KPR Institute of Engineering and Technology

Learn Beyond (Autonomous, NAAC "A")

Avinashi Road, Arasur, Coimbatore.

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

B.Tech. – Computer Science and Business Systems

Curriculum and Syllabi

Regulations– 2021 (Revised)

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KPRIET
Learn Beyond

B.Tech. - Computer Science and Business Systems

Curriculum and Syllabi

Regulations 2021 (Revised)

Department of Computer Science and Business Systems

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 responsibility

II. Vision and Mission of the Department

Vision

To be recognized as a technological hub in the field of Computer Science and Business Systems by contributing to the society through innovative teaching – learning process and advanced research.

Mission

- Impart quality computing education through effective teaching learning process to make students technically competent and develop lifelong learning
- Create new computing technologies and solutions for industry and society by providing a research ambience
- Adhere to the rich cultural and ethical values in all aspects of life

III. Programme Educational Objectives (PEOs)

The graduates of CSBS will

PEO1: Establish themselves in various **technical or managerial roles** using quality education acquired in the field of Computer Science and Business Systems.

PEO2: Excel in **higher education, conduct multi-disciplinary research** and develop novel solutions for industrial and social problems.

PEO3: Exhibit their leadership and business qualities with demonstrable attributes in **lifelong learning** to contribute to the societal needs.

IV. Program Outcomes (POs)

Graduates of Computer Science and Business Systems will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, naturalsciences, and engineering sciences.
3. **Design / development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

V. Programme Specific Outcomes (PSOs)

PSO1: Ability to practice as an ethical software engineer/researcher in different fields of computer science and business systems with innovative technical proficiency.

PSO2: Ability to apply analytical and business skills to provide viable solutions for various real world problems and become successful entrepreneurs.

VI. PEO / PO Mapping

Following three levels of correlation should be used

1: Low 2: Medium 3: High

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

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B.Tech. COMPUTER SCIENCE AND BUSINESS SYSTEMS

REGULATIONS – 2021 (Revised)

For the students admitted from 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	U21MA103	Probability, Statistics and Calculus	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	U21EN102	Business Communication and Value Science - I	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	U21CB201	Fundamentals of Economics	PCC	3	0	0	0	3
4	U21PH201	Materials Science	BSC	2	0	0	0	2
THEORY COURSES WITH LABORATORY COMPONENT								
5	U21EN202	Business Communication and Value Science - II	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 Sciences	MNC	1	0	0	0	0
			TOTAL	**15**	**1**	**10**	**0**	**20**

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SEMESTER III

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
THEORY COURSES								
1	U21MAG02	Discrete Mathematics	BSC	3	1	0	0	4
2	U21CS301	Computer Organization and Architecture	PCC	3	0	0	0	3
3	U21CS302	Database Management Systems	PCC	3	0	0	0	3
THEORY COURSES WITH LABORATORY COMPONENT								
4	U21CSG03	Data Structures	PCC	2	0	2	0	3
5	U21CSG04	Java Programming	PCC	2	0	2	0	3
6	U21CB301	Exploratory Data Analysis in Business	PCC	2	0	2	0	3
7	U21EN301	Business Communication and Value Science - III	HSMC	1	0	2	0	2
LABORATORY COURSES / LABORATORY COURSE WITH PROJECT COMPONENT								
8	U21CS304	Database Management Systems Laboratory	PCC	0	0	4	0	2
9	U21CB302	Design Studio I	EEC	0	0	0	2	1
MANDATORY NON CREDIT COURSE								
10	U21MYC03	Essence of Indian Traditional Knowledge	MNC	1	0	0	0	0
			TOTAL	**17**	**1**	**12**	**2**	**24**

SEMESTER IV

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
THEORY COURSES								
1	U21CB401	Business Strategy	PCC	3	0	0	0	3
2	U21CS401	Design and Analysis of Algorithms	PCC	3	0	0	0	3
3	U21CS403	Operating Systems	PCC	3	0	0	0	3
4	U21AD401	Machine Learning - Essentials	PCC	3	0	0	0	3
5		Open Elective - I	OEC	3	0	0	0	3
THEORY COURSE WITH LABORATORY COMPONENT								
6	U21MA409	Statistical Methods	BSC	2	0	2	0	4
LABORATORY COURSES / LABORATORY COURSE WITH PROJECT COMPONENT								
7	U21CS404	Operating Systems Laboratory	PCC	0	0	2	0	1
8	U21AD405	Machine Learning Laboratory	PCC	0	0	2	2	2
9	U21SSG01	Soft Skills - I	HSMC	0	0	2	0	1
10	U21CB402	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**	**24**

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SEMESTER V

Sl.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
THEORY COURSES								
1	U21CB501	Fundamentals of Management	PCC	3	0	0	0	3
2	U21CB502	Formal Language and Automata Theory	PCC	3	0	0	0	3
3	U21CB503	Software Engineering Methodologies	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
LABORATORY COURSES / LABORATORY COURSE WITH PROJECT COMPONENT								
7	U21CB504	Software Engineering Methodologies Laboratory	PCC	0	0	4	0	2
8	U21SSG02	Soft Skills - II	HSMC	0	0	2	0	1
9	U21CB505	Proto Studio I	EEC	0	0	0	2	1
MANDATORY NON CREDIT COURSE								
10	U21MYC05	Cyber Security Essentials	MNC	1	0	0	0	0
			TOTAL	**19**	**0**	**6**	**2**	**22**

SEMESTER VI

Sl.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
THEORY COURSES								
1	U21CB601	Digital Marketing and Analytics	PCC	3	0	0	0	3
2	U21CB602	Business Intelligence	PCC	3	0	0	0	3
3		Professional Elective - III	PEC	3	0	0	0	3
4		Professional Elective - IV	PEC	3	0	0	0	3
5		Open Elective - III	OEC	3	0	0	0	3
THEORY COURSE WITH LABORATORY COMPONENT								
6	U21CSG05	Computer Networks	PCC	2	0	2	0	3
LABORATORY COURSES								
7	U21CB603	Open Source Tools Laboratory	PCC	0	0	4	0	2
8	U21SSG03	Soft Skills - III	HSMC	0	0	2	0	1
9	U21CB604	Proto Studio II	EEC	0	0	0	2	1
MANDATORY NON CREDIT COURSE								
10	U21MYC06	Introduction to UN SDGs: An integrative Approach	MNC	1	0	0	0	0
			TOTAL	**18**	**0**	**8**	**2**	**22**

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SEMESTER VII

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
THEORY COURSES								
1	U21CB701	Human Values and Ethics	HSMC	3	0	0	0	3
2	U21ITG02	Information Security	PCC	3	0	0	0	3
3		Professional Elective – V	PEC	3	0	0	0	3
4		Professional Elective - VI	PEC	3	0	0	0	3
5		Open Elective - IV	OEC	3	0	0	0	3
6	U21CB702	Internet of Things	PCC	3	0	0	0	3
LABORATORY COURSES / LABORATORY COURSE WITH PROJECT COMPONENT								
7	U21ITG03	Information Security Laboratory	PCC	0	0	4	0	2
8	U21CB703	Project Work Phase - I	EEC	0	0	0	4	2
			TOTAL	**18**	**0**	**4**	**4**	**22**

SEMESTER VIII

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CB801	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	U21CBI01	Industrial Training / Internship *	EEC	0	0	0	0	2
			TOTAL	**0**	**0**	**0**	**0**	**2**

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

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NCC CREDIT COURSES:

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

Assessment and Evaluation:
Internal Assessment – 100 Marks
Written (50 marks) and Practical (Drill and Weapon) – 50 Marks

TOTAL CREDITS: 165

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PROFESSIONAL ELECTIVES COURSES: VERTICALS

Vertical I Data Science	Vertical II Artificial Intelligence and Machine Learning	Vertical III Cloud Computing and Data Processing Technologies	Vertical IV Networking and Cyber Security	Vertical V Full Stack Development	Vertical VI Management and Marketing
U21ADP01 - Mathematical Foundation for Data Science	U21AMP01 - Knowledge Engineering	U21CSP01- Foundations of Cloud Computing	U21ITP01- Parallel and Distributed Computing	U21CSP09 - UI / UX Design	U21CBP01 - Introduction to Innovation, IP Management and Entrepreneurship Development
U21ADP02 - Pattern Recognition	U21AMP02 - Soft computing	U21CSP02- Data Storage and Management in Cloud	U21ITP02- Mobile Computing	U21CSP10- Python Web Development	U21CBP02 - IT Project Management
U21ADP03 - Speech Processing and Analytics	U21AMP03 - Deep Neural Networks	U21CSP03- Virtualization Techniques	U21ITP03 - Wireless Sensor Networks	U21CSP11- App Development	U21CBP03 – E-Business Management
U21ADP04 - Web Mining	U21AMP04- Reinforcement Learning	U21CSP04- Security and Privacy in Cloud	U21ITP04 - Software Defined Networks	U21CSP12- JavaScript Frameworks	U21CBP04 - Recommender Systems
U21ADP05 - Exploratory Data Analysisand Visualization	U21AMP05 - Computer Vision	U21CSP05- Data Analysis in Cloud Computing	U21ITP05 - Cyber Security	U21CSP13- Web Services and API Design	U21CBP05 - Industrial Psychology
U21ADP06 - Predictive Analytics	U21AMP06 - Feature Engineering	U21CSP06 - Edge Computing	U21ITP06 - Internet Security	U21CSP14- SOA and Micro Services	U21CBP06 - Marketing Research and Marketing Management
U21ADP07 - Time Series Analysis and Forecasting	U21AMP07 - Object Detection & Facial Recognition	U21CSP07 - Cloud Service Management	U21ITP07 - Ethical Hacking	U21CSP15- Cloud Native Applications Development	U21CBP07 - Human Resource Management
U21ADP08 - Health Care Analytics	U21AMP08 - Text and Visual Analytics	U21CSP08- Big Data Integration and Processing	U21ITP08 - Digital Forensics	U21CSP16- DevOps	U21CBP08 - Financial Management

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 (Honors) or Minor degree shall be done from Semester V to VII.

PROFESSIONAL ELECTIVE COURSES

VERTICAL 1: DATA SCIENCE

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

VERTICAL 2: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

SI.NO.	COURSE CODE	COURSETITLE	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 & Facial Recognition	PEC	3	0	0	0	3
8	U21AMP08	Text and Visual Analytics	PEC	3	0	0	0	3

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VERTICAL 3: CLOUD COMPUTING AND DATA PROCESSING TECHNOLOGIES

SI.NO.	COURSE CODE	COURSETITLE	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

VERTICAL 4: CYBER SECURITY AND NETWORKING

SI.NO.	COURSE CODE	COURSETITLE	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

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VERTICAL 5: FULL STACK DEVELOPMENT

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

VERTICAL 6: MANAGEMENT AND MARKETING

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

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OPEN ELECTIVES

OPEN ELECTIVES – I (SEMESTER: IV)

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CBX01	Digital Marketing	OEC	3	0	0	0	3
2	U21CBX02	Web Designing	OEC	3	0	0	0	3

OPEN ELECTIVES – II (SEMESTER: V)

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CBX03	IT for Managers	OEC	3	0	0	0	3
2	U21CBX04	Security Analysis and Portfolio 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	U21CBX05	Brand Management	OEC	3	0	0	0	3

OPEN ELECTIVES – IV (SEMESTER: VII)

SI.NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21CBX06	Marketing Research and Management	OEC	3	0	0	0	3
2	U21CBX07	Fintech Regulations	OEC	3	0	0	0	3

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B.Tech.–CB–R2021–CBCS

Scheme of Credit Distribution –Summary

Sl.NO.	Stream	Credits/Semester								Credits
		I	II	III	IV	V	VI	VII	VIII	
1	Humanities and Social Sciences including Management (HSMC)	3	3	-	1	3	3	3	-	16
2	Basic Science Courses (BSC)	10	6	4	4	-	-	-	-	24
3	Engineering Science Courses (ESC)	8	8	3	-	-	-	-	-	19
4	Professional Core Courses (PCC)	-	3	14	15	10	11	7	-	60
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	14
8	Industrial Training / Internship	-	-	-	-	-	-	2	-	2
9	Mandatory Non-Credit Courses (MNC)	-	-	-	-	-	-	-	-	-
Total		**21**	**20**	**22**	**24**	**23**	**24**	**23**	**8**	**165**

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Head 01.02.2022
Centre for Academic Courses
KPR Institute of Engineering and Technology
Coimbatore - 641 407

B.Tech.–CB–R2021 –CBCS

SEMESTER I

		Category: HSMC				
		L	T	P	J	C
U21GEG01	HERITAGE OF TAMILS (Common to all programmes)	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 & Jainismin Tamil Land-Bakthi Literature Azhwars and Nayanmars-Forms of minor Poetry–Development of Modern literature in Tamil-Contribution of Bharathiyar 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 car making - - 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.

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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 OFTAMILS 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. கணினித்தமிழ் - முனைவர். இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறைவெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல்துறை 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) (Publishedby: 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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B.Tech.–CB–R2021 –CBCS

SEMESTER I

U21GEG01	தமிழர் மரபு (அனைத்து துறைகளுக்கும் பொதுவானது)	Category: HSMC				
		L	T	P	J	C
		1	0	0	0	1

முன்கூட்டிய துறைசார் அறிவு: தேவையில்லை

பாடத்தின் நோக்கங்கள்:

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

பாடம்கற்றதின் 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 திணைக் கோட்பாடுகள், 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)														

பாடத் திட்டங்கள்:

அலகு I 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, பௌத்தசமயங்களின் தாக்கம்–பக்தி இலக்கியம்–ஆழ்வார்கள் மற்றும் நாயன்மார்கள்–சிற்றிலக்கியங்கள்–தமிழில் நவீன இலக்கியத்தின்வளர்ச்சி–தமிழ் இலக்கியவளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின்பங்களிப்பு.

அலகு II மரபு பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை 3

நடுகல் முதல் நவீனசிற்பங்கள் வரை–ஐம்பொன் 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.

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அலகு III நாட்டுப் புறக்கலைகள் மற்றும் வீரவிளையாட்டுகள் 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான்கூத்து, ஓயிலாட்டம், தோல்பாவைக்கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின்விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள் 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 தேசிய 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 சங்ககால நகர நாகரிகம் (தொல்லியல்துறை 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) (Publishedby: 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

		Category : BSC				
U21MA103	PROBABILITY, STATISTICS AND CALCULUS	L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of probability, random variable and distributions
- To understand the concepts of Statistics in the field of engineering and technology
- To understand the basic concepts of differential and integral calculus

COURSE OUTCOMES:

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

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

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

CO3: Apply the concepts of statistics to numerical data for performing exploratory analysis (Apply)

CO4: Use histograms and box plots to display data graphically and calculate measures of central tendency and variability (Understand)

CO5: Compute maxima and minima of problems using differential calculus and find the area and volume using integral calculus (Understand)

CO – PO MAPPING:

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

SYLLABUS:

UNIT I PROBABILITY **9+3**

Probability – Axioms of Probability – Conditional probability – Baye's theorem – Discrete and Continuous Random variables – Moments – Moment generating functions.

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UNIT II PROBABILITY DISTRIBUTIONS 9+3

Discrete and continuous distributions: Binomial distribution – Poisson distribution – Uniform distribution – Exponential distribution – Normal distribution.

UNIT III STATISTICS 9+3

Definition of Statistics – Basic objectives – Applications in various branches of science with examples. Collection of Data: Internal and external data, Primary and secondary data.

UNIT IV DISCRIPTIVE STATISTICS 9+3

Classification and tabulation of univariate data – Frequency distribution – Bar graphs and Pie charts – Histogram- Ogive – Measures of central tendency – Measures of Variability.

UNIT V CALCULUS 9+3

Partial derivatives – Total derivatives – Extreme values of functions of two variables – double and triple integrals with applications.

Contact Periods:

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

Total: 60 Periods

TEXT BOOKS:

1. Milton J.S and Arnold J.C, "Introduction to Probability and Statistics", 4th Edition, Tata McGraw Hill, 2008.
2. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", 3rd Edition, John Wiley & Sons, 2003.
3. B.S. Grewal," Higher Engineering Mathematics", 44th Edition, Khanna Publication, Delhi, 2017.

REFERENCES:

1. S.M.Ross, "A first coursein Probability", 9th Edition, Prentice Hall, 2012.
2. I.R.Miller,J.E. Freund and R.Johnson,"Probability and Statistics for Engineers", 9th Edition, Pearson, 2017.
3. A.M.Mood, F.A.Graybill and D.C.Boes,"Introduction to the Theory of Statistics", 3rd Edition, McGrawHill Education, 2001.
4. A.M.Gun, M.K.Gupta and B.Dasgupta, "Fundamentals of Statistics", Vol.I &II, WorldPress, 2013 & 2017.

EVALUATION PATTERN:

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

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SEMESTER I

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

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1: Solve an electric network by applying basic laws (Apply)
CO2: Acquire the knowledge of operating principles, characteristics, starting, and speed control methods of DC motors (Understand)
CO3: Explain the operating principles of AC motor and characteristics, starting methods of induction motor (Understand)
CO4: Summarize the construction, principle and characteristics of semiconductor devices(Understand)
CO5: Interpret the applications of semiconductor devices (Understand)

CO – PO MAPPING:

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

SYLLABUS:

UNIT I BASIC CONCEPTS OF ELECTRIC CIRCUITS **9**

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

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UNIT II DC MOTOR 9

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

UNIT III TRANSFORMER AND AC MOTOR 9

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

UNIT IV SEMICONDUCTOR DEVICES 9

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

UNIT V APPLICATIONS OF SEMICONDUCTOR DEVICES 9

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

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", 5th Edition, McGraw – Hill Education, Jul 2017.
2. R.K.Rajput, "Electrical Machines", 6th Edition, Laxmi Publications, Jan 2016.
3. V.K Metha and Rohit Metha, "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, Aug 2013.
2. S.K. Bhattacharya, "Electrical Machines", 4th Edition, McGraw-Hill Education, July 2017.
3. R.Sedha, "A Text book of Applied Electronics", Revised Edition, S.Chand Publications, July 2017.

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examination Assessment
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	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	
40	60	40	60	40	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

U21EN102	BUSINESS COMMUNICATION & VALUE SCIENCE–I	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- Understand the key concepts of values, life skills and business communication and to motivate students to look within and create a better version of self
- Focus on the development of basic fluency in English, usage of vocabulary in technical field, strengthen reading and official written communication skill
- Understand the life skills and their importance in leading a happy and well-adjusted life

COURSE OUTCOMES:

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

CO1: Recognize the need for life skills and values (Understand)

CO2: Identify own strengths and opportunities (Analyze)

CO3: Recognize the importance of vocabulary enrichment (Understand)

CO4: Understand the basic tenets of communication and apply the basic communication practices in different types of communication (Apply)

CO5: Apply the life skills to different situations (Apply)

CO – PO MAPPING:

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

SYLLABUS:

UNIT I BASICS FOR COMMUNICATION 9

Applications of Tenses – Modal Verbs – Phrasal Verbs – Voices – Sentence formation and Completion Sentence Structure Word Puzzles – Introducing and Sharing Information – Introducing Peer Members – Note Making – Analyzing and Writing a Review.

UNIT II HUMAN VALUES AND BUSINESS COMMUNICATION 9

Self-exploration – SWOT Analysis and Goal setting – Values of individuals – Self – work withimmersion (Interviewing Community Workers) and narrate what you think are the values that drive them – Writing Newspaper report – record conversation between a celebrity and an interviewer – Self-awareness; Stress management-Team Work.

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UNIT III VOCABULARY ENRICHMENT 9

Word formation: – Word Puzzles – Compound words – Single word substitute – Verbal Analogy – Phrases – idioms – Significant abbreviations formal business vocabulary – Commonly confused words.

UNIT IV READING AND WRITING SKILLS 9

Reading articles – Short Comprehension – Creative Writing – Creating Slogans – Create a podcast ona topic – E-Mail Writing – Picture Inference.

UNIT V LANGUAGE ADEPTNESS 9

Listening for Specific Information – Listening to TED talks – Announcements – Documentaries – Extempore and Persuasive Speech.

LIST OF EXERCISES

1. Introducing Oneself and Sharing Information
2. Presentation on the persona of any well-known person & Role – Play
3. Create a podcast on a topic
4. Newspaper Report
5. Skit Based Communication
6. Listening to TED Talks/Announcements and Documentaries

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Rizvi and Ashraf, "Effective Technical Communication", 1st Edition, Mc Graw – Hill, India 2017.
2. Locker, Kitty O and Stephen Kyo Kaczmarek. "Business Communication: Building Critical Skills",McGraw-Hill/IrwinPublishers,2014.
3. Subroto Bagchi, "The Professional", 1st Edition, Penguin Publishers, 2009.

REFERENCES:

1. Alan Mc'carthy and O'dell, "English vocabulary in Use", Cambridge University Press, 2017.APAART: "SpeakWell1"(English language and communication).
2. Saroj Hiremath, "Business Communication", 1st Edition, Nirali Prakashan, 2018.

EVALUATION PATTERN:

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

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SEMESTER I

		Category :BSC				
U21PH101	ENGINEERING PHYSICS	L	T	P	J	C
	(Common to all programmes)	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 fiber optics in core engineering applications (Understand)

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

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

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

CO – PO MAPPING:

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

SYLLABUS:

UNIT I LASER 6

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

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.

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UNIT III ULTRASONICS 6

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

UNIT IV THERMAL PHYSICS AND PROPERTIES OF FLUIDS 6

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

UNIT V CRYSTAL PHYSICS 6

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

LIST OF EXPERIMENTS

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

Contact Periods:

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

Total: 60 Periods

TEXT BOOKS:

1. Bhattacharya D Kand Poonam Tandon, "Engineering Physics",2nd Edition, Oxford UniversityPress, Chennai, 2017.
2. Marikani A, "Engineering Physics",3rd Edition,PHI publishers,Chennai,2021.

REFERENCES:

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

EVALUATION PATTERN:

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

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SEMESTER I

		Category : BSC				
U21CY101	ENGINEERING CHEMISTRY	L	T	P	J	C
	(Common to all programmes)	2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

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

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

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

CO – PO MAPPING:

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

SYLLABUS:

UNIT I CHARACTERISTICS OF WATER AND ITS TREATMENT 6

Characteristics of water – Hardness – Types, Dissolved oxygen, Total dissolved solids, Disadvantages due to hard water in industries – (Scale, Sludge, Priming, Foaming and Caustic embrittlement), Water softening methods – Lime-soda, Zeolite, Ion exchange processes and reverse Osmosis and their applications. Specifications of domestic water (ICMR and WHO).Water treatment for municipal supply Sedimentation with coagulant – Sand Filtration – Chlorination, Disinfection methods – UV treatment, Ozonolysis, Electro dialysis.

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UNIT II ELECTRO CHEMISTRY 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 & 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 ofsynthetic 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 temperatureClassification of polymers , Difference between thermoplastics and thermosetting plastics, Engineering application of plastics - ABS, PVC, PTFE and Bakelite.Types of compounding of plastics Moulding, Injection moulding, Extrusion moulding, Compression Moulding. Conducting polymers – Polypyrrole, Polyacetylene, Polyaniline – Structure and applications, Composites – FRP – Properties and applications.

LIST OF EXPERIMENTS

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

Contact Periods:

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

TEXT BOOKS:

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

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REFERENCES:

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

EVALUATION PATTERN:

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

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SEMESTER I

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

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

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

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

CO – PO MAPPING:

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

SYLLABUS:

UNIT I COMPUTATIONAL THINKING 6

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

UNIT II ALGORITHMIC APPROACH 6

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

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UNIT III SEARCHING, SORTING AND MODULARIZATION 6

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

UNIT IV STRUCTURES AND POINTERS 6

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

UNIT V FILES 6

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

LIST OF EXPERIMENTS

A.Lab Programs

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

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11. Develop a banking application to store details of accounts in a file. Count the number of account holders based on a search condition such as - whose balance is less than the minimum balance.

B. Mini Project (Sample)

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

- Availability checking
- Cancellation
- Prepare chart

Contact Periods:

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

Total: 60 Periods

TEXT BOOKS:

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

REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)			
*Individual Assignment / / MCQ	Written Test	Mini Project	Lab Test	Total Internal Assessments	End Semester Examinations
40	60	75	25	200	100
Total				50	50
				100	

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SEMESTER I

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

PRE- REQUISITES:

- Nil

COURSEOBJECTIVES:

- 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)

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.

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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:

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

REFERENCES:

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

EVALUATION PATTERN:

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

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SEMESTER II

		Category: HSMC				
U21GEG02	TAMILS AND TECHNOLOGY (Common to all programmes)	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 –

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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 beats –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. கணினித் தமிழ் - முனைவர். இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்ககால 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) (Publishedby: 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

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

முன்கூட்டிய துறைசார் அறிவு: தேவையில்லை

பாடத்தின் நோக்கங்கள்:

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

பாடம் கற்றதின் விளைவுகள்:

CO1: சங்ககாலத் தமிழர்களின் நெசவு மற்றும் பானை வனைதல் குறித்த கற்றுணர்தல் (புரிதல்)
CO2: சங்ககாலத் தமிழர்களின் கட்டட தொழில் நுட்பம், 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:

COs \ POs	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)					

பாடத் திட்டங்கள்:

அலகு I நெசவு மற்றும் பானைத் தொழில் நுட்பம் 3

சங்க காலத்தில் நெசவுத்தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்

அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில் நுட்பம் 3

சங்ககாலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் மற்றும் சங்க காலத்தில் வீட்டுப்பொருட்களின் வடிவமைப்பு–சங்ககாலத்தில் கட்டுமானப்பொருட்களும் நடுகல்லும்–சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள்–மாமல்லபுரச் சிற்பங்களும் 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.

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அலகு III உற்பத்தித் தொழில் நுட்பம் 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 தொழில் நுட்பம் 3

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

அலகு V அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் 3

அறிவியல் தமிழின் வளர்ச்சி–கணினித் தமிழ் வளர்ச்சி–தமிழ் நூல்களை மின் பதிப்பு செய்தல்–தமிழ் மென்பொருட்கள் உருவாக்கம்–தமிழ் இணையக் கல்விக்கழகம்–தமிழ் மின்நூலகம்–இணையத்தில் தமிழ் அகராதிகள்–சொற்குவைத் திட்டம்.

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 சங்ககால நகர நாகரிகம் (தொல்லியல்துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல்துறை 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

மதிப்பீட்டுமுறை:

தொடர்ச்சியான உள்மதிப்பீடு	மொத்தம்
	100

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SEMESTER II

		Category : BSC				
U21MA208	LINEAR ALGEBRA	L	T	P	J	C
	(Common to CB & IT)	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	1	2
CO2	3	2	1	1	-	1	-	-	-	-	1	2	-	2
CO3	3	2	1	1	-	1	-	-	-	-	1	2	-	2
CO4	3	2	2	1	-	1	-	-	-	-	1	2	-	2
CO5	3	2	2	1	-	1	-	-	-	-	1	2	1	1
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 EIGEN VALUE PROBLEMS 9+3

Linear transformations – Range, Kernel and problems – Eigen values and Eigen vectors –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:

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

REFERENCES:

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

EVALUATION PATTERN:

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

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SEMESTER II

U21CB201	FUNDAMENTALS OF ECONOMICS	Category : PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To provide the basic knowledge on micro and macroeconomics to analyze the market structure and demand-supply in real time economy
- To imparts the knowledge of economic decision making by exploring the performance and behaviour of an economy

COURSE OUTCOMES:

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

CO1: Select the appropriate microeconomic demand-supply strategies to solve the business problems (Understand)

CO2: Develop strategies that measure, critique and interpret consumer's behavior in decision making (Apply)

CO3: Make use of the different production and cost functions to derive product decision (Apply)

CO4: Analyze the macroeconomics components and Keynesian Multiplier to solve the realtime economy problems (Apply)

CO5: Examine the banking and central bank's monetary policy concepts in economic development of a nation (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I MICRO ECONOMICS – PRINCIPLES OF DEMAND AND SUPPLY 9

Principles of Demand and Supply – Supply Curves of Firms - Elasticity of Supply – Demand Curves of Households – Elasticity of Demand – Equilibrium and Comparative Statics (Shift of a Curve and Movement along the Curve) – Welfare Analysis - Consumers' and Producers' Surplus – Price Ceilings and Price Floors.

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UNIT II MICRO ECONOMICS – CONSUMER BEHAVIOUR 9

Consumer Behavior - Axioms of Choice - Budget Constraints and Indifference Curves – Consumer's Equilibrium - Effects of a Price Change, Income and Substitution Effects - Derivation ofa Demand Curve - Applications - Tax and Subsidies – Intertemporal Consumption - Suppliers' Income Effect.

UNIT III MICRO ECONOMICS-THEORY OF PRODUCTION 9

Theory of Production - Production Function and ISO - quants - Cost Minimization - Cost Curves - Total, Average and Marginal Costs - Long Run and Short Run Costs - Equilibrium of a Firm Under Perfect Competition - Monopoly and Monopolistic Competition.

UNIT IV MACRO ECONOMICS-NATIONAL INCOME 9

National Income and its Components - GNP, NNP, GDP, NDP - Consumption Function – Investment - Simple Keynesian Model of Income Determination and the Keynesian Multiplier - Government Sector - Taxes and Subsidies - External Sector - Exports and Imports.

UNIT V MACRO ECONOMICS-MONEY 9

Money – Definitions - Demand for Money -Transactionary and Speculative Demand - Supply of Money - Bank's Credit Creation Multiplier - Integrating Money and Commodity Markets - IS, LM Model Business Cycles and Stabilization - Monetary and Fiscal Policy - Central Bank and the Government The Classical Paradigm - Price and Wage Rigidities - Voluntary and Involuntary Unemployment.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Pindyck, Robert S., and Daniel L. Rubinfeld, "Microeconomics", 8th Edition, The Pearson Education, Inc., 2013.
2. Dornbusch, Fischer and Startz, "Macroeconomics", 13th Edition, McGraw Hill, 2018.
3. Paul Anthony Samuelson, William D. Nordhaus, "Economics", 19th Edition, McGraw Hill, 2009.

REFERENCES:

1. Hal R, Varian "Intermediate Microeconomics: A Modern Approach", 9th Edition, W.W. Norton Company, 2014.
2. N. Gregory Mankiw, "Principles of Macroeconomics", 9th Edition,2014.
3. https://data.oecd.org/economy.htm.
4. https://www.focus-economics.com.
5. https://www.rbi.org.in.

EVALUATION PATTERN:

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

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SEMESTER II

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

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

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

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

CO-PO MAPPING:

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

SYLLABUS:

UNIT I CONDUCTING MATERIALS 6

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

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 6

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

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UNIT IV DIELECTRIC AND OPTICAL MATERIALS 6

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

UNIT V NEW ENGINEERNG MATERIALS AND CHARACTERIZATION TECHNIQUES 6

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

Contact Periods:

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

Total: 30 Periods

TEXT BOOKS:

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

REFERENCES:

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

EVALUATION PATTERN:

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

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SEMESTER II

		Category : HSMC				
U21EN202	BUSINESS COMMUNICATION & VALUE SCIENCE – II	L	T	P	J	C
		1	0	2	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop effective writing, reading, presentation and group discussion skills
- To introduce the organizational concepts and theory dedicated to a social cause
- To identify personality traits and evolve as a better team player

COURSE OUTCOMES:

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

CO1: Understand and use tools of structured written communication (Understand)

CO2: Develop materials to create an identity for an organization dedicated to a social cause (Apply)

CO3: Identify individual personality types and role in a team (Analyze)

CO4: Understand the basic concepts of Morality and Diversity (Understand)

CO5: Organize an event to generate awareness and get support for a cause (Apply)

CO – PO MAPPING:

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

SYLLABUS:

UNIT I LEXICAL REASONING 9

Establishing Associations – Verbal Analogy- Logical Reasoning – Reasoning and Assertions – Clozetest- Single word Substitute – Creating and launching E-magazine – Common Errors-Report Writing.

UNIT II SOCIAL CORRESPONDENCE 9

Each group forming an NGO - Create Vision, Mission, Value Statement, and tagline and design a logo – Groups to present their NGOs – Presentation recording and sharing the findings from recording – Practicing individual write up for E– magazine and evaluation – Speed Reading Session- Introduction to Skimming and Scanning.

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UNIT III ART OF NETWORKING 9

Brain Storming Session – Discussing and Exploring the means of articulating and amplifying the Social issue their NGOs are working for – Addressing a Multitude – Welcome Address – Vote of Thanks – Public Speaking.

UNIT IV CRITICAL THINKING 9

Learn Values from Movies – Film on Diversity – Discussion on key take away of the film – Mind Mapping – Conflict Management – Case Study – Time Management.

UNIT V LISTENING SKILLS 9

Listening to Product Description-Listening to Inspirational speech– Listening Comprehension – Critical Review – Book / Movie Review – Comparative Analysis.

LIST OF EXERCISES

1. Create E- Magazine
2. Presentation
3. Public Speaking
4. Listening to Product Description/Inspirational Speech
5. Listening Comprehension
6. Book/Movie Review

Contact Periods:

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

Total:45 Periods

TEXT BOOKS:

1. Shalini Verma,"Development of Life Skills and Professional Practice", 1st Edition, Vikas Publishing house Pvt. Ltd., 2014.
2. Barun. K.Mitra, "Personality Development and Soft Skills", OUP India, 2019.

REFERENCES:

1. Peter H. Diamandis and Steven Kotler; "Abundance: The Future is Better Than You Think" Free Press, 2012.
2. Nancy D. Mitchell, William D. Wells,Sandra Moriarty, "Advertising & IMC: Principles and Practice", Published: 15 June 2016; Publisher: Pearson Education India.

EVALUATION PATTERN:

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

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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	2	1
CO2	2	1	1	2	-	-	-	1	2	2	-	2	2	1
CO3	3	2	2	2	-	-	-	1	2	2	-	2	2	2
CO4	3	2	2	2	-	-	-	1	2	2	-	2	2	1
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 – Data types – Numbers and math functions – Input and Output operations – Comments – Reserved words – Indentation – Operators and expressions – Precedence and associativity – Type conversion – Debugging – Common errors in Python.

UNIT II CONTROL STATEMENTS, FUNCTIONS AND MODULES 6

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

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UNIT III PYTHON DATA STRUCTURES 6

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

UNIT IV EXCEPTION AND FILE HANDLING 6

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

UNIT V NUMPY AND PANDAS 6

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

LIST OF EXPERIMENTS

1. Programs on selection and Iteration operations
2. Get an integer input from a user. If the number is odd, then find the factorial of a number and find the number of digits in the factorial of the number. If the number is even, then check the given number is palindrome or not
3. Strings and its operations
4. Given two strings, PRINT (YES or NO) whether the second string can be obtained from the first bydeletion 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 data frames

Contact Periods:

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

Total: 60 Periods

TEXTBOOKS:

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

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REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
Individual Assignment/ /MCQ	Written Test	Evaluation of Laboratory Observation, Record (Rubrics Based Assessment)	Lab Test		
40	**60**	**75**	**25**	**200**	**100**
Total				**50**	**50**
				100	

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SEMESTER II

U21ECG01	DIGITAL ELECTRONICS (Common to all programmes)	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	PSO1	PSO2
CO1	3	2	1	-	-	-	-	1	2	1	-	1	-	-
CO2	3	2	1	-	-	-	-	1	2	1	-	1	-	-
CO3	3	3	1	-	-	-	-	1	2	1	-	1	-	-
CO4	3	2	1	-	-	-	-	1	2	1	-	1	-	-
CO5	3	3	1	-	-	-	-	1	2	1	-	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, Quine McCluskey method.

UNIT II COMBINATIONAL LOGIC DESIGN 6

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

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UNIT III LATCHES AND FLIP FLOPS 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

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 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. A.Anand Kumar, "Fundamentals of Digital Circuits", 2nd Edition, PHI Learning, 2013.
2. Ronald J Tocci, Neal S Widmer, Gregory L Moss, "Digital Systems Principles and Applications", 10th Edition, Pearson, 2009.
3. Thomas L.Floyd, "Digital Fundamentals", 11th Edition, Prentice Hall, 2015.
4. D. Donald Givone, "Digital Principles and Design", 4th Edition, Tata McGraw Hill, 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	Evaluation of Laboratory Observation, Record(Rubrics Based Assessments)	Test		
40	60	75	25	200	100
Total				50	50
Total				100	

*RolePlay/GroupDiscussions/Debates/OralPresentations/PosterPresentations/Technical presentation can also be provided based on the nature of the courses.

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SEMESTER II

		Category : ESC				
U21ECG03	ENGINEERING STUDIO (Common to all programmes)	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	-	-
CO2	3	3	3	3	2	2	1	1	2	-	-	1	-	-
CO3	3	3	3	3	3	2	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 work book, Tasks **(Rubrics based)**
100

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SEMESTER III

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

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

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

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

CO– PO MAPPING:

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

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

SYLLABUS:

UNIT I BOOLEAN ALGEBRA **9 + 3**

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

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UNIT II ABSTRACT ALGEBRA 9 + 3

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

UNIT III COMBINATORICS 9 + 3

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

UNIT IV GRAPH THEORY 9 + 3

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

UNIT V LOGIC 9 + 3

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

Contact Periods:

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

Total : 60 Periods

TEXT BOOKS:

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

REFERENCES:

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

EVALUATION PATTERN:

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

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SEMESTER III

U21CS301	COMPUTER ORGANIZATION AND ARCHITECTURE	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: Analyze 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	3	3	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.

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UNIT II DATAPATH 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, 2015.
2. Carl Hamacher, Zvonko Vranesic, Safwatzaky , "Computer Organization" , 5th Edition, Tata McGraw Hill, 2015.

REFERENCES:

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

EVALUATION PATTERN:

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

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

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SEMESTER III

U21CS302	DATABASE MANAGEMENT SYSTEMS	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the concept of DBMS and ER Modeling
- To explain the normalization, Query optimization and relational algebra
- To apply the concurrency control, security and indexing for the real time data

COURSE OUTCOMES:

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

CO1: Explain the basic concepts of the database management systems (Understand)

CO2: Formulate SQL queries to create, manipulate and control the database (Apply)

CO3: Apply normalization technique to design database (Apply)

CO4: Analyze database transactions using ACID properties (Analyze)

CO5: Compare the various storage and optimization techniques (Understand)

CO– PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO RELATIONAL DATABASE 9

Database – System Applications – Purpose of Database Systems – View of Data-Database Languages – Database Architecture – Database Schema and Diagram – Relational Algebra – ER Diagrams – Entities, Attributes, Relationships, Constraints, Keys – Extended ER features.

UNIT II STRUCTURED QUERY LANGUAGE 9

Basics of SQL, DDL, DML,DCL,TCL – creation, alteration, defining constraints – Functions – aggregate functions, Built-in functions – Views – Joins – Procedure.

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UNIT III DATABASE DESIGN 9

Functional dependencies – Normalization – Normal forms based on primary keys (1NF, 2NF, 3NF, BCNF, 4NF, 5NF) – Triggers – Cursor.

UNIT IV TRANSACTION MANAGEMENT 9

Introduction to transactions – States of transaction– ACID Properties – Concurrent executions – Serializability – Log Based Recovery – Need for Concurrency – Lock based protocols – SQL for Concurrency – Two Phase Commit Protocol – Deadlocks.

UNIT V IMPLEMENTATION TECHNIQUES AND NOSQL DATABASE 9

Indexing and Hashing – B+ tree Index Files – B Tree Index Files – Query Processing and optimization – Introduction to NoSQL Databases – Types of NOSQL Databases– CAP theorem – NoSQL Vs SQL – Limitations of NoSQL – Basics of MONGODB.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", 6th Edition, Tata McGraw Hill, 2011.
2. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson, 2017.

REFERENCES:

1. Pramod J. Sadalage and Marin Fowler, "NOSQL Distilled: A Brief guide to merging world of Polyglot persistence", 2nd Edition, Addision Wesley, 2012.
2. Ramakrishnan and Gehrke, "Database Management Systems", 3rd Edition, McGraw Hill, 2003.
3. https://nptel.ac.in/courses/106/105/106105175/.
4. https://www.edureka.co/mongodb-certification-training.
5. https://www.coursera.org/learn/introduction-to-nosql-databases.
6. https://www.guru99.com/nosql-tutorial.html.
7. https://www.coursera.org/learn/introduction-mongodb.

EVALUATION PATTERN:

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

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B.Tech.–CB –R2021–CBCS

SEMESTER III

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–REQUISITE:

- 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	-
CO4	3	2	2	2	-	2	-	1	2	2	-	3	2	-
CO5	3	2	2	2	-	2	-	1	2	2	-	3	2	-
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.

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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 EXPERIMENTS (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 in a sorted order
   v. Display the elements of the list
2. Write a main method to demonstrate the above functionalities
3. Creation of Array and linked list implementation of Stack and Queue ADTs
4. Implementation of quick, heap, and shell sort
5. Program to sort the elements in ascending order using selection sort and bubble sort
6. Implementation of hashing technique
7. Develop a program to perform a linear and binary search
8. Program to construct an expression tree for a given expression and perform various tree traversal methods
9. Implement Prim's 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 the 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
10. Choose an appropriate data structure and create a token system for banking service (withdrawal, deposit, and money transfer)
11. Create a food delivering system that allocates the path for the delivery of food using appropriate data structures
12. 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

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TEXT BOOKS:

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

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:

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

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

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SEMESTER III

		Category: PCC				
U21CSG04	JAVA PROGRAMMING (Common to AM, BM, CB, CS, EC & EE)	L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITE:

- U21CSG01 : Problem Solving and C Programming

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

CO1: Describe the object-oriented programming concepts to develop simple java programs (Understand)

CO2: Develop Java programs using Inheritance principle (Apply)

CO3: Apply exception handling techniques in Java programs (Apply)

CO4: Develop Java programs with Input / output classes and multithreading (Apply)

CO5: Implement Java programs with Collections (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	1	2	2	-
CO2	3	2	2	2	-	-	-	1	2	2	2	2	3	-
CO3	3	2	2	2	-	-	-	1	2	2	2	2	3	-
CO4	3	2	2	2	-	-	-	1	2	2	2	2	3	-
CO5	3	2	2	2	-	-	-	1	2	2	2	2	3	-
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I OBJECT ORIENTED DEVELOPMENT AND JAVA BASICS 6

Object Oriented Programming – Concepts – Abstraction – Encapsulation – Comparison with function oriented programming – Characteristics of Java – Java Environment – JVM and JDK – Classes – Constructors – Methods – Static members – Comments – Data Types – Variables – Operators – Control Flow.

UNIT II PACKAGES AND INHERITANCE 6

Defining a Package – Importing Packages – Inheritance – Creating super classes and sub classes –Access modifiers – Constructors in sub classes – Polymorphism – Method overloading –Method overriding – Abstract classes and abstract methods – Interfaces – Defining an interface – Implementing interface – Extending interfaces – Object class.

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UNIT III EXCEPTION HANDLING 6

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

UNIT IV I/O STREAMS AND MULTITHREADING 6

Input / Output Basics – Scanner class – Streams – Byte streams and Character streams comparison – Reading from and Writing to Console and Files – Multithreaded Programming – The Java Thread Model – Creating multiple threads – Thread class – Runnable Interface.

UNIT V COLLECTIONS 6

Collections Framework Overview – Basics of List – Set – Queue – Programs using Array list – HashMap and HashSet – Hashcode and equals methods.

LIST OF EXPERIMENTS

1. Write a Java program to create a class Student with private data members and public methods to implement encapsulation and abstraction
2. Develop a Java program to implement constructor overloading and method overloading
3. Develop a Java program to implement run-time polymorphism with inheritance
4. Develop a Java program to implement inheritance using Interfaces and Abstract classes. Use packages.
5. Develop a Java program to demonstrate exception handling
6. Develop a multithreaded java program using a Thread class and Runnable interface
7. Develop a Java program to implement basic console IO and File IO
8. Develop a Java program to store multiple objects in an Array List and to implement search and sort operations

Contact Periods:

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

Total: 60 Periods

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, 2018.
2. Cay.S.Horstmann and Gary Cornell, "Core Java 2, Vol 1, Fundamentals", 11th Edition,Pearson Education, 2020.

REFERENCES:

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

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EVALUATION PATTERN:

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

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

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SEMESTER III

		Category: PCC				
U21CB301	EXPLORATORY DATA ANALYSIS IN BUSINESS	L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITE:

- U21CSG02 : Python Programming

COURSE OBJECTIVES:

- To outline an overview of exploratory data analysis
- To perform univariate, bivariate, multivariate data exploration and analysis
- To use Data exploration and visualization techniques for time series data

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of exploratory data analysis (Understand)

CO2: Understand data transformation and aggregation (Understand)

CO3: Perform univariate, bivariate and multivariate data exploration and analysis (Apply)

CO4: Use Data exploration and visualization techniques for time series data (Apply)

CO5: Apply data exploration techniques for various business application (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	2	2
CO2	3	2	2	2	-	-	-	1	2	2	-	2	2	2
CO3	3	2	2	2	-	-	-	1	2	2	-	2	2	2
CO4	3	2	2	2	-	-	-	1	2	2	-	2	2	2
CO5	3	2	2	2	-	-	-	1	2	2	-	2	2	2
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I INTRODUCTION TO EXPLORATORY DATA ANALYSIS 6

Introduction to Exploratory Data Analysis (EDA) –Steps in EDA, Data Types: Numerical Data – Discrete data, continuous data – Categorical data – Measurement Scales: Nominal, Ordinal, Interval, Ratio – Comparing EDA with classical and Bayesian Analysis – Software tools for EDA– EDA automation tools: pycaret, pandas– profiling.

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UNIT II DATA TRANSFORMATION AND AGGREGATION 6

Transformation Techniques: Performing data deduplication – replacing error values– Discretization and binding. Introduction to Missing data, handling missing data. Traditional methods – Maximum Likelihood Estimation– Data aggregation - Time intervals for data collection and aggregation.

UNIT III UNIVARIATE, BIVARIATE AND MULTIVARIATE ANALYSIS 6

Introduction to Single variable: Distribution Variables – Numerical Summaries of Level and Spread– Scaling and Standardizing – Inequality, Relationships between Two Variables – Percentage Tables – Analysing Contingency Tables – Handling Several Batches – Scatter plots and Resistant Lines.

UNIT IV TIME SERIES ANALYSIS and VISUALIZATION 6

Fundamentals of TSA – characteristics of TSA – Time-based indexing – visualizing time series – grouping time series data – resampling time series data, EDA automation tools- pycaret, pandaqq2qq2qs-profiling, Visualization tools – matplotlib, pyplot, seaborn,Tableau, PowerBI.

UNIT V APPLICATIONS OF DATA EXPLORATION IN BUSINESS 6

Sales forecasting and prediction– Financial reporting and analysis– Marketing and customer insights– Operations and supply chain management– Human resources and workforce analytics– Loan prediction – Demand forecasting.

LIST OF EXPERIMENTS

1. Apply basic statistical techniques to analyze and understand properties of the data on any standard dataset (Kaggle, UCI repository)
2. Write python code that loads any standard dataset downloaded from Kaggle, UCI repository, and implement Univariate and Bivariate analysis with plots
3. Perform some basic data cleaning operations like removing duplicate records, input null values on standard dataset using Python (Dataset should contain minimum 1000 records)
4. Perform time series analysis to check the data quality over a time-period (no. of purchases in a month over years, quantity of sales in a year, etc.,), (dataset should contain minimum 1000 records) Using Python
5. Handle null and zero values in any sales dataset and plot different graphs which shows correlation between different variables
6. Plot and derive the insights on the automobiles sales / prediction for any standard (Dataset source: Kaggle, Github, etc)
7. Perform sales forecasting on bigmart dataset applying EDA techniques
8. Perform EDA on any E- commerce dataset

Contact Periods:

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

Total: 60 Periods

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TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python",Packt Publishing,2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working withData", First Edition, O Reilly,2017.
3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008.

REFERENCES:

1. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
2. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly publications, 2019.
3. Matthew O. Ward, Georges Grinstein, Daniel Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications", 2nd Edition, CRC press, 2015.

EVALUATION PATTERN:

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

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

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KPRIET Learn Beyond

U21EN301	BUSINESS COMMUNICATION & VALUE SCIENCE – III (For CSBS)	Category: HSM				
		L	T	P	J	C
		1	0	2	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop technical writing skills
- To practice self-analysis techniques like SWOT & TOWS
- To understand key concepts of pluralism & cultural spaces

COURSE OUTCOMES:

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

CO1: Identify the best practices of technical writing and apply in real life scenarios (Apply)

CO2: Relate and examine the basic principles of SWOT and life positions (Analyse)

CO3: Understand and respect pluralism in cultural spaces (Analyse)

CO4: Recognise the common mistakes made in cross-cultural communication (Understand)

CO5: Exchange information and formulate the plan for organisational goals (Understand)

CO-PO MAPPING:

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

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

SYLLABUS:

UNIT I SELF AWARENESS AND SELF DEVELOPMENT 9

Self-Assessment – Goal Setting – Personal and Career Goals – Self-Awareness – Perceptions and Positive attitudes – Behavioral Skills – Digital Profiling - Digital Communication - Life lessons.

UNIT II INTERPERSONAL SKILLS AND HR MANAGEMENT 9

Team work – Team Effectiveness – Decision Making – Conflict Resolution – Negotiation Skills– Preparation and Planning – Bargaining and Problem Solving – Closure & Implementation - Interview Etiquette – Mock Interview.

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UNIT III WRITTEN COMMUNICATION 9

Process and Product Description – Interpreting Charts and Graphs – Drafting Circulars (Business Context) – Report Writing - Drafting Appointment letters – Drafting Joining Letters - Formal and Business letters – Building Professionalism in Work Place.

UNIT IV NON-VERBAL AND INTERCULTURAL COMMUNICATION 9

Importance of Non-verbal Communication – Personal appearance – Facial expressions – Movement- posture – Gestures – Eye contact – Voice – Beliefs and customs – Worldview and attitude - Developing Leadership Qualities - Professional Ethics.

UNIT V BUSINESS CORRESPONDENCE 9

Enquiry & Complaint letters – Telephonic correspondence – Persuasive writing – Thanks Giving letters – Social media correspondence - Addressing the Grievances of Customer – Practices to Maintain Customer Satisfaction – Customer Survey.

Total: 45 Hours

LIST OF EXCERCISES

1. Digital Profiling
2. Group Discussion
3. Product Review
4. Business Etiquette
5. Writing for Advertisement
6. Listening to Business Talk

Contact Periods:

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

Total 45 Periods

TEXT BOOKS:

1. Kitty O Locker and Stephen KyoKaczmarek, "Business Communication: Building Critical Skills",6th Edition, McGraw-Hill / Irwin Publishers, 2014.
2. Mary Ellen Guffey and Dana Loewy, "Essentials of Business Communication", 11th Edition, Cengage Learning Publishers, 2012.

REFERENCES:

1. Meenakshi Raman and Sangeeta Sharma, "Fundamentals of Technical Communication", 1st Edition,OUP, 2014.
2. Lawrence G Fine, "The SWOT Analysis: Using Your Strength to Overcome Weaknesses", Using Opportunities to Overcome Threats, 1st Edition, Create Space Independent Publishing Platform, 2009.

Web References

1. https://freelance-writing.lovetoknow.com/kinds-technical-writing
2. https://m.youtube.com/watch?v=dT_D68RJ5T8&feature=youtube
3. https://m.youtube.com/watch?v=7sLLEdBgYYY&feature=youtube

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Learn to Beyond

EVALUATION PATTERN:

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

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B.Tech.–CB –R2021–CBCS

SEMESTER III

		Category: PCC				
U21CS304	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the DDL and DML commands
- To learn the use of nested and join queries
- To explore functions, procedures and procedural extension of databases

COURSE OUTCOMES:

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

CO1: Create a database using data definition language (Apply)

CO2: Implement data manipulation queries to retrieve data from the database (Apply)

CO3: Apply PL-SQL stored procedures to the database (Apply)

CO4: Create a NOSQL database using MongoDB (Apply)

CO5: Develop an application for a database (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	3	1	-	1	2	2	2	3	3	-
CO2	3	2	2	2	3	1	-	1	2	2	2	3	3	-
CO3	3	2	2	2	3	1	-	1	2	2	2	3	3	-
CO4	3	2	2	2	3	1	-	1	2	2	2	3	3	-
CO5	3	2	3	2	3	2	-	1	2	2	2	3	3	-
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

LIST OF EXPERIMENTS

1. Conceptual Database design using E-R model – case study
2. Implementation of SQL commands DDL, DCL, TCL
3. Queries to demonstrate implementation of various integrity and key constraints
4. Practice on various DML commands to write a query to interact with database
5. Practice on and aggregate functions and views
6. Implement joins, nested queries and stored procedures
7. Practice on procedural extensions (Functions, Cursors, Triggers)
8. Document Database creation using MongoDB

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9. Mini Project (App development using oracle DB)

   i. Campus Management System
   ii. Library Management System
   iii. Student information system
   iv. Hall Booking System
   v. Online Exam Registration system
   vi. Stock maintenance system
   vii. Event Registration System
   viii. Passport automation system
   ix. Blood bank Management system
   x. E-ticketing for Airline reservation System

Contact Periods:

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

Total: 60 Periods

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concepts", 6th Edition, Tata McGraw Hill, 2011.
2. RamezElmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson, 2017.
3. R. Elmasri S. B. Navathe, "Fundamentals of Database Systems", 2nd Edition, Addison Wesley, 2015.
4. Shashank Tiwari, "Professional NOSql", 2nd Edition, Wiley, 2011.
5. Pramod J. Sadalage and Marin Fowler, "NOSQL Distilled: A Brief guide to merging world of Polyglot Persistance", 1st Edition, Addison Wesley, 2012.
6. https://nptel.ac.in/courses/106/105/106105175/
7. https://www.edureka.co/mongodb-certification-training
8. https://www.coursera.org/learn/introduction-to-nosql-databases
9. https://www.coursera.org/learn/introduction-mongodb

EVALUATION PATTERN:

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

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B.Tech.–CB –R2021–CBCS

SEMESTER III

U21CB302	DESIGN STUDIO I	Category: EEC				
		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 (TRL3) (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	-	-	-	-	-
CO2	3	3	3	3	3	3	3	3	3	-	2	1	-	-
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 beprovided 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 theversion 1 of prototype.
- The student will learn teamwork, project management, 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 35th to 40th working day)	Review 2 (Between 80th to 90th working day)	Total
0	40	60	100

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SEMESTER IV

U21CB401	BUSINESS STRATEGY	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- NIL

COURSE OBJECTIVES:

- To introduce the concepts of strategic management and understand its nature in competitive and institutional landscape
- To develop a holistic approach to see business issues comprehensively and using other core and functional subject knowledge for decision-making
- To identify and interpret the critical challenges and opportunities before an organization

COURSE OUTCOMES:

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

CO1: Explain the fundamental concepts of strategic management to analyze business situations and apply these concepts to solve business problems(Understand)

CO2: Understand the fundamental principles and interrelationships among business functions such as R&D, production, marketing, finance, HR and information technology (Understand)

CO3: Understand the inter-relationships of business to individuals, other organizations, government and society(Understand)

CO4: Describe the tools of strategic analysis thoroughly, how they are used, and where they fit in the managerial process to frame and implement strategies(Apply)

CO5: Illustrate the latest trends in Strategic Management(Understand)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO STRATEGIC MANAGEMENT 9

Importance of Strategic Management– Vision and Objectives– Schools of thought in Strategic Management– Strategy Content– Process– and Practice– Fit Concept and Configuration Perspective in Strategic Management.

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UNIT II INTERNAL AND EXTERNAL ENVIRONMENT OF FIRM 9

Core Competence as the Root of Competitive Advantage– Sources of Sustained Competitive Advantage– Business Processes and Capabilities–based Approach to Strategy–Five Forces of Industry Attractiveness that Shape Strategy– The concept of Strategic Groups– and Industry Life Cycle.

UNIT III STRATEGIES 9

Generic Strategies– Generic Strategies and the Value Chain–The Motive for Diversification– Related and Unrelated Diversification–Business Portfolio Analysis–Expansion– Integration and Diversification–Strategic Alliances– Joint Ventures– and Mergers & Acquisitions.

UNIT IV STRATEGY IMPLEMENTATION: STRUCTURE AND SYSTEMS 9

The 7S Framework – Environmental Threat and Opportunity Profile (ETOP) – SWOT Analysis – GAP Analysis – GE 9 Cell Model – Balance Score Card –Case Study –Strategic Control and Corporate Governance

UNIT V CONTEMPORARY ISSUES 9

Recent Trends in Strategic Management – Introduction – Strategic Thinking – Organizational Culture and its Significance – Organizational Development and Change – Change Management – Strategic Management in a new globalized economy.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Schilling, M. A., & Shankar, R, "Strategic management of technological innovation", 3rd Edition, Mc.Graw Hill Education,2019.
2. Cusumano, M. A., Gawer, A., &Yoffie, D. B. "The business of platforms: Strategy in the age of digital competition, innovation, and power", 4th Edition, NewYork: Harper Business,2019.

REFERENCES:

1. D.Cornell , "Dislodging multinationals: India's strategy in comparative perspective", Encarnation, 2nd Edition, University Press,2019.
2. Malerba, F.,Caloghirou, Y.,McKelvey,M., & Radoševic,S.(Eds.), "Dynamics of knowledge intensive entrepreneurship: Business strategy and public policy", 2nd Edition,2018.

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EVALUATION PATTERN :

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

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

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SEMESTER IV

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

PRE–REQUISITES:

- U21CSG04 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	-
CO2	3	3	2	2	-	-	-	-	-	-	-	3	2	-
CO3	3	2	1	2	-	-	-	-	-	-	-	3	2	-
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 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					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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SEMESTER IV

U21CS403	OPERATING SYSTEMS (Common to CS,CB & 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	-	1
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO3	2	1	-	-	-	-	-	-	-	-	-	2	-	1
CO4	3	2	1	-	-	-	-	-	-	-	-	2	-	2
CO5	3	2	1	-	-	-	-	-	-	-	-	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: Pre-emptive, Non pre-emptive 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.

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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", Pearson Education, 9th Edition, 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, 2010.
3. Achyut S.Godbole, Atul Kahate, "Operating Systems", 3rd Edition, Mc Graw Hill, 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 / MiniProject / 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 IV

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

PRE–REQUISITE:

- U21CSG02 Python Programming

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

CO2: Illustrate the classification and regressions (Understand)

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

CO4: Illustrate the features of unsupervised learning (Understand)

CO5: Describe the applications of machine learning (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I MACHINE LEARNING LANDSCAPE 9

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

UNIT II SUPERVISED LEARNING - I 9

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

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UNIT III SUPERVISED LEARNING - II 9

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

UNIT IV UNSUPERVISED LEARNING 9

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

UNIT V MACHINE LEARNING APPLICATIONS 9

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

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

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

REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments				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	

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SEMESTER IV

		Category: BSC				
		L	T	P	J	C
U21MA409	STATISTICAL METHODS	2	0	2	0	4

PRE–REQUISITES:

- U21MA103: Probability, Statistics and Calculus

COURSE OBJECTIVES:

- To understand statistical techniques and methods of estimation
- To gain the knowledge on test of hypothesis and how they relate to engineering applications
- To know the fundamental concepts of nonparametric inference

COURSE OUTCOMES:

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

CO1: Apply the concept of sampling distribution and estimation theory in forecasting (Apply)

CO2: Analyze large and small sample tests and perform small sample tests based on Chi-square, t distributions and F distributions (Apply)

CO3: Use the appropriate non parametric hypothesis testing procedures based on inferences (Understand)

CO4: Design an experiment with proper observations and measurement to get a valid result using various design methods (Understand)

CO5: Develop the model for the given time series and estimate the required forecasting (Understand)

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	1
CO2	3	2	-	-	2	-	-	-	-	-	-	-	2	2
CO3	3	2	-	-	2	-	-	-	-	-	-	-	2	1
CO4	3	3	-	-	2	-	-	-	-	-	-	-	2	1
CO5	2	2	-	-	2	-	-	-	-	-	-	-	2	2
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I SAMPLING TECHNIQUES AND ESTIMATION THEORY 6

Random sampling – Sampling from finite and infinite populations – Estimates and standard error (sampling with replacement and sampling without replacement) – Sampling distribution of sample mean – Stratified random sampling – Estimation: Point estimation – Criteria for good estimates (unbiasedness, consistency) – Methods of estimation including maximum likelihood estimation – Sufficient statistic: concept and examples – Complete sufficiency their application in estimation – Central limit theorem (excluding proof).

UNIT II TESTING OF HYPOTHESIS 6

Concept and formulation – Type I and type II errors – Procedures of testing: large samples: tests for single mean – Difference of means and single proportion – Small samples – Student's t test: tests for single mean and difference of means – F test: test for equality of variances – Chi-Square test: tests for goodness of fit and Independence of attributes.

UNIT III NON PARAMETRIC INFERENCE 6

Comparison with parametric inference – Use of order statistics – Sign test – Wilcoxon signed rank test – Mann Whitney test – Run test – Kolmogorov-Smirnov test – Spearman's and Kendall's test – Tolerance region (simple problems only).

UNIT IV DESIGN OF EXPERIMENTS AND LINEAR STATISTICAL MODELS 6

Analysis of variance: completely randomized design – Randomized block design – Simple linear regression and correlation – Least squares method – Rank correlation.

UNIT V BASICS OF TIME SERIES ANALYSIS AND FORECASTING 6

Stationary – ARIMA models: least square method and maximum likelihood identification – Estimation – Forecasting.

LIST OF EXPERIMENTS

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

Contact Periods:

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

Total: 60 Periods

TEXT BOOKS:

1. Douglas C. Montgomery, George C. Runger, "Applied Statistics and Probability for Engineers", 3rd Edition, John Wiley & Sons, 2003
2. Chris Chatfield, "The Analysis of Time Series: An Introduction", 6th Edition, Chapman and Hall/CRC, 2003
3. Garrett Grolemund, "Hands-on Programming with R", 1st Edition, O'Reilly, 2014

REFERENCES:

1. Montgomery D C, Peck E A and Vining G G, "Introduction to Linear Regression Analysis", 5th Edition, John Wiley& Sons, 2012.
2. Mood A M, Graybill F A and Boes D C, "Introduction to the Theory of Statistics", 3rd Edition, McGraw Hill, 2001
3. Draper N and Smith H, "Applied Regression Analysis", 3rd Edition, John Wiley& Sons, 1998
4. Jared P.Lander, "R for Everyone: Advanced Analytics and Graphics", 2nd Edition, Addison Wesley Professional, 2017.

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EVALUATION PATTERN:

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

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SEMESTER IV

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

PRE–REQUISITE:

- 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

UNIT III INTERPERSONAL SKILLS 5

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

Contact Periods:

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

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Total 15 Periods

TEXT BOOKS:

1. Sharma, Prashant. "Soft Skills: Personality Development for Life Success." BPB Publications, 2022.
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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B.Tech.–CB –R2021–CBCS

SEMESTER IV

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

PRE–REQUISITES:

- U21CSG02 Python Programming

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

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

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

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

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

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

CO5: Develop simple ML application (Apply)

CO-PO MAPPING:

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

LIST OF EXPERIMENTS (INDICATIVE)

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

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6. Train and fine -tune a decision tree for MOONs Dataset by following these steps
   (1) Use make-moons (n_samples= 1000 noise =0.4) to generate a moons dataset
   (2) Use train_test_split() to split the dataset into training and testing dataset
   (3) Use grid search with cross-validation to find good hyper parameter values for a DecisionTree Classifier. Hint: Try various values for Max_leaf_nodes
   (4) Show what accuracy you have reached
7. Grow a forest by following these steps:
   (1) Generate 1000 subsets of MOONs Dataset each subset should contain 100 instances selected randomly. Hint: Use Scikit- Shuffle Split class
   (2) Evaluate these 1000 decision tree on the tests set. Since they were trained on smaller set, these Decision Trees will likely perform worse, Show the Accuracy
   (3) Now comes the magic, For each test set instance, Generate the prediction of 1000 Decision Trees and keep only the most Frequent prediction use SciPy's Mode() function. This Approach gives you *Majority-vote prediction* over the test set
   (4) Evaluate these predictions on the test set: show the accuracy
8. Load MNIST Dataset and train various classifiers like, random forest, Extra tree classifiers , SVM and try to combine them on Ensemble that outperform each individual classifier on the validation set, using soft or hard voting. Classify how much better does it perform as compared to Individual classifier
9. Use t-SNE to reduce the MNIST dataset down to 2-dimesions and plot the results using Matplotlib. You can use scatterplot using 10 different colors to represent each image target class. Alternatively, you can replace each dot in the scatterplot with the corresponding instance's class. Plot scaled-down version of digits images also. Do the same for other reduction algorithms such as PCA, LLE or MDS and compare the resulting visualization
10. Load the classic OLLIVETTI faces dataset split the dataset into a training set, a validation set and test set. Since dataset is small, you probably want to use Stratified sampling to ensure that there are same number of images per person, Next cluster the images using K-Mean. Now use K-mean as Dimensionality reduction tool, train the classifier on reduced set. Search for the number of clusters that allows the classifier to get the best performance

Contact Periods:

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

EVALUATION PATTERN:

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

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SEMESTER IV

U21CS404	OPERATING SYSTEMS LABORATORY (Common to CS,CB & 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 File 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	-	-	-	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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B.Tech.–CB –R2021–CBCS

SEMESTER IV

U21CB402	DESIGN STUDIO II	Category: EEC				
		L	T	P	J	C
		0	0	0	2	1

PRE–REQUISITE:

- **U21CB302** : 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	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	2	-
CO2	3	3	3	3	3	3	3	3	3	-	3	2	2	-
CO3	-	-	-	-	2	-	-	2	3	3	3	1	2	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 UNSDG, 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

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 35th to 40th working day)	Review 2 (Between 80th to 90th working day)	Total
0	40	60	100

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SEMESTER V

		Category: PCC				
U21CB501	FUNDAMENTALS OF MANAGEMENT	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- NIL

COURSE OBJECTIVES:

- To understand management theories, evolution of management over the years and basics concepts of management.
- To develop an understanding about how organizations work
- To explore the intricacies of different management areas such as finance, marketing, strategy etc

COURSE OUTCOMES:

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

CO1: Understand the basic theoretical concepts of management and organizational behavior (Understand)

CO2: Understand and link the concepts with contemporary issues (Understand)

CO3: Understand real-time management problems, analyze, and find solutions (Understand)

CO4: Develop and exhibit cross-cultural competencies by working in teams (Apply)

CO5: Develop managerial skills to become an effective manager (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I MANAGEMENT THEORIES 9

Concept and Foundations of Management – Evolution of Management Thoughts - Pre-Scientific Management Era (before 1880) – Classical management Era (1880-1930) – Neo-classical Management Era (1930-1950) – Modern Management era (1950-on word) – Contribution of Management Thinkers: Taylor, Fayol, Elton Mayo etc.

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UNIT II MANAGERIAL FUNCTIONS AND LEADERSHIP SKILLS 9

Basic Functions of Management – Planning – Organizing – Staffing – Directing – Controlling. Leadership Concept – Nature – Importance – Attributes of a leader– developing leaders across the organization – Leadership Grid.

UNIT III ORGANIZATION BEHAVIOR AND ORGANIZATIONAL DESIGN 9

Introduction–Personality–Perception, Learning and Reinforcement– Work Stress and Stress Management– Decision Making– Problems in Decision Making–Organization Design: Classical, Neoclassical and Contingency approaches–Organizational structure.

UNIT IV MOTIVATION & ORGANISATIONAL CULTURE 9

Motivation–Group Dynamics– Power & Influence–Organizational Culture– Decision-making frameworks– Managing Cultural Diversity – Contemporary issues in Management.

UNIT V MANAGERIAL ETHICS 9

Ethics and Business– Ethics of Marketing & advertising– Ethics of Finance & Accounting– Business and Social Responsibility– International Standards–Corporate Governance– Corporate Citizenship– Corporate Social Responsibility.

Contact Periods:

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

Total 45 Periods

TEXT BOOKS:

1. Harold Koontz, "Essentials of Management", 11th Edition, Mc Graw Hill, 2020.
2. Stephen P. Robbins, Timothy A. Judge, Neharika Vohra, "Organizational Behavior", 18th Edition, Pearson,2022.

REFERENCES:

1. PC Tripathi, PN Reddy , Ashish Bajpai, "Principles of Management", Seventh Edition, Mc Graw Hill, 2021.
2. Daniel King and Scott Lawley, "Organizational Behaviour", Fourth Edition, Oxford Press, 2022.
3. Richard L. Daft, "Understanding the Theory and Design of Organizations", Eleventh Edition, Cengage Publishers, 2020.

EVALUATION PATTERN:

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

		Category: PCC				
U21CB502	FORMAL LANGUAGES AND AUTOMATA THEORY	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- 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	-	-
CO	3	2	2	1	-	-	-	-	-	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					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	

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

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SEMESTER V

		Category: PCC				
U21CB503	SOFTWARE ENGINEERING METHODOLOGIES	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- NIL

COURSE OBJECTIVES:

- To introduce the fundamental concepts of Software development process.
- To teach the concepts of system analysis and design for system requirement specification
- To introduce the principles of Coding, Testing, documentation, and project Management

COURSE OUTCOMES:

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

CO1: Understand the system development life cycle for any business system (Understand)

CO2: Establish software project management activities such as planning, scheduling and estimation for the business system (Understand)

CO3: Specify the business requirements through appropriate system analysis and design (Understand)

CO4: Adapt good programming and documentation standards (Apply)

CO5: Implement and demonstrate any business system software from specification to validation and verification (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	2	-	-
CO2	3	2	2	2	-	-	-	1	2	2	2	2	-	-
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	2	2	2	2	-	-
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I INTRODUCTION 9

Software Engineering as a Discipline–Software Engineering Development from Structured Programming to Agile Development–Basic Concepts of Life Cycle Models – Different Models and Milestones; Software Project Planning – Identification of Activities And Resources; Concepts of Feasibility Study; Techniques for Estimation of Schedule and Effort.

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UNIT II SOFTWARE REQUIREMENT ANALYSIS, DESIGN AND CONSTRUCTION 9

Introduction To Software Requirements Specifications (SRS) And Requirement Elicitation Techniques– Introduction To UML– Design Quality– Design Concepts – Abstraction, Modularity, Specification, Encapsulation, Information Hiding, Abstract Data Type– Class Responsibility Collaborator (CRC) Model– Quality Of Design–Design Measurements.

UNIT III SOFTWARE PROJECT MANAGEMENT 9

Introduction To Software Metrics –Metrics-Based Control Methods– Measures Of Code — Concepts Of Design Patterns –Software Cost Estimation Models – Concepts Of Software Engineering Economics– Resource Management - Techniques Of Software Project Control And Reporting–Measurement Of Software Size–Concepts Of Risk And Its Mitigation– Configuration Management.

UNIT IV SOFTWARE TESTING 9

Introduction To Faults And Failures– Basic Testing Concepts– Concepts Of Verification And Validation – Black Box And White Box Tests–White Box Test Coverage, Black-Box Tests Coverage – Unit Testing – Integration Testing–System Testing – Acceptance Testing – Testing Use Cases – Transaction Based Testing – Testing For Non-Functional Requirements – Volume, Performance And Efficiency.

UNIT V SOFTWARE QUALITY MANAGEMENT AND RELIABILITY 9

Software quality – Garvin's quality dimensions –McCall's quality factor – ISO 9126 quality factor – Software Quality Dilemma – Introduction to Capability Maturity Models (CMM and CMMI) – Introduction to software reliability – reliability models and estimation – Agile Software Engineering: Concepts of Agile Methods– Extreme Programming– Agile Process Model – Scrum, Feature– Scenarios and Stories.

Contact Periods:

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

TEXT BOOK:

1. Roger S. Pressman, Software Engineering: a Practitioner's Approach, Palgrave macmillan, 7th Edition, 2017.

REFERENCES:

1. Sommerville, I., "Software Engineering", Pearson New International Edition. Pearson Education Limited, 10th Edition, 2017.
2. Ivar Jacobson, Harold Bud Lawson, Pan-Wei Ng, Paul E. McMahon and Michael Goedicke, "The Essentials of Modern Software Engineering: Free Practices from the Method Prisons",. 7th Edition, 2017.

EVALUATION PATTERN:

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

		Category: PCC				
U21CB504	SOFTWARE ENGINEERING METHODOLOGIES LABORATORY	L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the software engineering methodologies involved in the phases of project development.
- To gain knowledge about open source tools used for implementing software engineering methods.
- To exercise developing product-startups implementing software engineering methods.
- To explore the Open source Tools: StarUML / UMLGraph / Topcased

COURSE OUTCOMES:

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

CO1: Understand the ability to translate end-user requirements into system and software requirements (Understand)

CO2: Apply the UML Tools for High level design of the system (Apply)

CO3: Implement Ability to generate the SRS for the System design generated (Apply)

CO4: Develop the skills of writing sample testcases and testing problems (Apply)

CO5: Develop a simple test report in sample test cases (Analyze)

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

LIST OF EXPERIMENTS

Do the following exercises for any two projects given in the list of sample projects or any other projects:

1. Development of problem statement.

2. Preparation of Software Requirement Specification Document, Design Document and Testing Phase related documents.

3. Preparation of Software Configuration Management and Risk Management related documents.

4. Study and usage of any Design phase CASE tool

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5. Performing the Design by using any Design phase CASE tools.
6. Develop test cases for unit testing and integration testing
7. Develop test cases for various white box and black box testing techniques.

Sample Projects:

1. Passport automation System
2. Book Bank
3. Online Exam Registration
4. Stock Maintenance System
5. Online course reservation system
6. E-ticketing
7. Software Personnel Management System
8. Credit Card Processing
9. E-book management System.
10. Recruitment system

Contact Periods:

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

Total: 60 Periods

REFERENCES:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th Edition, Mc Graw Hill International Edition, 2018.
2. Software Engineering- Sommerville, 7th Edition, Pearson Education, 2018.
3. The Unified Modeling Language User Guide, Grady Booch, James Rambaugh, Ivar Jacobson, Pearson Education, 2017.

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 V

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 Activiti

UNIT III INTERVIEW SKILLS **10**

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

Contact Periods:

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

Total 30 Periods

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TEXT BOOKS:

1. Prashant Sharma, "Soft Skills: Personality Development for Life Success", BPB Publications, 1st Edition, 2022.
2. 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

U21CB505	PROTO STUDIO I	Category: EEC				
		L	T	P	J	C
		0	0	0	2	1

PRE–REQUISITES:

- U21CB402 - 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	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.

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

Total: 30 Periods

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EVALUATION PATTERN:

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

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SEMESTER VI

U21CB601	DIGITAL MARKETING AND ANALYTICS	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To know the basics of Digital marketing platforms
- To understand the theoretical aspects of creating a website
- To explore business strategies using digital marketing tools
- To assess the lead management in digital marketing
- To assess the strategies of search engine optimization

COURSE OUTCOMES:

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

CO1: Explain the concept of digital marketing platforms (Understand)

CO2: Administer the website and identify the suitable design (Apply)

CO3: Explore the various digital marketing tools for analytics (Apply)

CO4: Describe the concepts of lead management and digital marketing (Apply)

CO5: Investigate the trends and search engine optimization techniques (Analyze)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO1	1	2	1	2	2	-	-	-	-	2	1	1	-	2
CO2	1	2	2	2	2	-	-	-	-	2	1	1	-	2
CO3	2	3	2	3	3	-	-	-	2	2	1	2	-	3
CO4	2	3	3	3	3	-	-	-	2	2	2	2	-	3
CO5	2	3	3	3	3	-	-	-	2	2	2	2	-	3
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION TO DIGITAL MARKETING 9

Introduction – Needs of Digital Marketing–Digital Marketing Platforms– Organic and Paid Digital Marketing–Traditional Marketing and digital Marketing–Advantage of Digital Marketing.

UNIT II WEBSITE AND SEARCH ENGINE 9

Design a website – Hosting and Domain – Different platforms for website creation– Search Engine–Campaign–Digital media channels.

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UNIT III DIGITAL MARKETING TOOLS 9

Google Webmaster Tools– Sitemap Creators–Browser-based analysis tools–Page Rank tools–ranking & indexing tools– Dead links identification tools– Open site explorer Domain information who is tools– Quick sprout.

UNIT IV LEAD MANAGEMENT AND DIGITAL MARKETING 9

Lead forms– Case forms – Lead generation techniques–needs of Leads – social media and lead gen Inbuilt tools for Digital Marketing – Ip Tracker– CPC reduction – Group posting on Social Media platforms.

UNIT V SEARCH ENGINE OPTIMIZATION TECHNIQUES 9

SEO – Search Engine Optimization- SEM – Search Engine Marketing -Social Media Marketing/Optimization- Email Marketing. Website Designing and Development- Product Marketing- Content Writing. Copywriting- Blogging- Local Marketing. Google AdWords Campaign Management- PPC Advertising- Affiliate Marketing. Mobile and SMS Marketing- Marketing Automation-Web Analytics- Growth Hacking.

Contact Periods:

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

Total:45 Periods

TEXT BOOKS:

1.Chaffey, D., & Smith, P. R, "Digital marketing excellence: planning, optimizing and integrating online marketing", 2nd Edition, Taylor & Francis.,2017.

2.Dodson I, "The art of digital marketing: the definitive guide to creating strategic, targeted, and measurable online campaigns",1st Edition, John Wiley & Sons, 2016.

REFERENCES:

1. Kaufman I, Horton C , "Digital Marketing: Integrating strategy and tactics with values a guidebook for executives managers and students",1st Edition Routledge,2014.

2. Stokes R, "E-Marketing: The essential guide to digital marketing", 6th Edition ,Quirk eMarketing, 2011.

EVALUATION PATTERN:

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

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

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SEMESTER VI

U21CB602	BUSINESS INTELLIGENCE	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To know the basic principles of business intelligence system.
- To understand the techniques used for descriptive and predictive analytics.
- To understand the forecasting models for time series analysis
- To perform data analytics and derive inferences for decision making.

COURSE OUTCOMES:

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

CO1: Describe the fundamentals of business intelligence (Understand)

CO2: Explain the techniques for descriptive analytics (Apply)

CO3: Explain the techniques for prescriptive analytics (Apply)

CO4: Evaluate forecasting models for time series analysis (Analyze)

CO5: Formulate decision problems and strategies (Analyze)

CO-PO MAPPING:

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

SYLLABUS

UNIT I BUSINESS INTELLIGENCE 9

An Overview of Business Intelligence, Analytics, and Decision Support– A Framework for Business Intelligence– Foundations and Technologies for Decision Making– Decision Making: The Intelligence Phase– The Design Phase– The Choice Phase– The Implementation Phase.

UNIT II DESCRIPTIVE ANALYTICS 9

Data Integration and the Extraction, Transformation, and Load (ETL) Processes– Business Reporting, Visual Analytics, and Business Performance Management– Business Reporting, Visual Analytics, and

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Business Performance Management– Different Types of Charts and Graphs– The Emergence of Data Visualization and Visual Analytics.

UNIT III PREDICTIVE ANALYTICS 9

Techniques for Predictive Modeling –Text Analytics– Text Mining– Sentiment Analysis– Web Analytics, Web Mining – Social Analytics.

UNIT IV FORECATING TECHNIQUES 9

Qualitative and Judgmental Forecasting– Statistical Forecasting Models–Forecasting Models for Stationary Time Series– Forecasting Models for Time Series with a Linear Trend– Forecasting Time Series with Seasonality–Regression Forecasting with Casual Variables–Selecting Appropriate Forecasting Models.

UNIT V DECISION MAKING AND ANALYSIS 9

Formulating Decision Problems– Decision Strategies with Outcome Probabilities–Decision Trees–The Value of Information– Utility and Decision Making.

Contact Periods:

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

TEXT BOOKS:

1.Efraim Turban, "Ramesh Sharda, Dursun Delen, Business Intelligence and Analytics for Decision Support Systems", 10th Edition, Pearson, 2015.
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business Analytics Principles, Concepts and Applications", 2nd Edition, Pearson FT Press,2014.

REFERENCES:

1.Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", 1st Edition,Wiley Publications, 2009.
2.David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Managers Guide", 2nd Edition, 2012.
3.Cindi Howson, "Successful Business Intelligence: Secrets to Making BI a Killer App", 1st Edition, McGraw-Hill, 2007.

EVALUATION PATTERN:

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

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

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SEMESTER VI

		Category: PCC				
U21CSG05	COMPUTER NETWORKS	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.

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UNIT III NETWORK LAYER 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 TRANSPORT LAYER 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 APPLICATION LAYER 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. Observer, 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. Observer, understand, and experiment with the crimping process.

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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

    a) Router 1 (RT1) IP address: 192.168.1.2 (local)
    b) Router 3 (RT3) IP address: 110.120.1.2 (local)
    c) Router 2 (RT2) IP address: 110.120.1.2 (global)
    d) After configuring the IP address, check the packet situation by opening debug with the "debug ip icmp" command. Observe and under the displayed.
    e) 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.

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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.

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.

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EVALUATION PATTERN:

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

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

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SEMESTER VI

U21CB603	OPEN SOURCE TOOLS LABORATORY	Category: PCC				
		L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the importance of data visualization for business intelligence and decision making.
- To know approaches to understand visual perception
- To learn about categories of visualization and application areas
- To familiarize with the data visualization tools
- To gain knowledge of effective data visuals to solve workplace problems.

COURSE OUTCOMES:

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

CO1: Implement data visualization techniques using Python, R and Tableau (Apply)

CO2: Apply data visuals to convey trends in data over time using tableau (Apply)

CO3: Construct effective data and solve workplace problems (Apply)

CO4: Explore and work with different plotting libraries (Apply)

CO5: Learn and create effective visualizations (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	-	1	-	1
CO2	3	2	3	2	2	-	-	1	2	2	-	1	-	1
CO3	3	2	3	2	3	-	-	1	2	2	-	1	-	1
CO4	3	2	3	2	3	-	-	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

Do the following exercises for any two projects given in the list of sample projects or any other projects:

1. Introduction to various Data Visualization tools
2. Basic Visualization in Python

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3. Introduction to Tableau and Installation
4. Connecting to Data and preparing data for visualization in Tableau
5. Data Aggregation and Statistical functions in Tableau
6. Forecasting and predictive modeling in Tableau
7. Data Visualizations in Tableau
8. Basic Dashboards in Tableau

Sample Projects:

1. Sales Forecast Analysis Dashboard
2. Marketing Campaign Dashboard
3. Flight Price Analysis Dashboard
4. Crime Analysis Dashboard
5. Air Quality and Pollution Analysis Dashboard
6. Sales Pipeline Dashboard
7. Stock Exchange Analysis Dashboard
8. Twitter Sentiment Analysis Dashboard

Contact Periods:

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

Total: 60 Periods

REFERENCES:

1. Efraim Turban, Ramesh Sharda, Dursun Delen, "Business Intelligence and Analytics for Decision Support Systems", 10th Edition, Pearson, 2015.
2. Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, "Business analytics Principles Concepts and Applications", Pearson FT Press,2014.
3. Carlo Vercellis, "Business Intelligence: Data Mining and Optimization for Decision Making", Wiley Publications, 2009.
4. David Loshin Morgan, Kaufman, "Business Intelligence: The Savvy Managers Guide", 2nd Edition, 2012.

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 VI

		Category: HSMC				
U21SSG03	SOFT SKILLS – III	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 (Analyze)

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

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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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SEMESTER VI

U21CB604	PROTO STUDIO II	Category: EEC				
		L	T	P	J	C
		0	0	0	2	1

PRE–REQUISITES:

- **U21CB505** - Proto Studio I

COURSE OBJECTIVES:

- To inculcate the problem-solving and 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) (Apply)

CO2: Create Minimum Viable Prototype. (TRL 6)(Apply)

CO3: Analyze product to market fit (Apply)

CO4: Develop a business model (Analyze)

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

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.

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- 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 35th to 40th working day)	Review 2 (Between 80th to 90th working day)	Total
0	40	60	100

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B.Tech. – CB– R2021– CBCS

SEMESTER VII

U21CB701	HUMAN VALUES AND ETHICS	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- Nil

COURSE OBJECTIVES:

- To create an awareness on Engineering Ethics and Human Values
- To understand the Moral and Social Values and Loyalty
- To appreciate the rights of others
- To create awareness on assessment of safety and risk

COURSE OUTCOMES:

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

CO1: Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field

CO2: Identify the multiple ethical interests at stake in a real-world situation or practice

CO3: Articulate what makes a particular course of action ethically defensible

CO4: Assess their own ethical values and the social context of problems

CO5: Identify ethical concerns in research and intellectual contexts and the treatment of human

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

SYLLABUS:

UNIT I HUMAN VALUES 9

Morals, Values and Ethics-Integrity-Work Ethic-Service learning – Civic Virtue – Respect for others –Living Peacefully –Caring –Sharing –Honesty –Courage-Cooperation– Commitment – Empathy –Self Confidence Character – Spirituality – Case Study.

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UNIT II ENGINEERING ETHICS 9

Senses of 'Engineering Ethics-Variety of moral issued –Types of inquiry –Moral dilemmas – Moral autonomy –Kohlberg's theory-Gilligan's theory–Consensus and controversy –Models of professional roles-Customs and religion –Uses of Ethical theories –Valuing time –Co operation –Commitment–Case Study.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering As Social Experimentation –Framing the problem –Determining the facts – Code of Ethics – Clarifying Concepts –Application issues –Common Ground –General Principles –Utilitarian thinking respect for persons–Case study.

UNIT IV ENGINEERS RESPONSIBILITY FOR SAFETY AND RISK 9

Safety and risk – Assessment of safety and risk – Risk benefit analysis and reducing risk- Safety and the Engineer–Designing for the safety–Intellectual Property Rights(IPR).

UNIT V GLOBAL ISSUES 9

Globalization – Cross culture issues–Environmental Ethics – Computer Ethics – Computers as the instrument of Unethical behavior – Computers as the object of Unethical acts –Computer codes of Ethics – Weapons Development -Ethics and Research – Analyzing Ethical Problems in research–Case Study.

Contact Periods:

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

Total: 45 Periods

TEXTBOOKS:

1.M.Govindarajan, S.Natarajananad, V.S.SenthilKumar, "Engineering Ethics includes Human Values" - PHI Learning Pvt. Ltd, 2009.

2. Harris, Pritchard and Rabins, "Engineering Ethics", CENGAGE Learning, 4th Edition, 2009.

3. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", 2nd Tata McGraw Hill, 2003.

REFERENCES:

1. Prof.A.R.Aryasri, Dharanikota Suyodhana, "Professional Ethics and Morals", 2nd Edition, Maruthi Publications,2017.

2.A.Alavudeen, R.KalilRahman and M.Jayakumaran, "Professional Ethics and Human Values", 2nd Edition, Laxmi Publications, 2017.

EVALUATION PATTERN:

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

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

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SEMESTER VII

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

PRE–REQUISITES:

- NIL

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

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
CO2	3	2	2	1	1	-	-	1	-	-	-	2	-	3
CO3	3	2	2	1	1	-	-	1	-	-	-	2	-	3
CO4	3	2	2	1	-	-	-	1	-	-	-	2	-	3
CO5	3	2	2	2	-	-	-	-	-	-	-	2	-	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I CLASSICAL ENCRYPTION 8

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

UNIT II SYMMETRIC AND STREAM CIPHERS 10

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

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

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

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SEMESTER VII

		Category: PCC				
U21CB702	INTERNET OF THINGS	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To introduce system security related incidents and insight on potential defences, counter measures against common threat/vulnerabilities.
- To provide the knowledge of installation, configuration and troubleshooting of information security devices.
- To make students familiarize on the tools and common processes in information security audits and analysis of compromised systems.

COURSE OUTCOMES:

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

CO1: Contribute to managing information security (Understand)
CO2: Co-ordinate responses to information security incidents (Apply)
CO3: Contribute to information security audits (Apply)
CO4: Support teams to prepare for and undergo information security audits (Analyze)
CO5: Maintain a healthy, safe and secure working environment (Analyze)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO IOT 9

What is IoT, Genesis of IoT– IoT and Digitization– IoT Impact– Convergence of IT and IoT– IoT Challenges– IoT Network Architecture and Design– Drivers Behind New Network Architectures– Comparing IoT Architectures– A Simplified IoT Architecture– The Core IoT Functional Stack– IoT Data Management and Compute Stack.

UNIT II SMART OBJECTS 9

The "Things" in IoT–Sensors, Actuators, and Smart Objects– Sensor Networks–Connecting Smart Objects–Communications Criteria– IoT Access Technologies.

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UNIT III NETWORK LAYER 9

IP as the IoT Network Layer–The Business Case for IP– The need for Optimization– Optimizing IP for IoT– Profiles and Compliances– Application Protocols for IoT– The Transport Layer– IoT Application Transport Methods.

UNIT IV DATA ANALYTICS FOR IOT 9

Data Analytics for IoT– An Introduction to Data Analytics for IoT– Machine Learning–Big Data Analytics Tools and Technology– Edge Streaming Analytics– Network Analytics– Securing IoT–Common Challenges– Security Practices and Systems Vary– Formal Risk Analysis Structures: OCTAVE and FAIR– The Phased Application of Security in an Operational Environment.

UNIT V CASE STUDIES – APPLICATION OF IOT 9

IoT Physical Devices and Endpoints –Arduino UNO: Introduction– Arduino UNO–Installing –Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints–RaspberryPi: Introduction – Hardware Layout, Operating Systems- Configuring, Programming using Python– Simple Projects: Wireless Temperature Monitoring System Using Pi– Smart and Connected Cities– An IoT Strategy for Smarter Cities– Smart City IoT Architecture– Smart City Use-Case Examples.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.

REFERENCES:

1. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.
2. Srinivasa K G, "Internet of Things", 1st Edition, CENGAGE Leaning India, 2017.

EVALUATION PATTERN:

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

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

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SEMESTER VII

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

PRE–REQUISITES:

- Nil

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.

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3. Encrypt and decrypt messages using the Data Encryption Standard and Advanced Encryption Standard algorithms using the built-in packages supported by Java language.
4. Generate random number generators using Blum Blum Shuband encrypt messages using bitwise XOR operation.
5. Generate five random keys using RC4 algorithm for the given inputs: State array S[4] = {2, 3, 4, 5} and Initial key K[4] = {4, 7, 3, 5}. Also perform encryption and decryption of messages using RC4 algorithm.
6. Encrypt the plaintext message M = 25 using RSA algorithm with the following inputs: p = 11, q = 17, and public key (e) = 7. Find the private key (d) using Extended Euclid's Algorithm and perform decryption to get back the plaintext message.
7. Find secret key shared by the users A and B using Diffie-Hellman key exchange algorithm. Given the following inputs: q=353, α=3, A's private = 97, and B's private = 233.
8. Implement SHA hash functions and HMAC function using the built-in packages supported by Java language.
9. Perform signing and verification of the signature created for a document with hash value H(M)=100 using ElGamal digital signature scheme. The value of global elements q=467, and α=2. The private key X_A = 127 and the random integer K=213.
10. Simulate the working model of Kerberos protocol to accomplish client/server authentication.

Contact Periods:

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

Total: 60 Periods

REFERENCES:

1. William Stallings, "Cryptography and Network Security - Principles and Practices", Pearson Education, 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		

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SEMESTER VII

U21CB703	PROJECT WORK PHASE - I	Category: ECC				
		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)			

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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

EVALUATION PATTERN:

Continuous Internal Assessments			
Review I	**Review II**	**Review III**	**Total Assessment**
30	30	40	100

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SEMESTER VIII

U21CB801	PROJECT WORK PHASE - II	Category: ECC				
		L	T	P	J	C
		0	0	0	16	8

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To identify the real life problems and to design solutions using the concepts of Computer Science and Business Systems
- To 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: Evaluate and integrate the findings to offer solutions for real-life problems (Analyze)

CO4: 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
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

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EVALUATION PATTERN:

Continuous Internal Assessments (40 Marks)			End Semester Examinations (60 Marks)	
Review I	Review II	Review III	Project Report	Total Assessment
10	15	15	10	50
Total: 100 Marks				

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VERTICAL I

DATA SCIENCE

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To introduce the basic mathematical concepts relevant to data science
- To apply mathematical skills to solve real-time problems
- To introduce basic data science methods

COURSE OUTCOMES:

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

CO1: Describe the need of mathematical foundations for data science (Understand)

CO2: Illustrate linear algebra concepts required for data science (Understand)

CO3: Describe the basics of probability for data science (Understand)

CO4: Understand the basics of statistics for data science (Understand)

CO5: Describe the basics of optimization techniques for data science (Understand)

CO-PO MAPPING:

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

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UNIT III PROBABILITY 9

Probability – Axioms of Probability – Conditional probability – Baye's theorem. Discrete and Continuous random variables – Moments – Moment generating functions. Discrete and Continuous distributions: Binomial, Poisson, Geometric, Uniform, Exponential, and Normal distributions. Joint distributions: Marginal and conditional distributions – covariance – correlation and regression.

UNIT IV STATISTICS 9

Definition of Statistics – Basic objectives – Applications in various branches of science with examples.

Collection of Data: Primary and secondary data. Classification and tabulation of data – Frequency distribution – Bar graphs and Pie charts – Histogram – Measures of central tendency – Measures of Variability. Sampling: Sampling distributions – Statistical estimation of parameters-confidence intervals. Testing of hypothesis: large and small sample test. Design of Experiments: One way and two-way classifications.

UNIT V OPTIMIZATION: UNCONSTRAINED OPTIMIZATION 9

Necessary and sufficiency conditions for optima – Gradient descent methods – Constrained optimization – KKT conditions – Introduction to non-gradient techniques – Introduction to least squares optimization – Optimization view of machine learning.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

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

REFERENCES:

1. Montgomery, D. C. and G. C. Runger. "Applied Statistics and Probability for Engineers" 5thEdition, 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					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To introduce mathematical foundations of pattern recognition
- To describe different techniques involved in pattern recognition
- To familiarize various clustering techniques

COURSE OUTCOMES:

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

CO1: Describe pattern recognition and its mathematics fundamentals (Understand)

CO2: Understand the pattern recognition process (Understand)

CO3: Explain the pattern recognition models (Understand)

CO4: Describe non-parametric techniques in pattern recognition (Understand)

CO5: Illustrate unsupervised learning and clustering techniques (Understand)

CO-PO MAPPING:

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

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UNIT IV NON-PARAMETRIC TECHNIQUES 9

Density estimation – Parzen windows – K-Nearest Neighbor estimation – Nearest neighbor rule – Fuzzy classification.

UNIT V CLUSTERING TECHNIQUES 9

Unsupervised Bayesian learning – Criterion functions for clustering: Sum-of-Squared-Error – Related minimum variance – Hierarchical clustering: Agglomerative – Step-wise optimal.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Richard O. Duda, P. E. Hart, David G. Stork, "Pattern Classification", 2nd Edition, John Wiley, 2006

REFERENCES:

1. Andrew Webb, "Statistical Pattern Recognition", 2nd Edition, Arnold publishers, London, 1999
2. Bishop, Christopher M., "Pattern Recognition and Machine Learning", 1st Edition, Springer, 2009
3. S. Theodoridis, K. Koutroumbas, "Pattern Recognition", 4th Edition, Academic Press, 2009

EVALUATION PATTERN:

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the need for morphological processing and their representation
- To know about the various techniques used for speech synthesis and recognition
- To appreciate the syntax analysis and parsing that is essential for natural language processing
- To learn about the various representations of semantics and discourse
- To have knowledge about the applications of natural language processing

COURSE OUTCOMES:

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

CO1: Identify the basic concepts of speech processing (Understand)

CO2: Describe the speech analysis process (Understand)

CO3: Illustrate speech modeling with examples (Understand)

CO4: Describe speech recognition techniques (Understand)

CO5: Illustrate speech synthesis with examples (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I SPEECH PROCESSING 9

Phonetics – Articulatory Phonetics – Phonological Categories – Acoustic Phonetics and Signals – Speech Synthesis – Text Normalization – Phonetic and Acoustic Analysis – Diphone Waveform synthesis – Evaluation – Automatic Speech Recognition – Architecture – Hidden Markov Model to Speech – MFCC vectors – Acoustic Likelihood Computation – Evaluation. Triphones – Discriminative Training – Modeling Variation. Computational Phonology – Finite-State Phonology – Computational Optimality Theory – Syllabification – Learning Phonology and Morphology.

UNIT II SPEECH ANALYSIS 9

Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures – mathematical and perceptual – Log Spectral Distance, Cepstral Distances, Weighted Cepstral Distances and Filtering, Likelihood Distortions, Spectral Distortion using a Warped Frequency Scale,

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LPC, PLP and MFCC Coefficients, Time Alignment and Normalization – Dynamic Time Warping, Multiple Time – Alignment Paths.

UNIT III SPEECH MODELING 9

Hidden Markov Models: Markov Processes, HMMs – Evaluation, Optimal State Sequence – Viterbi Search, Baum-Welch Parameter Re-estimation, and Implementation issues.

UNIT IV SPEECH RECOGNITION 9

Large Vocabulary Continuous Speech Recognition: Architecture of a large vocabulary – continuous speech recognition system – acoustics and language models – n-grams, context dependent sub-word units; Applications and present status.

UNIT V SPEECH SYNTHESIS 9

Text-to-Speech Synthesis: Concatenative and waveform synthesis methods, sub-word units for TTS, intelligibility and naturalness – role of prosody, Applications and present status.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Jurafsky and Martin, "Speech and Language Processing", 2nd Edition,Pearson Prentice Hall, 2008
2. Lawrence 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 Becchetti, LucioPrinaRicotti, "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					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To describe web mining and understand the need for web mining
- To differentiate between Web mining and data mining
- To understand the different application areas for web mining
- To understand the different methods to introduce structure to web-based data

COURSE OUTCOMES:

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

CO1: Understand the fundamentals of Web Mining and Data Mining concepts (Understand)

CO2: Apply the Supervised Learning algorithms and its application areas (Apply)

CO3: Formulate the application areas of Unsupervised Learning Algorithms (Apply)

CO4: Apply the information retrieval techniques and the requirements of Web spamming (Understand)

CO5: Apply the concept of Basic Web crawler algorithms and overview of different web crawlers (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO WEB MINING **9**

Introduction to Web Data Mining and Data Mining Foundations, Introduction — World Wide Web (WWW), A Brief History of the Web and the Internet, Web Data Mining — Data Mining Foundations – Association Rules and Sequential Patterns – Basic Concepts of Association Rules, Apriori Algorithm – Frequent Itemset Generation, Association Rule Generation, Data Formats for Association Rule Mining, Mining with multiple minimum supports – Mining Algorithm, Rule Generation, Mining Class Association Rules

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UNIT II SUPERVISED LEARNING 9

Supervised and Unsupervised Learning. Supervised Learning – Basic Concepts, Decision Tree Induction – Classifier Evaluation – Rule Induction – Classification Based on Associations, Naïve Bayesian Classification, Naïve Bayesian Text Classification – Probabilistic Framework, Naïve Bayesian Model – SVM – KNN Learning

UNIT III UNSUPERVISED LEARNING 9

K-Means Clustering – Representation of Clusters – Hierarchical Methods – Distance Functions – Data Standardization – Handling of Mixed Attributes – Cluster Evaluation

UNIT IV INFORMATION RETRIEVAL AND WEB SEARCH 9

Basic Concepts of Information Retrieval – Information Retrieval Models – Evaluation Measures – Text and Web Page Pre-Processing – Inverted Index and Its Compression – Latent Semantic Indexing – Web Spamming

UNIT V WEB CRAWLING 9

A Basic Crawler Algorithm – Universal Crawlers – Focused Crawlers – Topical Crawlers – Crawler ethics and conflicts – Wrapper Introduction – Wrapper Introduction

Contact Periods:

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

Total: 45 Periods

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

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

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KPRIET Learn Beyond

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the purpose and concepts of data exploration
- To understand the basics of data visualization
- To explore the role of R language in data visualization

COURSE OUTCOMES:

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

CO1: Describe the basics of data explorations (Understand)

CO2: Illustrate univariate and multivariate analysis for data exploration (Understand)

CO3: Describe the basics of data visualization (Understand)

CO4: Illustrate data with graphs discrete and continuous probability distributions (Understand)

CO5: Explore the applications in data visualization (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO DATA EXPLORATORY 9

Introduction to single variable: Distribution variables – Numerical summaries of level and spread – scaling and standardising – Inequality – Smoothing time series.

UNIT II INTRODUCING TWO VARIABLE AND THIRD VARIABLE 9

Relationships between two variables – Percentage tables – Analysing contingency tables – Handling several batches – Scatterplots and resistant Lines – Transformations – Introducing a third variable – Causal explanations – Three-variable contingency tables and beyond – Longitudinal data.

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UNIT III BASICS OF DATA VISUALIZATION 9

The seven stages of visualizing data – Getting started with processing – Mapping – Time Series – Connections and correlations – Scatterplot maps –Trees, Hierarchies, and Recursion – Networks and graphs – Acquiring data – Parsing data

UNIT IV MISCELLANEOUS GRAPH 9

Basics of histogram, Making multiple histograms from grouped data – Basics of density curve, Making multiple density curves from grouped data – Frequency polygon – Box plot – Violin plot – Multiple dot plots for grouped data – Density plot of Two-dimensional data – Correlation matrix – Network graph – Heat map – Three-dimensional scatter plot – Dendrogram – QQ Plot an empirical cumulative distribution function – Mosaic plot – MAP.

UNIT V APPLICATIONS OF DATA EXPLORATION AND VISUALIZATION 9

Real world applications of data visualization – The basics of data exploration – Loading data from data sources – Transforming data – Creating tidy data – Basic data exploration techniques – Basic Data visualization techniques – Case study – Students performance in theory and practical examinations

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

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

REFERENCES:

1. 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.
2. Claus.O.Wlike, Fundamentals of Data Visualization, A primer on making informative and compelling Figures, 1st Edition, O'Reily Publications, 2019.

EVALUATION PATTERN:

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

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

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KPRIET

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To explain terminology, technology and applications of predictive analysis
- To apply data preparation techniques and generate appropriate association rules
- To discuss various descriptive models, their merits, demerits and application
- To describe various predictive modelling methods
- To introduce the text mining tools, technologies and case study which is used in day-today analytics cycle

COURSE OUTCOMES:

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

CO1: Explain data understanding and data visualization (Understand)

CO2: Apply data preparation techniques to effectively interpret big data (Apply)

CO3: Discuss various descriptive models and cluster algorithms (Understand)

CO4: Describe principles of predictive analytics and apply them to achieve real, pragmatic solutions (Apply)

CO5: Illustrate the features and applications of text mining (Understand)

CO-PO MAPPING:

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

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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 – Modelling 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:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th rowspan="3">Total Internal Assessments</th><th rowspan="3">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I (100 Marks)</th><th colspan="2">Assessment II (100 Marks)</th></tr>
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<tr><td>40</td><td>60</td><td>40</td><td>60</td><td>200</td><td>100</td></tr>
<tr><td colspan="4" rowspan="2">Total</td><td>40</td><td>60</td></tr>
<tr><td colspan="2">100</td></tr>
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U21ADP07	TIME SERIES ANALYSIS AND FORECASTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To equip students with various forecasting techniques
- To impart knowledge on modern statistical methods for analyzing time series data.

COURSE OUTCOMES:

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

CO1: Describe the concept of forecasting and regression analysis (Understand)

CO2: Illustrate multiple linear regression models (Understand)

CO3: Describe Time series regression and its features (Understand)

CO4: Classify non seasonal modeling techniques and forecasting (Understand)

CO5: Illustrate Box Jenkins Methods (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	P6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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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:

UNIT I INTRODUCTION TO FORECASTING 9

Forecasting and data – Forecasting methods – Errors in forecasting – Choosing a forecasting technique – An overview of quantitative forecasting techniques – Regression analysis: The simple linear regression model – The least squares point estimates – Point estimates and point predictions – Model assumptions and the standard error– Testing the significance of the slope and y intercept.

UNIT II MULTIPLE LINEAR REGRESSIONS 9

The linear regression model – The least squares estimates, and point estimation and prediction – The mean square error and the standard error – Model utility: R2, Adjusted R2, and the overall F test – Model building and residual analysis: Model building and the effects of multicollinearity –Residual analysis in simple regression – Residual analysis in multiple regression – Diagnostics for detecting outlying and influential observations.

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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, 4thEdition", 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.

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EVALUATION PATTERN:

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

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the health data formats, health care policy and standards
- To learn the significance and need of data analysis and data visualization
- To understand the health data management frameworks
- To learn the use of machine learning and deep learning algorithms in healthcare
- To apply healthcare analytics for critical care applications

COURSE OUTCOMES:

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

CO1: Describe the basics of health care analytics (Understand)
CO2: Illustrate the machine learning fundamentals required for health care data analysis (Understand)
CO3: Illustrate the health care data management using IoT and associated techniques (Understand)
CO4: Describe the role of deep learning in health care analytics (Apply)
CO5: Discuss real time applications in health care analytics (Understand)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO HEALTHCARE ANALYTICS 9

Overview - History of Healthcare Analysis Parameters on medical care systems – Health care policy – Standardized code sets — Data Formats — Machine Learning Foundations: Tree Like reasoning, Probabilistic reasoning and Bayes Theorem, Weighted sum approach.

UNIT II ANALYTICS ON MACHINE LEARNING 9

Machine Learning Pipeline – Pre-processing – Visualization – Feature Selection –Training model parameter – Evaluation model: Sensitivity, Specificity, PPV, NPV, FPR, Accuracy, ROC, Precision Recall Curves, Valued target variables
Python: Variables and types, Data Structures and containers, Pandas Data Frame: Operations – Scikit –Learn: Pre-processing, Feature Selection.

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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:

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

Total: 45 Periods

TEXT BOOKS:

1. VikasKumar,"HealthCareAnalyticsMadeSimple",1st Edition, PacktPublishing,2018
2. NilanjanDey,AmiraAshour,SimonJamesFong,ChintanBhatl,"HealthCareData Analysis and Management", 1stEdition,Academic Press,2018

REFERENCES:

1. Hui Jang, Eva K.Lee, "HealthCare Analysis: From Data to Knowledge to Healthcare Improvement",1stEdition, Wiley, 2016
2. Kulkarni, Siarry, Singh, Abraham, Zhang, Zomaya, Baki, "Big Data Analytics in HealthCare",1st Edition,Springer,2020

EVALUATION PATTERN:

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

*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

		Category: PEC				
U21AMP01	KNOWLEDGE ENGINEERING	L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- U21IT601 - Machine Learning Techniques

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 –

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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, DorinMarcu, 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", 1stedition, I.K.International Publisher House, 2018

REFERENCES:

1. Ronald J. Brachman, Hector J. Levesque, "Knowledge Representation and Reasoning",1stedition, 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", 1stedition Springer,2009
4. Jay Liebowitz, "Knowledge Management Learning from Knowledge Engineering," 1st edition, CRC Press,2001

EVALUATION PATTERN:

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

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

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

PRE-REQUISITES:

- U21MA403 - Probability and Queuing Theory

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

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UNIT III FUZZY SETS AND RELATIONS 9

Introduction – Uncertainty and imprecision – Chance vs ambiguity – Fuzzy sets – Fuzzy relations – Membership functions – Properties of membership functions – Fuzzification and defuzzification – Classical logic and Fuzzy logic – Fuzzy rule-based systems – Fuzzy decision making – Fuzzy classification

UNIT IV GENETIC ALGORITHMS 9

Introduction to evolutionary computation: Biological and artificial evolution – Evolutionary computation – Simple genetic algorithm – Search operators: Crossover, Mutation, Crossover and Mutation Rates – Selection schemes: Fitness proportional selection and Fitness scaling – Ranking – Tournament selection – Selection pressure and its impact on evolutionary search.

UNIT V HYBRID SYSTEMS 9

Hybrid systems – Optimization and decision support techniques – Swarm intelligence – Ant colony optimization – Particle swarm optimization – Applications

Contact Periods:

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

Total 45 Periods

TEXTBOOKS:

1. S.Rajasekaran, G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications ", 1st edition, PHI Learning Pvt. Ltd., 2017
2. Sivanandam S.N., Deepa S.N., "Principles of Soft Computing", 1st edition, 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		
40	60	40	60	200	100
Total				40	60
				100	

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

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U21AMP03	DEEP NEURAL NETWORKS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- U21IT601 - Machine Learning Techniques

COURSE OBJECTIVES:

- To understand the fundamental concepts related to Image formation and processing.
- To learn feature detection, matching and detection
- To become familiar with feature-based alignment and motion estimation
- To develop skills on 3D reconstruction and image-based rendering, recognition

COURSE OUTCOMES:

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

CO1: Understand the basic concepts of soft computing (Understand)

CO2: Implement the various image processing techniques (Apply)

CO3: Apply feature-based based image alignment, segmentation, and motion estimations (Apply)

CO4: Interpret 3D image reconstruction techniques (Apply)

CO5: Develop innovative image processing and computer vision applications (Apply)

CO-PO MAPPING:

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

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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 9

Loss functions for classification tasks: Cross-entropy loss, Softmax activation – Optimization algorithms: Stochastic Gradient Descent (SGD), Adam, RMS prop – Regularization techniques: Dropout, Weight decay – Transfer learning and fine-tuning: Using pretrained models, Freezing layers, Adapting to new tasks

UNIT IV EVALUATION PARAMETERS OF CNN 9

Performance evaluation metrics for classification tasks: Accuracy, Precision, Recall, F1 score – Confusion matrix and its interpretation – Receiver Operating Characteristic (ROC) curve and Area Under the Curve (AUC) – Evaluation metrics for object detection and localization tasks: Intersection over Union (IoU), Mean Average Precision – Handling class imbalance – Evaluation challenges

UNIT V ADVANCED CNN ARCHITECTURES 9

Convolutional layers with different receptive field sizes: Dilated convolutions, Atrous convolutions – Attention mechanisms in CNNs: Self-attention, Spatial attention – Advanced CNN architectures for specific tasks: Semantic segmentation, Instance segmentation and Image captioning

Contact Periods:

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

Total: 45 Periods

TEXTBOOKS:

1. Charu C. Aggarwal, "Neural Networks and Deep Learning A Textbook", 1st edition, Springer International Publishing, 2018.
2. Hasmik Osipyan, Bosedelyiade Edwards, Adrian David Cheok, "Deep Neural Network Applications", 1st edition, CRC Press, 2022.
3. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", 1st edition, MIT Press, 2016

REFERENCES:

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

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EVALUATION PATTERN:

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

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

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U21AMP04	REINFORCEMENT LEARNING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- Affords foundational ideas on modern reinforcement learning
- Develop an instinctive understanding on reinforcement learning
- Implementation and testing of complete decision-making systems

COURSE OUTCOMES:

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

CO1: Explain the knowledge of machine learning in reinforcement learning (Apply)

CO2: Classify the MDP models in reinforcement learning (Understand)

CO3: Experiment the value of a state or an action when similar circumstances occur (Apply)

CO4: Evaluate artificial neural networks that helps software agents to reach goals (Apply)

CO5: Examine the hierarchical reinforcement learning techniques (Understand)

CO-PO MAPPING:

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

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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:

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

REFERENCES:

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

EVALUATION PATTERN:

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

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

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

PRE-REQUISITES:

- U21AM501 – Machine Learning II
- U21AM602 - Deep Learning I

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

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UNIT III IMAGE SEGMENTATION AND OBJECT DETECTION 9

Introduction – Image segmentation algorithms – Thresholding, region-based segmentation – Edge detection techniques – Sobel, Canny – Contour detection and object representation – Introduction to object detection algorithms – Haar cascades, SSD, YOLO

UNIT IV HANDCRAFTED FEATURE EXTRACTION TECHNIQUES 9

Introduction – Feature Extraction – Feature extraction techniques – SIFT, SURF, ORB – Local feature descriptors – HoG, LBP – Feature matching algorithms – Brute-force matching, FLANN – Feature tracking and optical flow

UNIT V DEEP LEARNING FOR COMPUTER VISION 9

Introduction to deep learning and neural networks – Convolutional Neural Networks (CNNs) for image classification – Transfer learning and pre-trained models – Object detection using CNNs - Faster R-CNN, SSD – Semantic segmentation using CNNs - FCN, U-Net – Familiarity with popular libraries such as OpenCV and PyTorch

Contact Periods:

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

Total 45 Periods

TEXTBOOKS:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", 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					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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

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

PRE-REQUISITE:

- U21CSG02 - Python Programming

COURSE OBJECTIVES:

- To provide students with a comprehensive understanding of feature engineering principles
- To ensure data quality by scaling, normalizing, and transforming raw data before using it in a machine learning model
- To understand the techniques, and applications, equipping with the skills to effectively preprocess and engineer features for machine learning tasks

COURSE OUTCOMES:

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

CO1: Understand the basic concepts of feature engineering. (Understand)

CO2: Learn techniques for handling the missing data (Understand)

CO3: Describe feature creation and transformation in feature engineering (Understand)

CO4: Execute the anomaly detection and outlier detection (Apply)

CO5: Implement feature selection and dimensionality reduction using feature engineering (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO FEATURE ENGINEERING 9

Overview of feature engineering – Importance in machine learning – Types of features: Numerical, Categorical, Text – Feature representation and feature vectors – Evaluation metrics for feature engineering

UNIT II DATA PREPROCESSING AND HANDLING MISSING DATA 9

Introduction to data preprocessing – Techniques for handling missing data: Deletion, Imputation, Interpolation – Strategies for dealing with different types of missing data – Handling noisy data: Smoothing filters, Denoising algorithms – Data scaling and normalization techniques.

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UNIT III FEATURE CREATION AND TRANSFORMATION 9

Polynomial features and interaction terms – Binning and discretization techniques – Feature hashing and feature embedding – Logarithmic, Exponential, Power transformations.

UNIT IV ANOMALY DETECTION AND OUTLIER DETECTION 9

Introduction to anomaly detection and outlier detection – Statistical methods for anomaly detection: Z-score, Mahalanobis distance – Density-based methods: Local Outlier Factor (LOF), Isolation Forest One-class SVM for outlier detection – Deep feature extraction: Visual Geometry Group (VGG), Residual Networks (ResNet).

UNIT V FEATURE SELECTION AND DIMENSIONALITY REDUCTION 9

Univariate feature selection methods: Chi-square test, ANOVA – Recursive Feature Elimination (RFE) – Feature importance using ensemble methods (e.g., Random Forest, XGBoost) – Principal Component Analysis (PCA) for dimensionality reduction.

Contact Periods:

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

Total 45 Periods

TEXTBOOKS:

1. Sinan Ozdemir, "Feature Engineering Bookcamp",1st edition Manning Publications, 2022
2. Alice Zheng and Amanda Casari, "Feature Engineering for Machine Learning: Principles and Techniques",1st edition, O'Reilly Media, 2018

REFERENCES:

1. Alice Zheng and Amanda Casari, "Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists", 1st edition, O'Reilly Media, 2018
2. Sinan Ozdemir and Divya Susarla, "Feature Engineering Made Easy: Identify Unique Features from Your Dataset in Just 30 Minutes",1st edition, Packt Publishing, 2018
3. Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani, "Introduction to Statistical Learning: With Applications in R", 1st edition, Springer,2013

EVALUATION PATTERN:

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

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

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U21AMP07	OBJECT DETECTION AND FACE RECOGNITION	Category: ESC				
		L	T	P	J	C
		3	0	0	0	3

PRE-REQUISITES:

- U21IT601 - Machine Learning Techniques

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

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UNIT III REGION-BASED CNN, FAST R-CNN & FASTER R-CNN 9

R-CNN architecture for object detection – Selective search algorithm for region proposals – Feature extraction using CNN – Training and inference processes of R-CNN – Fast R-CNN architecture: RoI pooling, Shared convolutional layers – Study of faster R-CNN framework – Region Proposal Network (RPN) for efficient region proposal generation – End to end training and inference in Faster R-CNN

UNIT IV FACE & FACIAL EXPRESSION RECOGNITION 9

Introduction – Face Recognition and challenges – Face detection using Haar cascades – Face alignment and normalization – Face representation using deep learning (e.g., FaceNet, ArcFace) facial expression recognition – Facial feature extraction methods (e.g., Geometric, Appearance-based) – Representation – Deep learning architectures for facial expression analysis – Realtime facial expression recognition and emotion detection

UNIT V BIOMETRIC RECOGNITION 9

Overview of biometric recognition- biometric modalities (e.g., face, fingerprint, iris, voice) – Challenges (e.g., variability, spoof attacks) – Biometric Verification and Identification-Evaluation metrics – Temporal Analysis in Biometrics: Handling temporal variations in biometric data – Feature extraction techniques for capturing temporal dynamics – Temporal modeling approaches

Contact Periods:

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

Total: 45 Periods

TEXTBOOKS:

1. Vaibhav Verdhan, "Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras", 1st edition, Apress, 2021
2. Joseph Howse, Prateek Joshi ,"Object Detection and Recognition Using Deep Learning in OpenCV",1st edition, Packt Publishing, 2020
3. Rafael C. Gonzalez, David A. Forsyth, and Christopher R. Dance , "Deep Learning for Object Detection and Recognition",1st edition Cambridge University Press , 2019

REFERENCES:

1. Rajalingappaa Shanmugamani , "Deep Learning for Computer Vision: Expert Techniques to train advanced neural networks using TensorFlow and Keras",1st edition Packt Publishing, 2021
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4th edition, Thomson Learning, 2014
3. E. R. Davies, "Computer & Machine Vision", 4th edition, Academic Press, 2012
4. Kelleher, John D., Tierney, Brian and Pacheco, Aoife, "Applied Machine Learning: From Classification to Object Detection Using Python", 1st edition, Springer, 2021

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EVALUATION PATTERN:

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

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

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

PRE-REQUISITES:

- Nil

COURSE OBJECTIVES:

- To introduce students to the fundamentals of text and visual analytics
- To provide an overview of different techniques and tools for text and visual data analysis
- To perform text and visual analytics using programming languages and software tools
- To apply text and visual analytics techniques to real-world problems

COURSE OUTCOMES:

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

CO1: Understand the principles and concepts of text and visual analytics (Understand)

CO2: Analyze text data using sentiment analysis, topic modeling, and clustering (Apply)

CO3: Evaluate the effectiveness of different text and visual analytics techniques (Apply)

CO4: Apply text and visual analytics techniques to various real-world problems (Apply)

CO5: Use programming languages and software tools for text and visual analytics (Understand)

CO-PO MAPPING:

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

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UNIT III QUESTION ANSWERING AND DIALOGUE SYSTEMS 9

Information retrieval – IR-based question answering – Knowledge-based question answering – Language models for QA – Classic QA models – Chatbots – Design of dialogue systems — Evaluating dialogue systems.

UNIT IV VISUAL ANALYTICS 9

Overview of visual analytics and its applications – Techniques for visualizing text data – Interactive visualizations for exploratory analysis – Evaluation of visual analytics models.

UNIT V SENTIMENT ANALYSIS 9

Understanding sentiment analysis and its applications – Techniques for sentiment analysis: Rule-based, Machine Learning and Deep Learning – Sentiment lexicons and resources – Evaluation of sentiment analysis models.

Contact Periods:

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

Total 45 Periods

TEXT BOOKS:

1. Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", 3rd edition, Pearson Prentice Hall, 2022
2. Nan Cao, Weiwei Cui, "Introduction to Text Visualization", 1st edition, Atlantis Press, 2016

REFERENCES:

1. Steven Struhl, "Practical Text Analytics: Interpreting Text and Unstructured Data for Business Intelligence", 1st edition, Kogan Page Limited, 2016
2. Bing Liu, "Sentiment Analysis: Mining Opinions, Sentiments, and Emotions", 1st edition, Cambridge University Press, 2020
3. Tamara Munzner, "Visualization Analysis and Design", 1st edition, CRC press, 2015.
4. Dan Jurafsky and James H. Martin, "Speech and Language Processing", 1st edition, Prentice Hall, 2009
5. Li Bai, Alfred Kobsa, and JinahPark,"Visual Analytics and Interactive Technologies: Data, Text and Web Mining Applications", 1st edition, IGI Global, 2011

EVALUATION PATTERN:

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

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

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VERTICAL III

CLOUD COMPUTING AND DATA PROCESSING TECHNOLOGIES

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

PRE–REQUISITES:

- U21CSG05 - Computer Networks

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

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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 9

Introduction to Cloud Storage – Digital Universe – Provisioning Cloud Storage – Unmanaged and Managed Cloud Storage – Creating Cloud Storage Systems – Cloud Backup Types and Features – Cloud Attached Backup and solutions – Cloud Storage Interoperability, CDMI, OCCI – Introduction to Containers – Kubernetes – Heroku and Docker Containers.

UNIT IV CLOUD SECURITY 9

Cloud Security Defense Strategies – Securing the Cloud & Data – Distributed Intrusion and Anomaly Detection – Data and Software Protection Techniques – Data Security in the Cloud – Current State and Future Trends in the Cloud – Cloud Security Risks – The Cloud, Digital Identity, and Data Security Standards – Establishing Identity and Presence in Cloud.

UNIT V CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Hadoop – Map Reduce – Google App Engine (GAE) – Programming Environment for GAE – Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation – Introduction to Fog Computing – Introduction to Edge Computing.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Dac–Nhuong Le, Raghvendra Kumar, Gia Nhu Nguyen, Jyotir Moy Chatterjee, "Cloud Computing and Virtualizaton", 2nd Edition, Wiley Publishers, 2018
2. Nick, Gillam, Lee, "Cloud Computing – Principles, Systems and Applications", 2nd Edition, Springer, 2017

REFERENCES:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, "Mastering the Cloud Computing", 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

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EVALUATION PATTERN:

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

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

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

PRE–REQUISITES:

- U21AD402 - Database Design and Management

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	-	3
CO3	2	1	1	1	2	-	-	-	-	-	-	2	-	3
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 Storge 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.

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

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the virtualization concepts and its types
- To learn WAN 0026 VLAN architecture and its virtualization
- To acquire knowledge on virtualization technologies

COURSE OUTCOMES:

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

CO1: Illustrate a virtual machine and virtual network (Understand)

CO2: Describe various virtual machine products (Understand)

CO3: Perform server virtualization (Apply)

CO4: Implement the concept of network virtualization (Apply)

CO5: Carryout various tasks in storage virtualization (Apply)

CO–PO MAPPING:

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

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UNIT III NETWORK VIRTUALIZATION 9

Design of Scalable Enterprise Networks – Virtualizing the Campus – WAN Design – WAN Architecture – WAN virtualization – Virtual Enterprise Transport Virtualization – VLANs and Scalability – Theory Network Device Virtualization Layer 2 – VFIs Virtual Firewall Contexts

UNIT IV STORAGE VIRTUALIZATION 9

Hardware Devices – SCSI – SCSI Communication – Using SCSI Buses – Fiber Channel – Fiber Channel Cables – Fiber Channel Hardware Devices – iSCSI Architecture – Securing iSCSI SAN Backup & Recovery Techniques – RAID – Classic Storage Model – SNIA

UNIT V APPLYING VIRTUALIZATION 9

Comparison of Virtualization Technologies: Shared Kernel – Enterprise Solutions: VMware Server First Edition – ESXi – Citrix XenServer – Microsoft Virtual PC – Microsoft Hyper–V – Virtual Box – Case study: Migration to Open–source based messaging service (Exim, Dovecot and SOGo)

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", 2nd Edition, Elsevier/Morgan Kaufmann Publishers, 2015
2. Chris Wolf, Erick M. Halter, "Virtualization: From the Desktop to the Enterprise", 2nd Edition, Berkeley, Apress, 2016
3. Gerardus Blokdyk, "Virtualization Technology A Complete Guide", 1st Edition, Emer, 2020

REFERENCES:

1. William Von Hagen, "Professional Xen Virtualization", 1st Edition, Wrox Publications, 2014
2. Matthew Portnoy, "Virtualization Essentials", 2nd Edition, Wiley, 2015
3. David Marshall, Wade A. Reynolds, "Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center", 6th Edition, Addison–Wesley, Publications, 2012

EVALUATION PATTERN:

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

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

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U21CSP04	SECURITY AND PRIVACY IN CLOUD	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CSG05 - Computer Networks

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

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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", 1stEdition, Oreilly, 2019

REFERENCES:

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

EVALUATION PATTERN:

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

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the basic concepts of data mining
- To acquire basic knowledge on cloud based data analysis, scalable data analytics
- To learn security of sensitive data in cloud and research trends

COURSE OUTCOMES:

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

CO1: Describe the basic concepts of data mining (Understand)

CO2: Examine the techniques for cloud based data analysis (Apply)

CO3: Utilize the idea of scalable data analytics (Apply)

CO4: Integrate the concept of securing sensitive data in cloud (Apply)

CO5: Employ various research trends related to data analytics in cloud (Apply)

CO–PO MAPPING:

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

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UNIT III SCALABLE DATA ANALYTICS 9

Data Analysis System for Clouds – Amazon Athena – Amazon FinSpace – Swift – Spark – BigML – Mahout– Microsoft Azure Machine Learning – Design of Scalable Data Analysis Framework in Cloud – Work Flow based Data Analysis.

UNIT IV SECURITY OF SENSITIVE DATA IN CLOUD 9

Data in Cloud – Data Lie Cycle – Security Challenges in Cloud Computing for Data – Protection of Data – Tighter IAM Controls – Classical Cryptography for Cloud Computing – Homomorphic Crypto System.

UNIT V RESEARCH TRENDS 9

Data – Intensive Exscale 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 Chtterjee, Monika mangla, Suneetha Sathpathy,Sirisha Potluri, "Machine Learning Approch 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					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

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

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U21CSP06	EDGE COMPUTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge on Cloud Computing and enabling technologies
- To explore the need for Edge Computation
- To impart the knowledge to log the sensor data and to perform further data analytics

COURSE OUTCOMES:

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

CO1: Illustrate the principles and architectures of fog computing (Understand)

CO2: Interpret the communication and management of edge computing (Understand)

CO3: Analyze the storage and computation of fogs (Analyze)

CO4: Examine the performance of the applications developed using fog architecture (Apply)

CO5: Identify the security and privacy issues of edge computing (Apply)

CO–PO MAPPING:

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

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.

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

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

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

PRE–REQUISITE:

- U21CSG05 - Computer Networks

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

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UNIT IV SOFTWARE AS A SERVICE MANAGEMENT 9

SaaS – Advantages – Multiple Facets of the SaaS Model – Functional – Operational – Security and Financial –Working Model of SaaS Business – Transition to SaaS – Functional Blocks – SaaS Providers – Applications of SaaS – Management of SaaS

UNIT V CLOUD SECURITY MANAGEMNT 9

Vulnerable Areas – Finding and Fixing Vulnerabilities – Agentless, Agent Based Configuration Management – Vulnerability Management Metrics – Network Security features – VPCs– Address Translation – Encryption in Motion – Firewalls and Network Segmentation – Administrative Access and Techniques

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Rajkumar Buyya, James Broberg, Andrzej Goscinski, "Cloud Computing Principles and Paradigms",2nd Edition, Wiley Publishers, 2015
2. Justin Garrison & Kris Nova, "Cloud Native Infrastructure Patterns for Scalable Infrastructure and Applications in a Dynamic Environment" 1st Edition, Orielly, 2017

REFERENCES:

1. Michael P McGarth, " Understanding PaaS", 1st Edition, Orielly, 2012
2. Robert Michon, "The Complete Guide to Software as a Service Everything You Need to Know About Saas", 1st Edition, CreateSpace Independent Publishing Platform, 2017
3. Tim Mather, Subra Kumaraswamy, Shahed Latif, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", 1st Edition, O'Reilly, 2010

EVALUATION PATTERN:

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

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

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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.

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UNIT IV PROCESSING BIG DATA 9

Big Data Processing Pipelines – High level processing operations – Aggregation Operations in Big Data Pipelines – Typical analytical operations in Big data pipelines – Over view of Big Data Processing Systems – Work Flow Management – Integration and processing Layer Pipe Line and Tools.

UNIT V BIG DATA ANALYTICS 9

Big Data Analytics using Spark – Programming in Spark using RDDS in Pipelines – Spark Core Transformations– Spark Eco System – Spark SQL – Streaming – Spark MLLib – Data Processing Spark–Use case–Analyzing sensor data with Spark streaming.

Contact Periods:

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

Total: 45 Periods

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

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

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VERTICAL IV

NETWORKING AND CYBER SECURITY

U21ITP01	PARALLEL AND DISTRIBUTED COMPUTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CS301- Computer Organization and Architecture
- U21CS403 - Operating Systems

COURSE OBJECTIVES:

- To understand the technologies, system architecture, and communication architecture that propelled the growth of parallel and distributed computing systems
- To understand the basics of communication and communication modes in parallel and distributed systems
- To understand the basics ofconsistency control in parallel and distributed systems

COURSE OUTCOMES:

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

CO1: Explain the foundational principles behind parallel programming and distributed systems (Understand)

CO2: Apply the various design principles of parallel algorithms (Apply)

CO3: Recognise the effectiveness of parallel algorithms in considering elements like scalability, load balancing, and synchronisation (Understand)

CO4: Illustrate the techniques for designing scalable and high-performance distributed systems (Understand)

CO5: Comprehend the importance of distributed systems' communication, consistency control, fault tolerance, and recovery procedures (Understand)

CO-PO MAPPING:

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

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

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

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U21ITP02	MOBILE COMPUTING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- U21CSG05 - Computer Networks

COURSE OBJECTIVES:

- To understand the fundamentals of mobile computing
- To describe the various protocols used in MANETs
- To explore the operating systems used in mobile computing and e-commerce

COURSE OUTCOMES:

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

CO1: Explain the basic concepts and technologies used in mobile communication (Understand)

CO2: Outline the importance of MAC, Mobile Internet Protocol and DHCP in MANETs (Understand)

CO3: Illustrate the working of transport layer and databases in mobile computing (Understand)

CO4: Describe the basics of Mobile Adhoc networks and the various possible security issues in MANETs (Understand)

CO5: Demonstrate suitable operating systems for mobile computing and the basic principles of mobile commerce (Apply)

CO-PO MAPPING:

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

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 body.

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UNIT II MAC AND MOBILE IP 9

Properties of MAC protocols –Issues in wireless MAC protocols– Taxonomy of MAC protocols - Fixed assignment schemes– Random assignment schemes – Reservation-based schemes – The802.11 MAC Standard – MAC protocols for Ad hoc networks – Mobile Internet Protocol: Mobile IP terminologies–Packet delivery - Features of mobile IP–Key mechanism in mobile IP–Route optimization –Dynamic Host Configuration Protocol(DHCP)

UNIT III MOBILE TRANSPORT LAYER AND DATABASES 9

TCP/IP–Architecture of TCP/IP–Operation of TCP–Application layer protocols of TCP–TCP/IP versus ISO/OSI Model–Adaptation of TCP window–Improvement in TCP performance –Issues in transaction processing–Transaction processing environment - Data dissemination–Transaction processing in mobile environment–Data replication–Mobile transaction models–Rollback process –Two-phase commit protocol–Query processing–Recovery

UNIT IV MOBILE ADHOC NETWORKS 9

Characteristics of MANETs– Applications of MANETs – MANET design issues – Routing– Essentials of traditional routing protocols - Routing in MANETs: MANET routing protocols–Vehicular Ad Hoc Networks (VANETs)–MANET vs. VANET–Security issues in a MANET–Attacks on Ad Hoc networks–Security attack countermeasures

UNIT V OPERATING SYSTEMS FOR MOBILE COMPUTING AND MOBILE COMMERCE 9

Mobile operating systems–Constraints and requirements of mobile operating systems –Commercial mobile operating systems–Operating systems for sensor networks–Applications of M-Commerce – Business-to-Consumer (B2C) Applications–Business-to-Business (B2B) Applications–Structure of mobile commerce – Pros and Cons of M-Commerce–Mobile payment systems–Security issues

Contact Periods:

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

Total 45 Periods

TEXT BOOK:

1. Prasant Kumar Pattnaik, RajibMall,"Fundamentals of Mobile Computing", 1st Edition, PHI Learning 2019

REFERENCES:

1. Schiller J, "Mobile Communication", 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

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EVALUATION PATTERN:

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

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

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U21ITP03	WIRELESS SENSOR NETWORKS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

U21CSG05 – Computer Networks

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

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

SYLLABUS:

UNIT I WSN ARCHITECTURES 9

Single-node architecture–Hardware components–Energy consumption of sensor nodes– Operating systems and execution environments–Sensor network scenarios- Optimization goals– Design principles for WSNs–Service interfaces of WSNs–Gateway concepts.

UNIT II MEDIUM ACCESS CONTROL PROTOCOLS 9

Wireless channel and communication fundamentals–Physical layer and transceiver design considerations in WSNs–Fundamentals of wireless MAC protocols–Low duty cycle protocols and wakeup concepts–Contention-based protocols- Schedule-based protocols–Random Access-based Protocols–Case study: Sensor-MAC IEEE 802.15.4 LR-WPANs Standard.

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UNIT III ROUTING AND DATA GATHERING PROTOCOLS 9

Routing challenges and design issues in wireless sensor networks–Routing strategies in wireless sensor networks–Data-centric networking–Data-centric routing–Data aggregation–Data-centric storage.

UNIT IV NETWORK MANAGEMENT 9

Middleware principle, Middleware architecture–Existing middleware–Network management requirements, Traditional network management models–Network management design issues, Operating system design issues–WSN design issues- Performance modelling of WSN, Case study: Computation of the system life span.

UNIT V APPLICATIONS 9

Home control–Building automation–Industrial automation–Medical applications–Reconfigurable sensor networks–Highway monitoring–Military applications–Civil and environmental engineering applications–Wildfire instrumentation–Habitat monitoring - Nanoscopic sensor applications – Case study: Target detection and tracking–Contour/edge detection.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. KazemSohraby, Daniel Minoli, TaiebZnati,"Wireless Sensor Networks Technology, Protocols, and Applications", 2nd Edition, Wiley, 2016
2. Abbas Jamalipour,JunZheng,"Wireless Sensor Networks: A Networking Perspective", 1st Edition, Wiley, 2014
3. Hossam Mahmoud Ahmad Fahmy,"Wireless Sensor Networks: Concepts, Applications, Experimentation and Analysis", 1st Edition, 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		
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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U21ITP04	SOFTWARE DEFINED NETWORKS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- U21CSG05 – Computer Networks

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: BuildSDN 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.

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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 – Open daylight 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 DNadeau, Ken Gray,"SDN: Software Defined Networks",1stEdition,O'Reilly Media, 2013
2. Paul Goransson, Chuck Black,"Software Defined Networks: A Comprehensive Approach", 2ndEdition,Morgan Kaufmann,2016

REFERENCES:

1. Siamak Azodolmolky,"Software Defined Networking with Open Flow",2nd Edition, Packet Publishing, 2017
2. VivekTiwari,"SDN and Open Flow for Beginner",1st Edition, M.M. D.D. Multimedia LLC, 2013
3. Fei Hu, "Network Innovation through Open Flow and SDN: Principles and Design", 1st Edition, CRC Press, 2014

EVALUATION PATTERN:

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

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

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U21ITP05	CYBER SECURITY	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CS403 – Operating Systems
- U21CSG05 – Computer Networks

COURSE OBJECTIVES:

- To discuss cyber security evolution, policy and law
- To describe the cyber security metrics and issues
- To explore the attacking and defencing techniques

COURSE OUTCOMES:

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

CO1: Elucidate the cyber security evolution and its policy to handle cyber threats (Understand)

CO2: Describe the cybersecurity metrics and guidance for management of cyber issues (Understand)

CO3: Explain the cybersecurityissues faced by decision makers for understanding cyber security (Understand)

CO4: Illustrate the attacking techniques and exploitation to detect cyber-attacks (Understand)

CO5: Identify the different category of malicious code to defend cyber attacks (Apply)

CO-PO MAPPING:

Cos \ Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	-	2	-	2	-	-	-	2	-	3
CO2	2	1	-	1	-	2	-	2	-	-	-	2	-	3
CO3	2	1	-	1	-	2	-	2	-	-	-	2	-	3
CO4	2	1	-	2	3	2	-	3	-	-	-	2	-	3
CO5	3	2	-	2	3	2	-	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, Enterprisepolicy, Technology operations, Technology configuration – Strategy versus policy – IT Act – Cyber security evolution: Productivity, Internet,E-commerce, Counter measures, Challenges.

UNIT II CYBERSECURITY OBJECTIVES AND GUIDANCE 9

Cyber security metrics – Security management goals – Counting vulnerabilities – Security frameworks: E-commerce systems, Industrial control systems, Personal mobile devices – Security policy objectives – Guidance for decision makers – Cyber security management – Catalog approach.

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UNIT III CYBER SECURITY ISSUES 9

Cyber governance issues: Net neutrality, Internet names, and numbers, Copyright and trademarks, Email and messaging – Cyber user issues: Malvertising, Impersonation, Appropriate use, Cybercrime, Geolocation, Privacy – Cyber conflict issues: Intellectual, Property theft, Cyber espionage, Cybersabotage, Cyber welfare.

UNIT IV ATTACKER TECHNIQUES AND EXPLOITATION 9

Antiforensics, Tunneling techniques, Fraud techniques, Threat infrastructure – Techniques to gain a foothold, Misdirection, Reconnaissance, and Disruption methods.

UNIT V MALICIOUS CODE AND DEFENSE 9

Self – replicating malicious code, Evading detection and elevating privileges , Stealing information and exploitation – Defense and analysis techniques.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Jennifer L. Bayuk, J. Healey, P. Rohmeyer, Marcus Sachs , Jeffrey Schmidt, Joseph Weiss, "Cyber Security Policy Guidebook", 1st Edition, John Wiley & Sons, 2012
2. James Graham, Rick Howard, Ryan Olson, "Cyber Security Essentials", 1st Edition, CRC Press, 2016

REFERENCES:

1. "National Cyber Crime Reference – Handbook-I", National Cyber Safety and Security Standards, India, 2014
2. "National Cyber Defence Reference – Handbook-II", National Cyber Safety and Security Standards, India, 2016
3. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics", 2nd Edition, Tata McGraw –Hill, 2006
4. https://www.sans.org/white-papers

EVALUATION PATTERN:

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

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

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U21ITP06	INTERNET SECURITY	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITE:

- U21ITG02– Information Security

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	-	2
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).

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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, 7thEdition, 2017
2. Ronald L Krutz and Russell Dean Vines, "Cloud Security- A Comprehensive Guide to Secure Cloud Computing", 1st Edition, Wiley, 2016

REFERENCES:

1. J Bernard Menezes, "Network Security and Cryptography",2nd Edition, Cengage Learning, 2014
2. Chalie Kaufman, Radia Perlman, Mike Speciner, "Network Security: Private Communication in a Public World", 2nd Edition, Pearson Education, 2022
3. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms and Source Code in C", 20th Anniversary Edition, John Wiley and Sons, 2015
4. https://training.apnic.net/wp-content/uploads/sites/2/2016/12/TSEC01.pdf

EVALUATION PATTERN:

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

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

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U21ITP07	ETHICAL HACKING	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21CSG05 – Computer Networks

COURSE OBJECTIVES:

- To demonstrate penetration and port scanning tools
- To understand vulnerability assessment and network sniffing attacks
- To explore remote exploitation, wireless and web hackings

COURSE OUTCOMES:

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

CO1: Explain the concepts of penetration testing methodologies and tools to identifycyber threats (Understand)

CO2: Demonstrate port scanning tolls to detect vulnerable ports (Apply)

CO3: Explain vulnerability assessment and network sniffing tools to predict cyber threats (Understand)

CO4: Describe possible remote exploitation using network protocols and servers (Understand)

CO5: Experiment wireless and web hacking to detect cyber threats and attacks (Apply)

CO-PO MAPPING:

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

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

SYLLABUS

UNIT I PENETRATION TESTING 9

Important terminologies – Penetration testing: Methodologies – Categories of penetration test – Penetration testing report – Information gathering techniques: Active information gathering – Passive information gathering – Sources of information gathering – NeoTrace – Cheops-ng – Intercepting a Response – WhatWeb – Netcraft.

UNIT II PORT SCANNING TECHNIQUES 9

Scanning for open ports and services – Types of port scanning – TCP flags – Port status types – TCP SYN scan – TCP connect scan – UDP port scan – IDLE scan – Scanning for a vulnerable host – Performing an IDLE scan with NMAP – OS fingerprinting.

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UNIT III VULNERABILITY ASSESSMENT AND NETWORK SNIFFING 9

Vulnerability scanners – Vulnerability assessment with Nmap – Nessus vulnerability scanner – Types of sniffing – MITM attacks – ARP protocol – ARP attacks – Denial of service attacks, Dsnif – Sniffing the traffic with Dsnif – Sniffing with wireshark – Using ARP spoof to perform MITM Attacks – Hijacking session with MITM attack – Sniffing Session Cookies with Wireshark – DNS spoofing – DHCP spoofing.

UNIT IV REMOTE EXPLOITATION 9

Network protocols – Server protocols – Attacking network remote services – Common target protocols – Cracking services with hydra – OpenSSH username discovery bug – Cracking SSH with Medusa – Attacking SQL servers – Metasploit: commands – reconnaissance – port scanning – Metasploit databases – Useful scans with Metasploit.

UNIT V WIRELESSHACKING AND WEB HACKING 9

Aircrack-ng – Uncovering hidden SSIDs – Monitoring beacon frames on Wireshark – Determining the target with Airodump-ng – Cracking a WPA/WPA2 wireless network using Aircrack-ng – Capturing packets– Attacking the authentication – Brute force and dictionary attacks SQL injection attacks– Testing for SQL injection.

Contact Periods:

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

Total 45 Periods

TEXT BOOK:

1. Baloch, R, "Ethical Hacking and Penetration Testing Guide", 1st Edition, CRC Press, 2015

REFERENCES:

1. SagarRahalkar, "Quick Start Guide to Penetration Testing with NMAP, OpenVAS and Metasploit", Apress, 1st Edition, 2019
2. Alan T Norman, "Kali Linux and Wireless Hacking Ultimate Guide with Security and Penetration Testing Tools, Practical Step by Step Computer Hacking Book", 1stEdition,CB-India, 2018

EVALUATION PATTERN:

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

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

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U21ITP08	DIGITAL FORENSICS	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21ITG02 - Information Security
- U21CSG05 – Computer Networks

COURSE OBJECTIVES:

- Describe the knowledge requirement for computer forensics and documenting the evidence
- Understand the proccess of online investigations
- Explore the different category of cyber forensics

COURSE OUTCOMES:

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

CO1: Explain the scope for computer forensics and file system for digital crime investigations (Understand)

CO2: Describe the process of acquiring and documenting computer forensic evidence for investigation (Understand)

CO3: Illustrate the proccess of online intestigations to resolve security disputes (Understand)

CO4: Perform network and mobile forensics in the field of digital communication (Apply)

CO5: Perform digital photographic forensics to resolve crime disputes (Apply)

CO-PO MAPPING:

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

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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 PHOTOGRAPHFORENSICS 9

Macintosh file systems – forensic examination of a MAC – Mac operating systems – Apple mobile devices, Digital photography – Examining picture files – Evidence admissibility – Case studies.

Contact Periods:

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

Total 45 Periods

TEXT BOOK:

1. Darren R. Hayes, "A Practical Guide to Digital Forensics Investigations", 2nd Edition, Pearson, 2020

REFERENCES:

1. "National Cyber Crime Reference – Handbook-I", National Cyber Safety and Security Standards, India, 2014.
2. "National Cyber Defence Reference – Handbook – II", National Cyber Safety and Security Standards, India, 2016.
3. Bill Nelson, Amelia Phillips, Christopher Steuart, "Guide to Computer Forensics and Investigations", 6th Edition, Cengage learning, 2020.
4. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics", 2nd Edition, BCS, The chartered institute for IT, 2018.
5. https://www.sans.org/white-papers

EVALUATION PATTERN:

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

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

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VERTICAL V

FULL STACK DEVELOPMENT

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the fundamental concepts of UI/UX Design
- To understand prototyping, analyzing and testing an application
- To learn to develop real time applications

COURSE OUTCOMES:

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

CO1: Interpret the concepts of UI/UX Design (Understand)

CO2: Discover different methods for organizing the contents (Understand)

CO3: Describe the knowledge on different heuristics and design interaction for an application (Understand)

CO4: Elucidate the process of prototyping, analyzing and testing an application (Understand)

CO5: Apply real time product designing using design thinking (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION **9**

Fundamentals of graphics design, principles of visual design – Mental Model – Cognitive Model in UX – Means to an End – Basics of User Research– Patterns– Project Ecosystem – Project Objectives and approach – Four Tenets of UX Strategy – user research – Personas.

UNIT II ORGANIZING THE CONTENT **9**

Information Architecture and Application Structure: Big Picture – Content Patterns – Picture Manager – Dashboard – Canvas Plus Palette – Wizard – Settings Editor – Alternative Views – Many Workspaces– Multi–Level Help.

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UNIT III HEURISTICS AND INTERACTION DESIGN 9

Navigational Models – Defining to designing – Design Principles – Site maps and Task Flows – Wireframes and Annotations – Interaction Patterns – Core Responsive Design.

UNIT IV PROTOTYPING, ANALYSING AND TESTING 9

Prototyping – Paper Prototyping – Digital Prototyping – Wireframe vs. Realistic Prototypes – HTML vs. WYSIWYG Editors– Additional Tools for Prototyping – Prototype Examples– Conducting Competitive Analysis – Design Testing with Users – Usability Evaluation – Heuristic Evaluation.

UNIT V PRODUCT DESIGN 9

Design Thinking Life Cycle– Types of products & solutions– Design Psychology for e–commerce sites – Design and testing of social media site and online shopping site.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Jaime Levy, UX Strategy, O'Reilly, 1st Edition, 2015
2. Russer Unger, Carolyn Chandler, A Project Guide to UX Design, 2nd Edition, New Riders

REFERENCES:

1. Wiiliam Redwell, Kritina Holden, Jill Butler, "Universal Principles of Design", Rockport, 2010
2. Jesse James Garrett, "The Elements of User Experience: User–Centered Design for the Web and Beyond – Voices That Matter", 1st Edition, AIGA NEW RIDERS, 2010
3. Marcin Treder , "UX Design for startups", UXpin, 2013

EVALUATION PATTERN:

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

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the object oriented structure and user interface programming through Python
- To gain knowledge of web development using Flask Framework
- To learn to deploy the software in Linux and Windows platforms

COURSE OUTCOMES:

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

CO1: Describe the object–oriented concepts in Python (Understand)

CO2: Identify the UI applications in Python (Apply)

CO3: Utilize the use of flask framework for web development (Apply)

CO4: Develop real time web applications using flask and MangoDB (Apply)

CO5: Implement the steps to deploy the developed web applications (Apply)

CO–PO MAPPING:

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

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

SYLLABUS:

UNIT I OBJECT ORIENTED APPROACH IN PYTHON 9

Classes – Class Coding Basics: Instances – Behavior Methods – Operator Overloading – Customizing Behavior Methods – Constructors – Polymorphism – Inheritance.

UNIT II USER INTERFACE APPLICATIONS IN PYTHON 9

Wxpython installation – Menus and Toolbars – Layout Management – Wxpython Events – Wxpython Dialogs – Widgets – Graphics.

UNIT III FLASK FRAMEWORK FOR WEB DEVELOPMENT 9

Flask Basics – Routes – Templates – Control Flow – Inheritance – Forms – Modules – Connection with Databases – Relational Database versus NoSQL – Modeling – Mapping Classes to Mongodb – Building Data Layer with Mongo Engine.

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UNIT IV REAL TIME DEVELOPMENT OF WEB APPLICATION 9

Develop Web Applications with Flask and MongoDB – Example Applications – Blogs – Forums – Social media applications – Twitter clone – Instagram clone – Auto Evaluation of Student Assignments.

UNIT V DEPLOYMENT OF APPLICATIONS 9

Collaborative Version Control Systems – Git Commands – Real Time Usage of Git Commands – Deployment Using AWS, Google Cloud and Heroku.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Mark Lutz, "Learning Python",5th Edition, O' Reilly 2013.
2. Miguel Grinberg, "Flask Web Development Developing Web Applications with Python", 1stEdition, OReilly, 2014

REFERENCES:

1. Karl Seguin, "The Little Mongo DB Book", https://github.com/karlseguin/the–little–mongodb–book.
2. Gareth Dwyer, "Flask by Example", Packt Publishers, 2016
3. https://aws.amazon.com/education/awseducate/
4. http://packaging.ubuntu.com/html/packaging–new–software.html
5. Scott Chacon and Ben Straub, "Pro Git", Free e–book under Creative commons, 2nd Edition, Apress, 2016

EVALUATION PATTERN:

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

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn development of native applications with basic GUI Components
- To develop applications with location and data storage capabilities
- To implement cross platform applications with basic GUI and event handling

COURSE OUTCOMES:

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

CO1: Describe the Native applications with GUI Components (Understand)

CO2: Examine hybrid applications with basic event handling (Apply)

CO3: Integrate the cross–platform applications with location and data storage capabilities (Apply)

CO4: Employ the cross–platform applications with basic GUI and event handling (Apply)

CO5: Identify the web applications with cloud database access (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I FUNDAMENTALS OF MOBILE & WEB APPLICATION DEVELOPMENT 9

Basics of Web and Mobile application development–Native App– Hybrid App– Cross–platform App– What is Progressive Web App – Responsive Web design.

UNIT II NATIVE APP DEVELOPMENT USING JAVA 9

What is Native Web App– Benefits of Native App– Scenarios to create Native App– Tools for creating Native App– Cons of Native App– Popular Native App Development Frameworks– Java & Kotlin for Android– Swift & Objective–C for iOS– Basics of React Native– Native Components – JSX, State, Props.

UNIT III HYBRID APP DEVELOPMENT 9

What is Hybrid Web App– Benefits of Hybrid App– Criteria for creating Native App– Tools for creating Hybrid App– Cons of Hybrid App– Popular Hybrid App Development Frameworks– Ionic– Apache Cordova.

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UNIT IV CROSS–PLATFORM APP DEVELOPMENT USING REACT–NATIVE 9

What is Cross-platform App– Benefits of Cross-platform App– Criteria for creating Cross-platform App– Tools for creating Cross-platform App– Cons of Cross-platform App– Popular Cross-platform App Development Frameworks– Flutter– Xamarin– React–Native– Basics of React Native– Native Components – JSX, State, Props.

UNIT V NON–FUNCTIONAL CHARACTERISTICS OF APP FRAMEWORKS 9

Comparison of different App frameworks– Build Performance– App Performance– Debugging capabilities– Time to Market– Maintainability– Ease of Development– UI/UX, Reusability.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Dawn Griffiths, "Head First Android Development", O'Reilly, 1st Edition
2. Anthony Accomazzo, 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
2. Apache Cordova 4 Programming, John M Wargo, 2015
3. React Native Cookbook, Daniel Ward, Packt Publishing, 2nd Edition
4. Apache Cordova in Action, Raymond K. Camden, Manning, 2015

EVALUATION PATTERN:

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

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the various components of full stack development
- To learn the basics of java script frameworks
- To learn application development using MongoDB

COURSE OUTCOMES:

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

CO1: Describe the various stacks available for web application development (Understand)

CO2: Utilize the use of Node.js for application development (Apply)

CO3: Implement the function of MongoDB (Apply)

CO4: Employ the role of Angular and Express for web development (Apply)

CO5: Illustrate the features of React (Understand)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I BASICS OF FULL STACK 9

Understanding the Basic Web Development Framework – User – Browser – Webserver – Backend Services – MVC Architecture – Understanding the different stacks –The role of Express – Angular – Node – Mongo DB – React.

UNIT II NODE JS 9

Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers – Callbacks – Handling Data I/O – Implementing HTTP services in Node.js.

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.

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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, 2018, Pearson Education, Inc.
2. Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2017, Apress

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

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the types of web services, resources, APIs and their architectures
- To develop, deploy RESTful web service APIs in JAVA
- To understand the security concerns of web services

COURSE OUTCOMES:

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

CO1: Describe Web Services architectural pattern for a given design problem (Understand)

CO2: Examine the types of resources and suitable design patterns for development (Apply)

CO3: Adopt Restful API Design Patterns (Apply)

CO4: Utilize RESTful API web services (Apply)

CO5: Evaluate the performance and security aspects of web services (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION 9

Web Services – Building Blocks, Types; Service Oriented architectures – resource oriented architectures, API architectures, Micro services and architectures, HATEOAS, REST, URI, Code on Demand.

UNIT II RESOURCES AND DESIGN PATTERNS 9

Resources – Identification, Resource Relations, Representations, Parameters, types, methods, Requirements for APIs, Architectural Patterns. Basic and Advanced RESTful API patterns.

UNIT III RESTFUL API DESIGN PRINCIPLES 9

API front End Design, API back end Design, Identifier Design, Interaction Design with HTTP, Metadata Design, Representation Design, URI design, REST constraints, Best Practices.

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UNIT IV DEVELOPMENT AND DEPOLYMENT 9

Frameworks, Standard Languages, API Description Languages, Handover points, Development and Deployment of RESTful web service applications in Java, microservice API, Best Practices.

UNIT V PERFORMANCE AND SECURITY 9

Performance and availability – caching – Traffic shaping – Evolution and versioning, Security concerns – Mechanisms, Authentication, Validation, Access Control, Token Based Authentication, Authorization.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Matthias Biehl, "RESTful API Design, API University Series, 1st Edition, Create Space Independent Publishing Platform, 2016.
2. "RESTful web APIs", Packt Publishing, 2019.

REFERENCES:

1. JJ Geewax, "API Design Patterns", 1st Edition, Manning Publications, 2021.
2. Bogunuva Mohanram Balachandar, "Restful Java Web Services: A pragmatic guide to designing and building RESTful APIs using Java, 3rd Edition, Ingram Short Title, 2017.
3. Mark Masse, "REST API Design Rulebook: Designing Consistent RESTful Web Service Interfaces", 1st Edition, O' Reilly, 2011.
4. Harihara Subramanian, Pethuru Raj, "Hands–On RESTful API Design Patterns and Best Practices: Design, develop, and deploy highly adaptable, scalable, and secure

EVALUATION PATTERN:

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

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand service–oriented architecture and micro services
- 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 Micro services with Python – Micro service Discovery Framework – Coding, Testing & Documenting Micro services – Interacting with Other Services – Monitoring and Securing the Services – Containerized Services – Deploying on Cloud.

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UNIT III SERVICE ORIENTED ARCHITECTURE 9

Enterprise–wide SOA – Service oriented applications – Service oriented analysis and design – Technologies for SOA – SOA Implementation and Governance.

UNIT IV CLOUD AND DEVOPS 9

Origin of DevOps – The developers versus operations dilemma – Key characteristics of a DevOps culture – Deploying a Web Application – Creating and configuring an account – Creating a web server – Managing infrastructure with Cloud Formation – Adding a configuration management system.

UNIT V WORKING WITH APIs 9

Working with Third Party APIs: Overview of interconnectivity in cloud ecosystems. Working with Twitter API, Flickr API, Google Maps API. Advanced use of JSON and REST.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. Shankar Kambhampaty, "Service–oriented Architecture &Microservice Architecture: For Enterprise, Cloud, Big Data and Mobile", 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, [ISBN:9781786466815],2017
3. Jim Webber, Savas Parastatidis, Ian Robinson, "REST in Practice" O'Reilly Media; 1 edition, [ISBN: 978–0596805821] 2010.

EVALUATION PATTERN:

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

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To Introduce Cloud Environments and cloud native fundamentals
- To introduce the Docker environment
- To understand container orchestration and continuous integration and development

COURSE OUTCOMES:

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

CO1: Define the characteristics of various cloud environments (Understand)

CO2: Describe the concepts of cloud native fundamentals (Understand)

CO3: Employ Docker for cloud native development (Apply)

CO4: Implement container orchestration techniques (Apply)

CO5: Practice the features of continuous integration and development (Apply)

CO–PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	1	1	-	-	-	-	-	-	1	-	2
CO2	2	1	1	1	1	-	-	-	-	-	-	1	-	2
CO3	3	2	2	2	3	-	-	-	-	-	-	2	-	3
CO4	3	2	2	2	1	-	-	-	-	-	-	2	-	3
CO5	3	2	2	2	2	-	-	-	-	-	-	2	-	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 micro service based–architecture for an application – Evaluating the involved trade–offs for monoliths and micro services.

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UNIT III DOCKER 9

Introduction to Docker, Docker Components, Docker Container, Docker Images and Repositories. Cloud Native application design, Containers, Data Management in Cloud, Web–Queue–Worker, Serverless Computing.

UNIT IV CONTAINER ORCHESTRATION 9

Using Docker to package an application and distribute it via DockerHub – Bootstrap a Kubernetes cluster using k3s – Explore Kubernetes resources for an application deployment – Differentiate between declarative and imperative Kubernetes management techniques.

UNIT V CONTINUOUS INTEGRATION AND DEVELOPMENT 9

Continuous Integration fundamentals using GitHub – Continuous Delivery fundamentals using ArgoCD – Basics of Helm, as a configuration template manager – Kubernetes basics – Deploying an application using ArgoCD and a Helm chart.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS

1. Michael J Kavis, "Architecting the Cloud – Design Decisions for Cloud Computing", Wiley publication
2. Tom Laszewski, Kamal Arora, Eric Farr, Piyum Zanooz, "Cloud Native Architectures: Design high–availability and cost–effective applications for the cloud", Packt publishing

REFERENCE BOOKS

1. Bill Wilder, Cloud Architecture Patterns: Using Microsoft Azure, O'Reilly Media.
2. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.

EVALUATION PATTERN:

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

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

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

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To introduce DevOps terminology, definition & concepts
- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)

COURSE OUTCOMES:

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

CO1: Explain different actions performed through Version control tools like Git (Understand)

CO2: Describe Automated Continuous Deployment (Understand)

CO3: Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle (Apply)

CO4: Illustrate configuration management using Ansible (Understand)

CO5: Use Cloud–based DevOps tools (Apply)

CO–PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO DEVOPS 9

Devops Essentials – Introduction To AWS, GCP, Azure – Version control systems: Git and Github.

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE 9

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle.

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UNIT III CONTINUOUS INTEGRATION USING JENKINS 9

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 9

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible.

UNIT V BUILDING DEVOPS PIPELINES USING AZURE 9

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure–pipelines.yaml file.

Contact Periods:

Lecture: 45– Periods Tutorial: – Periods Practical: 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 Exercisesll, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, —Linux for Beginners: An Introduction to the Linux Operating System and Command Linell, Kindle Edition, 2014

REFERENCES:

1. Mitesh Soni, "Hands–On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure" (English Edition) Paperback – 1 January 2020
2. Jeff Geerling, "Ansible for DevOps: Server and configuration management for humansll", First Edition, 2015.
3. David Johnson, "Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOpsll", Second Edition, 2016.

EVALUATION PATTERN:

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

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

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VERTICAL VI

MANAGEMENT AND MARKETING

		Category: PCC				
U21CBP01	INTRODUCTION TO INNOVATION, IP MANAGEMENT AND ENTREPRENEURSHIP	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To develop and strengthen innovation, IP management and entrepreneurial quality
- To motivate in and to impart basic skills
- To understanding to run a business efficiently and effectively

COURSE OUTCOMES:

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

CO1: Outline the current and emerging trends in innovation (Understand)

CO2: Exemplify the importance of IPR in patents, copyrights, and geographical indications (Understand)

CO3: Apply legal and regulatory requirements for the registration of IPRs (Apply)

CO4: Analyze various types of entrepreneurs and analyze their motivations (Apply)

CO5: Develop a comprehensive small business plan integrating feasibility and financial strategies (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO INNOVATION 9

Adoption of Innovations, Exploring Innovations, Idea generation, Developing innovative culture, Executing innovations, Innovation attributes and their adoption rate, Measuring and evaluation of innovation Exploiting and renewing innovations, Managing innovations in organizations, Innovation and intellectual property rights, Innovation portfolio.

UNIT II INTRODUCTION TO IPR 9

Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT III REGISTRATION OF IPRs 9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad, Agreements and Legislations.

UNIT IV ENTREPRENEURSHIP 9

Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur, Major Motives Influencing an Entrepreneur –Achievement Motivation Training, Self Rating, Business Games, Thematic Apperception Test – Stress Management.

UNIT V BUSINESS AND FINANCING 9

Small Enterprises – Characteristics, Ownership Structures – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project 100 Appraisal –Sources of Finance, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.

Contact Periods:

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

Total: 45 Periods

TEXT BOOKS:

1. V. Scople Vinod, "Managing Intellectual Property : The Strategic Imperative", 5th Edition, Prentice Hall of India pvt Ltd, 2012.
2. Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", 9th Edition, Cengage Learning, 2014.

REFERENCES:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, 3rd Edition, 2012.
2. Oliver Gassmann, Martin A. Bader, Mark James Thompson, "Patent Management Protecting Intellectual Property and Innovation", 1st Edition, Springer, 2020.
3. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill, 2013.

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EVALUATION PATTERN:

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

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

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U21CBP02	IT PROJECT MANAGEMENT	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To learn the concepts of managing IT projects
- To understand about planning, budgeting, resource allocation and scheduling
- To learn software quality management

COURSE OUTCOMES:

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

CO1: Describe the project management principles to manage business situations effectively (Understand)
CO2: Illustrate the planning, budgeting, and scheduling skills to create effective project plans (Understand)
CO3: Optimize resource utilization and time management to ensure project success (Apply)
CO4: Analyze and control resource allocation for successful project completion (Analyze)
CO5: Implement software quality management techniques to ensure high-quality project deliverables (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO PROJECT MANAGEMENT 9

Project Management – Definition –Goal - Lifecycles. Project Selection Methods. Project Portfolio Process – Project Formulation. Project Manager – Roles- Responsibilities and Selection – Project Teams, Project support activities, Types of project organizations

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UNIT II PLANNING AND BUDGETING 9

The Planning Process – Work Break down Structure – Role of Multidisciplinary teams, Critical path analysis. Budget the Project – Methods. Cost Estimating and Improvement. Budget uncertainty and risk management.

UNIT III SCHEDULING & RESOURCE ALLOCATION 9

PERT & CPM Networks - Crashing – Project Uncertainty and Risk Management – Simulation – Gantt Charts – Expediting a project – Resource loading and levelling. Allocating scarce resources – Goldratt"s Critical Chain.

UNIT IV CONTROL AND COMPLETION 9

The Plan-Monitor-Control cycle – Data Collecting and reporting – Project Control – Designing the control system. Project Evaluation, Earned Value Analysis, Auditing and Termination, Risk Management, – Conflict – Origin & Consequences. Managing conflict – Team methods for resolving conflict

.

UNIT V SOFTWARE QUALITY MANAGEMENT 9

Product quality and software quality, quality management systems, principles and features, System quality specification and measurement, Process and product quality approaches, Quality assurance and quality control, project audit and quality audit, Methods of enhancing quality: the different types of testing, inspections, reviews, standards, Management and control of testing.

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

Total:45 Periods

TEXT BOOKS:

1. Hughes B, "IT-related Projects" . 2nd Edition, BCS Publications, 2012
2. Greg Horine , " Project Management Absolute Beginner's Guide " , 4th Edition, Pearson Education 2017.
3. John M. Nicholas, " Business and Technology - Principles and Practice ", 2nd Edition, Pearson Education, 2006.

REFERENCES:

1. Gido and Clements, Successful Project Management, 2nd Edition, Thomson Learning, 2003.
2. Harvey Maylor, Project Management, 3rd Edition, Pearson Education, 2006.

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EVALUATION PATTERN:

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

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

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U21CBP03	E – BUSINESS MANAGEMENT	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the practices and technology to start an online business
- To learn e-business payment and security
- To understand legal and privacy issues

COURSE OUTCOMES:

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

CO1: Infer the need for e-business (Understand)
CO2: Identify the technology infrastructure required for e-business (Understand)
CO3: Apply the knowledge of consumer-oriented e-business models (Apply)
CO4: Employ the e-business payment and security protocols (Apply)
CO5: Apply the ethical, legal, privacy issues and encryption policies for e-business (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO e-BUSINESS 9

e-business, e-business vs e-commerce, Economic forces – advantages – myths – e-business models, design, develop and manage e-business, Web 2.0 and Social Networking, Mobile Commerce's-commerce.

UNIT II TECHNOLOGY INFRASTRUCTURE 9

Internet and World Wide Web, internet protocols - FTP, intranet and extranet, information publishing technology- basics of web server hardware and software.

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UNIT III BUSINESS APPLICATIONS 9

Consumer oriented e-business – e-tailing and models - Marketing on web – advertising, e-mail marketing, affiliated programs - e-CRM; online services, Business oriented e-business, e-governance, EDI on the internet, Delivery management system, Web Auctions, Virtual communities and Web portals– social media marketing

UNIT IV E-BUSINESS PAYMENTS AND SECURITY 9

E-payments - Characteristics of payment of systems, protocols, e-cash, e-cheque and Micro payment systems- internet security – cryptography – security protocols – network security.

UNIT V LEGAL AND PRIVACY ISSUES 9

Legal, Ethics and privacy issues – Protection needs and methodology – consumer protection, cyber laws, contracts and warranties, Taxation and encryption policies.

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

Total:45 Periods

TEXT BOOKS:

1. Lee, I. " Electronic Commerce Management for Business Activities and Global Enterprises: Competitive Advantages" , 2nd Edition ,Business Science Reference, 2012.
2. Lee, I. ,"Encyclopedia of E-Commerce Development, Implementation, and Management" , IGI Global, 2016.
3. Martínez-López, F. J., Jelassi, T, " Strategies for E-Business: Concepts and Cases on Value Creation and Digital Business Transformation", 4th,Springer International Publishing,2020.

REFERENCES:

1. Harvey M.Deitel, Paul J.Deitel, Kate Steinbuhler, "e-business and e-commerce for managers",1st ,Pearson, 2011.
2. Efraim Turban, Jae K. Lee, David King, Ting Peng Liang, Deborrah Turban, "Electronic Commerce –A managerial perspective", 8th Edition, Pearson Education Asia, 2015.

EVALUATION PATTERN:

Continuous Internal Assessments				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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U21CBP04	RECOMMENDER SYSTEMS	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the foundations and significance of machine learning and data mining algorithms for Recommender systems
- To gain the design and implementation of a recommender system using collaborative filtering
- To acquire a comprehensive understanding of collaborative filtering techniques

COURSE OUTCOMES:

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

CO1: Elucidate different recommender systems and their effective construction using data mining methods (Understand)
CO2: Illustrate the content-based recommendation systems through user and item profile learning (Understand)
CO3: Evaluate user and item-based collaborative filtering techniques for building recommendation systems (Apply)
CO4: Apply strategies to detect and protect recommender systems from attacks (Apply)
CO5: Employ appropriate evaluation paradigms and metrics to assess the recommender systems (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION 9

Introduction and basic taxonomy of recommender systems - Traditional and non-personalized Recommender Systems - Overview of data mining methods for recommender systems- similarity measures- Dimensionality reduction – Singular Value Decomposition (SVD),Applications of recommendation systems, Issues with recommender system.

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UNIT II CONTENT-BASED RECOMMENDATION SYSTEMS 9

High-level architecture of content-based systems -Advantages and drawbacks of content based filtering, Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT III COLLABORATIVE FILTERING 9

A systematic approach, Nearest-neighbour collaborative filtering (CF), user-based and item-based CF, components of neighbourhood methods (rating normalization, similarity weight computation, and neighbourhood selection.

UNIT IV ATTACK-RESISTANT RECOMMENDER SYSTEMS 9

Introduction – Types of Attacks – Detecting attacks on recommender systems – Individual attack – Group attack – Strategies for robust recommender design - Robust recommendation algorithms.

UNIT V EVALUATING RECOMMENDER SYSTEMS 9

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Error metrics, Decision-Support metrics, User-Centred metrics, and Design Issues – Accuracy metrics – Limitations of Evaluation measures.

Contact Periods:

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

Total:45 Periods

TEXT BOOKS:

1. Charu C. Aggarwal, "Recommender Systems: The Textbook, Springer ",2nd Edition, Springer, 2016.
2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , "Recommender Systems: An Introduction, Cambridge University Press" , 1st Edition, 2011.
3. Francesco Ricci ,LiorRokach , Bracha Shapira , "Recommender Systems Handbook", 1st Edition, Springer 2011,
4. 4. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, "Mining of massive datasets", 3rd edition, Cambridge University Press, 2020.

REFERENCES

1. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender "Systems Handbook, Springer" , 1st Edition, 2011.
2. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer",1st Edition, 2013.

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EVALUATION PATTERN:

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

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

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U21CBP05	INDUSTRIAL PSYCHOLOGY	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To introduce students to industrial psychology and its applications in organizational settings
- To understand key topics such as employment law, job analysis, recruitment, selection, training, performance appraisal, motivation, and workplace safety
- To emphasize an applied approach to prepare students for their roles as employees and managers

COURSE OUTCOMES:

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

CO1: Elucidate the I/O psychology research methods for job analysis, evaluation, compensation, and recruitment (Understand)
CO2: Illustrate the employee performance measurement and evaluation methods (Understand)
CO3: Analyze theories of employee motivation, satisfaction, commitment, diversity, and leadership for organizational development (Apply)
CO4: Apply the knowledge of organizational culture, cultural fit, cross-cultural issues, and work behaviour (Apply)
CO5: Employ stress management strategies to mitigate stress-inducing factors (Apply)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION **9**

I/O Psychology-definition. Research Methods, Statistics, and Evidence-based Practice, Introduction &Legal Context of Industrial Psychology, Job Analysis & Competency Modelling, Job Evaluation &Compensation, Job Design & Employee Well-Being, Recruitment.

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UNIT II EMPLOYEES PERFORMANCE AND EVALUATION 9

Identifying Criteria & Validating Tests and Measures, Screening Methods, Intensive Methods, Performance Goals and Feedback, Performance Coaching and Evaluation, Evaluating Employee Performance

UNIT III LEADERSHIP AND ORGANIZATIONAL DEVELOPMENT 9

Employee Motivation, Satisfaction and Commitment, Fairness and Diversity, Leadership, Leadership vs Management, Leadership Theories, Organizational Climate, Culture, and Development,, Emerging issues in Leadership

UNIT IV ORGANIZATIONAL CULTURE 9

Organizational Climate and Culture, Functions of organizational culture, Organizational Socialization, Assessing Cultural Values and Fit, Cross Cultural issues. Teams in Organizations, The Organization of Work Behaviour

UNIT IV STRESS MANAGEMENT 9

Source of Stress, Consequences of stress, Managing Stress, Stress Reduction Interventions Related to Life/Work Issues, Measuring Stress, Demands of Life and Work.

TEXT BOOKS:

1. Jeffrey M. Conte, Frank J. Landy."Work in the 21st Century: An Introduction to Industrial and Organizational Psychology",6th Edition,Wiley, 2019.
2. Aamodt, M. G. "Industrial/Organizational Psychology: An Applied Approach" , 1st Edition, Cengage Learning, 2022

REFERENCES:

1. Ashwathappa, K. "Human Resource Management: Text & Cases, McGraw Hill Education ", 8th Edition, 2017.
2. Donald M. Truxillo, Talya N. Bauer, Berrin Erdogan," Psychology and Work An Introduction to Industrial and Organizational Psychology",2nd Edition, Taylor & Francis, 2021.

EVALUATION PATTERN:

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

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

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U21CBP06	MARKETING RESEARCH AND MARKETING MANAGEMENT	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the changing business environment and the fundamental premise underlying market driven strategies
- To analyse the nature of consumer buying behaviour
- To understanding the marketing research and new trends in the arena of marketing

COURSE OUTCOMES:

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

CO1: Explain contemporary marketing theories to practical business and management situations (Understand)
CO2: Illustrate the marketing strategies for consumer and industrial markets (Understand)
CO3: Select and manage appropriate marketing mix elements and integrated marketing channels for a given product or service (Apply)
CO4: Evaluate the factors influencing consumer buying behavior (Apply)
CO5: Analyze emerging marketing trends and recommend strategies for adaptation (Analyze)

CO-PO MAPPING:

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

SYLLABUS:

UNIT I INTRODUCTION TO MARKETING RESEARCH AND MARKETING MANAGEMENT 9

Defining Marketing – Core concepts in Marketing – Evolution of Marketing – Marketing Planning Process – Scanning Business environment: Internal and External – Value chain – Core Competencies – PESTEL – SWOT Analysis – Marketing interface with other functional areas – Production – Finance Human Relations Management – Information System – Marketing in global environment – International Marketing – Rural Marketing – Prospects and Challenges.

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UNIT II MARKETING STRATEGY 9

Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial Marketing – Consumer Marketing – Services marketing – Competition Analysis – Analysis of consumer and industrial markets – Influence of Economic and Behavioural Factors – Strategic Marketing Mix components.

UNIT III MARKETING MIX DECISIONS 9

Product planning and development – Product life cycle – New product Development and Management – Defining Market Segmentation – Targeting and Positioning – Brand Positioning and Differentiation – Channel Management – Managing Integrated Marketing Channels – Managing Retailing, Wholesaling and Logistics – Advertising and Sales Promotions – Pricing Objectives, Policies and Methods

UNIT IV BUYER BEHAVIOUR 9

Understanding Industrial and Consumer Buyer Behaviour – Influencing factors – Buyer Behaviour Models – Online buyer behaviour – Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection – Creating Long Term Loyalty Relationships.

UNIT V MARKETING RESEARCH & TRENDS IN MARKETING 9

Marketing Information System – Marketing Research Process – Concepts and applications: Product – Advertising – Promotion – Consumer Behaviour – Retail research – Customer driven organizations - Cause related marketing – Ethics in marketing – Online marketing trends - social media and digital marketing.

Contact Periods:

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

TEXT BOOKS:

1. Philip T. Kotler and Kevin Lane Keller, "Marketing Management", Prentice Hall India, 15th Edition, 2017.
2. KS Chandrasekar, "Marketing management-Text and Cases", 1st Edition ,Tata McGraw Hill Education, 2012

REFERENCES:

1. Philip T. Kotler and Kevin Lane Keller, "Marketing Management", 15th Edition ,Prentice Hall India 2017.
2. Paul Baines, Chris Fill, Kelly Page, "Marketing", Asian edition,5th Edition , Oxford University Press, 2019.
3. Philip Kotler , Gay Armstrong, Prafulla Agnihotri, "Principles of Marketing",7th Edition , 2018.

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EVALUATION PATTERN:

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

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

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U21CBP07	HUMAN RESOURCE MANAGEMENT	Category: PEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To understand the fundamental concepts and theories of HRM
- To practice the ethical values in achieving stakeholders welfare
- To involve stakeholders and team members in executing decisions

COURSE OUTCOMES:

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

CO1: Explain the concepts of human resource management (Understand)
CO2: Illustrate the recruitment and selection strategies for an organization (Understand)
CO3: Utilize training programs to enhance employee performance and appraisal (Apply)
CO4: Manage wage and salary programs aligned with the industry standards (Apply)
CO5: Apply legal and ethical principles to manage employee relations and promote workplace safety (Apply)

CO-PO MAPPING:

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

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

SYLLABUS:

UNIT I INTRODUCTION TO HRM 9

Meaning and Definition – Characteristics of HRM – Evolution of HRM – Organization and Policies of Personnel Department – Scope of HRM – Functions of HRM– Objectives of HRM– Qualities of HR Manager– Important Trends in HR Management

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UNIT II HR PLANNING, RECRUITMENT AND SELECTION 9

Importance of HR Planning– Job Analysis-Job description and job specification– Recruitment Sources of Recruitment– Selection- Importance of careful selection– Process of selection– Types of Tests for selection– Interview- Methods of Selection Interview– Induction Process.

UNIT III TRAINING AND DEVELOPMENT & PERFORMANCE APPRAISAL 9

Training and Development: Objectives of training – Identification of Training needs – Concepts of Training – Training methods – Orientation and Placement – Management development – Purposes and Principles of promotion – Bases and types for promotion – Transfer – Separation Performance Appraisal: Introduction – Identification of issues in performance appraisal – Uses of Performance Appraisal – limitations of Performance Appraisal– Performance Management – Career Management Basics – Talent Management – Methods of appraisal.

UNIT IV WAGE AND SALARY ADMINISTRATION 9

Meaning and Definition – Job Evaluation – Basic Factors in Determining Pay Rates – Establishing Pay Rates – Competency – Based Pay – Money and Motivation: An Introduction – Insurance Benefits – Retirement Benefits – Personal Services and Family-Friendly Benefits – Flexible Benefits Programs.

UNIT V INDUSTRIAL RELATION, HEALTH AND SAFETY 9

Industrial Relation– Health and safety measures Industrial Relations – Meaning & Characteristics, Industrial Relations – Parties to Industrial relations – Nature of Trade Unions – Problems of Trade– Union – Measures to Strengthen Trade Union Movement in India – Causes for Industrial Disputes- Settlement of Industrial Disputes – Occupational Security and Safety : Accidents – Workplace Health Hazards: Problems and Remedies.

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

Total: 45 Periods

TEXT BOOKS

1. Gary Dessler, BijuVarkkey,"Human Resource Management", 15th Edition, Pearson Education, 2018.
2. Denisi, Griffin, Sarkar, "Human Resource Management", 2nd Edition Cengage Learning , 2016.
3. George W.Bchlander, Scott A.Snell," Principles of Human Resource Management", 16th Edition, Cengage Learning, 2014.

REFERENCES:

1. Denisi, Griffin, Sarkar, "Human Resource Management", 2nd Edition Cengage Learning ,2016.
2. Aswathappa K, " Human Resource Management: Text and Cases ", 17th Edition, Tata McGraw-Hill, 2013.
3. Armstrong Michael," A Handbook of Human Resource Management", 13th Edition, Kogan Page, 2014.
4. Peter J. Dowling, Marion Festing, Allen D Engle, Sr, "International Human Resource Management ", 6th Edition, Cengage Learning, 2013.

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EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
				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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U21CBP08	FINANCIAL MANAGEMENT	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- Understand the operational nuances of a Finance Manager
- Comprehend the technique of making decisions related to finance functions

COURSE OUTCOMES:

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

CO1: Elucidate the concepts of financial decision of an organisation (Understand)

CO2: Illustrate the capital budgeting principles and techniques (Understand)

CO3: Apply EBIT-EPS analysis, capital structure theories, and dividend decisions to understand the impact on business (Apply)

CO4: Apply the principles of working capital management (Apply)

CO5: Assess the short-term and long-term sources of finance (Apply)

CO-PO MAPPING:

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

SYLLABUS

UNIT I INTRODUCTION TO FINANCE 9

Introduction to finance- Financial Management – Nature, scope and functions of Finance, organization of financial functions, objectives of Financial management, Major financial decisions – Time value of money – features and valuation of shares and bonds – Concept of risk and return – single asset and of a portfolio.

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UNIT II INVESTMENT DECISIONS 9

Capital Budgeting: Principles and techniques - Nature of capital budgeting- Identifying relevant cash flows - Evaluation Techniques: Payback, Accounting rate of return, Net Present Value, Internal Rate of Return, Profitability Index - Comparison of DCF techniques - Concept and measurement of cost of capital – Specific cost and overall cost of capital.

UNIT III FINANCING AND DIVIDEND DECISION 9

Leverages - Operating and Financial leverage – measurement of leverages – degree of Operating &Financial leverage – Combined leverage, EBIT – EPS Analysis- Indifference point. Capital structure – Theories – Net Income Approach, Net Operating Income Approach, MM Approach –Determinants of Capital structure. Dividend decision- Issues in dividend decisions, Importance, Relevance & Irrelevance theories Walter"s – Model, Gordon"s model and MM model. – Factors determining dividend policy – Types of dividend policies – forms of dividend.

UNIT IV WORKING CAPITAL MANAGEMENT 9

Principles of working capital: Concepts, Needs, Determinants, issues and estimation of working capital- Receivables Management - Inventory management – Cash management - Working capital finance: Commercial paper, Company deposit, Trade credit, Bank finance.

UNIT V LONG TERM SOURCES OF FINANCE 9

Indian capital market- New issues market- Secondary market - Long term finance: Shares, debentures and term loans, lease, hire purchase, venture capital financing, Private Equity.

TEXT BOOKS

1. I M. Pandey, "Financial Management", Vikas Publishing House Pvt. Ltd., 11th edition, 2018
2. James C. Van Horne, Sanjay Dhamija, "Financial Management and Policy", 12th Edition, Pearson Education, 2012.
3. Eugene F Brigham, Michael C. Ehrhardt, "Financial Management Theory and Practice", 14th Edition, Cengage Learning, 2014.

REFERENCES:

1. M.Y. Khan and P.K.Jain, "Financial management, Text, Problems and cases", Tata McGraw Hill, 8th edition, 2017.
2. James C. Vanhorne, "Fundamentals of Financial Management", PHI Learning, 13th Edition, 2014.
3. Prasanna Chandra, "Financial Management", 9th Edition, Tata McGraw Hill, 2017.

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EVALUATION PATTERN:

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

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

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