:

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

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

SYLLABUS:**UNIT I VERBAL COMPETENCE**

5

Verbal Analogy - Spotting Errors - Ordering of Sentences – Effective Listening

UNIT II EFFECTIVE COMMUNICATION

5

Overcoming Communication Barriers - Body Language and its Etiquettes - Contextual Communication - 7C's of Communication

5

UNIT III INTERPERSONAL SKILLS

Group Decision Making - Paralanguage - Negotiation Skills - Preparation & Planning, Bargaining & Problem Solving - Closure & Implementation

Contact Periods:

Lecture: - Periods Tutorial: - Periods Practical: 15 Periods Project: – Periods
Total: 15 Periods

TEXT BOOKS:

1. Sharma, Prashant. "Soft Skills: Personality Development for Life Success." BPB Publications, 2022

B.Tech. – IT – R2021 – CBCS

2. Kumar, Suresh E., P Sreehari and J Savithri "Communication Skills and Soft Skills: An Integrated Approach." Dorling Kindersley, 2011

REFERENCES:

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

EVALUATION PATTERN:

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



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U21CS404	OPERATING SYSTEMS LABORATORY (Common to CB, CS, IT)	Category: PCC				
L	T	P	J	C		
0	0	2	0	1		

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn Unix commands and shell programming
- To implement various CPU Scheduling algorithms
- To implement process creation and inter process communication.
- To implement deadlock avoidance and deadlock detection algorithms
- To implement page replacement algorithms
- To implement file organization and file allocation strategies

COURSE OUTCOMES:

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

CO1: Compare the performance of various CPU scheduling algorithms (Understand)

CO2: Implement deadlock avoidance and detection algorithms (Apply)

CO3: Create processes and implement IPC (Apply)

CO4: Analyze the performance of the various page replacement algorithms (Analyze)

CO5: Implement files organization and file allocation strategies (Apply)

CO-PO MAPPING:

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

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

LIST OF EXPERIMENTS

1. Write programs using basic Unix commands and shell programming.
2. Write programs using process and file management system calls of UNIX operating system.
3. Develop programs to implement CPU scheduling algorithms (FCFS, SJF, SRTF, Priority, and Round Robin).
4. Developing application to implement Inter Process Communication using shared memory and pipes.
5. Develop a program to understand synchronization using producer-consumer problem.
6. Develop a program to understand deadlock avoidance using Banker's algorithm.
7. Develop programs to implement the page replacement algorithms (FIFO, Optimal, and LRU).

8. Develop programs to implement disk scheduling algorithms (FCFS, SSTF, SCAN, C-SCAN).
9. Implementation of the various file organization techniques (Sequential , Random and Serial)
10. Implementation of the following File allocation strategies
 - a) Sequential
 - b) Indexed
 - c) linked

Contact Periods:

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

REFERENCES:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.
2. William Stallings, "Operating Systems: Internals and Design Principles", Pearson Education, 9th Edition, 2018.
3. Maurice J Bach, "The Design of the Unix Operating System", 3rd Edition, Pearson Education, 2017.
4. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems: A Spiral Approach", 1st Edition, Tata McGraw Hill Edition, 2010.
5. Achyut S.Godbole, Atul Kahate, "Operating Systems", 3rd Edition, Mc Graw Hill Education, 2016.

EVALUATION PATTERN:

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

U21AD406	DATABASE LABORATORY (Common to AD & IT)	Category: PCC				
		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)

- Database Development Life cycle: Student should decide a case study and formulate.
 - Problem statement, Problem definition and Requirement analysis
 - Scope and Constraints
- 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
- Implement the database using SQL Data definition with Database Querying – Simple queries, Nested queries, Sub queries.
- Query the database using SQL Manipulation Insert, Select, Update, Delete and Joins(Inner, Outer and Equi).

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: 30 Periods	Project: 30 Periods
			Total: 30 Periods

TEXT BOOKS:

3. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc., 2018.
4. William Stallings, "Operating Systems: Internals and Design Principles", 9th Edition, Pearson Education 2018.

REFERENCES:

4. Maurice J Bach, "The Design of the Unix Operating System", 3rd Edition, Pearson Education, 2017.
5. Ramaz Elmasri, A. Gil Carrick, David Levine, "Operating Systems: A Spiral Approach", 1st Edition, Tata McGraw Hill Edition, 2010.
6. Achyut S.Godbole, Atul Kahate, "Operating Systems", 3rd Edition, Mc Graw Hill Education, 2016.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (Practical) (100 Marks)		Assessment II (Project) (100 Marks)			Practical Examinations (Examinations will be conducted for 100 Marks)
Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test	Review I	Review II	Review III	
		75	25	15	60
		25		25	50
		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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U21IT402	DESIGN STUDIO II	Category: EEC				
		L	T	P	J	C
		0	0	0	2	1

PRE-REQUISITES:

- U21IT302 - Design Studio I

COURSE OBJECTIVES:

- To inculcate the problem-solving & Innovation mindset
- To provide a platform for self-learning, experimenting, solving the real-world problems and to develop a product
- To enable hands-on experience for active learning

COURSE OUTCOMES:

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

CO1: Apply the problem-solving techniques (Design thinking & system thinking)

CO2: Create and validate low fidelity prototype / Experimental proof of concept (TRL 4)

CO3: Demonstrate teamwork, project management, technical report writing and presentation skills

CO-PO MAPPING:

POs Cos \ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	-	2	1	3	3
CO2	3	3	3	3	3	3	3	3	3	-	3	2	2	2
CO3	-	-	-	-	2	-	-	2	3	3	3	1	1	1

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

Course conduction:

- The students will be divided into batches (maximum 4 students / batch). They will be provided the space, time, resources, and a mentor for this design clinic 2 course.
- With the guidance of assigned mentor, the students will find & validate a problem statement, map to UNSGD, identify the skills required for the project and self-learn.
- Applying design thinking & system thinking concept the students will solve the problem and produce the version 1 of prototype. (TRL 4)
- The student will learn teamwork, project management, technical report writing and presentation skills through this course.

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

Total: 30 Periods

EVALUATION PATTERN:

Review 0 (Within 10 days of commencement of semester)	Review 1 (Between 35 th to 40 th working day)	Review 2 (Between 80 th to 90 th working day)	Total
0	40	60	100



SEMESTER V

U21ITG01	SOFTWARE ENGINEERING (Common to IT & AM)	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To describe the process of requirements gathering and analysis
- To focus on principles and proven software engineering practices, within the framework of unified processes
- To acquire the knowledge and abilities necessary to assist software testing projects with the usage modern testing technology

COURSE OUTCOMES:

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

- CO1:** Recognise several process models and the essential management tasks for software projects (Understand)
CO2: Interpret software engineering principles involved in building large software programs and process of requirements specification and requirements validation (Understand)
CO3: Recognise the principles of object orientation and model development (Understand)
CO4: Compare various testing strategies and assess their usefulness in the project through the use of modern tools (Apply)
CO5: Illustrate CASE tools for enhancing software development processes (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	-	-	-	-	-	-	-	3	2
CO2	2	2	3	2	1	-	-	-	-	-	-	-	3	2
CO3	2	2	1	1	-	-	-	-	-	-	-	-	3	2
CO4	-	3	2	2	3	-	-	-	-	-	3	-	3	2
CO5	2	2	2	2	3	-	-	-	3	-	-	3	3	2

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

SYLLABUS:**UNIT I SOFTWARE PROCESS MODELS**

9

Software - Software engineering- Software process - Work products - Importance of software Engineering - Standard for software process -Waterfall model - Prototyping model- Iterative enhancement model - Spiral Model - Rapid application development model - 4th Generation models - Formal methods – Agile development.

UNIT II UNDERSTANDING REQUIREMENTS

9

Functional and non-functional - User requirements - System requirements - Software requirements

document - Requirement engineering process: Feasibility studies - Requirements elicitation and analysis - Requirements validation and management.

UNIT III SOFTWARE DESIGN AND CODING

9

Design process - Data and behavioral modelling - Design concepts - Modularity - Architectural design - Coupling and cohesion - Top-down and bottom-up design - Object-oriented analysis - Function - Object-oriented design approach - Software design document - Coding styles and Documentation.

UNIT IV SOFTWARE TESTING

9

Software testing strategies - System testing - Debugging - White box testing - Black box testing - Model based testing - Testing for specialized environments, Architectures and applications - Testing Object-oriented and web based applications - User interface testing - Configuration testing - Security testing - Performance testing.

UNIT V COMPUTER AIDED SOFTWARE ENGINEERING

9

Computer Aided Software Engineering (CASE) and its scope - CASE support in software life cycle - Architecture of CASE environment - Upper CASE and lower CASE - Exposure to CASE tools - Software process improvement - Component based software engineering.

Contact Periods:

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

TEXT BOOKS:

1. Roger Pressman S., Bruce R. Maxim, "Software Engineering: A Practitioner's Approach", 9th Edition, McGraw- Hill, 2021.
2. Pankaj Jalote, "Software Engineering, A Precise Approach", 2nd Edition, Wiley India, 2020.

REFERENCES:

1. Ian Sommerville , "Software Engineering", 10th edition, Pearson, 2016.
2. Hans van Vliet, "Software Engineering: Principles and Practice", 4th Edition, Wiley, 2020.
3. Waman.SJawadekar, "Software Engineering: A Primer", 4th Edition, Tata McGraw-Hill, 2021.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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 V

U21ITG02	INFORMATION SECURITY (Common to IT & CS)	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21MA208 - 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	-	-	-	1	-	-	-	2	3	1
CO2	3	2	2	1	1	-	-	1	-	-	-	2	3	2
CO3	3	2	2	1	1	-	-	1	-	-	-	2	3	1
CO4	3	2	2	1	-	-	-	1	-	-	-	2	3	2
CO5	3	2	2	2	-	-	-	-	-	-	-	2	3	2

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

SYLLABUS:**UNIT I CLASSICAL ENCRYPTION**

9

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

UNIT II SYMMETRIC AND STREAM CIPHERS

9

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 BOOKS:

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, 3rd Edition, 2013.
3. <https://www.khanacademy.org/computing/computer-science/cryptography>.

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.



SEMESTER V

U21CB502	FORMAL LANGUAGES AND AUTOMATA THEORY (Common to IT & CB)	Category: PCC				
L	T	P	J	C		
3	0	0	0	3		

PRE–REQUISITE:

- U21MAG02 - Discrete Mathematics

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1: Understand the concept of finite automata for a given language with its types (Understand)

CO2: Understand the equivalence of languages described by finite automata and regular expressions (Understand)

CO3: Develop a CFG for a given language, simplify and transform to a normal form (Apply)

CO4: Design Push Down Automata and convert into CFG (Apply)

CO5: Apply Turing machine and prove the undecidability or complexity of a variety of problems (Apply)

CO-PO MAPPING:

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

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

SYLLABUS:**UNIT I FUNDAMENTALS OF FINITE AUTOMATA**

9

Central Concepts of Automata Theory – Alphabets, Strings, Languages, Problems – Finite Automata – Deterministic Finite Automata(DFA) – Non-deterministic Finite Automata(NFA) – Finite Automata with Epsilon Transitions – Equivalence of NFA and DFA – Equivalence of NFAs with and without Epsilon moves.

UNIT II REGULAR EXPRESSIONS AND LANGUAGES

9

Regular Expressions – Equivalence of Finite Automata and Regular Expressions – Pumping

lemma for regular sets – Closure properties of regular languages – Equivalence and minimization of automata.

UNIT III GRAMMARS
9

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

UNIT IV PUSHDOWN AUTOMATA
9

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

UNIT V TURING MACHINE AND UNDECIDABILITY
9

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

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

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

REFERENCES:

1. H.R.Lewis and C.H.Papadimitriou, "Elements of the theory of Computation", 2nd Edition, Prentice Hall of India, 2010.
2. Peter Linz, "An Introduction to Formal Language and Automata", 3rd Edition, Narosa Publishers, 2011.
3. Micheal Sipser, "Introduction to Theory of Computation", 3rd Edition, Cengage Publishers, 2014.

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.

SEMESTER V

U21CSG05	COMPUTER NETWORKS (Common to CS & IT)	Category: PCC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1: Summarize the network models and functionality of physical layer (Understand)

CO2: Understand Data-Link Layer Protocols and Media Access Control methods (Apply)

CO3: Analyze the IP addresses and routing protocols (Analyze)

CO4: Inspect transport layer protocols and Quality of Services (Understand)

CO5: Interpret the significance of different application layer protocols (Understand)

CO-PO MAPPING:

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

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

SYLLABUS:**UNIT I INTRODUCTION & PHYSICAL LAYER**

6

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

UNIT II DATA-LINK LAYER & MEDIA ACCESS

6

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



UNIT III NETWORKLAYER

6

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

UNIT IV TRANSPORTLAYER

6

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

UNIT V APPLICATIONLAYER

6

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

LIST OF EXPERIMENTS

1. Use commands like traceroute, tcpdump, ifconfig, netstat, and nslookup. Utilizing a network protocol analyzer, record ping and traceroute PDUs and investigate them.
 - a. The tcpdump command examines TCP/IP packets sent across networks when two end systems are connected via a specified interface.
 - b. Consider that the laboratory has 60 machines connected to the internet, use netstat commands to monitor incoming and outgoing network connections, view routing tables, interface statistics, etc.
 - c. The IP address has information about how to reach a specific host, especially outside the LAN. An IP address is a 32-bit unique address having an address space of 2³². Use ipconfig command to identify the IP address of a node in a network and tracert command to show connection details about the path that a packet takes from the computer or device you're on to whatever destination you specify.
2. You are assigned to configure the facility, which has ten computers. Now your job is to configure the network cable in the facility, which has two types of cables (a) cross-through cable and (b) straight-through cable.
 - a. First, use the color coding and understand how the cables are jacked with RJ45. You are assigned to crimp the two sides of the cable with a cross-through cable. Observe, understand, and experiment with the crimping process.
 - b. Second, use the color coding and understand how the cables are jacked with RJ45. You are assigned to crimp the two sides of the cable with different network end devices through the cable. Observe, understand, and experiment with the crimping process.
3. PC1(192.168.1.2) and PC2 (192.168.1.3) are to be configured to communicate with each other. You are about to use the switch as an intermediate device in this experiment. Configure Cisco 2960 switch with the two PCs mentioned above. Experiment and observe that the data transfer between two computers is reliable.
4. Two computers, PC1(192.168.1.2) and PC2 (192.168.2.3), from different networks must be configured to communicate with each other. In this experiment, you will use the router as an intermediate device. Configure Cisco 1841 ISR router with the two PCs mentioned above. Experiment and observe that the data transfers between two computers are reliable.
5. The communication between LAN and WAN is to be configured through Network Address Translation (NAT) as a border router. Create a NAT topology with three routers, RT1, RT2, and RT3. Configure static NAT on Router 2(RT2) while Router RT1 is configured in LAN and RT3 is configured in WAN. Use the following IP address to configure the router
 Router 1 (RT1) IP address: 192.168.1.2 (local)

Router 3 (RT3) IP address: 110.120.1.2 (local)

Router 2 (RT2) IP address: 110.120.1.2 (global)

After configuring the IP address, check the packet situation by opening debug with the "debug ip icmp" command. Observe and under the displayed.

Now configure the NAT using packet tracer (use the manual to configure). Experiment with different configuration scenarios and check the packet situation between LAN and WAN.

6. The routing information protocol (RIP) is used in this experiment to understand the hop count as a routing metric to find the most suitable route between the source and destination network. Configure RIP across the network and set up end devices to communicate on the network by enabling and verifying RIP commands. Create a routing table consisting of the following parameters: device name, IP address, subnet mask, and default gateway. Assign RIP route to a particular router and verify the network by pinging the IP address of any PC.
7. The client-server communication is studied in this experiment using socket programming to understand the UDP protocol. The server program and client program is executed separately. Initially, the UDP socket is created at the server and client sides. The binding is carried with the server address. Ensure that the client initiates the communication. Check the response of the client from the server side. Process the datagram packet and send a reply to the client. Observer that the data transfer between Client and Server occurred.
8. The client-server communication is studied in this experiment using socket programming to understand the TCP protocol. The server program and client program are executed separately. Initially, the TCP socket is created on the server and client sides. The binding is carried with the server address. Ensure that the client initiates the communication. Check the response of the client from the server side. Process the packet and send a reply to the client. Observer and ensure that the data transfers between Client and Server are reliable.
9. The active and passive File Transfer Protocol is studied in this experiment to understand the basic communication architecture between client and server. The server and client program with the following IP address should be used

Server: 127.0.0.1

Client: 192.168.x.x

Active FTP: Write the client and server program and ensure that client initiates a session via a command channel request and the server creates a data connection back to the client and begins transferring data. Use Wireshark to snip the data packets. Experiment and observer the above by enabling and disabling the local firewall.

Passive FTP: Write the client and server program and ensure that server uses the command channel to send the client information to open the data channel and ensure that the transfer has begun. Use Wireshark to snip the data packets. Experiment and observer the above by enabling and disabling the local firewall.

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, Tata McGraw–Hill, New Delhi, 2015.
2. J.F. Kurose, K.W. Ross, "Computer Networking: A Top-Down Approach", 5th Edition, Addison- Wesley, 2017.



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REFERENCES:

1. Larry L. Peterson, Bruce S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufmann Publishers Inc., 2012.
2. William Stallings, "Data and Computer Communications", 10th Edition, Pearson Education, 2013.
3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, "Computer Networks: An Open Source Approach", 1st Edition, McGraw Hill Publisher, 2011.

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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U21SSG02	SOFT SKILLS - II	Category: HSMC				
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 Activity.

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

TEXT BOOKS:

- Prashant Sharma, "Soft Skills: Personality Development for Life Success", BPB Publications, 1st Edition, 2022.
- Leader Interpersonal and Influence Skills: The Soft Skills of Leadership." 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 V

U21ITG03	INFORMATION SECURITY LABORATORY (Common to IT & CS)	Category: ESC				
		L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- U21MA208 - 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	2	-	-	1	2	-	-	2	-	3
CO2	3	2	2	2	2	-	-	1	2	-	-	2	-	3
CO3	3	2	2	2	2	-	-	1	2	-	-	2	-	3
CO4	3	2	2	2	2	-	-	1	2	-	-	2	-	3
CO5	3	2	2	2	2	-	-	1	2	-	-	2	-	3

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
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 BlumShuband 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, $\alpha=3$, 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 $\alpha=2$. 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

TEXT BOOKS:

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. William Stallings, "Cryptography and Network Security - Principles and Practices", Pearson Education, 7th Edition, 2017
2. Behrouz A Forouzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", Tata McGraw Hill, 3rd Edition, 2011
3. Atulkahate, "Cryptography and Network Security", Tata Mcgraw Hill, 4th Edition, 2017
4. Douglas R Stinson, "Cryptography - Theory and Practice", Chapman and Hall / CRC Press, Std Edition, 2018
5. <https://www.khanacademy.org/computing/computer-science/cryptography>

EVALUATION PATTERN:

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





SEMESTER V

U21IT501	PROTO STUDIO I	Category: EEC				
L	T	P	J	C		
0	0	0	2	1		

PRE-REQUISITES:

- U21IT402 - Design Studio - II

COURSE OBJECTIVES:

- To inculcate the problem-solving & Innovation mindset
- To provide a platform for self-learning, experimenting, solving the real-world problems and to develop a product
- To enable hands-on experience for active learning

COURSE OUTCOMES:

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

CO1: Apply the problem-solving techniques (Design thinking & system thinking)

CO2: Create Minimum Viable Prototype (TRL 5)

CO3: Analyze product to technology fit

CO4: Demonstrate teamwork, project management, technical report writing and presentation skills

CO-PO MAPPING:

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

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

Course conduction:

- The students will be divided into batches (maximum 4 students / batch). They will be provided the space, time, resources, and a mentor.
- With the guidance of assigned mentor, the students will find & validate a problem statement, map to UNSGD, identify the skills required for the project and self-learn.
- Applying the design thinking concept, the student will provide a solution and produce the version 1 of prototype.
- The student will learn teamwork, project management, product development, technical report writing and presentation skills through this course.

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Contact Periods:

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

EVALUATION PATTERN:

Review 0 (Within 10 days of commencement of semester)	Review 1 (Between 35 th to 40 th working day)	Review 2 (Between 80 th to 90 th working day)	Total
0	40	60	100



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U21IT601	MACHINE LEARNING TECHNIQUES	Category: PCC				
L	T	P	J	C		
3	0	0	0	0	3	

PRE–REQUISITES:

- U21CSG02 - Python Programming
- U21MA403 – Probability and Queuing Theory

COURSE OBJECTIVES:

- To describe the fundamental concepts of machine learning and the process of similarity based learning, regression techniques, decision tree induction algorithms and Bayesian techniques
- Focuses on support vector machine, Ensemble learning, Clustering algorithms and Reinforcement learning
- To acquire the knowledge and abilities necessary to assist machine learning projects with the usage modern testing technology

COURSE OUTCOMES:

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

CO1: Describe the basic concepts of machine learning data, concept learning and life cycle (Understand)

CO2: Apply similarity-based learning and regression analysis for real time datasets (Apply)

CO3: Examine decision tree learning and rule-based learning concepts for predictive analytics (Apply)

CO4: Construct bayesian learning, probabilistic and support vector machine models for real time problems (Apply)

CO5: Demonstrate ensemble learning, clustering algorithms and working with machine learning pipeline (Apply)

CO-PO MAPPING:

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

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

SYLLABUS:**UNIT I INTRODUCTION**

9

Machine learning – Types of machine learning – Challenges of machine learning – Machine learning process and applications –Data analytics –Descriptive statistics– Univariate, Bivariate and Multivariate data – Feature engineering – Dimensionality reduction techniques– Learning and its types.

UNIT II **SIMILARITY BASED LEARNING AND REGRESSION ANALYSIS**

9

Similarity based learning – Nearest neighbor learning – Weighted K-Nearest neighbor algorithm – Nearest centroid classifier – Introduction to regression – Linear regression – Multiple linear regression.

UNIT III DECISION TREE LEARNING

9

Decision tree learning model – Decision tree induction algorithms: ID3 tree construction – C4.5 construction – Classification and regression trees construction – Regression trees – Validating and pruning of decision trees.

UNIT IV BAYESIAN LEARNING AND SUPPORT VECTOR MACHINES

9

Probability based learning – Bayes theorem – Classification using bayes model – Naïve bayes algorithm for continuous attributes – Introduction to support vector machine – Optimal hyperplane – Functional and geometric margin – Hard margin – Soft margin – Kernels and non-linear SVM.

UNIT V ENSEMBLE LEARNING, CLUSTERING ALGORITHMS AND REINFORCEMENT LEARNING 9

9

Parallel ensemble models – Incremental ensemble models – Sequential ensemble models – Clustering approaches – Hierarchical clustering algorithms – Partitional Clustering algorithm – Reinforcement learning – Reinforcement learning as machine learning – Components – Markov decision process.

Contact Periods:

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

TEXT BOOK:

1. Andreas C. Müller, Sarah Guido, "Introduction to Machine Learning with Python", 1st Edition, O'Reilly Media, Inc., 2016.

REFERENCES:

1. David Forsyth, "Applied Machine Learning", 1st Edition, Springer, 2019.
 2. M.Gopal, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, O'Reilly Media, 2019.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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 VI

U21ECG05	EMBEDDED SYSTEMS AND IOT (Common to EC & IT)	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn about embedded processor, its hardware and software
- To acquaint with interfacing of sensors and actuators with controllers
- To apply Internet of Things techniques in real time applications

COURSE OUTCOMES:

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

- CO1:** Explain the real time embedded system and its components (Understand)
CO2: Illustrate the architecture of microcontroller based devices (Understand)
CO3: Compare various communication technologies for IoT applications (Analyze)
CO4: Develop an IoT based system for the given application (Analyze)
CO5: Apply knowledge of IoT and Cloud interface for application development (Apply)

CO-PO MAPPING:

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

SYLLABUS:**UNIT I FUNDAMENTALS OF EMBEDDED SYSTEM DESIGN 9**

Embedded system (ES) – Architecture, characteristics, types – Embedded system on chip (SOC) – Components of embedded system – Hardware and software – Power supply – Types, characteristics, selection criteria – Design process.

UNIT II OVERVIEW OF MICROCONTROLLER 9

8-bit Micro controllers - ARM: ARM Architecture and Organization – Registers – ARM Instruction Set – Timers – Interfacing – LED – ADC – ARM programming in embedded C – IDE's for ARM- Interrupt Handling --External Memory Interface.

UNIT III IoT ARCHITECTURE AND COMMUNICATION TECHNOLOGIES 9

Internet of Things – IoT architectural overview – M2M and IoT technology fundamentals – Devices and gateways – IoT protocols – MQTT – CoAP – XMPP – IoT Communication technologies – Bluetooth – Zigbee.

UNIT IV IoT DESIGN AND PROGRAMMING 9

Types of sensors – Temperature, humidity and PIR – Introduction to ESP8266 – Tools used for programming-Functions and loops used in programming- Creating a Webserver on NodeMCU– Analog and Digital sensor interfacing with NodeMCU.

UNIT V IoT- CLOUD INTERFACING AND CASE STUDY 9

Cloud storage models – Communication API – Cloud for IoT – Case Studies – Home intrusion detection – Weather monitoring system – Air pollution monitoring – Smart irrigation.

Contact Periods:

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

TEXT BOOKS:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, VPT, 2017.
2. Lyla B. Das, " Embedded Systems: An Integrated Approach" , 1st bedition, Pearson Education, 2013 .

REFERENCES:

1. Dogan Ibrahim, "ARM Based Microcontroller Projects using mbed",1st edition, Newnes Publications, 2019.
2. Raj Kamal, "Embedded Systems Architecture, Programming and Design",3rdedition, McGraw-Hill Higher Education, 2017.
3. T. Bansod, Pratik Tawde, "Microcontroller Programming (8051, PIC, ARM7 ARM Cortex)", Original edition, Shroff Publishers & Distributors Pvt. Ltd, 2017.
4. Steve Furber, "ARM System-on-Chip Architecture", 2ndedition, Pearson Education, 2015.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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 VI**

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

PRE–REQUISITES:

- U21CSG02 –Soft skills - II

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, 2010.

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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U21IT602	MACHINE LEARNING TECHNIQUES LABORATORY	Category: PCC				
L	T	P	J	C		
0	0	4	0	2		

PRE–REQUISITES:

- U21CSG02 - Python Programming

COURSE OBJECTIVES:

- To create dataset and explore the statistical operations
- To implement similarity based learning and regression algorithms
- To implement decision trees, regression trees and clustering techniques

COURSE OUTCOMES:

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

CO1: Create dataset and explore statistical operations for the same (Apply)

CO2: Implement similarity based learning and regression algorithms with sample dataset for real time applications (Apply)

CO3: Implement decision trees and regression trees with sample dataset for making prediction (Apply)

CO4: Apply clustering methods with sample dataset in unsupervised learning algorithms (Apply)

CO-PO MAPPING:

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

LIST OF EXPERIMENTS

The following experiments are to be implemented using Python programming language.

- Create a sample dataset and explore statistical operations using Pandas and visualize the results through plots.
- Implement K-Nearest Neighbor Algorithm.
- Implement linear regression Algorithm.
- Implement multiple linear regression Algorithm.
- Implement and demonstrate decision tree based ID3 algorithm.
- Implement and demonstrate regression trees.
- Implement and demonstrate the working of Naive Bayesian classifier.

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8. Implement Random forest classifier for a real time dataset.
9. Implement Adaboost model and compare its working with Random forest classifier.
10. Implement K-Means clustering algorithm.
11. Develop mini project by collecting the real time dataset, pre-processing the data, applying different machine learning algorithms and evaluate the performance of each algorithm. Prepare the mini project report.

Contact Periods:

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

TEXT BOOK:

1. Andreas C. Müller, Sarah Guido, "Introduction to Machine Learning with Python", 1st Edition, O'Reilly Media, Inc., 2016.

REFERENCES:

1. David Forsyth, "Applied Machine Learning", 1st Edition, Springer, 2019.
2. M.Gopal, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", 2nd Edition, O'Reilly Media, 2019.
3. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
4. <https://www.geeksforgeeks.org/machine-learning-with-python/>

EVALUATION PATTERN:

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


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U21ECG06	EMBEDDED SYSTEMS AND IOT LABORATORY (Common to EC & IT)	Category: PCC				
		L	T	P	J	C
		0	0	2	2	2

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the working of Arduino and ARM processor
- To write programs to interface the peripheral devices with ARM processor
- To design and develop IoT based projects for real time application

COURSE OUTCOMES:

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

CO1: Construct an LED based running display with different brightness level (Apply)

CO2: Develop an LCD based system for character display (Analyze)

CO3: Experiment with ARM Processor for speed control of stepper motor (Apply)

CO4: Utilize the IoT platform for data transmission and reception (Apply)

CO5: Implement the concept of IoT for providing solutions to real world applications (Create)

CO-PO MAPPING:

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

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

LIST OF EXPERIMENTS

1. Interfacing LED to toggle at equal time delay using Arduino
2. Interfacing of LED circuit for various intensity levels with different duty cycles using LPC2148 and MSP430
3. Display a character in a 16x2 LCD using LPC2148
4. Stepper motor to rotate in clockwise and anti-clockwise direction using LPC2148
5. Real Time Clock using LPC2148
6. PIR sensor based object detection using LPC2148
7. IoT based Gas monitoring system using MQ5 sensor

AUGMENTED EXPERIMENTS

1. Study and implement an Arduino based IoT application with Thing Speak Cloud
2. IoT based Smart power saving system for home automation
3. Firebase web app for home automation

TYPICAL PROJECTS (INDICATIVE)

1. Temperature Logging System using ESP8266
2. Air Pollution Meter
3. ESP8266 based Colour Sorting Machine
4. Humidity controller
5. Distance measurement
6. Flame detection and E - notification
7. Smart blind stick
8. Water level monitoring system
9. Smart dust bin
10. Room temperature control using LM35 sensor

Contact Periods:

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

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (Practical) (100 Marks)		Assessment II (Project) (100 Marks)			Practical Examinations (Examinations will be conducted for 100 Marks)
Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)	Test	Review I	Review II	Review III	
75	25	15	25	60	
25	25			50	
50				50	
Total: 100					

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SEMESTER VI

U21IT603	PROTO STUDIO II	Category: EEC				
		L	T	P	J	C
		0	0	0	2	1

PRE–REQUISITE:

- U21IT501-Proto Studio I

COURSE OBJECTIVES:

- To inculcate the problem-solving & Innovation mindset
- To provide a platform for self-learning, experimenting, solving the real-world problems and to develop a product.
- To enable handson experience for active learning

COURSE OUTCOMES:

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

CO1: Apply the problem-solving techniques (Design thinking & system thinking)

CO2: Create Minimum Viable Prototype (TRL 6)

CO3: Analyze product to market fit

CO4: Develop a business model

CO5: Demonstrate teamwork, project management, technical report writing and presentation skills

CO-PO MAPPING:

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

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

COURSE CONDUCTION:

- The students will be divided into batches (maximum 4 students / batch). They will be provided the space, time, resources, and a mentor for this Proto clinic 2 course.
- With the guidance from assigned mentor, the students will find & validate a problem statement, map to UNSGD, identify the skills required for the project and self-learn.
- Applying the design thinking concept, the students will provide a solution and produce the version 1 of prototype.
- The student will learn teamwork, project management, product development, technical report writing and pitching through this course.

Lecture: –

Tutorial: –

Practical: -

Project: -30 Periods

Total: 30 Periods

EVALUATION PATTERN:

Review 0 (Within 10 days of commencement of semester)	Review 1 (Between 35 th to 40 th working day)	Review 2 (Between 80 th to 90 th working day)	Total
0	40	60	100



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U21IT701	SOFTWARE PROJECT MANAGEMENT	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- U21ITG01 - Software Engineering

COURSE OBJECTIVES:

- To understand the Software project planning, evaluation techniques, activity planning and risk management principles
- To plan and manage projects at each stage of the software development life cycle (SDLC)
- To be familiar with the different methods and techniques used for project management

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: Illustrate the cost and effort estimation techniques to various software development life cycle models (Apply)
CO4: Implement project plans using various charts and identify challenges within the project life cycle (Apply)
CO5: Demonstrate project management principles while acquiring understanding of the staff selection process and resolving issues associated with people management (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	2
CO2	2	1	1	-	-	-	-	-	2	-	2	-	2	2
CO3	3	2	1	2	2	-	-	-	2	2	3	-	2	2
CO4	3	2	1	2	2	-	-	-	1	2	3	-	2	2
CO5	3	1	1	2	-	-	-	-	1	2	3	-	2	2

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.

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 and 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 Cotterell and Rajib Mall, "Software Project Management", 5thEdition, Tata McGraw Hill, 2022.

REFERENCES:

1. Gopalaswamy Ramesh, "Managing Global Software Projects", McGraw Hill Education, 14th Reprint, 2017.
2. Robert K. Wysocki, "Effective Software Project Management", 6th Edition,Wiley Publication,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 / 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.

U21IT702	CLOUD COMPUTING	Category: PCC				
L	T	P	J	C		
3	0	0	0	0	3	

PRE-REQUISITES:

- U21CSG02 – Python Programming
- U21CS403 – Operating Systems

COURSE OBJECTIVES:

- To understand the concepts of virtualization and virtual machines
- To explore and experiment with various Cloud deployment environments
- To learn about the security issues in the cloud environment

COURSE OUTCOMES:

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

CO1: Understand the design challenges in the cloud (Understand)

CO2: Apply the concept of virtualization and its types (Apply)

CO3: Utilize virtualization techniques for efficient hardware resource management and apply Docker (Apply)

CO4: Develop and deploy services on the cloud and set up a cloud environment (apply)

CO5: Explain security challenges in the cloud environment (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	3	3
CO2	3	2	2	2	1	-	-	-	-	-	-	1	3	3
CO3	2	2	2	2	1	-	-	-	-	-	-	1	3	3
CO4	1	2	3	2	2	-	-	-	-	-	-	1	3	3
CO5	2	2	3	1	2	-	-	-	-	-	-	1	3	3
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:**UNIT I CLOUD ARCHITECTURE**

9

System models for distributed and cloud computing – NIST cloud computing reference architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural design of compute and storage clouds – Design challenges.

UNIT II VIRTUALIZATION

9

Virtual machine basics – Taxonomy of virtual machines – Hypervisor – Key concepts – Virtualization structure – Implementation levels of virtualization – Virtualization types: Full virtualization– Para virtualization – Hardware virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER

9

Desktop virtualization – Network virtualization – Storage virtualization – System-level of operating virtualization – Application virtualization – Virtual clusters and Resource management – Containersvs. Virtual machines – Introduction to Docker – Docker components – Docker container– Docker images and repositories.

UNIT IV CLOUD DEPLOYMENT ENVIRONMENT

9

Google app engine – Amazon AWS – Microsoft Azure; Cloud software environments-Eucalyptus – OpenStack.

UNIT V CLOUD SECURITY

9

Virtualization system-Specific attacks: Guest hopping – VM migration attack – hyperjacking. Data security and storage; Identity and access management (IAM) - IAM challenges - IAM architecture and practice.

Contact Periods:

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

TEXT BOOKS:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", 1st Edition, Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", 1st Edition, O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", 1st Edition, Wiley Publishing, 2010.

REFERENCES:

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", 1st Edition, Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", 1st Edition, O'Reilly Media, Inc., 2009.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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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U21IT703	DESIGN PATTERNS	Category: PCC				
L	T	P	J	C		
3	1	0	0	4		

PRE–REQUISITES:

- U21AD303 – Programming using Java
- U21ITG01 – Software Engineering

COURSE OBJECTIVES:

- To analyze the problem to implement a solution
- To comprehend the most crucial design patterns and adeptly apply object-oriented techniques
- To understand the differences between structural patterns and behavioural patterns of a model

COURSE OUTCOMES:

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

CO1: Describe the design patterns that are common in software applications (Understand)

CO2: Narrate the patterns related to object oriented design (Understand)

CO3: Illustrate the complex software design problems (Analyze)

CO4: Develop hands-on experience by implementing design patterns in real time projects (Apply)

CO5: Demonstrate the design pattern to ensure optimal performance, correctness, and adherence to established software design principles (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
CO2	2	-	1	-	-	-	-	-	-	-	1	-	2	2
CO3	3	2	1	2	-	-	-	-	-	-	2	-	2	2
CO4	3	2	1	2	2	-	-	-	-	-	2	-	2	2
CO5	3	2	1	2	2	-	-	-	-	-	2	-	2	2
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:**UNIT I INTRODUCTION** 9+3

Design pattern – Design patterns in Smalltalk – Catalog of Design patterns Organizing the catalog – Design patterns solve design problems – Select a design pattern – Design pattern usage.

UNIT II DESIGNING DOCUMENT EDITOR 9+3

A case study: Design problems – Document structure – Formatting – Embellishing the User Interface– Supporting multiple look and feel standards – Supporting multiple windows – User operations – Spelling checking and hyphenation.

UNIT III DESIGN PATTERN CATALOG 9+3

Structural Pattern– Adapter– Bridge– Composite– Decorator– Facade– Flyweight– Proxy.

UNIT IV BEHAVIORAL PATTERNS
9+3

Chain of Responsibility– Command– Interpreter– Iterator– Mediator– Memento– Observer– Discussion of Behavioral Patterns.

UNIT V PATTERN CONCLUSION
9+3

Expect from Design Patterns – The Pattern Community– An Invitation– A Parting Thought.

Contact Periods:

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

TEXT BOOK:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, "Design Patterns: Elements of Reusable Object – Oriented Software", 1st Edition, Addison-Wesley, 2015

REFERENCES:

1. Eric Freeman , Elisabeth Robson, Head First Design Patterns: Building Extensible and Maintainable Object-Oriented Software, 2nd Edition, Orelly, 2020
2. Shalloway, Design Patterns Explained, 2nd Edition, Addison Wesley, 2016
3. Devendra Singh; "Java design patterns", 1st Edition, Pearson, 2019

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*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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U21IT704	CLOUD COMPUTING LABORATORY	Category: PCC				
L	T	P	J	C		
0	0	4	0	2		

PRE–REQUISITES:

- U21CSG01 – Python Programming
- U21CS403 -Operating Systems

COURSE OBJECTIVES:

- To implement virtualization and virtual machines using operating system
- To Develop Web applications using Google App Engine
- To explore security issues and storage requirement in the cloud environment

COURSE OUTCOMES:

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

CO1: Configure various virtualization tools such as Virtual Box, VMware workstation (Apply)

CO2: Apply cloud technology principles and to demonstrate the development of a web application by leveraging cloud services (Apply)

CO3: Develop and deploy services on the cloud and set up a cloud environment (Apply)

CO4: Experiment with virtualization of hardware resources and Docker (Apply)

CO5: To gain knowledge about security challenges in the cloud environment (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	3	3
CO2	2	1	2	2	1	-	-	-	1	-	-	1	3	3
CO3	2	2	2	3	1	-	-	-	1	-	-	1	3	3
CO4	1	2	2	3	2	-	-	-	1	-	-	1	3	3
CO5	1	2	1	1	1	-	-	-	1	-	-	1	3	3
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. Install Virtual box/VMware/ Equivalent open-source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs.
3. Installation of AWS management console.
4. Development of Web Applications using AWS EC²
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.

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6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Install Hadoop single node cluster and run simple applications like wordcount.
8. Creating and Executing Your First Container Using Docker.
9. Run a Container from Docker Hub.
10. Data storage and security using cloud platform.

Contact Periods:

Lecture: – Periods

Tutorial: – Periods

Practical: 60 Periods

Project: – Periods

Total: 60 Periods

TEXT BOOKS:

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", 1st Edition, Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", 1st Edition, O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", 1st Edition, Wiley Publishing, 2010.

REFERENCES:

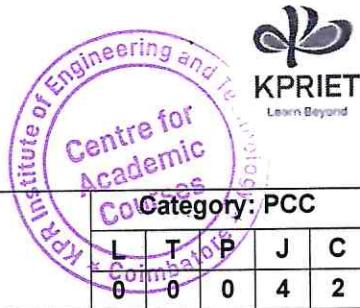
1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", 1st Edition, Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", 1st Edition, O'Reilly Media, Inc., 2009.

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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U21IT705	PROJECT WORK PHASE - I	Category: PCC				
		L	T	P	J	C
		0	0	0	4	2

PRE-REQUISITES:

- NIL

COURSE OBJECTIVES:

- To enhance the capacity to recognize and address particular problems within the realm of Information Technology
- To establish objectives and outline the methodology for executing a project that contributes value to both society and the knowledge base of Information Technology

COURSE OUTCOMES:

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

- CO1: Integrate and synthesize knowledge acquired from diverse and multiple topic areas (Apply)
 CO2: Recognize the complexities inherent in designing solutions for real-world problems (Analyze)
 CO3: Design and develop a novel approach to problem-solving, leveraging analytical and problem-solving skills (Apply)
 CO4: Highlight the significance of teamwork in the process of developing solutions for real-world problems (Apply)
 CO5: Acquire hands-on experience in the field of Information Technology (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	2	2	3	3	2	2	3	3
CO2	2	3	2	3	2	2	2	2	3	3	2	2	3	3
CO3	3	2	2	3	2	2	2	2	3	3	2	2	3	3
CO4	3	2	2	3	2	2	2	2	3	3	2	2	3	3
CO5	2	2	2	3	2	2	2	2	3	3	2	2	3	3

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

STRATEGY:

To identify a topic of interest in consultation with Faculty/Supervisor. Conduct a comprehensive review of relevant literature and gather information related to the chosen subject. Clearly articulate the objectives and formulate a methodology to attain them. Proceed with the design, fabrication, or coding phase. Showcase the uniqueness of the project through the presentation of results and outputs.

Contact Periods:

Lecture: – Periods

Tutorial: – Periods

Practical: - Periods

Project: 60 Periods

Total: 60 Periods

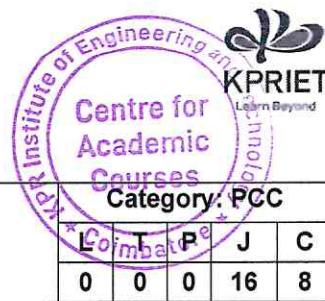
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EVALUATION PATTERN:

Continuous Internal Assessments (60 Marks)			End Semester Examinations (40 Marks)			
Review I	Review II	Review III	Project Report		Viva-Voce	
10	20	30	Supervisor	External	Internal	External
			10	10	10	10



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U21IT801	PROJECT WORK PHASE - II	
		Category: PCC
	L Coimbatore	J C
	0 0 0	16 8

PRE-REQUISITES:

- NIL

COURSE OBJECTIVES:

- To deploy the suggested solutions on the intended platform and put them into practice based on the design documents.
- To develop a communication skill to work in a collaborative environment
- Develop a comprehensive project report and presentation

COURSE OUTCOMES:

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

- CO1:** Identify, formulate and analyze the problem statements with appropriate consideration of societal needs (Analyze)
- CO2:** Illustrate the solution for the problem utilizing modern tools in the context of information technology (Apply)
- CO3:** Apply ethical principles and professional practices throughout the project (Apply)
- CO4:** Evaluate and integrate the findings to offer solutions for real-life problems (Analyze)
- CO5:** Demonstrate the working model either individually or collaboratively as a team, and compile the outcomes in the form of technical reports (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	2	2	3	3	2	2	3	3
CO2	2	3	2	3	2	2	2	2	3	3	2	2	3	3
CO3	3	2	2	3	2	2	2	2	3	3	2	2	3	3
CO4	3	2	2	3	2	2	2	2	3	3	2	2	3	3
CO5	3	2	2	3	2	2	2	2	3	3	2	2	3	3

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

STRATEGY:

To identify a topic of interest in consultation with Faculty/Supervisor. Conduct a comprehensive review of relevant literature and gather information related to the chosen subject. Clearly articulate the objectives and formulate a methodology to attain them. Proceed with the design, fabrication, or coding phase. Showcase the uniqueness of the project through the presentation of results and outputs.

Contact Periods:

Lecture: – Periods

Tutorial: – Periods

Practical: - Periods

Project 240 Periods

Total 240 Periods

EVALUATION PATTERN:

Continuous Internal Assessments (60 Marks)			End Semester Examinations (40 Marks)			
Review I	Review II	Review III	Project Report		Viva-Voce	
10	20	30	Supervisor	External	Internal	External
			10	10	10	10



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VERTICAL I
COMPUTATIONAL ANALYTICS

U21ADP01	MATHEMATICAL FOUNDATION FOR DATA SCIENCE	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITE:

- 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	2	2
CO2	3	2	2	2	-	-	-	-	-	-		-	1	1	2
CO3	3	2	2	2	2	-	-	-	-	-		-	2	1	2
CO4	3	3	3	3	2	-	-	-	2	-		-	2	2	2
CO5	3	3	3	3	3	-	-	-	2	-		-	2	2	2

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.

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", 5th Edition, Wellesley-Cambridge Press, 2016.
2. Bendat, J. S. and A. G. Piersol. "Random Data: Analysis and Measurement Procedures", 4th Edition, John Wiley & Sons, Inc., 2010.

REFERENCES:

1. Montgomery, D. C. and G. C. Runger. "Applied Statistics and Probability for Engineers" 5th Edition, John Wiley & Sons, Inc., 2011.
2. David G. Luenberger, "Optimization by Vector Space Methods", John Wiley & Sons, 1969.
3. Cathy O'Neil and Rachel Schutt, "Doing Data Science", 3rd Edition, O'Reilly Media, 2013.

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.

U21ADP02	PATTERN RECOGNITION	Category: PEC				
L	T	P	J	C		
3	0	0	0	3		

PRE–REQUISITE:

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

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 BOOK:

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				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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U21ADP03	SPEECH PROCESSING AND ANALYTICS	Category: PEC				
L	T	P	J	C		
3	0	0	0	3		

PRE–REQUISITE:

- 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, 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 Rabiner, Biing-Hwang Juang, "Fundamentals of Speech Recognition", 1st Edition, Pearson Education, 2003.

REFERENCES:

1. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing", 2nd Edition, California Technical Publishing, 1999.
2. Thomas F Quatieri, "Discrete-Time Speech Signal Processing – Principles and Practice", 1st Edition, Pearson Education, 2001.
3. Claudio Beccetti, Lucio Prina Ricotti, "Speech Recognition", 1st Edition, John Wiley and Sons, 1999.
4. Ben gold, Nelson Morgan, "Speech and audio signal processing", processing and perception of speech and music, 1st Edition, Wiley- India, 2006.

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.

U21ADP04	WEB MINING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- 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	-	-	-	-	-	-	-	2	1
CO2	1	1	1	-	1	-	-	-	-	-	-	-	2	1
CO3	1	1	1	-	1	1	-	-	-	-	-	-	2	2
CO4	1	2	2	2	1	-	-	-	-	-	-	-	1	3
CO5	1	1	-	1	1	1	-	-	-	-	1	1	3	2

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.

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 BOOK:

1. Bing Liu, "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data", 2nd Edition, Springer Publications, 2011.

REFERENCES:

1. Jiawei Han, Micheline Kamber, "Data Mining: Concepts and Techniques", 2nd Edition, Elsevier Publications, 2017.
2. Anthony Scime, "Web Mining : Applications and Techniques", 1st Edition, Idea group publishing, 2004.
3. Soumen Chakrabarti, "Mining the Web: Discovering Knowledge from Hypertext Data", 1st Edition, 2006.

EVALUATION PATTERN:

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

U21ADP05	EXPLORATORY DATA ANALYSIS AND VISUALIZATION	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- 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	2
CO2	3	3	3	-	3	2	-	-	-	-	-	-	2	3	2
CO3	3	3	3	-	3	2	-	-	-	-	-	-	2	3	2
CO4	3	3	3	2	3	2	-	-	-	-	-	-	2	3	3
CO5	3	3	3	2	3	2	-	-	-	-	-	-	2	3	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.

UNIT III BASICS OF DATA VISUALIZATION

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

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

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:

- Allen B. Downey, "Exploratory Data Analysis", 2nd Edition, Think Stats, 2014.
- Eric Pimpler, "Data Visualization and Exploration with R", Geo Spatial Training service, 1st Edition, 2017.

REFERENCES:

- Glenn J. Myatt, and Wayne P. Johnson, "Making Sense of Data II: A Practical Guide to Data Visualization, Advanced Data Mining Methods, and Applications", 1st Edition, John Wiley, 2009.
- Claus.O.Wlike, Fundamentals of Data Visualization, A primer on making informative and compelling Figures, 1st Edition, O'Reilly Publications, 2019.

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.



U21ADP06	PREDICTIVE ANALYTICS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- 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	-	-	-	-	-	-	-	-	-	2	1
CO2	3	3	3	-	-	-	-	-	-	-	-	-	2	1
CO3	2	2	2	-	-	-	-	-	-	-	-	-	2	1
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	3
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	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 – 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", 1st Edition, Wiley, 2014.
2. Jiawei Han and MichelineKamber, "Data Mining Concepts and Techniques", 3rdEdition, Elsevier, 2012.

REFERENCES:

1. Conrad Carlberg, "Predictive Analytics: Microsoft Excel", 1stEdition, Que Publishing, 2012.
2. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", 1st Edition, Wiley, 2014 .
3. Anasse Bari, Mohamed Chaouchi, Tommy Jung, Predictive Analytics for Dummies, 2nd Edition, Wiley, 2017.

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.

Code	Course Name	Category:	PEC				
			L	T	P	J	C
U21ADP07	TIME SERIES ANALYSIS AND FORECASTING		3	0	0	0	3

PRE–REQUISITE:

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

SYLLABUS:**INTRODUCTION TO FORECASTING**

9

UNIT I

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 – 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 non-stationary 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, 2005.
2. Enders W, "Applied Econometric Time Series", 1st Edition, John Wiley & Sons, Inc., 1995.

REFERENCES:

1. Mills, T.C, "The Econometric Modelling of Financial Time Series", 3rd Edition, Cambridge University Press, 2008.
2. Andrew C. Harvey, "Time Series Models", 2nd Edition, Harvester wheatsheaf, 1993.
3. P. J. Brockwell, R. A. Davis, "Introduction to Time Series and Forecasting", 3rd Edition, Springer, 2016.
4. Cryer, Jonathan D, Chan, Kung-sik, "Time series analysis: with applications in R", 2nd Edition, Springer, 2008.

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.

U21ADP08	HEALTHCARE ANALYTICS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- 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.

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 –

UNIT III HEALTHCARE 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:

TEXT BOOKS:

1. Vikas Kumar, "HealthCareAnalyticsMadeSimple", 1st Edition, Packt Publishing, 2018.
 2. Nilanjan Dey, Amira Ashour, Simon James Fong, Chintan Bhati, "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", 1st Edition, Springer, 2020.

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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VERTICAL II
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 methodologies 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	3
CO2	3	2	3	2	1	-	-	-	1	1	-	1	2	3
CO3	3	2	3	2	2	-	-	-	1	1	-	1	2	3
CO4	3	2	3	1	1	-	-	-	1	1	-	1	2	3
CO5	3	2	2	1	1	-	-	-	1	1	-	1	2	3

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.

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", 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, CRC Press, 2001.

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 anyone / two components based on the nature of the course.

U21AMP02	SOFT COMPUTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITE:

- 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	-	-	-	1	2
CO2	3	2	1	1	-	-	-	-	1	-	-	-	1	1
CO3	3	2	1	1	-	-	-	-	1	-	-	-	1	1
CO4	3	2	2	2	1	-	-	-	1	1	-	-	1	1
CO5	3	2	2	1	1	-	-	-	1	1	-	-	1	3

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.

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, 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				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	200	100
40	60	40	60	40	60
Total				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.

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

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.

UNIT III TRAINING AND FINE-TUNING IN CNN

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

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

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", 1stedition, Springer International Publishing, 2018.
2. Hasmik Osipyan, Bosedelyiade Edwards, Adrian David Cheok, "Deep Neural Network Applications", 1stedition, CRC Press, 2022.
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", 1stedition, MIT Press, 2016.

REFERENCES:

1. Katy Warr, "Strengthening Deep Neural Networks Making AI Less Susceptible to Adversarial Trickery", 1stedition, O'Reilly Media, 2019.
2. Information Resources Management Association, "Deep Learning and Neural Networks: Concepts, Methodologies, Tools, and Applications", 1stedition, IGI Global, 2020.
3. Aston Zhang, Zack C. Lipton, Mu Li, and Alex J. Smola, "Dive into Deep Learning", 1stedition, Cambridge University Press, 2023.
4. Coursera Course: <https://www.coursera.org/learn/neural-networks-deep-learning>.

EVALUATION PATTERN:

Continuous 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	Total Internal Assessments	
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.

**PRE-REQUISITE:**

- 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	-	-	-	3	2
CO2	3	2	2	2	1	-	-	-	1	1	-	1	3	3
CO3	3	2	2	2	1	-	-	-	1	1	-	1	3	3
CO4	3	2	2	2	1	-	-	-	1	1	-	1	2	3
CO5	3	2	1	1	-	-	-	-	1	-	-	-	2	3

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

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:

- Richard S. Sutton and Andrew G. Barto, "Reinforcement Learning: An Introduction", 2ndedition, The MIT Press, 2020.
- CsabaSzepesvári, "Algorithms for Reinforcement Learning", 1st edition, Morgan & Claypool, 2013.

REFERENCES:

- Kevin Murphy, "Machine Learning - A Probabilistic Perspective", 1stedition, MIT press, 2012.
- Christopher Bishop, "Pattern Recognition and Machine Learning", 1stedition, Springer, 2006.

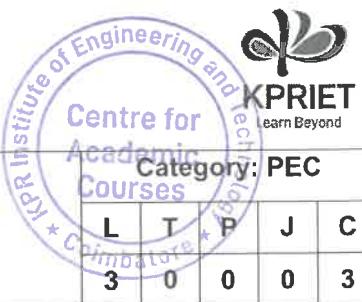
EVALUATION PATTERN:

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 anyone / two components based on the nature of the course.



Department of Information Technology
 KPR Institute of Engineering and Technology
 Coimbatore - 641 407



U21AMP05	COMPUTER VISION	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITE:

- 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	-	-	-	1	2
CO2	3	2	2	2	2	-	-	-	1	1	-	1	1	3
CO3	3	2	2	2	3	-	-	-	1	1	-	1	1	3
CO4	3	2	2	2	3	-	-	-	1	1	-	1	1	3
CO5	3	2	2	2	3	-	-	-	1	1	-	1	1	3

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 .

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", 2nd edition, Springer- Texts in Computer Science, 2022.
2. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", 2nd edition, Pearson Education, 2015.
3. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", 3rd edition, Pearson Education, 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				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 anyone / two components based on the nature of the course.



U21AMP06	FEATURE ENGINEERING	Category: PEC				
L	T	P	J	C		
3	0	0	0	3		

PRE-REQUISITE:

- 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.

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:

Continuous 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	Total Internal Assessments	
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.

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	-	-	-	1	2
CO2	3	2	1	1	-	-	-	-	1	-	-	-	1	2
CO3	3	2	2	2	1	-	-	-	1	1	-	1	1	3
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 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.

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. Rajalingappa 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.

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.

U21AMP08	TEXT AND VISUAL ANALYTICS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITE:

- 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	3
CO3	3	2	2	2	1	-	-	-	1	1	-	1	1	3
CO4	3	2	2	2	1	-	-	-	1	1	-	1	1	3
CO5	3	2	1	1	-	-	-	-	1	-	-	-	1	3

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.

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", 3rdedition, Pearson Prentice Hall, 2022.
2. Nan Cao, Weiwei Cui, "Introduction to Text Visualization", 1stedition, Atlantis Press, 2016.

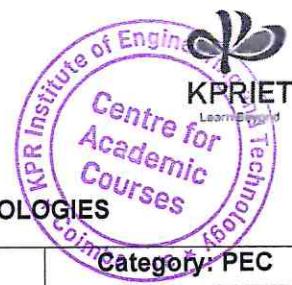
REFERENCES:

1. Steven Struhl, "Practical Text Analytics: Interpreting Text and Unstructured Data for Business Intelligence", 1stedition, Kogan Page Limited, 2016.
2. Bing Liu, "Sentiment Analysis: Mining Opinions, Sentiments, and Emotions", 1stedition, Cambridge University Press, 2020.
3. Tamara Munzner, "Visualization Analysis and Design", 1stedition, CRC press, 2015.
4. Dan Jurafsky and James H. Martin, "Speech and Language Processing", 1stedition, Prentice Hall, 2009.
5. Li Bai, Alfred Kobsa, and Jinah Park, "Visual Analytics and Interactive Technologies: Data, Text and Web Mining Applications", 1stedition, IGI Global, 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 anyone / two components based on the nature of the course.



VERTICAL III

CLOUD COMPUTING AND DATA STORAGE TECHNOLOGIES

U21CSP01	FOUNDATIONS OF CLOUD COMPUTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITE:

- 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	3	2
CO2	3	3	1	1	3	-	-	-	-	-	-	2	3	2
CO3	3	2	1	1	3	-	-	-	-	-	-	2	3	2
CO4	3	2	1	1	-	-	-	-	-	-	-	2	3	3
CO5	3	2	1	1	3	-	-	-	-	-	-	2	3	3

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.

UNIT III CLOUD STORAGE AND CONTAINERS

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

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

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 Virtualization", 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", Illustrated Edition, Morgan Kaufmann, 2017.
2. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation Management, and Security", 3rd Edition, CRC Press, 2016.
3. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", 1st Edition, Morgan Kaufmann Publishers, 2012.
4. Barrie Sosinsky, "Cloud Computing Bible", 1st Edition, Wiley Publishing, 2015.

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.



U21CSP02	DATA STORAGE AND MANAGEMENT IN CLOUD	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- 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	2
CO2	2	1	1	1	-	-	-	-	-	-	-	-	2	2
CO3	2	1	1	1	2	-	-	-	-	-	-	-	2	2
CO4	3	2	2	1	3	-	-	-	-	-	-	-	2	3
CO5	3	3	2	1	-	-	-	-	-	-	-	-	2	3

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 Storage Access – Infrastructure and Resource Management – Data Movement and Migration – I/O Connectivity and Networking Fundamentals.

UNIT II STORAGE SERVICES AND NETWORK CONNECTIVITY

9

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", 1st Edition, CRC Press, 2011.
2. Kayla Kipps, Allison Kaiser Jones, "Collection Management in the Cloud,A Guide for Using Cloud Computing Technologies in Libraries", 1st Edition, 2022.

REFERENCES:

1. Somasundaram Gnanasundaram, Alok Shrivastava, "Information Storage and Management: Storing, Managing and Protecting Digital Information in classic, Virtualized and Cloud Environments", 2nd Edition, EMC Education Services, Wiley, 2012.
2. Robert Spalding, "Storage Networks: The Complete Reference", Illustrated Edition,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.

U21CSP03	VIRTUALIZATION TECHNIQUES	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- 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	2
CO2	2	1	1	1	-	-	-	-	-	-	-	-	2	2
CO3	3	2	2	1	2	-	-	-	-	-	-	-	3	2
CO4	3	2	2	1	2	-	-	-	-	-	-	-	3	2
CO5	3	2	2	1	3	-	-	-	-	-	-	-	3	2
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

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

UNIT IV STORAGE VIRTUALIZATION

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

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", 2ndEdition, Elsevier/Morgan Kaufmann Publishers, 2015.
2. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", 2ndEdition, Berkeley, Apress, 2016.
3. Gerardus Blokdyk, "Virtualization Technology A Complete Guide", 1st Edition, Emer, 2020.

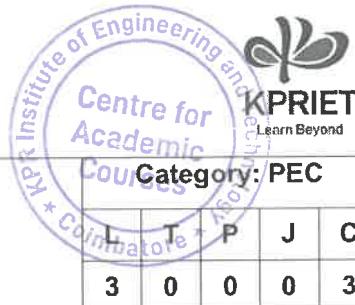
REFERENCES:

1. William von Hagen, "Professional Xen Virtualization", 1stEdition, Wrox Publications, 2014.
2. Matthew Portnoy, "Virtualization Essentials", 2ndEdition, Wiley, 2015.
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", 6thEdition, Addison-Wesley, Publications, 2012

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.



U21CSP04	SECURITY AND PRIVACY IN CLOUD	Category: PEC					
L	T	P	J	C			
3	0	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	2	2
CO2	3	2	1	1	-	-	-	-	-	-	-	2	2	3
CO3	3	2	1	1	-	-	-	-	-	-	-	2	3	3
CO4	3	2	1	1	-	-	-	-	-	-	-	2	3	3
CO5	3	3	1	1	-	-	-	-	-	-	-	2	3	3

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.

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, O'reilly, 2019.

REFERENCES:

1. Vic (J.R.) Winkler, "Securing the Cloud: Cloud Computer Security Techniques and Tactics", 1st Edition, Elsevier 2011.
2. Riyan Ko,Kim-Kwang Raymond Choo , "The Cloud Security Ecosystem, Technical, Legal, Business and Management Issues", 1st Edition, Elsevier,2015.
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, " Cloud Security and Privacy", 1st Edition, O'reilly, 2009.

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.

U21CSP05	DATA ANALYSIS IN CLOUD COMPUTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- 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	2	2
CO2	3	2	1	1	3	-	-	-	-	-	-	2	2	3
CO3	3	2	1	1	3	-	-	-	-	-	-	2	2	3
CO4	3	2	2	1	1	-	-	-	-	-	-	2	3	3
CO5	3	2	2	1	3	-	-	-	-	-	-	2	3	3

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.

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 life 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 Exa scale 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", 1st Edition, Elsevier, 2016.
2. Sachi Nandhan Mohanty, Jyotir Moy Chatterjee, Monika mangla, Suneetha Sathpathy,Sirisha Potluri, 'Machine Learning Approach for Cloud Data Analytics in IoT', 1st Edition, 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", 1st Edition, Morgan Kaufmann,2013.
3. John W. Rittinghouse and James F. Ransome, "Cloud Computing: Implementation "Management, and Security", 1st Edition, 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	200	100
40	60	40	60	40	60
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.

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 \ 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	3	2	1	-	-	-	-	-	-	-	-	3	2
CO4	3	2	1	1	-	-	-	-	-	-	-	-	3	2
CO5	3	2	1	1	-	-	-	-	-	-	-	-	3	2

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 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, Satish Narayana Srirama, eds, "Fog and edge computing: principles and paradigms", 1st edition, John Wiley & Sons, 2019.
2. Bilay, Peter Gutsche, Mandy Krimmel, 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				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.

U21CSP07	CLOUD SERVICE MANAGEMENT	Category: PEC					
		L	T	A	P	J	C
		3	0	0	0	0	3

PRE–REQUISITE:

- 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	2	2
CO2	2	1	1	1	1	-	-	-	-	-	-	2	2	2
CO3	3	2	2	2	2	-	-	-	-	-	-	2	2	3
CO4	3	3	3	2	2	-	-	-	-	-	-	2	2	3
CO5	3	3	2	2	2	-	-	-	-	-	-	2	2	3

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.

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 MANAGEMENT

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, O'Reilly, 2017.

REFERENCES:

1. Michael P McGarth, " Understanding PaaS", 1st Edition, O'Reilly, 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:

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.



Department of Information Technology
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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	2	2
CO2	3	2	2	1	3	-	-	-	-	-	-	3	3	3
CO3	3	2	2	1	3	-	-	-	-	-	-	3	3	3
CO4	3	2	2	1	2	-	-	-	-	-	-	3	3	3
CO5	3	2	2	1	3	-	-	-	-	-	-	3	3	3

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

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 BOOK:

1. Xin Luna Dong, Divesh Srivastava, "Big data Integration and Management in Cloud", 1st Edition,Morgan & Claypool Publishers, 2015.

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",1st Edition, IGI Global, 2021.
3. Course Era, "Big Data Integration and Processing", University of California San Diego.

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.

VERTICAL IV
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 of consistency 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	1	-
CO2	3	2	3	2	1	-	-	-	-	-	-	2	2	-
CO3	2	1	2	2	1	-	-	-	-	-	-	2	2	-
CO4	2	1	2	1	-	-	-	-	-	-	-	2	1	-
CO5	2	1	1	1	-	-	-	-	-	-	-	2	1	-

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.

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.

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	200	100
40	60	40	60	40	60
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.

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	2	1
CO2	2	1	-	-	-	-	-	-	-	-	-	2	2	1
CO3	2	1	-	-	-	-	-	-	-	-	-	2	2	1
CO4	2	2	-	-	-	-	-	-	-	-	-	2	3	1
CO5	2	3	-	-	-	-	-	-	-	-	-	2	3	1

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 – The 802.11 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, PHILearning, 2019.

REFERENCES:

1. Schiller J, "Mobile Communication", 2ndEdition, 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				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.

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	3
CO2	2	1	-	-	1	-	-	-	-	-	-	-	1	3
CO3	2	1	2	-	2	-	-	-	-	-	-	-	2	3
CO4	3	2	2	2	2	-	-	-	-	-	-	-	2	3
CO5	3	2	2	2	3	-	-	-	-	-	-	-	2	3

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.

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: 45Periods			

TEXT BOOKS:

1. KazemSohraby, Daniel Minoli, TaiebZnati,"Wireless Sensor Networks Technology, Protocols, and Applications", 2ndEdition, Wiley, 2016
2. Abbas Jamalipour,JunZheng,"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				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	200	100
40	60	40	60	40	60
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.

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 center network – Virtual Local Area Network VLANs – Ethernet VPN – Virtual extensible LAN – Network Virtualization using Generic Routing Encapsulation.

UNIT IV SDN FRAMEWORK 9

SDN Frameworks – Openaylight controller – Floodlight controller – Bandwidth calendaring – Data center orchestration.

UNIT V SDN APPLICATIONS AND OPEN SOURCE 9

SDN in other environments – SDN applications – SDN open source: open source environment, OpenFlow source 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 D'Nadeau, Ken Gray, "SDN: Software Defined Networks", 1st Edition, O'Reilly Media, 2013.
2. Paul Goransson, Chuck Black, "Software Defined Networks: A Comprehensive Approach", 2nd Edition, Morgan Kaufmann, 2016.

REFERENCES:

1. Siamak Azodolmolky, "Software Defined Networking with Open Flow", 2nd Edition, Packet Publishing, 2017.
2. Vivek Tiwari, "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				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.

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 defending 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 cybersecurity issues 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 \ Pos Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	2	-	2	-	-	-	2	2	3
CO2	2	1	-	1	-	2	-	2	-	-	-	2	2	3
CO3	2	1	-	1	-	2	-	2	-	-	-	2	2	3
CO4	2	1	-	2	3	2	-	3	-	-	-	2	3	3
CO5	3	2	-	2	3	2	-	3	-	-	-	3	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, Enterprise policy, 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", 1stEdition, 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", 2ndEdition, Tata McGraw –Hill, 2006.

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	200	100
40	60	40	60	40	60
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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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	2
CO2	2	1	1	1	-	-	-	-	-	-	-	-	1	2
CO3	2	1	2	2	-	-	-	-	-	-	-	-	1	2
CO4	2	1	2	2	-	-	-	-	-	-	-	-	1	3
CO5	2	1	2	2	-	-	-	-	-	-	-	-	2	3
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).

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. Charlie 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				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	200	100
40	60	40	60	40	60
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.

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 identify cyber threats (Understand)
CO2: Demonstrate port scanning tools 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	2	3
CO2	2	1	1	1	2	2	-	2	-	-	-	2	2	3
CO3	3	2	1	1	1	2	-	2	-	-	-	2	2	3
CO4	2	1	1	2	3	2	-	2	-	-	-	2	2	3
CO5	3	2	2	2	3	2	-	2	-	-	-	3	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.

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				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.

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 process 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 process of online investigations 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	-	-	-	-	1	3
CO2	2	1	1	1	-	2	-	1	-	-	-	-	1	3
CO3	2	1	1	1	-	2	-	1	-	-	-	-	1	3
CO4	3	2	2	2	3	2	-	2	-	-	-	-	2	3
CO5	3	2	2	2	3	2	-	2	-	-	-	-	2	3

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.

UNIT III ONLINE INVESTIGATIONS 9

9Working 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 PHOTOGRAPH FORENSICS 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				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	200	100
40	60	40	60		
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.

VERTICAL V
FULL STACK DEVELOPMENT

U21CSP09	UI / UX DESIGN	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- 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	2	3
CO2	2	1	1	-	-	-	-	-	-	2	-	1	2	3
CO3	2	1	1	-	-	-	-	-	-	2	-	1	2	3
CO4	2	1	1	-	-	-	-	-	-	2	-	1	3	3
CO5	3	2	2	-	-	-	-	-	-	2	-	2	3	3

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.

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. William 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", 1st Edition, AIGA NEW RIDERS, 2010.
3. Marcin Treder , "UX Design for startups", UXpin, 2013.

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.

U21CSP10	PYTHON WEB DEVELOPMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- 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 MongoDB (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	2	-
CO4	3	2	3	1	3	-	-	-	-	-	-	3	2	-
CO5	3	2	3	1	3	-	-	-	-	-	-	3	2	3

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", 1st Edition, O'Reilly, 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				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.



U21CSP11	APP DEVELOPMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- 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	2
CO2	3	2	2	2	3	-	-	-	-	-	-	1	1	2
CO3	3	2	2	2	3	-	-	-	-	-	-	1	2	2
CO4	3	2	2	2	3	-	-	-	-	-	-	1	2	2
CO5	3	2	2	2	3	-	-	-	-	-	-	1	2	3
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.

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, Houssein Djirdeh, 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, 2015.
2. Apache Cordova 4 Programming, John M Wargo, 2015.
3. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition, 2019.
4. Apache Cordova in Action, Raymond K. Camden, Manning, 2015.

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.

U21CSP12	JAVASCRIPT FRAMEWORKS	PEC				
		T	P	J	C	
		3	0	0	0	3

PRE–REQUISITE:

- 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	2	3
CO2	3	2	2	1	3	-	-	-	-	-	-	-	3	2	3
CO3	3	2	2	1	3	-	-	-	-	-	-	-	3	2	3
CO4	3	2	2	1	3	-	-	-	-	-	-	-	3	2	3
CO5	3	2	2	1	3	-	-	-	-	-	-	-	3	2	3
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

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, 2018.
2. Kirupa Chinnathambi, "Learning React: A Hands-On Guide to Building Web Applications Using React and Redux", Addison-Wesley Professional, 2nd Edition, 2018.
3. Shannon Bradshaw, Eoin Brazil, Kristina Chodorow, "MongoDB: The Definitive Guide: Powerful and Scalable Data Storage", 3rd Edition, O'Reilly publication, 2019.

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.

U21CSP13	WEB SERVICES AND API DESIGN	Category: PEC				
		L	K	T	P	J
		3	0	0	0	3

PRE–REQUISITE:

- 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	2	3
CO2	3	2	2	2	2	-	-	-	-	-	-	2	2	3
CO3	3	2	2	2	2	-	-	-	-	-	-	2	2	3
CO4	3	2	2	2	2	-	-	-	-	-	-	2	2	3
CO5	3	2	2	2	2	-	-	-	-	-	-	2	2	3

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.

UNIT IV DEVELOPMENT AND DEPLOYMENT

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. Harihara Subramanian J , Pethuru Raj, "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.

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	200	100
40	60	40	60	40	60
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.

U21CSP14	SOA & MICRO SERVICES	Category: PEC					
L*	T	P	J	C			
3	0	0	0	3			

PRE–REQUISITE:

- 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	1
CO3	2	1	1	-	-	-	-	-	-	-	-	-	1	1
CO4	3	2	2	2	-	-	-	-	-	-	-	-	2	2
CO5	3	2	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

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", Third 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, 2017.
3. Jim Webber, Savas Parastatidis, Ian Robinson, "REST in Practice" O'Reilly Media; 1st edition, 2010.

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.



U21CSP15	CLOUD NATIVE APPLICATIONS DEVELOPMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- 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	2	2
CO2	2	1	1	1	1	-	-	-	-	-	-	1	2	2
CO3	3	2	2	2	3	-	-	-	-	-	-	2	3	3
CO4	3	2	2	2	1	-	-	-	-	-	-	2	3	3
CO5	3	2	2	2	2	-	-	-	-	-	-	2	3	3

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.

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, 18th Edition 2014.
2. Tomaszewski, Kamal Arora, Eric Farr, Piyum Zanooz, "Cloud Native Architectures: Design high-availability and cost-effective applications for the cloud", Packt publishing, 2018.

REFERENCES:

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				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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Coimbatore - 641 407

U21CSP16	DEVOPS	Category: PEC					
		L	T	P	J	C	
		3	0	0	0	3	

PRE–REQUISITE:

- 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	2	2
CO2	2	1	1	1	2	-	-	-	-	-	-	1	2	2
CO3	3	2	2	2	3	-	-	-	-	-	-	2	3	3
CO4	3	2	2	2	2	-	-	-	-	-	-	2	2	2
CO5	3	2	2	2	3	-	-	-	-	-	-	1	3	3

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 Artifacts, 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: 30 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!, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, —Linux for Beginners: An Introduction to the Linux Operating System and Command Line!, 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 humans!", First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps!", Second Edition, 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.

VERTICAL VI
IT AND IT ENABLED SERVICES (ITES)

U21ITP09	NEXT GENERATION NETWORKS	Category: PEC <table border="1" style="margin-left: auto; margin-right: 0; border-collapse: collapse;"> <tr> <th style="text-align: center; padding: 2px;">L</th><th style="text-align: center; padding: 2px;">T</th><th style="text-align: center; padding: 2px;">P</th><th style="text-align: center; padding: 2px;">J</th><th style="text-align: center; padding: 2px;">C</th></tr> <tr> <td style="text-align: center; padding: 2px;">3</td><td style="text-align: center; padding: 2px;">0</td><td style="text-align: center; padding: 2px;">0</td><td style="text-align: center; padding: 2px;">0</td><td style="text-align: center; padding: 2px;">3</td></tr> </table>	L	T	P	J	C	3	0	0	0	3
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 application with 5G network support and mobile cloud (Apply)
CO5: Analyze the security risks in 5G networks (Analyze)

CO-PO MAPPING:

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

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				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.

U21ITP10	GAME DEVELOPMENT	Category: PEC					
L	T	P	J	C			
3	0	0	0	3			

PRE–REQUISITE:

- 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	-	-	-	-	-	-	-	-	-	-	1	2
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO3	3	2	1	2	3	-	-	-	-	-	-	-	3	2
CO4	3	2	2	2	3	-	-	-	-	-	-	-	-	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

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).

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, 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. Yoav Shoham, Kevin Leyton-Brown, "Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations", 4th Edition, Cambridge University Press, 2008.
4. Zhu Han, Dusit Niyato, Walid Saad, Tamer Basar and Hjorungnes, "Game Theory in Wireless and Communication Networks", 1st Edition, Cambridge University Press, 2012.

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.

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	1
CO2	2	1	1	2	2	-	-	-	-	-	-	2	2	1
CO3	2	1	1	2	2	-	-	-	-	-	-	2	2	2
CO4	2	1	1	2	2	-	-	-	-	-	-	2	2	2
CO5	3	2	3	3	3	-	-	-	-	-	3	3	1	2

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.

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:

- Elad Elrom, "The Blockchain Developer: A Practical Guide for Designing, Implementing, Publishing, Testing, and Securing Distributed Blockchain-based Projects", 1st Edition, Apress, 2019.
- Chandramouli Subramanian, Asha A George, Abhilash K A "Blockchain Technology", 1st Edition, Universities Press, 2020.

REFERENCES:

- Joseph Bonneau , "SoK: Research Perspectives and Challenges for Bitcoin and Cryptocurrency", IEEE Symposium on Security and Privacy, 2015.
- Imran Bashir, "Mastering Blockchain", 2nd Edition, Pactz, 2018.

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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U21ITP12	AUGMENTED REALITY / VIRTUAL REALITY					
L	T	P	J	C		
3	0	0	0	3		

PRE–REQUISITE:

- Nil

COURSE OBJECTIVES:

- To describe the fundamentals of XR, virtual reality architecture and modelling.
- 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 modelling 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	-	-	-	-	-	-	-	-	1	1
CO2	2	1	2	1	-	-	-	-	-	-	-	-	2	1
CO3	3	2	3	3	2	-	-	-	-	-	-	-	3	2
CO4	2	1	2	2	-	-	-	-	-	-	-	-	1	2
CO5	3	2	3	3	2	-	-	-	-	-	-	-	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.

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				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.



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	2
CO2	2	1	1	1	-	-	-	-	-	-	-	2	1	2
CO3	2	1	1	1	-	-	-	-	-	-	-	2	1	2
CO4	3	2	2	2	3	-	-	-	-	-	-	2	2	2
CO5	3	2	2	2	3	-	-	-	-	-	-	3	2	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.

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:

- Ray LaPierre, "Introduction to Quantum Computing", 1st Edition, Springer, 2021.
- Eleanor Rieffel, Wolfgang Polak, "Quantum Computing: A Gentle Introduction", 1st Edition, MIT Press, 2011.
- Bernhardt, Chris, "Quantum Computing for Everyone" 1st Edition, MIT Press, 2019.

REFERENCES:

- David J Griffiths, "Introduction to Quantum Mechanics", 1st Edition, Cambridge, 2016.
- Scott Aaronson, "Quantum Computing Since Democritus", Cambridge University Press, 1st Edition, 2013.
- Michael A. Nielsen, Isaac L. Chuang , "Quantum Computation and Quantum Information", 10th Anniversary Edition, Cambridge University Press, 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	200	100
40	60	40	60	40	60
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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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.

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				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	200	100
40	60	40	60	40	60
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.



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	1
CO2	2	1	1	1	-	1	-	1	2	-	2	1	1	1
CO3	2	1	1	1	-	1	-	1	2	-	2	2	1	1
CO4	3	2	2	2	2	1	-	1	2	-	3	2	2	2
CO5	3	2	2	2	2	1	-	1	2	-	3	2	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.

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 Directions", 1st Edition, Springer, 2010.
2. Karl Weigers, John Beatty, "Software Requirement", 3rd Edition, Microsoft Press US, 2013.

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.

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 testing 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	2
CO2	2	1	-	1	-	-	-	2	-	-	-	2	2	2
CO3	2	1	-	1	-	-	-	-	-	-	-	2	2	2
CO4	3	2	-	2	3	-	-	-	-	-	-	2	2	2
CO5	3	2	-	2	3	-	-	-	-	-	-	3	2	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.

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

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

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, Adactln 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				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.