Fina
Loyola-ICAM
College of Engineering and Technology (LICET)
(Autonomous)
Loyola Campus, Nungambakkam, Chennai – 600 034

Curriculum and Syllabi (R-2024)

B.TECH. INFORMATION TECHNOLOGY

Loyola-ICAM
College of Engineering and Technology (LICET)
(Autonomous)
CURRICULUM AND SYLLABI (R-2024)
CHOICE BASED CREDIT SYSTEM (CBCS)

B.TECH. INFORMATION TECHNOLOGY

Vision of the Institution:

- To form responsible engineers, who would engineer a just society.

Mission of the Institution:

- To provide technical education in a Christian atmosphere to deserving students who are economically poor and socially marginalized
- To train young men and women of quality to be leaders in all walks of life and serve their fellow men with justice, truth and love
- To implement teaching learning processes that ensure guidance and mentoring for students throughout their period of study
- To provide higher education through academic collaboration and pursue research in international perspective of Engineering.

Vision of the Department:

- To build proficient Information Technologists through moral, ethical and technological standards for the societal well-being.

Mission of the Department:

M1: To provide a practice-oriented methodology with access to contemporary knowledge in Information Technology for the betterment of the society

M2: To prepare students for competent careers in Information Technology through innovation, team spirit, ethics and entrepreneurial skills in evolving technologies

M3: To integrate our department with quality organizations worldwide and promote industry institute interaction for symbiotic benefits

M4: To promote interdisciplinary research through innovation and reflective thinking

Programme Educational Objectives:

PEO1: Graduates will possess the ability to apply their technological skills to comprehend and analysssze complex problems to design and implement the feasible solutions.

PEO2: Graduates will acquire the desire for lifelong learning and ability to work in multidisciplinary teams for meeting the global challenges

PEO3: Graduates will be able to exhibit professional ethics, skills for management and responsibility towards societal needs.

Programme Outcomes:

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for
i) independent and life-long learning
ii) adaptability to new and emerging technologies and
iii) critical thinking in the broadest context of technological change. (WK8)

Programme Specific Outcomes:

PSO1 - To apply technological advances in the field of Information Technology for societal issues through professional ethics.

PSO2 - To acquire design skills for conducting domain-specific experiments and interpreting data to synthesize and analyze information.

PSO3 - To deploy appropriate algorithms, the latest open-source software, and other related programming engineering applications.

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CHOICE BASED CREDIT SYSTEM (CBCS)
B.Tech. Information Technology

SEMESTER – I

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1.	MA24101	Calculus for Engineers	BSC	3	1	0	4	4
2.	BE24101	Basic Electrical and Electronics Engineering	ESC	3	0	0	3	3
3.	CY24101	Applied Chemistry	BSC	3	0	0	3	3
4.	HS24101	English for Professional Communication	HSMC	3	0	0	3	3
5.	GE24101	Heritage of Tamils/ தமிழர் மரபு	HSMC	1	0	0	1	1
LABORATORY INTEGRATED THEORY COURSES								
6.	GE24112	Problem Solving using Python	ESC	2	0	4	6	4
LABORATORY COURSES								
7.	CY24121	Engineering Chemistry Laboratory	BSC	0	0	2	2	1
8.	GE24121	Engineering Practices Laboratory – Civil and Mechanical	ESC	0	0	2	2	1
FORMATION COURSES								
9.	FC24101	Life Skills[$]	HSMC	2	0	0	2	1
			TOTAL	17	1	8	26	21

[$]Skill based courses

SEMESTER – II

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	MA24204	Probability and Statistics	BSC	3	1	0	4	4
2	CS24201	Programming in C	PCC	3	0	0	3	3
3	PH24201	Physics for Information Science	BSC	3	0	0	3	3
4	GE24201	Tamils and Technology/ தமிழரும் தொழில்நுட்பமும்	HSMC	1	0	0	1	1
LABORATORY INTEGRATED THEORY COURSES								
5	GE24111	Engineering Graphics	ESC	2	0	4	6	4
LABORATORY COURSES								
6	CS24221	C Programming Laboratory	PCC	0	0	4	4	2
7	GE24122	Engineering Practices Laboratory– Electrical and Electronics	ESC	0	0	2	2	1

8	PH24121	Physics Laboratory	BSC	0	0	2	2	1
FORMATION COURSES								
9	GE24123	Design Thinking[$]	HSMC	0	0	2	2	1
10	FC24102	Cultural Identities and Globalization	HSMC	2	0	0	2	0
TOTAL				14	1	14	29	20

[$]Skill based courses

SEMESTER – III

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	MA24301	Discrete Mathematics	BSC	3	1	0	4	4
2	BS24301	Environmental Science and Sustainability	BSC	3	0	0	3	3
3	IT24301	Data Structures and Algorithms	PCC	3	0	0	3	3
LABORATORY INTEGRATED THEORY COURSES								
4	CS24311	Digital Principles and Computer Organization	ESC	3	0	2	5	4
5	CS24312	Object Oriented Programming in JAVA	PCC	2	0	4	6	4
6	CS24413	Foundation of Data Science	PCC	2	0	2	4	3
LABORATORY COURSES								
7	IT24321	Data Structures and Algorithms Laboratory	PCC	0	0	4	4	2
FORMATION COURSES								
8	FC24301	Soft Skills[$]	HSMC	2	0	0	2	1
9	BS24321	System Discovery and Analysis	BSC	0	0	2	2	0
			TOTAL	18	1	14	33	24

[$]Skill based courses

SEMESTER – IV

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	MA24401	Linear Algebra and Number Theory	BSC	3	1	0	4	4
2	CS24302	Database Management Systems	PCC	3	0	0	3	3
3	CS24401	Operating Systems	PCC	3	0	0	3	3
4	IT24402	Computer Architecture	PCC	3	0	0	3	3
LABORATORY INTEGRATED THEORY COURSES								
5	IT24411	Web Essentials	PCC	3	0	2	5	4
LABORATORY COURSES								
6	CS24322	Database Management Systems Laboratory	PCC	0	0	3	3	1.5
7	CS24421	Operating Systems Laboratory	PCC	0	0	3	3	1.5
FORMATION COURSES								

8	HS24321	Communication Skills Building Laboratory[$]	HSMC	0	0	2	2	1
9	IT24423	Project Driven Learning[$]	EEC	0	0	2	2	1
			TOTAL	15	1	12	28	22

[$]Skill based courses

Foreign language course to be completed by the end of IV semester

SEMESTER – V

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	IT24501	Computer Networks	PCC	3	0	0	3	3
2	GE24501	Project Management and Operations Management	HSMC	2	0	0	2	2
LABORATORY INTEGRATED THEORY COURSES								
3	IT24511	Software Engineering	PCC	3	0	2	5	4
4	CS24511	Artificial Intelligence and Machine Learning	PCC	3	0	2	5	4
5		Professional Elective - I	PEC	-	-	-	-	3
6		Professional Elective – II	PEC	-	-	-	-	3
LABORATORY COURSES								
7	IT24521	Networks Lab	PCC	0	0	4	4	2
FORMATION COURSES								
8	FC24501	Universal Human Values and Service Learning[$]	HSMC	1	0	1[*]	1	1
9	BS24502	Logical Reasoning and Aptitude Training	BSC	2	0	0	2	1[#]
10	GE24503	Financial Literacy	HSMC	2	0	0	2	0
			TOTAL	-	-	-	-	22

[$]Skill based courses

[*]Activities on non-working days/hours

[#] Not included for GPA calculation

SEMESTER – VI

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	IT24601	Full Stack Web Development	PCC	3	0	0	3	3
2		Open Elective -I	OEC	3	0	0	3	3
3	GE24502	Entrepreneurship and International Business Market	HSMC	2	0	0	2	2
LABORATORY INTEGRATED THEORY COURSES								
4	CS24612	Embedded Systems and IoT	PCC	3	0	2	5	4
5		Professional Elective - III	PEC	-	-	-	-	3
6		Professional Elective – IV	PEC	-	-	-	-	3
LABORATORY COURSES								
7	IT24621	Full Stack Web Development Laboratory	PCC	0	0	4	4	2
FORMATION COURSES								
8	GE24621	Interdisciplinary Project[$]	EEC	0	0	2	2	1
9	GE24622	Problem Solving Techniques	EEC	0	0	2	2	1[#]
			TOTAL	-	-	-	-	21

[$]Skill based courses [#] Not included for GPA calculation

SEMESTER – VII

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
THEORY COURSES								
1	IT24701	Cryptography and Network Security	PCC	3	0	0	3	3
2		Open Elective – II	OEC	3	0	0	3	3
3		Open Elective – III	OEC	3	0	0	3	3
4	GE24701	Working to Engineer a Better World	HSMC	2	0	0	2	2
5		Audit Courses	HSMC	2	0	0	2	0
LABORATORY INTEGRATED THEORY COURSES								
6		Professional Elective – V	PEC	-	-	-	-	3
7		Professional Elective - VI	PEC	-	-	-	-	3
LABORATORY COURSES								
8	IT24721	Security Laboratory	PCC	0	0	4	4	2
9	IT24722	Professional Project - I	EEC	0	0	4	4	2
FORMATION COURSES								
10	IT24723	Internship[$]	EEC	0	0	0	0	2
			TOTAL	-	-	-	-	23

[$]Skill based courses

SEMESTER – VIII

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
LABORATORY COURSES								
1	IT24821	Professional Project - II	EEC	0	0	20	20	10
			TOTAL	0	0	20	20	10

PROFESSIONAL ELECTIVE COURSES: VERTICALS

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V	Vertical VI
Data Science	**Full Stack Development for IT**	**Cloud Computing**	**Cyber Security**	**Emerging Technologies**	**Intelligent Systems and Machine Learning**
PCS2401 Exploratory Data Analysis	PIT2401 Java Programming for Web Applications	PIT2404 Distributed computing	PIT2407 Cyber Security	PCS2432 Cryptocurrency and Blockchain Technologies	PCS2440 Knowledge Engineering
PCS2402 Recommender Systems	PCS2410 App Development	PIT2405 Cloud Computing and Virtualization	PCS2425 Ethical Hacking	PCS2421 Storage Technologies	PCS2441 Soft Computing
PCS2403 Text and Speech Analysis	PCS2412 UI and UX Design	PIT2406 Information Storage and Management	PCS2428 Modern Cryptography	PCS2429 Security and Trust in IoT	PCS2403 Text and Speech Analysis
PCS2404 Healthcare Analytics	PCS2409 Cloud Application Development	PCS2417 Data Warehousing and Data Mining Techniques	PCS2427 Social Network Security	PCS2434 Augmented Reality/Virtual Reality	PCS2442 Neural Network and Deep Learning
PCS2405 Business Analytics	PIT2402 Database Technologies for Web Applications	PCS2420 Security and Privacy in Cloud	PIT2403 Web Security and Privacy	PCS2435 Game Development	PCS2443 Pattern Recognition Techniques
PCS2406 Image and Video Analytics	PIT2403 Web Security and Privacy	PCS2422 Software Defined Networks	PIT2408 Information Retrieval Techniques	PCS2442 Neural Networks and Deep Learning	PCS2444 Reinforcement Learning
PCS2407 Computer Vision	PCS2415 DevOps	PCS2424 Fog and Edge computing	PCS2420 Security and Privacy in Cloud	PCS2437 Quantum Computing	PCS2445 Cognitive Science
PCS2408 Big Data Analytics	PCS2413 Software Testing and Automation	PCS2421 Storage Technologies	PCS2422 Software Defined Networks	PCS2433 Robotic Process Automation and Intelligent Agents	PCS2446 Ethics and AI

PROFESSIONAL ELECTIVE COURSES
VERTICALS
VERTICAL 1: DATA SCIENCE

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
1	PCS2401	Exploratory Data Analysis	PEC	2	0	2	4	3
2	PCS2402	Recommender Systems	PEC	2	0	2	4	3
3	PCS2403	Text and Speech Analysis	PEC	2	0	2	4	3
4	PCS2404	Healthcare Analytics	PEC	2	0	2	4	3
5	PCS2405	Business Analytics	PEC	2	0	2	4	3
6	PCS2406	Image and Video Analytics	PEC	2	0	2	4	3
7	PCS2407	Computer Vision	PEC	2	0	2	4	3
8	PCS2408	Big Data Analytics	PEC	2	0	2	4	3

VERTICAL 2: FULL STACK DEVELOPMENT FOR IT

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
1	PIT2401	Java Programming for Web Applications	PEC	2	0	2	4	3
2	PCS2410	App Development	PEC	2	0	2	4	3
3	PCS2412	UI and UX Design	PEC	2	0	2	4	3
4	PCS2409	Cloud Application Development	PEC	2	0	2	4	3
5	PIT2402	Database Technologies for Web Applications	PEC	2	0	2	4	3
6	PIT2403	Web Security and Privacy	PEC	2	0	2	4	3
7	PCS2415	DevOps	PEC	2	0	2	4	3
8	PCS2413	Software Testing and Automation	PEC	2	0	2	4	3

VERTICAL 3: CLOUD COMPUTING

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
1	PIT2404	Distributed computing	PEC	2	0	2	4	3
2	PIT2405	Cloud Computing and Virtualization	PEC	2	0	2	4	3
3	PIT2406	Information Storage and Management	PEC	2	0	2	4	3
4	PCS2417	Data Warehousing and Data Mining Techniques	PEC	2	0	2	4	3
5	PCS2420	Security and Privacy in Cloud	PEC	2	0	2	4	3
6	PCS2422	Software Defined Networks	PEC	2	0	2	4	3
7	PCS2424	Fog and Edge computing	PEC	2	0	2	4	3

8	PCS2421	Storage Technologies	PEC	2	0	2	4	3

VERTICAL 4: CYBER SECURITY

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
1	PIT2407	Cyber Security	PEC	2	0	2	4	3
2	PCS2425	Ethical Hacking	PEC	2	0	2	4	3
3	PCS2428	Modern Cryptography	PEC	2	0	2	4	3
4	PCS2427	Social Network Security	PEC	2	0	2	4	3
5	PIT2403	Web Security and Privacy	PEC	2	0	2	4	3
6	PIT2408	Information Retrieval Techniques	PEC	2	0	2	4	3
7	PCS2420	Security and Privacy in Cloud	PEC	2	0	2	4	3
8	PCS2422	Software Defined Networks	PEC	2	0	2	4	3

VERTICAL 5: EMERGING TECHNOLOGIES

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
1	PCS2432	Cryptocurrency and Blockchain Technologies	PEC	2	0	2	4	3
2	PCS2421	Storage Technologies	PEC	2	0	2	4	3
3	PCS2429	Security and Trust in IoT	PEC	2	0	2	4	3
4	PCS2434	Augmented Reality/Virtual Reality	PEC	2	0	2	4	3
5	PCS2435	Game Development	PEC	2	0	2	4	3
6	PCS2443	Neural Networks and Deep Learning	PEC	2	0	2	4	3
7	PCS2437	Quantum Computing	PEC	2	0	2	4	3
8	PCS2433	Robotic Process Automation	PEC	2	0	2	4	3

VERTICAL 6: INTELLIGENT SYSTEMS AND MACHINE LEARNING

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
1	PCS2440	Knowledge Engineering	PEC	2	0	2	4	3
2	PCS2441	Soft Computing	PEC	2	0	2	4	3
3	PCS2403	Text and Speech Analysis	PEC	2	0	2	4	3
4	PCS2443	Neural Network and Deep Learning	PEC	2	0	2	4	3
5	PCS2444	Pattern Recognition Techniques	PEC	2	0	2	4	3
6	PCS2445	Reinforcement Learning	PEC	2	0	2	4	3

7	PCS2446	Cognitive Science	PEC	2	0	2	4	3
8	PCS2447	Ethics and AI	PEC	2	0	2	4	3

SUMMARY

Name of the Programme: B.Tech. Information Technology										
S. No	**Subject Area**	**Credits per Semester**								**Total Credits**
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	
1.	**HSMC**	5	2	1	1	3	2	2		16
2.	**BSC**	8	8	7	4					27
3.	**ESC**	8	5	4						17
4.	**PCC**		5	12	16	12.5	9	5		59.5
5.	**PEC**					6	6	6		18
6.	**OEC**						3	6		9
7.	**EEC**				1		1	4	10	16
8.	**Non-Credit /(Mandatory)**									
Total		21	20	24	22	21.5	21	23	10	162.5

MA24101 **Calculus for Engineers** **BSC** **L T P C**

3 1 0 4

Course Objectives:

- To develop the usage of matrix algebra techniques and its applications, which are essential for engineers.
- To provide the students with the rules of differentiation.
- To impart the students with the concepts of functions of several variables.
- To make the students understand various techniques of integration.
- To acquaint the students with mathematical knowledge in evaluating multiple integrals and their applications.

UNIT I **TRANSFORMATIONS** **12**

Stretching of an elastic membrane - eigenvalues and eigenvectors of a real matrix – properties – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms - Cayley Hamilton Theorem

UNIT II DIFFERENTIAL CALCULUS 12

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Parametric differentiation- Maxima and Minima of functions of single variable

UNIT III FUNCTIONS OF SEVERAL VARIABLES 12

Partial differentiation – Total derivative – Partial differentiation of implicit functions – Jacobians – Taylor's series – Maxima and Minima of a function of two variables - Method of Lagrangian Multipliers - Evaluating extremum of single and two variable functions.

UNIT IV INTEGRAL CALCULUS 12

Techniques of Integration: Substitution rule, Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Moments and centre of mass.

UNIT V MULTIPLE INTEGRALS 12

Double integrals in Cartesian and Polar coordinates – Area enclosed by plane curves - Change of order of integration – Change of variables in double integrals - Triple integrals in Cartesian coordinates – Volume of solids - Change of variables from Cartesian to Spherical polar coordinates and Cylindrical polar coordinates.

Total Periods:60

Course Outcomes:

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

CO1: To identify the eigenvalues and eigenvectors of a matrix and to execute diagonalization.
CO2: Identify the limit of functions and apply the rules of differentiation to differentiate functions.
CO3: Apply differentiation to functions of several variables
CO4: Evaluate extreme values of functions
CO5: Evaluate integrals using various techniques of integration
CO6: Evaluate multiple integrals in various coordinate systems and applications of multiple integrals

Suggested Activities:

1. Evaluation of eigenvalues and eigenvectors using scientific tool
2. Plotting and visualizing curves, and extreme values using a scientific tool
3. Plotting and visualizing surfaces, and extreme values using a scientific tool
4. Evaluation of line integrals using scientific tool
5. Evaluation of multiple integrals using a scientific tool
6. Visualizing 2D and 3D functions using GeoGebra and Desmos

Text Books:

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2018.

3. James Stewart, " Calculus: Early Transcendentals", Cengage Learning, 8th Edition, New Delhi, 2015.

References:

1. Anton. H, Bivens. I and Davis. S, "Calculus", Wiley, 10th Edition, 2016.
2. Bali.N., Goyal.M. and Watkins. C., “Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain.R.K. and Iyengar. S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5th Edition, 2016.
4. Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
5. Kuldeep Singh, “Engineering Mathematics Through Applications”, 2nd Edition, Bloomsbury Academic.
6. Thomas. G. B., Hass. J, and Weir. M.D, "Thomas Calculus", 14th Edition, Pearson India, 2018.
7. Amos Gilat, “MATLAB: An Introduction with Applications”, 4th Edition, John Wiley.

MAPPING OF COs WITH POs AND PSOs

COs	PSOs													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

BE24101	**Basic Electrical and Electronics Engineering**	**PCC**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:

- To introduce the basics of Electric Circuits and analysis.
- To impart knowledge in the basics of working principles and application of Electrical Machines.
- To introduce analog devices and their characteristics.
- To educate on the fundamental concepts of digital electronics.
- To interpret the fundamentals of Sensors.

UNIT I ELECTRICAL CIRCUITS 9

DC Circuits: Basic circuit components - Ohm’s Law - Kirchhoff’s Laws – Nodal Analysis, Mesh analysis - Simple problems with Independent Sources – Introduction to AC Circuits - Purely resistive, Inductive & Capacitive excited by AC Source (Qualitative Treatment Only).

UNIT II ELECTRICAL MACHINES 9

Construction, Working principle, Types and Applications: DC Motor – DC Generator - Single phase Transformers - Stepper Motor - Servo Motor (Qualitative Treatment Only).

UNIT III ANALOG ELECTRONICS **9**

Construction, Operation, Characteristics and Application of PN Junction diode – Zener diode – Bipolar Junction Transistor (Common Emitter Characteristics only) – Half wave and full wave Rectifiers.

UNIT IV DIGITAL ELECTRONICS **9**

Review of number systems, Binary codes, Hamming and Parity code, Combinational logic - representation of logic functions - SOP and POS forms, K-Map representations- minimization using K maps (Simple Problems with 3 variables only).

UNIT V SENSORS **9**

Introduction to Sensors - Photovoltaic - LDR - Piezo electric - RTD - Principle and application of IR sensor - Ultrasonic sensor.

Total Periods:45

Course Outcomes:

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

CO1: Understand the fundamental components of DC circuits.
CO2: Compute the electric circuit parameters for simple problems.
CO3: Explain the working principle and applications of electrical machines.
CO4: Describe the characteristics of analog electronic devices.
CO5: Explicate the basic concepts of digital electronics.
CO6: Explain the principles and applications of sensors.

Text Books:

1. S.K.Bhattacharya "Basic Electrical and Electronics Engineering", Pearson Education, Second Edition, 2017.
2. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020
3. Sedha R.S., "A textbook book of Applied Electronics", S. Chand & Co., 2008
4. James A .Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
5. A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2015.

References:

1. Kothari DP and I.J Nagrath, "Basic Electrical Engineering", Fourth Edition, McGraw Hill Education, 2019.
2. Thomas L. Floyd, 'Digital Fundamentals', 11th Edition, Pearson Education, 2017.
3. Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017.
4. Mahmood Nahvi and Joseph A. Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, 2002.
5. H.S. Kalsi, 'Electronic Instrumentation', Tata McGraw-Hill, New Delhi, 2010.

MAPPING OF COs WITH POs AND PSOs

COs	PSOs													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	-	-	-	1	-	-	-	2	-	1	1
CO2	2	2	1	-	-	-	1	-	-	-	2	-	1	1
CO3	2	1	1	-	-	-	1	-	-	-	2	-	1	1
CO4	2	2	1	-	-	-	1	-	-	-	2	-	1	1

CO5	2	2	1	-	-	-	1	-	-	-	2	-	1	1
CO6	2	2	1	-	-	-	1	-	-	-	2	-	1	1
Avg.	**2**	**1.8**	**1**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**2**	**0**	**1**	**1**

1 - low, 2 - medium, 3 - high, '-"- no correlation

CY24101	**Applied Chemistry**	**BSC**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:

- To familiarize the water quality criteria and interpret its significance in water purification.
- To identify various boiler troubles and its treatment techniques.
- To assimilate the preparation, properties, and applications of nanomaterials in various fields.
- To illustrate the principles of electrochemical reactions in the corrosion of materials and methods for corrosion prevention and protection of materials.
- To familiarize the students with the operating principles, working processes, and applications of energy conversion and storage devices.
- To impart knowledge about the types of sensors and their applications.

UNIT I WATER TECHNOLOGY 9

Water – Sources and Impurities, Water Quality Parameters: Definition and Significance of Colour, Odour, Turbidity, pH, Hardness, Alkalinity, TDS, COD and BOD, Fluoride and Arsenic.
Municipal water treatment: Screening, Sedimentation, Coagulation, Sand filtration and Disinfection (Ozonation, UV treatment, Chlorination), Desalination of brackish water: Reverse Osmosis. Boiler troubles (Scale & Sludge, Caustic embrittlement, Boiler Corrosion, Priming & Foaming). Internal Conditioning (Colloidal, Sodium Aluminate, Phosphate and Calgon Conditioning) and External Conditioning (Zeolite and Ion-Exchange Demineralization).

UNIT II NANO CHEMISTRY 9

Basics: Distinction between Molecules, Nanomaterials and Bulk materials; Size-Dependent Properties (Optical, Electrical, Mechanical, Magnetic and Catalytic). Types of Nanomaterials: Definition, Properties and Uses of - Nanoparticle, Nanocluster, Nanorod, Nanowire and Nanotube. Preparation of Nanomaterials: Sol -Gel, Solvothermal, Laser Ablation, Chemical Vapour Deposition, Electrochemical Deposition and Electro Spinning. Applications of Nanomaterials in Medicine, Agriculture, Energy, Electronics and Catalysis.

UNIT III ELECTROCHEMISTRY AND CORROSION 9

Electrochemical Cell, Redox reaction, Electrode Potential - Oxidation and Reduction Potential. Nernst Equation and Applications. Emf Series.
Introduction to Corrosion - Chemical and Electrochemical Corrosion (Galvanic Corrosion, Concentration Cell Corrosion), Galvanic Series - Factors Influencing Corrosion. Corrosion Control - Material Selection and Design - Electrochemical Protection - Sacrificial Anodic Protection and Impressed Current Cathodic Protection. Protective Coatings - Metallic Coatings (Galvanizing, Tinning), Organic Coatings (Paints). Paints: Constituents and Functions.

UNIT IV STORAGE DEVICES AND ENERGY SOURCES 9

Batteries - Characteristics - Types of Batteries – Primary Battery (Alkaline Battery), Secondary Battery (Lead Acid, Lithium - Ion - battery) - Emerging Batteries – Nickel - Metal Hydride Battery, Aluminium Air Battery, Batteries for Automobiles and Satellites - Fuel Cells (Types) – H2-O2 Fuel

Cell - Super capacitors - Types and Applications, Nuclear Energy – Nuclear Fission, Fusion, Differences, Characteristics – Nuclear Chain reactions – Light Water Nuclear Reactor – Breeder Reactor. Renewable Energy: Solar energy - Solar Cells, DSSC.

UNIT V CHEMICAL SENSORS 9

Sensors, Sensor Science and Technology, Types of Sensors. Chemical Sensors – Characteristics and Elements. Electrochemical Sensors – Voltammetry, Potentiometric Sensors, Amperometric Sensors, Polarization Techniques.

Total Periods:45

Course Outcomes:

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

CO1: Analyze the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
CO2: Explain the various boiler problems and water treatment techniques.
CO3: Apply basic concepts of Nano chemistry in designing the synthesis of nanomaterials for engineering applications.
CO4: Apply the principles of electrochemistry in corrosion control.
CO5: Analyze different forms of energy resources for suitable applications in energy sectors.
CO6: Explain the types of sensors and their applications.

Suggested Activities:

- Quiz
- Mind Mapping on type of nanomaterials
- Seminar
- Animated videos on reverse osmosis, nuclear power plant
- Demonstration of water parameter analysis
- Electroplating process by group of students
- Demonstration of sensors

Text Books:

1. Jain P. C. & Monica Jain., “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2015.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi,2012.
3. Dara S.S., “A Textbook of Engineering Chemistry”, Chand Publications, 2004.
4. B.K.Sharma, “Instrumental Methods of Chemical Analysis” , 28th Edition, Goel Publishing House. 2012.

References:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Text Book of Nanoscience and Nanotechnology”, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.
4. ShikhaAgarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, Second Edition, 2019.
5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

MAPPING OF COs WITH POs AND PSOs

COs	PSOs													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	1	-	-	-	-	1	-	-	-
CO2	3	2	2	1	-	1	-	-	-	-	1	-	-	-
CO3	2	-	-	1	-	2	-	-	-	-	-	-	-	-
CO4	3	2	2	1	-	1.5	-	-	-	-	2	-	-	-
CO5	3	1	2	1	-	2	-	-	-	-	2	-	-	-
CO6	2	1	2	1	-	2	-	-	-	-	2	-	-	-
Avg.	**2.7**	**1.6**	**2**	**1**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**

1 - low, 2 - medium, 3 - high, '-"- no correlation

HS24101	English for Professional Communication	HSMC	L	T	P	C
			3	0	0	3

Course Objectives:

- To develop effective listening, speaking, reading, and writing skills for professional contexts.
- To cultivate formal correspondence skills for workplace communication.
- To analyze and apply rhetorical techniques in writing and speaking.
- To encourage self-expression through storytelling and reflective writing.
- To strengthen grammar and vocabulary for improved language proficiency.

UNIT I COMMUNICATION BASICS **9**

Listening – Link verbal and nonverbal cues and listen to podcasts and news stories.
Reading – Read brochures and running headlines. Social media messages and electronic correspondence relevant to professional advancement
Writing – Formal letters
Speaking – Self-introduction – Dialogues and role plays, discussing news stories, asking doubts (clarification, direction, inquiring details…)
Grammar – Noun, Pronoun, Articles
Vocabulary – one-word substitution, phrasal verbs

UNIT II PROFESSIONAL CORRESPONDENCE 9

Listening – Listen to voicemails, presentations, and panel discussions
Reading - MoM – minutes of the meeting, memos, business and economic articles
Writing – Respond to Business Emails
Speaking - Inaugural speech, Vote of thanks, and mini-presentation
Grammar – Verb, concord, wh questions, and Yes/no, question tag
Vocabulary – Word forms (Prefix & suffix)

UNIT III RHETORIC COMMUNICATION 9

Listening - Monologue from plays and movies, and sale pitches (marketing and promotions)
Reading – Looking for ambiguity – Ethos, pathos, and logos (poem or play)
Writing – Essays – problem solution, cause and effect essay
Speaking – Deliver a monologue – situational scenarios
Grammar – Conjunctions, prepositions, interjections
Vocabulary – Discourse markers for contextual essays, idioms, and phrases

UNIT IV EXTENDED NARRATION 9

Listening – Listen to documentaries, debates, discussions, and Toastmasters speech
Reading – Read professional resumes, LinkedIn profiles, newsletter
Writing – Blog writing, writing reviews
Speaking – Debate, group discussion
Grammar – Mixed tenses, Adverb
Vocabulary – Compound words, Collocation

UNIT V LANGUAGE AND SELF 9

Listening – Listen to tone, mood, and attitude. Find meanings based on the context, and listen to different accents.
Reading – An excerpt from an autobiography
Writing – Reflective journal and diary entries
Speaking – Narrate stories from personal experience
Grammar - Adjective, direct, and indirect speech
Vocabulary – Contextual meaning of words, Abbreviations, and acronyms

Total Periods:45

Course Outcomes:
On completion of the course, the students will be able to

CO1: Demonstrate enhanced listening, speaking, reading, and writing skills tailored for professional environments.
CO2: Compose clear formal emails and letters for workplace communication.
CO3: Analyze and use rhetorical techniques to engage and persuade audiences.
CO4: Develop storytelling and reflective writing skills to share personal experiences.
CO5: Improve grammar and vocabulary for effective communication.
CO6: Foster teamwork and discussion abilities through debates and group presentations

Suggested Activities:
Take a set of 15 messages and classify them into spam, alerts, scams, discount texts, news, cautionary, personnel, and informative.
Reflective journal – write your own personal and learning experience so far at LICET. Page limit: 3 pages.
Rhetoric Writing – Find a product or create a product and employ ethos, pathos, and logos to persuade the customers to buy your product. Write in 250 words.
Creative writing – Create your account on Blogger and write reviews, articles, and stories.

Text Books:

1. English for Engineers and Technologists. Volume I by Orient Blackswan, 2022
2. English for Science & Technology – I by Cambridge University Press, 2023

References:

1. Interchange. Cambridge University Press. USA, 2022.
2. Embark. Cambridge University Press. USA, 2016.
3. A course in Technical English. Cambridge University Press. USA, 2023.
4. High School English Grammar & Composition. Wren & Martin's Regular & Multicolour Edition. S.Chand Publishing, 2016.
5. Interchange by Jack C. Richards, Fifth Edition, Cambridge University Press, 2017.
6. English for Academic Correspondence and Socializing. Adrian Wallwork, Springer, 2011.
7. The Study Skills Handbook. Stella Cortrell, Red Globe Press, 2019
8. www.uefap.com

MAPPING OF Cos WITH Pos AND PSOs

COs	POs	PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	1	1	3	-	2	3	-	3	-	-	-
CO2	-	-	-	1	1	3	-	2	3	-	3	-	-	-
CO3	-	-	-	1	1	2	-	3	3	1	3	-	-	-
CO4	-	-	-	1	1	2.5	1	1	1	2	3	-	-	-
CO5	-	-	-	1	1	2	-	2	3	-	3	-	-	-
CO6	-	-	-	1	1	3	-	3	3	1	3	-	-	-
Avg.	**-**	**-**	**-**	**1**	**1**	2.15	**1**	**2.1**	**2.6**	**1.3**	**3**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-"- no correlation

GE24101	**Heritage of Tamils**	**HSMC**	**L**	**T**	**P**	**C**
			1	**0**	**0**	**1**

Course Objectives:

This course enables the students to

- provide an insight to the students into the rich culture and heritage of the state
- provide the students with detailed information on the engineering techniques to construct architectural marvels practiced in Tamil Nadu
- make the students connect with their roots, appreciate, and preserve it.

UNIT I LANGUAGE AND LITERATURE 3

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

UNIT III FOLK AND MARTIAL ARTS 3

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

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and 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.

Total Periods:15

Course Outcomes:

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

CO1: Understand the human values and rights in Tamil literature
CO2: Learn the art and culture being practiced by the people of Tamil Nadu
CO3: Understand various games and dance practices by the people of Tamil Nadu
CO4: Understand the Tamil Culture and Customs through Folklore
CO5: Learn the concepts of Sangam Literature and the bravery of Kings
CO6: Learn the life history of freedom fighters Vedic herbs and developments in lifestyle

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) (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.

GE24101	தமிழர் மரபு	HSMC	L	T	P	C
			1	0	0	1

அலகு I மொழி மற்றும் இலக்கியம்: 3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை: 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் : 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தொல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்: 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறைமுகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குக் தமிழர்களின் பங்களிப்பு: 3

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் – தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

Total Periods:15

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) (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.

GE24112	Problem Solving using Python	ESC	L	T	P	C
			2	0	4	4

Course Objectives:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To define Python functions and use function calls to solve problems.
- Learn to manage file operations, handle exceptions, and apply object-oriented programming principles in Python
- To familiarize with Python's module system, packages, and essential scientific libraries

UNIT I PROBLEM SOLVING AND INTRODUCTION TO PYTHON PROGRAMMING 7

Fundamentals of Computational Problems, algorithmic problem solving, notations (pseudo code, flowchart) - Introduction to Python – Literals – Variables and Identifiers -Comments- Reserved words –Data Types- Operators and Expressions- Input and Output: Working with user input, displaying output, and formatting - Conditional if - alternative if - chained conditional - Iteration: state, while, for, break, continue, pass

UNIT II DATA STRUCTURES AND MANIPULATION 5

Lists: List operations - List slices - List methods - List loop - Mutability - Aliasing - Cloning lists - List parameters - Lists as arrays-Advanced list processing-List Comprehension- Tuples: Tuple assignment - Tuple as return value- Dictionaries: Operations and Methods- Sets: Creating Sets – Operations and methods – Set comprehension

UNIT III STRINGS AND FUNCTIONS 6

Functions - definition and use - Flow of execution - Parameters and arguments - Fruitful functions: Return values - Parameters - Local and global scope -Function composition - Recursion - Strings: string slices, immutability, string functions and methods, string module

UNIT IV FILES, EXCEPTIONS, CLASSES AND OBJECTS 6

Files and exception: Text files - Reading and writing files - Command line arguments-Errors and exceptions - Handling exceptions - Classes and Objects: Defining classes - Creating Objects - Data abstraction - Class variables and Object variables - Working with objects and Methods

UNIT V MODULES AND PACKAGES 6

Introduction to Modules and Packages- Basics of NumPy - N-dimensional Array in NumPy - Methods and Properties - Basics of SciPy - Broadcasting in NumPy Array Operations - Array Indexing in NumPy, Pandas - Introduction - Series - Data Frame - Matplotlib - Basics - Figures and Axes - Method subplot - Axis container

Periods:30

LIST OF EXPERIMENTS:

1. Identification and solving of simple real life or technical problems related to applications to specific discipline and developing algorithms/flowcharts.
2. Python programming using simple statements and expressions.
3. Solving problems using conditional statements.
4. Solving problems using iterative loops (Palindrome, Factorial, Prime Numbers).
5. Implementing real-time/technical applications using List.
6. Implementing real-time/technical applications using Tuples.
7. Implementing real-time/technical applications using Dictionaries.
8. Implementing real-time/technical applications using sets.
9. Implementing programs using functions.
10. Implementing programs using strings.
11. Implementing programs using modules.
12. Implementing programs using command line arguments.
13. Implementing real-time/technical applications using file handling (Word count- longest word - Copy file).
14. Implementing real-time/technical applications using exception handling.
15. Creating and Instantiating classes (Creating student class and object, Voter's age validation, Marks range validation (0-100).
16. Implement programs using standard libraries (Pandas, Numpy, Scipy).
17. Generating basic plots using Matplotlib.
18. Developing a game activity using Pygame.

Total Periods:60

Total Periods:90

Course Outcomes:

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

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop solutions to problems using control structures.
CO3: Process compound data using Python data structures.
CO4: Structuring python program into functions and to implement String handling functions.
CO5: Read and write data from/to files in Python programs and handle exceptions.
CO6: Understand object-oriented programming concepts through classes and objects.
CO7: Utilize Python modules and packages for performing data analysis.

Suggested Activities:

- Developing Pseudocodes and flowcharts for real life activities such as railway ticket booking using IRCTC, admission process to undergraduate course, academic schedules during a semester etc.
- Assign a project to create a small application that uses various Python data structures (lists, tuples, dictionaries, and sets) to manage and process a dataset (e.g., a contact list or inventory system).

- Data Analysis and Visualization using NumPy, Pandas, and Matplotlib - Provide a dataset (e.g., weather data, sales records) and ask students to perform data analysis using NumPy and Pandas, followed by visualizing the results using Matplotlib.
- External Learning - Recursion vs. Iteration.
- Flipped Learning - tkinter package
- Mini-project

Text Books:

1. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.
2. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017.

References:

1. Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4. Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5. S.Sridhar,J.Indumathi,V.M.Hariharan," Python Programming", 3rd Edition, Pearson,2024
6. https://www.python.org/
7. Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

Laboratory Requirements:

Sl.No	Description of Equipment	Required numbers (for batch of 30 students)
1	Standalone desktops (Windows/Linux) with Python 3 interpreter	30

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-"- no correlation

CY24121	**Engineering Chemistry Laboratory**	**BSC**	**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**

Course Objectives:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as acidity, alkalinity, hardness, DO, TDS, and Chloride.
- To demonstrate the synthesis of nanoparticles.
- To familiarize the students with the determination of the molecular weight of a polymer by a viscometer.
- To familiarize the students with electroanalytical techniques such as pH metry, Potentiometry, and Conductometry to determine impurities in aqueous solutions.
- To understand the factors influencing corrosion.

LIST OF EXPERIMENTS:(Minimum of 7 experiments to be conducted)

1. Estimation of HCl using Na2CO3 as primary standard
2. Determination of alkalinity in water sample.
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Determination of strength of given hydrochloric acid using pH meter.
8. Conductometric titration of strong acid vs strong base.
9. Estimation of iron content of the given solution using potentiometer.
10. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline/thiocyanate method).
11. Estimation of sodium and potassium present in water using a flame photometer.
12. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
13. Preparation of nanoparticles (TiO2/ZnO/CuO) by Sol-Gel method.
14. Corrosion experiment-weight loss method.
15. Conductometric titration of barium chloride Vs Sodium Sulphate - Precipitation method.

Total Periods: 30

Course Outcomes:

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

CO1: Analyze the quality of water samples with respect to their acidity, alkalinity.
CO2: Determine the hardness and chloride content of the water sample.
CO3: Demonstrate precipitation method for synthesis of nanoparticles.
CO4: Determine the molecular weight of the polymer.
CO5: Estimate the amount of analyte by conductometry.
CO6: Quantitatively analyze the impurities in solution by electroanalytical techniques.

References:

1. Engineering Chemistry Laboratory Manual – Department of SH-CHEMISTRY, LICET,2024.
2. Vogel's Textbook of Quantitative Chemical Analysis (8th edition, 2014).

Laboratory Requirements:

1.Conductivity meter – 15 Nos.
2. pH meter - 15 Nos.
3. Potentiometer - 15 Nos.
4.Viscometer - 35 Nos.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	2	-	-	-	-	2	-	-	-
CO2	3	2	1	-	-	2	-	-	-	-	2	-	-	-
CO3	2	1	2	-	-	2	-	-	-	-	-	-	-	-
CO4	2	1	2	-	-	1	-	-	-	-	1	-	-	-
CO5	3	1	2	-	1	2	-	-	-	-	2	-	-	-
CO6	3	1	2	-	1	2	-	-	-	-	2	-	-	-
Avg.	2.7	1.3	2	0	1	2	0	0	0	0	2	0	0	0

1 - low, 2 - medium, 3 - high, '-"- no correlation

GE24121	Engineering Practices Laboratory - Civil and Mechanical	ESC	L	T	P	C
			0	0	2	1

Course Objectives:

- Familiarize students with basic tools and equipment used in engineering.
- Develop practical skills in Mechanical, Civil and 3D Printing practices.
- Encourage teamwork and collaboration in a lab environment.
- Foster an understanding of safety protocols and procedures.

INTRODUCTION AND SAFETY PRACTICES

Overview of lab rules, expectations, and safety protocols**,** Personal Protective Equipment (PPE), handling tools and equipment safely, emergency procedures.

MECHANICAL PRACTICES

Workshop Tools: Identification and usage of basic mechanical tools (hammers, wrenches, screwdrivers, etc.). **Basic Machining:** Introduction to lathe and drilling machines. Practicing Facing, Turning, and Drilling. **Sheet Metal Works:** Making a dustpan and funnel.

CIVIL PRACTICES

Plumbing: Exposure to different plumbing components. Exposure to plumbing repair methods and troubleshooting of existing connections. Practicing pipe connection to the wash basin from the water tank. **Carpentry:** A study on carpentry procedure. Making joints like the Tee joint and the Dovetail joint. Exposure and usage of power tools.

ADDITIVE MANUFACTURING PRACTICES

Welding: Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding, CO2, gas, and MIG welding techniques. **Foundry:** Introduction to the foundry process and tools. Mold preparation for solid and split patterns. **3D Printing:** Basics of 3D printing and simple projects.

ASSEMBLING AND FITTING

Introduction to Systems - Dismantling and Assembling of Mixer/IC Engines/Refrigerator and Air Conditioner

Total Periods: 30

Course Outcomes:
On completion of the course, the students will be able

CO1: To perform basic machining operations
CO2: To perform operations on the given sheet metal
CO3: To understand the concepts of additive manufacturing methods like Welding, Moulding and 3D Printing
CO4: To understand the rudimentary concepts of refrigeration and air conditioning systems
CO5: To do basic household works like Plumbing, Carpentry Joints
CO6: To identify the components of Mixer/IC Engines/Refrigerator/AC.

Text Books:

1. Workshop Technology by W.A.J. Chapman
2. Electrical Engineering Fundamentals by Vincent Del Toro
3. Basic Civil Engineering by M.S. Palanichamy

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	2	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	2	-	-	-	-	-	-
CO3	2	-	-	-	2	-	-	2	-	-	-	-	-	-
CO4	2	-	-	-	1	-	-	2	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	2	-	-	-	-	-	-
CO6	1	-	-	-	-	-	-	2	-	-	-	-	-	-
Avg.	**1.7**	**0**	**0**	**0**	**2**	**0**	**0**	**2**	**0**	**0**	**0**	**0**	**0**	**0**

1 - low, 2 - medium, 3 - high, '-"- no correlation

FC24101	Life Skills	HSMC	L	T	P	C
			2	0	0	1

Course Objectives:

- To enhance self-awareness and understanding of personal strengths, weaknesses, and potential.
- To develop mechanisms to navigate through emotions and stress.
- To build effective interpersonal skills and maintain healthy social relationships.
- To foster and develop strategies for holistic well-being.
- To reflect on personal growth.

UNIT I KNOWING THYSELF 6

- Knowing Thyself
  - Strengths, Limitations, Characteristics, Habits and Experiences
- Sense of SELF
  - Self Awareness, Self Image, Self-esteem, Self Love, Self Respect
- Three Dimensions of SELF
  - 1) Ideal Self, 2) Social Self, and 3) Real Self
- Personality Types
  - 1) Introvert, 2) Extrovert, and 3) Ambivert

UNIT II EMOTIONAL COMPETENCE 6

- Understanding emotions

- Understanding the patterns of thoughts, feelings, and behaviors (Cognitive Behavior Theory)
- Handling stress, anxiety, and fear (flight mode) / anger (fright mode)
- Happy chemicals (4 chemicals - Dopamine, Oxytocin, etc)
- Positive Thinking

UNIT III INTERPERSONAL SKILLS 6

- Interpersonal relationships
- Communicating Positive Expressions
  (Empathy, Trust, Forgiveness, Gratitude, Compassion)
- Personal and Social Associations - Family systems, Relationship management
- Building personal, social, and digital intelligence
- Sense of OTHERS
- Gender Equity

UNIT IV DIMENSIONS OF WELL-BEING 6

- Intellectual Well-being
- Emotional Well-being
- Spiritual Well-being
- Physical Well-being
- Social Well-being

UNIT V LIFE TO THE FULLEST 6

- Happiness v/s Having fun
- Self-Retrospection and Positive Transformation
- Synthesis, Personal Reflection, and Way Forward

Total Periods: 30

Course Outcomes:
On completion of the course, the students will be able to

CO1: Identify their strengths and weaknesses and demonstrate self-awareness through reflective practices.
CO2: Demonstrate the ability to recognize emotions and handle stress.
CO3: Enhance interpersonal skills to build strong and positive relationships.
CO4: Adapt to a comprehensive understanding of well-being, and be able to implement strategies for maintaining mental health.
CO5: Develop a deeper understanding of personal and social relationships, and identify areas for growth.
CO6: Synthesize learning into a cohesive life plan for future growth.

Suggested Activities:
- Cognitive behavior therapy
- PLOT
- SLOT
- SWOT
- Johari Window

References:

1. Bradberry, Travis, and Jean Greaves. *Emotional Intelligence 2.0*. TalentSmart,2009.
2. Republic of Philippines, Department of Education. *K to 12 Senior High School Core Curriculum.* - Personal Development, May 2016.

3. US Department of Education, *Career Guidance and Counselling Programs.* Rich South High School Horizon Program: (Rich Town Park Illinois: Rich South High School, 1998)

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	3	-	-	-	-	-	-	-
CO2	-	-	-	-	-	2	3	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	3	3	3	-	-	-	-	-
CO4	-	-	-	-	-	3	3	-	3	-	3	-	-	-
CO5	-	-	-	-	-	3	3	-	-	-	3	-	-	-
CO6	-	-	-	-	-	-	3	-	-	-	-	-	-	-
Avg.	0	0	0	0	0	2.8	3	3	3	0	3	0	0	0

1 - low, 2 - medium, 3 - high, '-"- no correlation

MA24204	Probability and Statistics	BSC	L	T	P	C
			3	1	0	4

Course Objectives:

- This course aims to provide the required skill to apply statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two-dimensional random variables.
- To acquaint the knowledge of testing hypotheses for small and large samples which plays an important role in real-life problems.
- To introduce the basic ANOVA techniques

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability – Total Probability - Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions

UNIT II TWO - DIMENSIONAL RANDOM VARIABLES 12

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (without proof)

UNIT III TESTING OF HYPOTHESIS 12

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit

UNIT IV ANOVA TECHNIQUES 12

One-way and Two-way classifications - Completely randomized design – Randomized block design – Latin square design - 2^2 factorial design

UNIT V STATISTICAL QUALITY CONTROL 12

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling

Total Periods: 60

Course Outcomes:

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

CO1: To introduce the basic concepts of probability and random variables
CO2: To apply standard distributions in real-life phenomena
CO3: To introduce the concepts of two-dimensional random variables
CO4: To apply the concept of testing of hypothesis for large samples and small samples in real life problems
CO5: To apply the basic concepts ANOVA technique
CO6: To understand the concepts of statistical quality control

Suggested Activities:

- Generate random variables using scientific tool
- Generate two dimensional random variables using scientific tool
- Performing Z-test using scientific tool
- Performing analysis of variance using scientific tool
- Visualizing control charts using scientific tool

Text Books:

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

References:

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
4. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	-	-	-	-	-	2	-	-	-
CO2	3	2	2	2	2	-	-	-	-	-	2	-	-	-
CO3	3	2	2	2	2	-	-	-	-	-	2	-	-	-
CO4	3	2	2	2	2	-	-	-	-	-	2	-	-	-
CO5	3	2	2	2	2	-	-	-	-	-	2	-	-	-
CO6	3	2	2	2	2	-	-	-	-	-	2	-	-	-
Avg.	**3**	**2**	**2**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**0**	**0**

1 - low, 2 - medium, 3 - high, '-"- no correlation

CS24201	Programming in C	PCC	L	T	P	C
			3	0	0	3

Course Objectives:

- To understand the constructs of C Language.
- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop modular applications in C using functions
- To develop applications in C using pointers and structures
- To do input/output and file handling in C

UNIT I BASICS OF C PROGRAMMING 9

Introduction to programming paradigms – Applications of C Language - Structure of C program - C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Preprocessor directives - Compilation process

UNIT II ARRAYS AND STRINGS 9

Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

UNIT III FUNCTIONS AND POINTERS 9

Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions –Pointers - Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Function pointers - Parameter passing: Pass by value, Pass by reference.

UNIT IV STRUCTURES AND UNION 9

Structure - Nested structures – Pointer and Structures – Array of structures – Self referential structures – Dynamic memory allocation - Singly linked list – typedef – Union - Storage classes and Visibility.

UNIT V FILE PROCESSING 9

Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file - Command line arguments.

Total Periods: 45

Course Outcomes:
On completion of the course, the students will be able to
CO1: Develop simple applications in C using basic constructs
CO2: Develop simple applications in C using control flow constructs
CO3: Design and implement applications using arrays and strings
CO4: Develop and implement modular applications in C using functions
CO5: Develop applications in C using structures and pointers
CO6: Design applications using sequential and random-access file processing

Suggested Activities:

- Create exercises where students write their own macros and use preprocessor directives like #define, #include, etc., in various scenarios.
- Quizzes on Code Snippets
- Assignment on numerical problems
- Present real-world problem scenarios that can be solved using C. For example, writing a simple command-line calculator, implementing sorting algorithms, or creating a small text-based game.
- External Learning – Graphics in C

Text Books:

1. Reema Thareja, "Programming in C", Oxford University Press, Second Edition, 2016.
1. 2. Kernighan, B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2015.

References:

1. Paul Deitel and Harvey Deitel, "C How to Program with an Introduction to C++", Eighth edition, Pearson Education, 2018.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
4. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
5. Anita Goel and Ajay Mittal, "Computer Fundamentals and Programming in C", 1st Edition, Pearson Education, 2013.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	3	1	-	-	-	2	-
CO2	3	2	1	-	-	-	-	3	1	-	-	-	2	-
CO3	3	2	1	-	-	-	-	3	1	-	-	-	2	-
CO4	3	2	2	-	-	-	-	3	1	-	-	-	2	-
CO5	3	2	2	1	-	-	-	3	1	-	-	-	2	-
CO6	3	2	2	1	-	-	-	3	1	-	-	-	2	-
Avg.	**3**	**2**	**2**	**1**	-	-	-	**3**	**1**	-	-	-	**2**	**-**

1 - low, 2 - medium, 3 - high, '-"- no correlation

PH24201	Physics for Information Science	BSC	L	T	P	C
			3	0	0	3

Course Objectives:

- To make the students understand the basics of elastic properties of matter and Thermal Physics
- To instill knowledge of oscillations and waves and make them able to apply this knowledge in engineering situations.
- To establish a sound grasp of foundational principles of quantum mechanics and enable them to perform basic quantum mechanical calculations.
- To introduce the basics principles of photonics and fibre optic communication to students
- To make students understand the applications of quantum mechanics in solid state physics to decipher the electrical properties of materials.

UNIT I PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity –Hooke's law - stress-strain diagram for ductile and brittle materials – uses- Bending of beams –Bending moment - Young's modulus determination - Cantilever - uniform and non-uniform bending (Theory and experiment) - I shaped girders.
Thermal conduction in solids – Fourier's law - thermal conductivity -Thermal resistance - Determination of thermal conductivity-Lee's disc method: theory and experiment.

UNIT II OSCILLATIONS AND WAVES 9

Simple harmonic motion - Torsional pendulum – Damped oscillations –Shock Absorber -Forced oscillations and Resonance (qualitative)–Applications of resonance - Electrical analogy of mechanical oscillators - waves on a string - progressive waves - stationary waves- Energy transfer of a wave.

UNIT III QUANTUM MECHANICS 9

Black body radiation – Planck's hypothesis and black body radiation formula (qualitative)- Wave particle duality–de Broglie hypothesis– Uncertainty Principle – The Schrodinger Wave equation (time-dependent and time-independent) – Physical interpretation of wave function - Normalization - Particle in an infinite potential well - Energy values and wavefunctions-Quantum mechanical tunnelling. Scanning tunnelling microscope.

UNIT IV PHOTONICS AND FIBRE OPTICS 9

Laser – characteristics – Spontaneous and Stimulated emission-Einstein's coefficients - population inversion - Metastable states - Basic components of a laser system - CO_2 laser, Semiconductor laser - Industrial and medical applications - Optical Fibres – Total internal reflection – Numerical aperture and acceptance angle – Fibres optic communication system.

UNIT V QUANTUM THEORY OF SOLIDS 9

Electrons in metals - Classical free electron theory- quantum free electron theory Fermi- Dirac statistics – Density of energy states. Fermi energy and free electron density. Drawbacks of quantum free electron theory- Electrons in a periodic potential- Kronig-Penney Model (qualitative) -Band theory. Classification of solids based on energy band structure.

Total Periods: 45

Course Outcomes:

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

CO1: Illustrate applications of mechanical and thermal properties of materials in engineering systems.
CO2: Estimate the vibrational stability of an engineering system which employs periodic motion.
CO3: Calculate basic measurable quantities of simple quantum mechanical models.
CO4: Apply the characteristics of lasers for material processing and in the medical field.
CO5: Outline the operational principle of fiber optic communication systems.
CO6: Apply quantum mechanical principles towards the formation of energy bands.

Text Books:

1. Avadhanulu M N, Kshirsagar P G, "A Textbook of Engineering Physics", S Chand & Co Ltd, Ninth Revised Edition, 2012.
2. Hitendra K Malik, A K Singh " Engineering Physics McGraw Hill Education; Second edition (3 August 2017)
3. Gaur R K, Gupta S L, "Engineering Physics", Dhanpat Rai Publishers, 2012.

References:

1. Serway R A, Jewett J W, "Physics for Scientists and Engineers", Cengage Learning, 2010.

2. Halliday D, Resnick R, Walker J, “Principles of Physics”, Wiley, 2015.
3. K. Thyagarajan and A. Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4. S.O. Kasap, Principles of Electronic Materials and Devices, Mc-Graw Hill, 2018.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	-	-	-	-	-	-	1	-	-	-
CO2	2	1	1	1	-	-	-	-	-	-	1	-	-	-
CO3	2	1	1	1	-	-	-	-	-	-	1	-	-	-
CO4	2	1	1	1	-	-	-	-	-	-	1	-	-	-
CO5	2	1	1	1	-	-	-	-	-	-	1	-	-	-
CO6	2	1	1	1	-	-	-	-	-	-	1	-	-	-
Avg.	**2**	**1**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**	**0**

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

GE24201	**Tamils and Technology**	**HSMC**	**L**	**T**	**P**	**C**
			1	**0**	**0**	**1**

Course Objectives:

This course enables the students to

- Understand the art of making things and developments in the lifestyle of people
- Understand the various methods of constructing buildings
- Understand the techniques being used in Architecture by Tamils
- Understand and apply the concepts of Tamils with modern technology

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold-Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone 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.

Total Periods:15

Course Outcomes:

On completion of the course, the students will be able to:

CO1: Know the gradual improvement in the life history of Tamils
CO2: Construct buildings with the impact of the past with the present
CO3: Learn to manufacture remarkable things with the help of technology
CO4: Apply new Concepts in agriculture to the upliftment of the future society
CO5: Apply the ancient skills to find out the measurements of oceans
CO6: Apply the concepts of Tamil with modern technology

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) (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.

GE24201	தமிழரும் தொழில்நுட்பமும்	HSMC	L	T	P	C
			1	0	0	1

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம்: 3

சங்க காலத்தில் நெசவு தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்: 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் –நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தொ-சாரோசெனிக் கட்டிடக் கலை.

அலகு III உற்பத்தித் தொழில் நுட்பம்: **3**

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்: **3**

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு V அறிவியல் தமிழ் மற்றும் கணித்தமிழ்: **3**

அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

Total Periods:15

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) (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.

GE24111	Engineering Graphics	ESC	L	T	P	C
			2	0	4	4

Course Objectives:

- To draw engineering curves and freehand sketch of simple objects.
- To draw orthographic projection of solids and sections of solids.
- To draw development of solids
- To draw isometric and perspective projections of simple solids.

CONVENTIONS AND GEOMETRIC CONSTRUCTION (Not for examinations) 1

Importance of graphics in engineering applications - Use of drafting instruments - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 6+11

Basic curves used in engineering practices: Construction of conic sections by eccentricity method - Construction of cycloidal curves - Construction of involutes of square and circle - Drawing of tangents and normal to the above curves.
Visualization concepts and Free Hand sketching: Visualization principles - Layout of views- Freehand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+11

Projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 6+11

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV SECTION AND DEVELOPMENT OF SOLIDS 6+12

Sectioning of simple solids like prisms, pyramids, cylinders, and cone in a simple vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other - obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids - Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection - isometric scale - isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones - Perspective projection of simple solids - Prisms, pyramids and cylinders by visual ray method.

COMPUTER AIDED DRAFTING (Demonstration Only, Not for Exam) 3

The Concepts of Computer Aided Drafting for Engineering drawing, Computer graphics & Geometrical modelling (2D Orthographic Views) and 3D drafting (Isometric Views) using design software.

Total Periods: 90

Course Outcomes:

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

CO1: Construct the conic curves, involutes and cycloids.
CO2: Visualize and construct multiple views of solid.
CO3: Solve practical problems involving projection of lines and planes.
CO4: Draw the projection of simple solids.
CO5: Draw the sectional views of simple solids, obtain true shape and develop sectioned solids.
CO6: Draw the isometric and perspective projections of simple solids.

Text Books:

1. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, 53rd Edition, 2019.
2. Jayapoovan T, "Engineering Graphics using AUTOCAD", Vikas Publishing ,7 th Edition.
3. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.

References:

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., "Engineering Drawing" (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Shah M.B., and Rana B.C., "Engineering Drawing", Pearson Education India, 2nd Edition, 2009.

Publication of Bureau of Indian Standards:

1. IS10711 — 2001: Technical products Documentation — Size and layout of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation —Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
4. 5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

Special points applicable to End semester Examinations on Engineering Graphics:

1. There will be five questions, each of either-or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	-	-	-	2	-	2	2	-	-
CO2	3	1	2	-	2	-	-	-	2	-	2	2	-	-
CO3	3	1	2	-	2	-	-	-	2	-	2	2	-	-
CO4	3	1	2	-	2	-	-	-	2	-	2	2	-	-
CO5	3	1	2	-	2	-	-	-	2	-	2	2	-	-
CO6	3	1	2	-	2	-	-	-	2	-	2	2	-	-
Avg.	3	1	2	0	2	0	0	0	2	0	2	2	0	0

1 - low, 2 - medium, 3 - high, '-"- no correlation

CS24221	C Programming Laboratory	PCC	L	T	P	C
			0	0	4	2

Course Objectives:

- To familiarise with C programming constructs.
- To develop programs in C using basic constructs.
- To develop programs in C using arrays.
- To develop applications in C using strings, pointers, functions.
- To develop applications in C using structures.
- To develop applications in C using file processing.

LIST OF EXPERIMENTS:

Note: The lab instructor is expected to design problems based on the topics listed.

1. I/O statements, operators, expressions.
2. decision-making constructs: if-else, goto, switch-case, break-continue.
3. Loops: for, while, do-while.
4. Arrays: 1D and 2D, multi-dimensional arrays, traversal.
5. Strings: operations.
6. Functions: call, return, passing parameters by (value, reference), passing arrays to function.
7. Recursion.
8. Pointers: Pointers to functions, Arrays, Strings, Pointers to Pointers, Array of Pointers
9. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
10. Files: reading and writing, File pointers, file operations, random access, processor directives.

Total Periods: 60

Course Outcomes:

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

CO1: Develop simple applications in C using basic constructs
CO2: Develop simple applications in C using control flow constructs
CO3: Design and implement applications using arrays and strings
CO4: Develop and implement modular applications in C using functions
CO5: Develop applications in C using structures and pointers
CO6: Design applications using sequential and random-access file processing-

References:

1. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.
2. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.
3. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018.
4. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
6. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013.

Laboratory Requirements:

Sl.No	Description of Equipment	Required numbers (for batch of 30 students)
1	INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17” or higher TFT Monitor, Keyboard and mouse	30
2	Windows 10 or higher operating system / Linux Ubuntu 20 or higher	30
3	Dev C++ / Linux Operating System with GNU compiler / equivalent open source IDE	30

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	3	1	-	-	-	2	-
CO2	3	2	1	-	-	-	-	3	1	-	-	-	2	-
CO3	3	2	1	-	-	-	-	3	1	-	-	-	2	-
CO4	3	2	2	-	-	-	-	3	1	-	-	-	2	-
CO5	3	2	2	1	-	-	-	3	1	-	-	-	2	-
CO6	3	2	2	1	-	-	-	3	1	-	-	-	2	-
Avg.	**3**	**2**	**2**	**1**	-	-	-	**3**	**1**	-	-	-	**2**	**-**

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

GE24122	Engineering Practices Laboratory – Electrical and Electronics	ESC	L	T	P	C
			0	0	2	1

Course Objectives:

- To give an exposure of electronic components, measuring instruments for designing an electronic circuit.
- To give hands on experience to design a printed circuit board with a conventional approach.
- To introduce the functionality of various electrical components namely switches, fuse, and meters to perform wiring various electrical joints in common household electrical wire work.
- To introduce the methods for measuring electrical quantities
- To learn and understand the basics of electronic components

- To understand the internal structure and working of the measuring instruments.
- To construct a circuit on a breadboard and verify.
- To design a PCB for the given circuit and verify the output.

LIST OF EXPERIMENTS:

Electrical

1. Introduction to Electrical Components switches, fuses, indicators, and lamps
2. Basic switchboard wiring with lamp, fan, three-pin socket, and energy meter
3. Staircase wiring
4. Fluorescent Lamp wiring with introduction to CFL and LED types
5. Measurement of electrical quantities – voltage, current, power & power factor in RLC circuit

Electronics

1. Study of Electronic components
    a. Overview of Electrical vs Electronics, Analog vs digital signal.
    b. Active and Passive components
    i. Identification of a component and value (Resistor, capacitor, inductor, Transistor, Diode)
    ii. Data sheets.
2. Measuring and testing instruments
    a. Power supply, Multimeter
    b. CRO, DSO, MSO
    c. FG

    One simple circuit (Rectifier) will be taken as an example and output of that circuit will be ve through CRO, DSO and MSO.
3. Circuit prototyping and verification.
    a. Build a prototype of the given circuit (Clock Signal Generation) and verify th output
4. PCB design and Verification.
    a. Build a PCB of the given circuit. - (Layout design, etching and drilling)
    b. Place and solder the components in PCB.
    c. Test and verify the desired output in PCB.

Total Periods:30

Course Outcomes:

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

CO1: Identify the electronic components and utilise the measuring instruments to design a circuit.

CO2: Understand the printed circuit fabrication process.

CO3: Understand the working of electrical switches, measuring instruments, and wiring layouts used in domestic applications and carry out basic electrical wiring work.

CO4: Comprehend the concepts of current, voltage, power, and power factor using various measuring instruments.

Laboratory Requirements:

S. No.	Description of equipment	Required numbers (for a batch of 30 students)

1.	Resistors, Capacitors, Inductors – sufficient quantities. Bread Boards	15 nos.
2.	CRO, MSO, DSO, FG, Power Supply	5 Nos.
3.	PCB etching kit (Ferric Chloride, Drilling machine, Layout design)	15 kits
4.	Soldering iron, paste, lead, desoldering pump	15 nos. each
5.	Single way switch, Two way switch, fuses, indicators, 230 V - 60W incandescent lamp	5 nos. each
6.	Basic switchboard wiring kit and ,Energy meter	5 nos. each
7.	Staircase wiring kit	5 nos. each
8.	Fluorescent Lamp wiring kit, CFL and LED lamps	5 nos. each
9	1φ Auto Transformer, Voltmeter, Ammeter, Rheostat, Capacitor, Choke	5 nos. each
10.	Multimeters	6 nos.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	2	1	2	1	-	-	-	-	-
CO2	2	1	1	2	1	-	-	2	1	-	-	-	-	-
CO3	2	1	1	1	1	-	-	2	1	-	-	-	-	-
CO4	2	1	1	1	1	-	-	2	1	-	-	-	-	-
CO5	2	1	1	1	1	-	1	2	1	-	-	-	-	-
CO6	2	1	1	2	1	2	-	2	1	-	-	-	-	-
Avg.	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**1**	**0**	**0**	**0**	**0**	**0**

1 - low, 2 - medium, 3 - high, '-"- no correlation

PH24121	**Physics Laboratory**	**BSC**	**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**

Course Objectives:

- To learn the measurements of various elastic moduli of materials
- To learn determination of thermal properties of materials.
- To study different optical phenomena involving ordinary light.
- To measure the characteristic properties of lasers.
- To understand the characteristics of oscillatory motion.
- To learn measurement of rigid body moment of inertia.

LIST OF EXPERIMENTS (any six experiments):

1 Non-uniform bending - Determination of Young's modulus

2 Uniform bending – Determination of Young's modulus

3	Lee's Disc Experiment - Determination of thermal conductivity of bad conductors.
4	Torsional pendulum - Determination moment of inertia of regular and irregular objects.
5	Simple harmonic oscillations of cantilever
6	Ultrasonic interferometer – determination of sound velocity and liquids compressibility
7	Viscosity of Liquids
8	Air wedge - Determination of thickness of a thin sheet/wire
9	Optical fibre -Determination of Numerical Aperture and acceptance angle
10	Spectrometer-Determination of the wavelength of light using grating
11	(a) Laser- Determination of the wavelength of the laser using grating (b) Compact disc- Determination of width of the groove using laser.

Total Periods: 30

Course Outcomes:

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

CO1: Determine various moduli of elasticity of materials
CO2: Determine thermal properties of solids
CO3: Analyze various optical phenomena involving ordinary light.
CO4: Determine the characteristic properties of lasers.
CO5: Measure characteristic properties of systems executing oscillatory motion.
CO6: Determine the moment of inertia of rigid bodies

Text Books:

1. Engineering Physics Practicals by Dr. P. Mani, Dhanam Publications, 2023
2. Practical Physics by Gordon L Squires, Cambridge University Press; 4th edition, 2001

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	2	-	-	-	2	-	-	1	-	-	-
CO2	2	1	1	2	-	-	-	2	-	-	1	-	-	-
CO3	2	1	1	2	-	-	-	2	-	-	1	-	-	-
CO4	2	1	1	2	-	-	-	2	-	-	1	-	-	-
CO5	2	1	1	2	-	-	-	2	-	-	1	-	-	-
CO6	2	1	1	2	-	-	-	2	-	-	1	-	-	-
Avg.	**2**	**1**	**1**	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**0**	**0**

1 - low, 2 - medium, 3 - high, '-"- no correlation

GE24123	**Design Thinking**	**HSMC**	**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**

Course Objectives:

- Students will understand the different learning methodologies
- Students will learn the art of observation and visualization
- Students will understand the need for empathy in problem-solving
- Students will learn how to work in a team
- Students will learn to use different design thinking tools to solve problems

Module 1	An Insight to Learning: Understanding the Learning Process and Kolb's Learning Styles	2
Module 2	Journey of my life: Visualization and Wheel of Life. *Introduction to project*	4
Module 3	Observation: Listening vs hearing, Beyond observations and Mind maps	2
Module 4	Teamwork: Divergent thinking and Brainstorming	2
Module 5	Customer Journey: Journey mapping	2
Module 6	Conflict management: Balancing priorities, Reacting and Responding, Constraints to opportunities	2
Module 7	Empathy: Persona and Empathy map	2
Module 8	Design Thinking Model: 5-step process: Empathize, define, ideate, prototype, and scale	2
Module 9	Appreciation: The wonder of recognition, Articulation and Influence	2
Module 10	Project presentation	10
	Total Periods:	30

Course Outcomes:
On completion of the course, the students will be able to

CO1: To understand various learning processes and stages
CO2: To observe and visualize different scenarios
CO3: To empathize with a customer
CO4: To develop a journey map based on experiences
CO5: To understand the art of conflict management
CO6: To use design thinking as a tool to solve problems

Suggested Activities:
Solve real-life problems using Design Thinking

Text Books:

1. Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-solving, Pavan Soni, Penguin Random House India, Pvt. Ltd. 2020
2. Developing Thinking Skills (The Way to Success), E. Balagurusamy, 2024, Khanna Publishing House
3. The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods, Michael Lewrick, Patrick Link, Larry Leifer, Wiley, March 2020

References:

1. Internet Reference: https://www.interaction-design.org/
2. Internet Reference: https://online.hbs.edu/

3. Internet Reference: https://dschool.stanford.edu/

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	1	1	-	-	3	-	-	-
CO2	-	-	-	-	-	2	-	-	-	-	3	-	-	-
CO3	-	-	-	-	-	2	2	2	2	-	3	-	-	-
CO4	-	-	-	-	-	2	-	-	-	-	3	-	-	-
CO5	-	-	-	-	-	2	2	2	2	-	3	-	-	-
CO6	-	-	-	-	-	3	2	3	2	2	3	-	-	-
Avg.	**0**	**0**	**0**	**0**	**0**	**2.2**	**1.8**	**2**	**2**	**2**	**3**	**0**	**0**	**0**

1 - low, 2 - medium, 3 - high, '-"- no correlation

FC24102	Cultural Identities and Globalisation	HSMC	L	T	P	C
			2	0	0	0

Course Objectives:

- To enable students to reflect on their own cultural identity in relation to their socialisation.
- To encourage cultural diversity that underpins the formation of identity and social behaviours.
- To give exposure to the varied cultural influences on the parent culture.
- To prepare to address the challenges and tensions in the globalised society.

UNIT I EXPLORING SOCIAL AND CULTURAL IDENTITY 5

Identity formation & environmental interaction

- Race/ethnicity
- Gender
- Language
- Religion
- Socialisation (contact with different cultures)

UNIT II REGIONAL AND CULTURAL INFLUENCE ON SOCIAL BEHAVIOUR AND IDENTITY 6

- Assimilation, Amalgamation and Hybridisation
- Cultural Behaviour - dialect, traditions, social behaviour (customs), etiquette (work culture), habits, cuisine and regional variation

UNIT III DISSEMINATION OF MASS CULTURE PRACTICES 6

- Cultural Imperialism
- Colonisation and Globalization - Cultural turn
- Manufacturing pop culture - Language, food, movies, music, fashion, cosmetics.

UNIT IV SOCIO-CULTURAL CHANGES VIA GLOBALISATION 6

- Indian globalisation through trade liberalisation
- Increased migration flow with economic opportunities
- Cultural exchange, global networks

- Urbanisation - impact on family ideology and social structure

UNIT V EMBRACING GLOBAL IDENTITIES 7

- Challenges and tension
- Adaptable to changing society - etiquettes (in cross-cultural workspace) and social behaviours
- Building understanding and tolerance

Total Periods: 30

Course Outcomes:

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

CO1: Engage in conversations with themselves in relation to their local culture and society.
CO2: Realise the nuances of identity formation through various means of socialisation.
CO3: Critically assess the countless social and cultural behaviours that influence their identity and behaviour.
CO4: Examine the role of globalisation and liberalisation in urbanisation and cultural imperialism.
CO5: Adapt to the cross-cultural changes and engage in global networking.
CO6: Respond appropriately in a multicultural space by building tolerance and understanding.

Suggested Activities:

- Exercise on identity formation - creation of mind maps / storyboards
- A mini presentation on “Identifying one's own culture amidst the influence of the diverse cultural environment” - expressing only one cultural aspect (language, attire, habits, food, …)
- Opinion piece speech - Deliver a short speech expressing personal opinions
- Survey report - Comparison chart (5 exchanges) by engaging conversations with a elderly stranger or grandparents
- Produce a 30-second reel showcasing their understanding of the social etiquette of a specific country.

References:

1. Brooks, Ann. Popular Culture: Global Intercultural Perspectives. United Kingdom, Bloomsbury Publishing, 2014.
2. Verkuyten, Maykel. Identity and Cultural Diversity: What Social Psychology Can Teach Us. United Kingdom, Taylor & Francis, 2013, pp. 1-27.
3. Savage, Michael, et al. Globalization and Belonging. United Kingdom, SAGE Publications, 2004, pp. 29-77.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	-	2	1	-	2	-	-	-
CO2	-	-	-	-	-	2	-	-	1	-	-	-	-	-
CO3	-	-	-	-	-	2	-	-	1	-	2	-	-	-
CO4	-	-	-	-	-	1.5	-	2	1	-	2	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	2	-	2	1	-	2	-	-	-
Avg.	0	0	0	0	0	1.9	0	2	1	0	2	0	0	0

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

MA24301	Discrete Mathematics	BSC	L	T	P	C
			3	1	0	4

Course Objectives:

- To develop logical skills for reasoning and constructing mathematical arguments using propositional and predicate calculus
- To equip students with the foundational techniques in combinatorics
- To familiarise with the basic concepts of graph theory
- To provide an understanding of algebraic structures and related applications in computer science
- To understand the concepts and significance of Lattices and Boolean algebra which are widely used in computer science and engineering

UNIT I LOGIC AND PROOFS 9+3

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference

UNIT II COMBINATORICS 9+3

Mathematical induction – Pigeonhole principle – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle

UNIT III GRAPHS 9+3

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connected Graphs – Eulerian and Hamiltonian Graphs

UNIT IV ALGEBRAIC STRUCTURES 9+3

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphisms (Applications only) – Isomorphisms (Applications only) - Ring (Definition only)- Field (Definition only)

UNIT V LATTICES AND BOOLEAN ALGEBRA 9+3

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Boolean Algebra and properties

Total Periods: 60

Course Outcomes:

Upon successful completion of the course, students should be able to:
CO1: Apply propositional and predicate calculus equivalences, and inference rules for valid mathematical arguments
CO2: Apply combinatorial techniques to solve problems
CO3: Identify and analyse properties of graph models inclusive of Eulerian and Hamiltonian graphs
CO4: Understand concepts of semi-groups, monoids, and groups in algebraic systems.
CO5: Understand the structure of lattices
CO6: Understand the concept of Boolean algebra

Suggested Activities

1. Create logic puzzle incorporating quantifiers (∀, ∃).

2. Solve the Tower of Hanoi puzzle with different disk counts.
3. Model a city's tourist spots and paths using a graph.
4. Create a network diagram (e.g., of websites or devices) and analyze connectivity using graph theory concepts.

Text Books:

1. Rosen, K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2011.
2. Tremblay, J.P. and Manohar.R, " Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

References:

1. Grimaldi, R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 4th Edition, Pearson Education Asia, Delhi, 2007.
2. Lipschutz, S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.
3. Koshy, T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.
4. Veerarajan, T., "Discrete Mathematics with Graph Theory and Combinatorics", Mc Graw Hill Publishers, India, 2017.
5. J.A. Bondy , U.S.R. Murty, "Graph Theory With Applications" , North Holland, New York, 1976
6. Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Dover Publication, 2016.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	-	-	-	-	-	-	3	2	1
CO2	3	2	1	1	-	-	-	-	-	-	-	3	2	1
CO3	3	2	1	1	-	-	-	-	-	-	-	3	2	1
CO4	3	2	1	2	-	-	-	-	-	-	-	3	2	1
CO5	3	2	1	1	-	-	-	-	-	-	-	3	2	1
CO6	3	2	1	2	-	-	-	-	-	-	-	3	2	1
Avg.	3	2	1	1.5	-	-	-	-	-	-	-	3	2	1

1 - low, 2 - medium, 3 - high, '-"- no correlation

BS24301	Environmental Science and Sustainability	BSC	L	T	P	C
			3	0	0	3

Course Objectives:

- To introduce the basic concepts of environment, ecosystems.
- To emphasize on the biodiversity of India and its conservation.
- To familiarise with the causes and effects of different types of pollution in the environment.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability**.**
- To impart knowledge about waste management and their recovery methods.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles.

UNIT I ENVIRONMENT AND BIODIVERSITY 9

Definition, scope and importance of environment – need for public awareness. Ecosystem and Energy flow – food chain, food web, ecological pyramids-ecological succession. Types of biodiversity: genetic, species and ecosystem diversity – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – endangered and endemic species of India, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 9

Causes, Effects and Preventive measures of Air, Water, Soil, Thermal and Noise Pollutions. Nuclear hazards and human health risks-case study. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection-Air act, Water act, Environmental protection act. Role of an individual in prevention of pollution.

UNIT III SUSTAINABILITY AND MANAGEMENT 9

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals - intervention areas- Climate change-global warming, acid rain, Ozone layer depletion- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT IV WASTE MANAGEMENT AND RESOURCE RECOVERY 9

Biodegradable, non-biodegradable wastes, Solid, Hazardous and E-Waste management.
Bio-medical waste management, Concept of waste to energy processes (WTE) - Combustion, Pyrolysis, Landfill gas (LFG) recovery. Recycling of spent batteries, end-of- life vehicle (ELV) recycling-Waste engine oil recycling-Solvent recovery, Barriers for material recycling-social, legal and economic factors-Environment impact of waste recycling.

UNIT V SUSTAINABILITY PRACTICES 9

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources-Ocean energy sources, Geothermal energy, Energy Cycles- carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio- economical and technological change.

Total Periods: 45

Course Outcomes:

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

CO1: To understand the functions of the environment, ecosystems.
CO2: To analyse the threats of biodiversity and their conservation.
CO3: To explain the types of environmental pollution and environment protection acts.
CO4: To recognize the different goals of sustainable development and environmental standards.
CO5: To correlate the different types of waste management and possible resource recovery methods.
CO6: To explain the sustainability practices pertaining to sustainable energy, sustainable habitat and sustainable urbanization.

Suggested Activities

5. Quiz

6. Mind Mapping
7. Group discussion
8. Seminar
9. Animated videos

Text Books:

Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.
Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998

References:

7. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38. edition 2010.
8. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
9. Dharmendra S. Sengar, 'Environmental law', Prentice Hall of India PVT. LTD, New Delhi, 2007.
10. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, Third Edition, 2015.
11. Erach Bharucha "Text book of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

MAPPING OF COs WITH Pos

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2.5	-	-	-	-	2	2	1	-
CO2	2	1	-	-	-	2.5	-	-	-	-	2	2	1	-
CO3	3	2	-	-	-	3	-	1	-	-	2	3	2	-
CO4	3	2	1	-	-	2	-	1	-	-	2	3	2	1
CO5	3	2	1	-	-	2	-	-	-	-	2	3	2	1
CO6	3	2	1	-	-	2	-	1	-	-	2	3	2	1
Avg.	2.7	1.7	1	0	0	2.3	0	1	0	0	2	2.7	1.7	1

1 - low, 2 - medium, 3 - high, '-"- no correlation

IT24301	Data Structures & Algorithms	PCC	L	T	P	C
			3	0	4	4

Course Objectives:

- To understand the basic concepts of data structures and comprehend the necessity of analysis of algorithm
- To apply the concept of linear data structure operations and applications.
- To learn various sorting and searching algorithms.

- To be able to apply different hashing techniques in real time scenarios.
- To critically analyse tree, graph algorithms and its applications.
- To solve programming problems using different algorithm design techniques

UNIT I INTRODUCTION TO DATA STRUCTURES & ALGORITHM ANALYSIS 7

Data Structures - Importance of data structure & algorithms – Abstract data types - Fundamentals of algorithm analysis: Space and time complexity – Asymptotic notations – Order of growth – Algorithm Efficiency (Best case, Average case, Worst case) – Mathematical analysis for Recursive and Non-recursive algorithms- Solving Recurrences using Master's Theorem.

UNIT II LINEAR DATA STRUCTURES 9

Array based implementations of List – Linked list implementations: Singly linked list – Doubly linked list – Circularly linked list — Applications (Polynomial Manipulation).Stack ADT - Application of Stack (Infix, postfix, prefix conversions) – Queue ADT – Double ended queues – Applications.

UNIT III SORTING, SEARCHING AND HASHING TECHNIQUES 9

Sorting: Bubble sort – Selection sort – Insertion sort – Quick sort – Merge sort. Searching: Linear search, Binary search. Hashing: Definition - Hash key - Hash Functions – Collision Resolution – Rehashing – Extendible hashing – Load Factor.

UNIT IV NON-LINEAR DATA STRUCTURES 10

Fundamentals of tree: Definition, Types – Binary tree – Tree traversal: In-order, Pre-order, Post-order – Binary search tree – AVL tree – Heap tree – Graphs: Introduction to graph, Graph Traversal: BFS, DFS – Direct Acyclic graph - Topological ordering- Minimum spanning tree: Kruskal's and Prim's algorithm- shortest path: Dijkstra's algorithm - Floyd-Warshall algorithm.

UNIT V BACKTRACKING, GREEDY AND DYNAMIC ALGORITHMS 10

Backtracking: N-Queens Problem, Hamiltonian Circuit Problem. Greedy Algorithm: Huffman Encoding Tree, Optimal Merge Pattern. Dynamic Algorithms: Optimal Binary Search Tree - Multistage Graph Problem- P, NP, NP-Complete, and NP-Hard Classes- Travelling Salesman Problem - 0/1 Knapsack Problem.

Periods: 45

Course Outcomes:

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

CO1: Understand the fundamentals of data structures and ability to estimate the algorithmic complexity for the given problem.
CO2: Articulate linear data structure operations and its applications.
CO3: Identify and apply algorithms for sorting and searching.
CO4: Analyse and apply different hashing techniques for real time scenarios.
CO5: To efficiently implement tree, graph algorithms based on the requirement of application.
CO6: Apply appropriate design techniques to solve a problems.

Suggested Activities

- Create a tool that visually demonstrates the steps of different sorting algorithms (e.g., bubble sort, merge sort, quicksort).
- Explore the concept of heaps (max-heap, min-heap) and their applications in sorting and priority queues.

Text Books:

1.Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005

References:

1. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft, Data Structures and Algorithms, 1st edition, Pearson, 2002.
2. Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	2	3	2	-		2		2	1	1	1	1
CO2	2	3	2	2	2	-		2		2	2	3	2	2
CO3	2	2	3	2	3	-		3		2	2	3	2	2
CO4	2	2	3	2	3	-		3		2	2	3	2	2
CO5	2	2	2	2	1	-		2		2	2	3	2	2
CO6	2	2	2	2	1	-		2		2	2	3	2	2
Avg.	**2**	**2.2**	**2**	**2.2**	**2**	**0**	**0**	**2.3**	**0**	**2**	**1.8**	**2.7**	**1.8**	**1.8**

1 - low, 2 - medium, 3 - high, '-"- no correlation

CS24311	Digital Principles and Computer Organization	ESC	L	T	P	C
			3	0	2	4

Course Objectives:

- Understand the fundamentals of number systems, codes, and combinational logic circuits.
- Analyze and design sequential logic circuits using flip-flops, counters, and state machines.
- Comprehend the basic structure, functional units, and operations of a digital computer.
- Develop knowledge on processor architecture including data path design, control units, and pipelining concepts.
- Explore memory organization, management techniques, and understand input/output interfacing mechanisms.

UNIT I COMBINATIONAL LOGIC 9

Number systems, Conversion of bases, Signed arithmetic, Complement, Parity bits, weighted and non-weighted codes, Logic gates, Combinational Circuits – Karnaugh Map - Design Procedures – Binary Adder – Subtractor – Decimal Adder - Decoder – Encoder – Multiplexers – Demultiplexers.

UNIT II SYNCHRONOUS SEQUENTIAL LOGIC 9

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation – Shift Registers – Counters.

UNIT III COMPUTER FUNDAMENTALS 9

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA) of MIPS: Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of MIPS Instruction – Interaction between Assembly and High Level Language.

UNIT IV DATAPATH & CONTROL DESIGN 9

Instruction Execution – Building a Data Path – Single cycle and Multicycle Implementation - Designing a Control Unit – Pipelining - Pipelined data path – Structural Hazard - Data Hazard - Control Hazards

UNIT V MEMORY AND I/O 9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.

Periods: 45 Hours

List of Experiments:

1. Design and implementation of combinational circuits using gates for arbitrary functions.
2. Implementation of 4-bit binary adder/subtractor circuits.
3. Implementation of code converters.
4. Implementation of BCD adder.
5. Implementation of encoder and decoder circuits.
6. Implementation of Multiplexers and Demultiplexers.
7. Implementation of functions using Multiplexers.
8. Implementation of the counters.
9. Implementation of Shift register.
10. Simulator based study of Computer Architecture.

Periods: 30 Hours

Total Periods: 75 Hours

Course Outcomes:

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

CO1: Perform conversions between number systems, and solve problems related to signed arithmetic and binary codes.
CO2: Design and simplify combinational logic circuits using logic gates and Karnaugh Maps.
CO3: Analyze and design synchronous sequential circuits using flip-flops, shift registers, and counters.
CO4: Explain the functional units of a digital computer and describe instruction execution, addressing modes, and instruction sequencing.
CO5: Develop data path and control unit designs (both hardwired and microprogrammed) and analyze the concept of pipelining with hazards.
CO6: Understand memory hierarchy, cache mapping techniques, virtual memory concepts, and various I/O interfacing standards like DMA, USB, and SATA.

Suggested Activities:

- Virtual lab
- Tutorial
- Peer group study
- Gate questions

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS SOFTWARE

S. No.	Name of the Equipment / Software
1	Digital Trainer Kit
2	ICs - OR, AND, NOT, NAND, XOR, 4-bit Adder, FFs
3	Connecting Wires

Text Books:

1. M. Morris Mano, Michael D. Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", Sixth Edition, Pearson Education, 2018.
2. David A. Patterson, John L. Hennessy, "Computer Organization and Design, The Hardware/Software Interface", Sixth Edition, Morgan Kaufmann/Elsevier, 2020.
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", Sixth Edition, Tata McGraw-Hill, 2012.

References:

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.
2. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2			-		3	2		1		2	
CO2	3	3	2			-		3	2		1		2	
CO3	3	3	2			-		3	2		1		2	
CO4	3	1	1			-		0	0		1		2	
CO5	3	1	1			-		0	0		1		2	
CO6	3	0	1			-		0	0		1		2	
Avg.	**3**	**1.8**	**2**	**0**	**0**	**0**	**0**	**1.5**	**1**	**0**	**1**	**0**	**2**	**0**

1 - low, 2 - medium, 3 - high, '-"- no correlation

CS24312 Object Oriented Programming in Java PCC L T P C

2 0 4 4

Course Objectives:

- To understand Object Oriented Programming concepts and basics of Java programming language
- To know the principles of classes and inheritance
- To define interfaces and handle strings
- To define exception handling mechanisms
- To develop a java application with I/O operations, threads and generics classes

- To modularize Java applications using packages and efficiently manage data using the Collection Framework.

UNIT I INTRODUCTION TO OOP AND JAVA 6

Object oriented programming paradigms – Features of Object-Oriented Programming –Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java

UNIT II CLASSES AND INHERITANCE 6

Defining classes in Java – Access modifiers - Constructors-Methods: Objects as Parameters – Returning Objects –Static: block, class, methods, and variables. Inheritance: Types of Inheritance – Super and final keywords – Method overloading and overriding – Dynamic Method Dispatch – Abstract Classes.

UNIT III INTERFACE, EXCEPTION HANDLING AND STRINGS 6

Interfaces: Implementing and extending interfaces - Exceptions – exceptions hierarchy- throwing and catching exceptions - built-in Exceptions – User defined Exception. Strings: Basic String class, methods and String Buffer Class.

UNIT IV I/O, GENERICS, MULTITHREADING 6

I/O Basics – Reading and Writing Console I/O– Reading and Writing Files (csv and txt file). Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Differences between multithreading and multitasking, thread life cycle, creating threads, Inter-thread communication.

UNIT V PACKAGES AND COLLECTIONS 6

Packages – Packages and Member Access – Importing Packages – Lambda Expressions – Collection Interfaces and classes: ArrayList, LinkedList, HashSet, TreeSet, HashMap, EnumMap.

Periods: 30

LIST OF EXPERIMENTS:

1. Develop java programs to solve simple problems (factorial, Fibonacci, binary search, selection/insertion sort)
2. Develop java programs using OOP principles.
3. Develop a java program to develop payslips for the employees with their gross and net salary. Define subclasses for Programmer, Assistant Professor, Associate Professor, Professor extending Employee.
4. Develop a Java Program to create an abstract class named Shape that contains two integers, and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area() that prints the area of the given shape.
5. Develop a java program for implementation of interface.
6. Develop a program that takes as input the size of the array and the elements in the array and asks the user to enter a particular index and prints the element at that index. This program should generate different exceptions. To handle these exceptions, use exception handling mechanisms.
7. Develop a Java program to implement string handling mechanisms.
8. Develop a Java program to perform file operations (Count the number of times a character appears in a file, Copy the content from one file to another).

9. Develop applications to demonstrate features of generic classes.
10. Develop a Java program to implement a multithreaded application.
11. Develop a java program to search for an element in an array using generic classes.
12. Develop a java program to find the average of an array of elements using generic classes.
13. Create a Java program to demonstrate Java built in packages.
14. Create a Java program to create and use a user defined package.
15. Develop a Java program that demonstrates different Collection Framework classes and interfaces.
16. Develop a real-time GUI based Java application.

Periods: **60**

Total Periods: 90

Course Outcomes:

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

CO1: Apply the concepts of Object-Oriented Programming to solve simple problems
CO2: Develop programs using classes and inheritance
CO3: Develop programs using interfaces and string methods
CO4: Make use of exception handling mechanisms to solve real world problems
CO5: Build Java applications with generics and multithreading concepts
CO6: Apply Java packages and collections to solve real world problems

Suggested Activities

- Mini Project

Text Books:

1. Herbert Schildt, ―Java The complete reference, 11th Edition, McGraw Hill Education, 2019
2. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11 th Edition, Prentice Hall, 2018.

References:

1. Paul Deitel, Harvey Deitel, "JAVA SE 8 for programmers", 3rd Edition, Pearson, 2015.
2. Oracle Academy Resources.

Laboratory Requirements:

1. INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17" or higher TFT Monitor, Keyboard and mouse.
2. Windows 10 or higher operating system / Linux Ubuntu 20 or higher.
3. JDK 17 or above (Oracle or OpenJDK)/ Eclipse IDE for Java Developers / IntelliJ IDEA Community Edition / NetBeans / VS Code with Java Extension Pack.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	2			-					2	3	2	
CO2	3	2	3		3	-					2	3	2	
CO3	3	2	3		3	-					2	3	2	
CO4	3	2	3		3	-					2	3	2	
CO5	3	2	3		3	-					2	3	2	
CO6	3	2	3		3	-					2	3	2	
Avg.	3	2	3	0	3	0	0	0	0	0	2	3	2	0

1 - low, 2 - medium, 3 - high, '-"- no correlation

CS24413	Foundations of Data Science	PCC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the data science fundamentals and process.
- Equip students with practical skills in data collection, cleaning, and preparation.
- Provide a solid foundation in statistical thinking and inference.
- Teach effective data visualization and storytelling methods.
- To present and interpret data using visualization libraries in Python

UNIT I INTRODUCTION 6

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing

UNIT II DATA COLLECTION, CLEANING, AND REPARATION 6

Data Collection Techniques: Surveys, APIs, Scraping, Logs - Data Cleaning Techniques: Missing Values, Duplicates, Outliers - Data Transformation: Normalization, Scaling, Encoding (One-Hot, Label) - Handling Textual and Categorical Data - Feature Engineering Basics: Date-Time Features, Aggregations, Binning

UNIT III DESCRIBING DATA 6

Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores

UNIT IV DESCRIBING RELATIONSHIPS 6

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –regression towards the mean - Principal Component Analysis

UNIT V DATA VISUALIZATION AND INTERPRETATION 6

Principles of Data Visualization: Clarity, Integrity, Aesthetics - Visualization Types: Line, Bar, Histogram, Boxplot, Heatmap, Scatterplot - Visualizing Categorical vs. Numerical Data - Tools: Python (Matplotlib, Seaborn), Tableau, Excel - Dashboarding Concepts and Use Cases - Visual Storytelling: Communicating Findings Effectively

Periods: 30

LIST OF EXPERIMENTS:

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Data Cleaning with Uncleaned Laptop Price Dataset
3. EDA with Iris/Indian Diabetes Dataset
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:
a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
b. Bivariate analysis: Linear and logistic regression modelling
c. Multiple Regression analysis
d. Also compare the results of the above analysis for the two data sets.
6. Apply and explore various plotting functions on UCI data sets.
a. Normal curves
b. Density and contour plots
c. Correlation and scatter plots
d. Histograms
e. Three-dimensional plotting
7. Creating an Interactive Sales Dashboard.

Periods: **30**

Total Periods: 60

Course Outcomes:

At the end of this course, the students will be able to:
CO1: Understand the data science process
CO2: Apply practical skills in data collection, cleaning and preparation
CO3: Apply descriptive statistics to summarize, analyze and interpret data in the data science process
CO4: Apply correlation and regression techniques to analyze relationships among data
CO5: Apply visualization libraries in Python, explore data using visualization tools and interpret them
CO6: Perform end-to-end data analysis by integrating data preparation, statistical methods and visualization techniques to derive and communicate actionable insights

Suggested Activities:
1. Mini Project: Real-time Data Collection
2. Data Cleaning Challenge
3. EDA Storytelling Contest
4. Data Cleaning + Regression Modeling
5. Dashboard Creation, Data Story Video Presentation, Hackathon

Text Books:

1. Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (Unit I)
2. Jason Brownlee, “Data Preparation for Machine Learning”, Machine Learning Mastery, 2020.(Unit II)
3. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. (Units III and IV)
4. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016. (Unit V)

References:

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press,2014.
2. Cole Nussbaumer Knaflic, “Storytelling with Data: A Data Visualization Guide for Business Professionals”, Wiley, 2015.

Laboratory Requirements:

1. INTEL based desktop PC with min. 16 GB RAM and 512 GB SSD
2. Python Version: 3.8 to 3.12 - Environment Manager: Anaconda Distribution (Recommended)/ Miniconda/ Virtualenv + pip
3. Integrated Development Environment (IDE) – Jupyter Notebook / JupyterLab / VS Code (with Python and Jupyter extensions)/ R PyCharm (Community Edition or Professional)

MAPPING OF COs WITH POs AND PSOs

COs	PSOs													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	-	-	-	1	1	1	2	2	2
CO2	2	1	-	1	1	-	-	-	2	1	1	2	2	3
CO3	2	1	-	1	1	-	-	-	2	1	1	2	2	3
CO4	2	2	1	2	2	1	1	-	1	2	1	3	3	2
CO5	3	2	2	1	2	-	-	-	1	1	2	2	2	3
CO6	2	2	1	2	2	-	-	-	1	1	1	2	2	2
Avg.	2	2	1	2	2	1	1	-	1	1	1	2	2	2

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

IT24321	Data Structures & Algorithms Laboratory	PCC	L	T	P	C
			0	0	4	2

Course Objectives:

- To understand the basic concepts of data structures and comprehend the necessity of analysis of algorithm
- To apply the concept of linear data structure operations and applications.
- To learn various sorting and searching algorithms.
- To be able to apply different hashing techniques in real time scenarios.
- To critically analyse tree, graph algorithms and its applications.
- To solve programming problems using different algorithm design techniques

LIST OF EXPERIMENTS:

1. Analyse the complexity of iterative problems.
2. Implement recursive algorithms using C
3. Implement List ADT using arrays
4. Implementation of Stack ADT and its application (Stack using Queue).
5. Implementation of Queue ADT and its application (Queue using Stack).
6. Linked list implementations of List. (Singly, Doubly, Circularly)
7. Implementation of sorting techniques. (Bubble, Selection, Insertion, Quick, Merge)
8. Implementation of searching techniques. (Linear, Binary)
9. Implementation of Hash tables.
10. Implementation of Tree traversal algorithm.
11. Implementation of Binary search trees
12. Implementation of Heap tree. (Min heap, Max heap)

13. Graph Traversal algorithms: BFS, DFS
14. Implementation of minimum spanning tree: Prims, Kruskal's algorithm
15. Implementation of single source shortest path: Dijikstra's algorithm
16. Implementation of greedy algorithm: Huffman Encoding Tree
17. Implementation of Dynamic Algorithm: Optimal binary search tree

Periods: 60

Laboratory Requirements:

Sl.No	Description of Equipment	Required numbers (for batch of 30 students)
1	INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17" or higher TFT Monitor, Keyboard and mouse	35
2	Windows 10 or higher operating system / Linux Ubuntu 20 or higher	35
3	Dev C++ / Eclipse CDT / Code Blocks / CodeLite / equivalent open source IDE	35

Course Outcomes:

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

CO1: Understand the fundamentals of data structures and ability to estimate the algorithmic complexity for the given problem.
CO2: Articulate linear data structure operations and its applications.
CO3: Identify and apply algorithms for sorting and searching.
CO4: Analyse and apply different hashing techniques for real time scenarios.
CO5: To efficiently implement tree, graph algorithms based on the requirement of application.
CO6: Apply appropriate design techniques to solve a problems.

References:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005
2. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.
3. Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022

MAPPING OF COs WITH POs AND PSOs

COs	PSOs													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	3	2	-		2		2	1	1	1	1
CO2	2	3	2	2	2	-		2		2	2	3	2	2
CO3	2	2	3	2	3	-		3		2	2	3	2	2
CO4	2	2	3	2	3	-		3		2	2	3	2	2
CO5	2	2	2	2	1	-		2		2	2	3	2	2
CO6	2	2	2	2	1	-		2		2	2	3	2	2
Avg.	**2**	**2.2**	**2**	**2.2**	**2**	**0**	**0**	**2.3**	**0**	**2**	**1.8**	**2.7**	**1.8**	**1.8**

1 - low, 2 - medium, 3 - high, '-"- no correlation

FC24301	Soft Skills	HSMC	L	T	P	C
			2	0	0	1

Course Objectives:

- Understand and apply proper etiquette in social, corporate, and online interactions
- Develop effective verbal and nonverbal communication skills, including body language and posture
- Enhance participation in group discussions and structured professional conversations
- Prepare for job interviews with appropriate etiquette, research, and response techniques
- Communicate professionally in written formats such as emails, inquiries, and job offer letters
- Deliver structured and engaging presentations using storytelling and persuasive techniques

UNIT I ETIQUETTE **6**

Definition

- Social
- Corporate/Business - Meeting
- Telephone
- Netiquette

UNIT II BODY LANGUAGE AND NONVERBAL COMMUNICATION 6

- Posture
- Personal grooming
- Facial expression/ gesture/eye contact

UNIT III GROUP DISCUSSION 6

- Etiquette - Rules of conduct
- GD flow
- Pestel - Political, economic, social, tech, legal, environmental
- Handling unpredictable situation

UNIT IV JOB INTERVIEW - ETIQUETTE 6

- Pre-interview prep and research
- Responding to non technical questions (star model - situation/task/ action plan/ result)
- Speaking your resume
- Writing inquiries and responding to job offer letters

UNIT V PRESENTATION SKILLS 6

- Setting the tone/ storytelling
- JAM/ Turn your Court

Total Periods: 30

Course Outcomes:

1. Demonstrate professionalism in meetings, telephone calls, and digital communication
2. Use appropriate body language, facial expressions, and gestures to enhance communication
3. Participate effectively in group discussions, debates, and structured dialogues
4. Apply job interview strategies, including answering behavioral questions using the STAR model
5. Write clear and professional business correspondence, including inquiries and job offers
6. Present ideas confidently with a structured approach, engaging tone, and strong delivery

Suggested Activities

1. **Role-Playing Business Meetings** – Students are assigned different corporate roles (CEO, Manager, Employee) and have them conduct a mock meeting with proper etiquette.
2. Group Discussion
3. **PESTEL Case Study** – Students analyze a real-world company using PESTEL factors and present their findings.
4. **Resume Pitching** – Students present their resumes as a story, explaining their achievements in an engaging way.
5. **Turn the Court Debate Organizer** – Students list arguments for and against a topic to prepare for persuasive speaking.

Work Sheets:

1. Business Meeting Etiquette Checklist – A checklist where students identify correct/incorrect meeting behaviors.
2. PESTEL Case Study Template – A table where students analyze a company using Political, Economic, Social, Technological, Environmental, and Legal factors.
3. STAR Method Interview Worksheet – Students write answers to common behavioral questions using the situation, Task, Action, Result format.

References:

1. Pachter, Barbara. The Essentials of Business Etiquette: How to Greet, Eat, and Tweet Your Way to Success. McGraw-Hill, 2013.
2. Pease, Allan, and Barbara Pease. The Definitive Book of Body Language. Bantam, 2004.
3. Gage, Martha. The Power of STAR Method: How to Succeed at Behavioral Job Interviews. Independently published, 2019.

MAPPING OF COs WITH POs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1						-		1	1		
CO2						-			1		
CO3						-		1	1		
CO4						-			1		
CO5						-			1		
CO6						-		1	1		
Avg.	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**

1 - low, 2 - medium, 3 - high, '-"- no correlation

BS24321	**System Discovery and Analysis**	**BSC**	**L**	**T**	**P**	**C**
			0	0	2	0

Course Objectives:

- To identify key components of any hardware.
- To analyse individual components and its working.
- To understand how data and control flows within a system
- To identify the need, the user, and functional specifications of the system
- To understand the evolution of an electronic system through study and presentation

LIST OF COMPONENTS:

Any two components can be selected per semester

1) Installation of various Operating Systems.
2) CPU.
3) Wifi Access Point / Switch.
4) Printer
5) Raspberry Pi/ Arduino Board

System Discovery (6 periods)
System Analysis (18 periods)
Presentation + Documentation (6 periods)

Total Periods: 30

Course Outcomes:

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

CO1: Identify and describe the essential components and architecture of commonly used hardware systems.

CO2: Evaluate and document system design requirements, including end-user needs, functional goals, constraints, and standards.

CO3: Use project management tools, bull and octopus diagrams to understand the existing system.

CO4: Disassemble and analyze systems to distinguish between hardware, software, and network components

CO5: Understand and articulate how information is processed, transmitted, and stored.

CO6: Propose an improvisation of any existing system by adopting a new design and technology.

Text Books:

- Laboratory Manual

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	2	-	1	-	-	-	3	1	-	1
CO2	2	2	-	1	-	-	-	3	1	1	1
CO3	2	2	-	1	-	-	-	3	1	1	1
CO4	2	2	-	2	-	-	-	3	1	-	1
CO5	2	2	-	2	-	-	-	3	1	-	1
CO6	2	2	-	1	-	-	-	3	1	-	1
Avg.	**2**	**2**	**0**	**1.3**	**0**	**0**	**0**	**3**	**1**	**1**	**1**

1 - low, 2 - medium, 3 - high, '-"- no correlation

MA24401	**Linear Algebra and Number Theory**	**BSC**	**L**	**T**	**P**	**C**
			3	**1**	**0**	**4**

Course Objectives:

- To provide a fundamental understanding of vector spaces, subspaces, and their properties
- To facilitate the understanding of the concepts of linear transformation and diagonalization
- To familiarise the concepts of inner product spaces and orthogonalization
- To understand the basic concepts in number theory
- To give an integrated approach to number theory and abstract algebra, and provide a firm basis for further reading and study in the subject.

UNIT I VECTOR SPACES 9+3

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

UNIT II LINEAR TRANSFORMATION AND DIAGONALIZATION 9+3

Linear transformation — Null spaces and ranges — Dimension theorem — Matrix representation of a linear transformations — Eigenvalues and eigenvectors — Diagonalizability.

UNIT III INNER PRODUCT SPACES 9+3

Inner product, norms — Gram Schmidt orthogonalization process — Adjoint of linear operations — Least square approximation.

UNIT IV DIVISIBILITY THEORY AND CANONICAL DECOMPOSITIONS 9+3

Division algorithm — Base b representations — Number patterns — Prime and composite numbers (proof excluded) — GCD (proof excluded) — Euclidean algorithm — Fundamental theorem of arithmetic — LCM (proof excluded).

UNIT V DISTRIBUTED SYSTEMS, NO SQL DATABASES AND DATABASE SECURITY 9+3

Linear Diophantine equations (proof excluded) — Congruence's (proof excluded) — Linear Congruence's (proof excluded) — Applications: Divisibility tests — Modular exponentiation — Chinese remainder theorem — 2 x 2 linear systems — Wilson's theorem — Fermat's little theorem — Euler's theorem — Euler's Phi functions — Tau and Sigma functions

Total Periods: 45

Course Outcomes:

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

CO1: Apply the knowledge to solve problems involving linear combinations, independence, and dimension.
CO2: Understand the concepts of linear transformations and diagonalization
CO3: Effectively use the concepts of orthogonalization and least square method to solve problems
CO4: Understand the concept of divisibility and base-b number representations
CO5: Solve linear Diophantine equations and systems of congruences
CO6: Understand the classical theorems

Suggested Activities:

1. Explore linear span and linear dependence graphically using Mathematical tool
2. Convert verbal description into linear transformation and represent them using matrices
3. Google Pagerank Algorithm
4. Fit a line to non-perfect data points using Mathematical tool
5. Use clock face analogies to solve modular arithmetic problems

Text Books:

1. Grimaldi, R.P and Ramana, B.V., "Discrete and Combinatorial Mathematics", Pearson Education, 5th Edition, New Delhi, 2007.
2. Koshy, T., ―Elementary Number Theory with Applications, Elsevier Publications, New Delhi, 2002.
3. Friedberg, A.H., Insel, A.J. and Spence, L., ―Linear Algebra, Prentice Hall of India, New Delhi, 2004
4. Kwak, J.H, Hong, S., -Linear Algebra, Birkhauser Publishers, Second Edition, Springer International Edition, 1997.

References:

5. Kolman, B. Hill, D.R., ―Introductory Linear Algebra, Pearson Education, New Delhi, First Reprint, 2009.
6. Kumaresan, S., ―Linear Algebra – A Geometric Approach, Prentice – Hall of India, New Delhi, Reprint, 2010.
7. Lay, D.C., ―Linear Algebra and its Applications, 5th Edition, Pearson Education, 2015.

8. Strang, G., ―Linear Algebra and its applications, Thomson (Brooks/Cole), New Delhi, 2005.
9. Niven, I., Zuckerman.H.S., and Montgomery, H.L., ―An Introduction to Theory of Number, John Wiley and Sons , Singapore, 2004.
10. San Ling and Chaoping Xing, ―Coding Theory – A first Cours, Cambridge Publications, Cambridge, 2004

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	2	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-
CO3	3	2	1	2	-	-	-	-	-	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-
CO6	3	2	-	-	-	-	-	-	-	-	-
Avg.	**3**	**1.8**	**1**	**1.7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

1 - low, 2 - medium, 3 - high, '-"- no correlation

CS24302	**Database Management Systems**	**PCC**	**L**	**T**	**P**	**C**
			3	0	0	3

Course Objectives:

- To learn the fundamentals of data models, relational algebra and SQL
- To represent a database system using ER diagrams and to learn normalization techniques
- To understand the fundamental concepts of transaction, concurrency and recovery processing
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design
- To have an introductory knowledge about the Distributed databases, NOSQL and database security

UNIT I RELATIONAL DATABASES 9

Purpose of Database System – View of data – Database Architecture. Introduction to relational Model: Structure of Relational Databases – Database Schema – Keys – Relational Algebra. Introduction to SQL: Data Definition – Basic Operations - Set Operations – Aggregate Functions. Intermediate SQL: Join – Views – Integrity Constraints. Advanced SQL: Accessing SQL from a Programming Language – Functions and Procedures – Triggers.

UNIT II DATABASE DESIGN 9

Database Design and the ER Model: The Entity-Relationship Model – ER Diagrams – Reduction to Relational Schemas – ER Design Issues – Enhanced ER Features. Relational Database Design: Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT III DATA STORAGE AND QUERYING 9

Storage and File Structure: RAID – File Organization – Organization of Records in Files – Data Dictionary Storage – Database Buffer. Indexing and Hashing: Ordered Indices – B+ tree Index Files – Static Hashing – Dynamic Hashing – Index Definition in SQL. Query Processing: Overview – Measure of Query Cost – Selection Operation – Sorting – Join Operation – Evaluation of Expressions. Query Optimization: Overview – Transformation of Relational Expressions – Heuristics in Optimization.

UNIT IV TRANSACTION MANAGEMENT 9

Transaction Management: Transaction Concepts – ACID Properties – Serializability – Transaction Isolation and Atomicity - Transaction support in SQL. Concurrency Control: Lock based Protocols – Deadlock Handling – Multiple Granularity - Timestamp – Validation – Multiversion – Snapshot Isolation. Recovery System: Failure Classification – Storage - Recovery and Atomicity – Recovery Algorithm – Buffer Management – ARIES Algorithm – Remote Backup Systems.

UNIT V DISTRIBUTED SYSTEMS, NO SQL DATABASES AND DATABASE SECURITY 9

Distributed Databases: Data Storage – Transactions – Commit Protocols – Concurrency Control - Query Processing. – NOSQL Databases: Introduction – CAP Theorem – Document based Systems – Key Value Stores – Column Based Systems – Graph Databases. Database Security: Introduction to Security Issues – Access Control based on Granting and Revoking Privileges – Multilevel Security - SQL Injection – Statistical Database Security – Flow Control – Encryption and Public Key Infrastructures – Challenges.

Total Periods: 45

Course Outcomes:

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

CO1: Implementation of Relational Databases using Structure Query Language
CO2: Design and Normalize Databases using ER Models
CO3: Compare and Optimize Indexing Strategies for Performance Tuning.
CO4: Construct SQL Queries for Transaction Processing and Consistency
CO5: Implement Access Control with Privileges and Roles
CO6: Design a Real-Time Application using a suitable Database

Suggested Activities

- Case Study to ER Diagram Conversion (Team Activity)
- Normalization of Real-World Data (Hands-On Exercise)
- SQL Query Challenges & Competitive Quizzes
- Comparative Analysis: Relational vs. NoSQL Databases
- Oracle Academy SQL/PLSQL Certification (Industry-Aligned Learning)

Text Books:

11. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2020.
12. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017.

References:

1. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	3	3	-		3	3	3	3
CO2	3	2	1	3	3	-		3	3	3	3
CO3	3	2	1	3	3	-		3	3	3	3
CO4	3	2	1	3	3	-		3	3	3	3
CO5	3	2	1	3	3	-		3	3	3	3
CO6	3	3	2	3	3	-		3	3	3	3
Avg.	**3**	**2.2**	**1**	**3**	**3**	**0**	**0**	**3**	**3**	**3**	**3**

1 - low, 2 - medium, 3 - high, '-"- no correlation

CS2401	**Operating Systems**	**PCC**	**L**	**T**	**P**	**C**
			3	0	0	3

Course Objectives:

- Understand core operating system concepts and their role in modern computing environments.
- Analyze the management of processes and multithreaded programs.
- Study CPU scheduling algorithms and mechanisms for process synchronization.
- Understand and address deadlock situations in concurrent systems.
- Examine memory management strategies and virtual memory implementations.
- Explore I/O systems and storage management techniques.

UNIT I FUNDAMENTALS OF OPERATING SYSTEMS 7

Computer Systems Overview - Components, Architecture, and Functions - Evolution of Operating Systems - Historical milestones to modern trends - Operating System Structures - Monolithic, Layered, Microkernel, and Modular Approaches-System Calls and OS Services - User and Kernel Modes - System Programs and Utilities - Operating System Design and Implementation - Best Practices and Structuring Techniques.

UNIT II PROCESS AND THREAD MANAGEMENT 8

Processes - Concepts, States, Process Control Block (PCB) - Operations on Processes - Creation and Termination - Threads - Models (1:1, N:1, M:N), Advantages, Threading Issues, Multithreading Models and Applications - Inter-Process Communication (IPC) - Shared Memory and Message Passing

UNIT III CPU SCHEDULING AND SYNCHRONIZATION 10

CPU Scheduling - Scheduling Criteria, Algorithms (FCFS, SJF, Round Robin, Priority, Multilevel Queue) - Process Synchronization - The Critical Section Problem - Synchronization Techniques – Semaphores, Mutexes, Monitors, Spinlocks and Livelocks - Classical Synchronization Problems - Producer-Consumer - Deadlocks - Conditions, Prevention, Avoidance, Detection, and Recovery.

UNIT IV MEMORY MANAGEMENT AND VIRTUAL MEMORY 10

Memory Management Overview - Contiguous and Non-contiguous Allocation – Paging - Page Tables, TLBs - Segmentation and Segmentation with Paging - Virtual Memory Concepts - Demand

Paging, Copy-on-Write (CoW) - Page Replacement Algorithms - FIFO, LRU, Optimal - Thrashing and Working Set Model - Frame Allocation Strategies.

UNIT V STORAGE AND FILE SYSTEM MANAGEMENT 10

Storage Systems - Disk Structures, Disk Scheduling (FCFS, SSTF, SCAN, C-SCAN) - File Systems - Architecture, Implementation, Directory Structures - File Access Methods, File Sharing and Protection - Free Space Management – Bitmaps, Linked Lists - I/O Systems - Device Management, Kernel I/O Interface, Application I/O Interface - Introduction to RAID Levels and Storage Virtualization Concepts.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to
CO1: Understand the structure and functionalities of modern operating systems and system calls.
CO2: Apply process management techniques, multithreading and inter-process communication.
CO3: Compare various CPU scheduling algorithms and implement synchronization.
CO4: Design solutions for deadlock handling in concurrent systems.
CO5: Compare and apply memory management techniques.
CO6: Understand file system structures, disk scheduling and storage management methods.

Suggested Activities:

- Research and present a timeline of the evolution of operating systems (from batch systems to cloud-native OS like AWS Nitro).
- Mini Project: Build a producer-consumer model using multithreading concepts.
- Create a CPU Scheduling simulator

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts, 10th Edition, Wiley, 2018.
2. Andrew S. Tanenbaum, Modern Operating Systems, 5th Edition, Pearson, 2022.

References:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, Operating Systems – A Spiral Approach, McGraw Hill, 2010.
2. William Stallings, Operating Systems: Internals and Design Principles, 7th Edition, Prentice Hall, 2018.
3. Achyut S. Godbole, Atul Kahate, Operating Systems, McGraw Hill Education, 2016.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2				-					2
CO2	3	3		2		-					2
CO3	3	3	2	2		-					2
CO4	3	3	2	2		-					2
CO5	3	2	2	2		-					2
CO6	3	2				-					2
Avg.	**3**	**2.5**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**2**

1 - low, 2 - medium, 3 - high, '- "- no correlation

IT24402	Computer Architecture	PCC	L	T	P	C
			3	0	0	3

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 basics of pipelined execution
- To understand the memory hierarchies, cache and virtual memories and communication with I/O devices
- To understand parallelism and multi-core processors.

UNIT I BASIC STRUCTURE OF A COMPUTER SYSTEM 9

Functional Units – Basic Operational Concepts – Performance; Instructions: Language of the computer – Operations, Operands – Instruction representation; Logical operations – Decision making; MIPS addressing.

UNIT II ARITHMETIC FOR COMPUTERS 9

Addition and subtraction; Multiplication-Sequential multiplication algorithm, Booth's algorithm; Division- – Restoring and Non-Restoring algorithm; Floating Point Representation: Floating point operations.

UNIT III PROCESSORS AND CONTROL UNIT 9

A Basic MIPS implementation: Building a datapath – Control implementation scheme; Pipelining: Pipelined datapath and control – Handling data hazards & Control hazards – Exceptions – Issues in predictive branching: Spectre and Meltdown.

UNIT IV MEMORY & I/O SYSTEMS 9

Memory Hierarchy; Memory technologies; Cache Memory: Basics and cache mapping techniques; Measuring and improving cache performance; Virtual Memory: TLBs; Accessing I/O devices – Interrupts; Direct memory access; Bus structure – Bus operation – Arbitration; Interface circuits; USB.

UNIT V PARALLEL PROCESSORS 9

Parallel processing challenges; Flynn's classification: SISD – SIMD- MISD- MIMD and Vector Architectures; Hardware multithreading; multi-core processors and other shared memory multiprocessors; Introduction to Graphics Processing Units.

Total Periods: 45

Course Outcomes:

On successful completion of this course, the student will be able to:
CO 1. Explain the basics structure of computers, operations and instructions (K2)
CO 2. Design arithmetic and logic unit (K3)
CO 3. Explain pipelined execution and design its control unit (K3)
CO 4. Design various memory systems and understand I/O communication (K3)
CO 5. Explain parallel processing architectures (K2)

CO 6. Design a multi-functional ALU as per the requirement by applying best practices of system design (K4)

Suggested Activities

- Quizzes
- Flipped class room
- Problem solving in Tutorial sessions

Text Books:

1. David A Patterson, John L Hennessy, "Computer Organization and Design: The Hardware/Software Interface", 5th Edition, Morgan Kaufmann / Elsevier, 2014.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", 6th Edition, Tata McGraw Hill, 2012.

References:

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", 8th Edition, Pearson Education, 2010.
2. John P Hayes, "Computer Architecture and Organization", 3rd Edition, Tata McGraw Hill, 2012.
3. John L Hennessey, David A Patterson, "Architecture – A Quantitative Approach", 5th edition, Morgan Kaufmann, Elsevier, 2012.
4. Morris Mano M, "Computer System Architecture", Revised 3rd Edition, Pearson Publication, 2017.
5. Chakraborty P, "Computer Architecture and Organization", JAICO Publishing House, 2010.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3					-					
CO2	3	2	3			-					
CO3	3	2	3			-					
CO4	3	2	2		2	-					
CO5	2	1			2	-					
CO6	3	2	3	2		-					
Avg.	**2.8**	**1.8**	**3**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**

1 - low, 2 - medium, 3 - high, '-"- no correlation

IT24411	**Web Essentials**	**BSC**	**L**	**T**	**P**	**C**
			3	**0**	**2**	**5**

Course Objectives:

- Understand web architecture and protocols like HTTP, clients, and servers.
- Create styled web pages using HTML, XHTML, CSS, and XML.
- Use JavaScript and DOM for dynamic and interactive web content.
- Build server-side applications using Servlets and JSP.
- Work with XML, AJAX, and Web Services for data exchange and integration.

UNIT I WEB ESSENTIALS & MARKUP LANGUAGES 9

Web Architecture: Clients, Servers, and Communication – Internet Protocols – World Wide Web – HTTP Request & Response – Web Clients and Web Servers. Markup Languages: Introduction to HTML – History and Versions – Syntax and Semantics – Fundamental Elements – Lists, Tables, Forms, Frames – Relative URLs – HTML5 Semantics. XHTML and XML: Introduction – Syntax – Differences between HTML, XHTML, and XML – Creating Web Documents using HTML & XML.

UNIT II CLIENT-SIDE PROGRAMMING 9

CSS Styling: Introduction to CSS – Syntax – Box Model – Positioning – Flexbox & Grid – Responsive Design Principles – Style Inheritance – Case Study: Responsive Layout. JavaScript Programming: Syntax, Variables, Data Types – Statements – Functions – Arrays – Objects – Events – Built-in Objects – Debugging.
Modern UI Tools: Introduction to Canva – UI/UX Prototyping – Integration into Web Design Workflow.

UNIT III DOM AND SERVER-SIDE PROGRAMMING 9

Document Object Model (DOM): DOM Levels and History – Document Tree – Event Handling – Dynamic Style Updates – Noncompliant Browser Handling – window Object – Case Study.
Server-side Technologies: Java Servlets – Architecture – Life Cycle – Sessions – Cookies – URL Rewriting – Data Persistence. Scripting Languages: Introduction to PHP – Syntax – Form Handling – File I/O – Server-side Validation – Comparison with Java Servlet

UNIT IV WEB DATA PROCESSING & APPLICATION FRAMEWORKS 9

Data Representation & XML: XML Syntax and Vocabularies – Namespaces – XML with JavaScript – AJAX – DOM-based XML – SAX Parsing – XPath – XSLT – Displaying XML – Case Study. Server-side Frameworks: JSP – JavaBeans – Tag Libraries – MVC Pattern. Python Frameworks: Introduction to Flask and Django – URL Routing – Templates – Form Handling – Database Connectivity – Comparison with JSP.

UNIT V WEB SERVICES, REST APIs & WEB FRAMEWORKS 9

Web Services & APIs: RESTful Services – JSON vs XML – HTTP Methods – API Authentication (Tokens, Headers) – Introduction to OpenAPI/Swagger. Modern Front-End Frameworks: Introduction to ReactJS and Angular – Components – Props – State Management – Routing – Single Page Application Overview.
E-Commerce Concepts: Architecture – Shopping Cart – Payment Integration – Security – Mini Case Study: Online Storefront Design.

Total Periods:45

LIST OF EXPERIMENTS:

1. Create a Personal Profile Webpage using HTML & CSS
2. Design a Student Registration Form with HTML5 and JavaScript Validation
3. Build a Responsive Webpage Layout using CSS Box Model and Flexbox
4. Create a Dynamic To-Do List using JavaScript and DOM Manipulation
5. Design a Web UI Prototype using Canva
6. Create and Validate an XML File with XSD
7. Use AJAX to Load Server Data and Update the DOM
8. Develop a JSP Page to Display User Input from a Form
9. Create a Simple Flask App with Form Submission
10. Implement a Login System using Java Servlets (Session Management)

Total Periods:30

Total Periods: 75 Hours

Course Outcomes:

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

CO1: Explain the architecture of the web, HTTP protocol, and structure of HTML/XML documents.

CO2: Design structured and styled static web pages using HTML5, CSS, and visual tools like Canva

CO3: Build server-side applications using Java Servlets, JSP, and scripting languages like PHP and Flask.

CO4: Build server-side applications using Java Servlets and JavaServer Pages (JSP) to handle dynamic content, session management, and user data.

CO5: Use AJAX, XML, XSLT, and XPath to process, transform, and retrieve structured web data.

CO6: Develop RESTful web services, implement front-end frameworks (React/Angular), and understand e-commerce systems.

Suggested Activities:

- Conduct a group discussion or mini-presentation on how HTTP works
- Conduct a peer review activity where students test and critique each other's pages.
- Conduct a demo session on SOAP request/response

TEXT BOOK:

1. Jeffrey C.Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2				-					
CO2	2	2	2		3	-			2		
CO3	3	3	3		3	-			2		
CO4	3	2	3	2	3	-			2		
CO5	2	3	3	3	3	-			2		
CO6	3	3	3	3	3	-			2		
Avg.	**2.7**	**2.5**	**3**	**2.7**	**3**	**0**	**0**	**0**	**2**	**0**	**0**

1 - low, 2 - medium, 3 - high, '-"- no correlation

CS24322	**Database Management Systems Laboratory**	**PCC**	**L**	**T**	**P**	**C**
			0	0	3	1.5

Course Objectives:

- To learn and implement important commands in SQL.
- To learn the usage of nested and joint queries.
- To understand functions, procedures and procedural extensions of databases.

- To understand design and implementation of typical database applications.
- To be familiar with the use of a front end tool for GUI based application development.

LIST OF EXPERIMENTS:

1. Create a database table, add constraints (Primary Key, Unique, Check, Not Null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create a set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different 'where' clause conditions, implement aggregate functions and set operations.
4. Query the database tables to explore sub queries and join operations.
5. Write user defined functions and stored procedures in SQL.
6. Execute complex transactions and realize DCL and TCL commands.
7. Write SQL Triggers for insert, delete, and update operations in a database table.
8. Create PL/SQL code to demonstrate the purpose of implicit and explicit cursors.
9. Write PL/SQL code to trap a predefined and non-predefined Oracle Server error.
10. Create View and Index for database tables with a large number of records.
11. Create an XML database and validate it using XML schema.
12. Create Document, column and graph based data using NOSQL database tools.
13. Develop a simple GUI based real life database application from the following list
    a) Inventory Management for a EMart Grocery Shop
    b) Society Financial Management
    c) Cop Friendly App – Eseva
    d) Property Management – eMall
    e) Star Small and Medium Banking and Finance

    and perform the following operations
    - Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
    - Apply Normalization rules in designing the tables in scope.
    - Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
    - Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.
    - Ability to showcase ACID Properties with sample queries with appropriate settings

Total Periods: 45

Course Outcomes:

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

CO1: Create and manipulate relational database tables using SQL DDL and DML commands, incorporating key constraints and referential integrity.
CO2: Develop and execute SQL queries involving conditional statements, aggregate functions, set operations, subqueries, and various types of joins.
CO3: Implement database programming constructs such as user-defined functions, stored procedures, triggers, and cursors using PL/SQL.
CO4: Apply transaction control and data control operations using DCL and TCL commands to ensure data integrity and access control.
CO5: Design and manage data using semi-structured (XML) and NoSQL (document, column, and graph-based) databases.
CO6: Design and develop GUI-based real-time database applications using advanced features like entity modeling, normalization, triggers, and stored procedures.

References:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2020.
2. Feuerstein, Steven, and Bill Pribyl. “Oracle PL/SQL Programming”, 6th ed., O'Reilly Media, 2014.
3. Sadalage, P. J., & Fowler, M., “NoSQL distilled: A brief guide to the emerging world of polyglot persistence”, Addison-Wesley, 2013.

Laboratory Requirements:

1. INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17” or higher TFT Monitor, Keyboard and mouse
2. Windows 10 or higher operating system / Linux Ubuntu 20 or higher
3. Oracle Database 12 or higher, MySQL 5.7 or higher versions, SQL Server 2022(16.x)

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2	2	2	-					2
CO2	3	3	2	2	2	-					2
CO3	3	2	3	2	3	-				1	2
CO4	3	2	2	2	2	-					2
CO5	3	2	2	2	3	-				1	2
CO6	3	3	3	2	3	2		2		3	3
Avg.	**3**	**2.3**	**2**	**2**	**3**	**2**	**0**	**2**	**0**	**1.7**	**2.2**

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

CS24421	**Operating Systems Laboratory**	**PCC**	**L**	**T**	**P**	**C**
			0	**0**	**3**	**1.5**

Course Objectives:

- Provide hands-on experience in understanding operating system concepts.
- Familiarize students with system calls, process management, and scheduling techniques.
- Enable students to implement memory management and file system operations.
- Demonstrate synchronization techniques using semaphores and threads.
- Train students to simulate deadlock prevention, avoidance, and detection strategies.
- Explore disk scheduling and virtualization through real-world tools and C programming.

LIST OF EXPERIMENTS:

1. Execute basic UNIX/Linux shell commands.
2. Develop simple shell scripts for automation tasks.
3. Write C programs to demonstrate process creation and management using fork(), exit(), getpid(), wait(), and close() system calls.
4. Develop C programs to simulate various CPU scheduling algorithms:
    i. First-Come, First-Served (FCFS)
    ii. Shortest Job First (SJF)
    iii. Priority Scheduling
    iv. Round Robin (RR)
5. Implement IPC mechanisms such as pipes, shared memory, and message queues.
6. Write C programs to achieve mutual exclusion using semaphore primitives.
7. Implement Banker's Algorithm in C to prevent deadlock scenarios.

8. Develop a C program to detect deadlocks using deadlock detection algorithm.
9. Write C programs to create and manage multiple threads using POSIX threads (pthreads).
10. Develop C programs to demonstrate:
    i. First Fit
    ii. Best Fit
    iii. Worst Fit memory allocation methods.
11. Write C programs to simulate page replacement policies:
    i. FIFO (First-In-First-Out)
    ii. LRU (Least Recently Used)
    iii. Optimal Page Replacement.
12. Simulate disk scheduling strategies like:
    i. FCFS
    ii. SSTF (Shortest Seek Time First)
    iii. SCAN
    iv. C-SCAN.

Total Periods: 45

Course Outcomes:

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

CO1: Demonstrate basic UNIX/Linux commands and shell scripting.
CO2: Apply system calls to create, manage, and synchronize processes and threads in C.
CO3: Implement and analyze various CPU scheduling algorithms and IPC techniques.
CO4: Develop programs to simulate deadlock handling and synchronization.
CO5: Simulate memory allocation methods, paging techniques, and page replacement algorithms.
CO6: Implement disk scheduling techniques using C.

References:

1. https://man7.org/linux/man-pages/
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts, 10th Edition, Wiley, 2018.
3. Andrew S. Tanenbaum, Modern Operating Systems, 5th Edition, Pearson, 2022.
4. William Stallings, Operating Systems: Internals and Design Principles, 7th Edition, Prentice Hall, 2018.

Laboratory Requirements:

1. INTEL based desktop PC with min. 8GB RAM and 500 GB HDD, 17” or higher TFT Monitor, Keyboard and mouse
2. Windows 10 or higher operating system / Linux Ubuntu 20 or higher
3. Linux Ubuntu 20 or higher
4. DevC++ / Eclipse CDT / Code Blocks / CodeLite / equivalent open source IDE

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	1	3	1	1	-		1	3	3	3
CO2	3	1	1	2	2	-		3	2	1	1
CO3	3	3	2	1	2	-		3	3	1	2
CO4	1	2	2	3	2	-		3	1	3	1
CO5	2	2	1	1	3	-		1	2	2	3
CO6	2	2	2	1	3	-		2	2	2	3
Avg.	**2.3**	**1.8**	**2**	**1.5**	**2**	**0**	**0**	**2.2**	**2.2**	**2**	**2.2**

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

HS24321	Communication Skills Building Laboratory	HSMC	L	T	P	C
			0	0	2	1

Course Objectives:

- Develop the ability to construct grammatically correct and contextually appropriate sentences
- Enhance critical thinking skills for analyzing and interpreting texts, media, and experiences
- Strengthen comprehension, summarization, and documentation skills for professional contexts
- Improve verbal and non-verbal communication for effective interaction in diverse professional settings
- Equip learners with teamwork, networking, and interview skills essential for career advancement
- Enable the creation of a professional digital identity through resumes, LinkedIn profiles, and self-presentation techniques

UNIT I THE ART OF DISCOURSE 6

Listening: Listen to stand-up comedy, political commentaries, and campaigns for appreciative listening.
Reading: Read and evaluate business and economic news articles; determine tone (neutral, positive, negative) and fact-check.
Writing: Craft commentary and opinion pieces to persuade or provoke discussion.
Speaking: Explain satire comic strips (e.g., Amul advertisements, political cartoons)

UNIT II PROFESSIONAL COMMUNICATION ESSENTIALS 6

Listening: Listen to voicemail, messages, and fill out forms.
Reading: Compare products & services; analyze advertisements.
Writing: Draft meeting agendas and minutes.
Speaking: Engage in open-field group discussions.

UNIT III DOCUMENTATION AND SUMMATION 6

Listening: Listen to documentaries, book summaries, and movie summaries for comprehensive understanding.
Reading: Read and analyze reports on significant events (e.g., environmental disasters, economic downturns).
Writing: Write survey reports and paraphrase key information.
Speaking: Report news, weather forecasts, and predictions.

UNIT IV REFINING PROFESSIONAL COMPETENCE 6

Listening: Translate informal language into formal business communication (Contextual translation)
Reading: Read and interpret technical texts and industry-specific jargon.
Writing: Write cover letters and statements of purpose.
Speaking: Role-play professional etiquette in workplace scenarios (e.g., expressing empathy, kindness, courtesy).

UNIT V DEVELOPING A PROFESSIONAL PROFILE 6

Listening: Listen to podcasts, Josh Talks, and professional interviews.
Reading: Analyze professional resumes and LinkedIn profiles.

Writing: Set up a LinkedIn profile and write engaging posts.
Speaking: Conduct mock interviews and deliver an effective elevator pitch.

Total Periods:30

Course Outcomes:
CO1: Construct coherent and professional sentences tailored to various workplace scenarios
CO2: Analyze and critically interpret professional texts and multimedia content
CO3: Document, summarize, and report information effectively across multiple formats
CO4: Communicate effectively in professional and social interactions
CO5: Demonstrate teamwork, networking, and interview skills relevant to career development
CO6: Curate a professional online presence through resume development - LinkedIn, Indeed.

Suggested Activities

- Documentation and Summation

Assignment: Newsroom Simulation

- Students record a 2-minute news report on an environmental/economic issue.
- Must include paraphrased content from real news reports (cite sources).
- Submission: Video + written news script.
- Group Discussion
- Refining Professional Competence

Assignment: Corporate Dilemma Roleplay

- Scenario-based role play on professional etiquette (handling client complaints, rejecting proposals kindly, etc.).
- Each student submits a formal email responding to the scenario professionally.
- Developing a Professional Profile

Assignment: LinkedIn Challenge (30 Marks)

- Students create or optimize their LinkedIn profile and write a compelling post (e.g., career reflections, lessons from a recent project).
- Submit a screenshot of updated profile + link to post.
- Optional: Engage with at least three classmates' posts with meaningful comments.

Text Books:

1. English for Engineers and Technologists. Volume I by Orient Blackswan, 2022
2. English for Science & Technology - I by Cambridge University Press, 2023

References:

1. **Seely, John.** Oxford Guide to Effective Writing and Speaking: How to Communicate Clearly. Oxford University Press, 2013.
2. **Cottrell, Stella.** Critical Thinking Skills: Developing Effective Analysis and Argument. Bloomsbury Academic, 2017.
3. **Bhatnagar, Nitin.** Communicative English for Professional Courses. Pearson, 2010.
4. **Guffey, Mary Ellen, and Dana Loewy.** Essentials of Business Communication. Cengage Learning, 2021.
5. **Collins, Patrick.** Speak with Power and Confidence: Tested Ideas for Becoming a More Powerful Communicator. Prentice Hall, 2009.
6. **Locker, Kitty O., and Stephen Kyo Kaczmarek.** Business Communication: Building Critical Skills. McGraw-Hill, 2020.

MAPPING OF COs WITH POs

COs	POs										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11

CO1						1	1	1	1	1	
CO2		1		1		-		1	1		1
CO3						-			1		1
CO4						-	1	1	1		
CO5						-		1	1		1
CO6						-					1
Avg.	**0**	**1**	**0**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**1**

1 - low, 2 - medium, 3 - high, '-"- no correlation

IT24423	**Project Driven Learning**	**EEC**	**L**	**T**	**P**	**C**
			0	**0**	**2**	**1**

Course Objectives:

- Apply Design Thinking & Problem-Solving Techniques
- Develop and Implement a Structured Project Plan
- Build Functional Prototypes & Minimum Viable Products (MVPs)
- Evaluate Performance & Optimize Solutions
- Present and Deploy Innovative Solutions

UNIT I IDEATION & PROBLEM IDENTIFICATION 6

- Icebreaker & Team Formation
  - Tools: Miro, MURAL
- Brainstorming Sessions (Design Thinking, Mind Mapping)
  - Tools: Miro, XMind, Lucidchart
- Understanding User Needs & Problem Validation
  - Tools: Google Forms, Typeform
- Conducting Market Research & Competitor Analysis
  - Tools: Google Trends, Statista, Crunchbase

UNIT II SOLUTION CONCEPTUALIZATION & PLANNING 6

- Exploring Feasible Solutions (Convergent Thinking)
  - Tools: Miro, FigJam
- Selecting the Tech Stack & Tools
- Creating a Project Timeline (Agile/Scrum Basics)
  - Tools: Jira, Trello
- Sketching Wireframes, Flowcharts, or System Diagrams
  - Tools: Figma, Lucidchart
- Risk Analysis & Contingency Planning
  - Tools: SWOT Analysis Templates, Risk Assessment Matrix

UNIT III PROTOTYPING & IMPLEMENTATION 6

UNIT IV PERFORMANCE METRICS, BENCHMARKING & OPTIMIZATION 6

- Defining Key Performance Metrics (KPIs) for the Project
  - Tools: Google Analytics
- Setting Industry Benchmarks & Performance Goals
- Conducting Functional & Usability Testing
  - Tools: Selenium

- Analyzing System Performance & Bottleneck Detection
- Optimizing Code, UI/UX, and Resource Utilization

UNIT V PRESENTATION & DEPLOYMENT 6

- Crafting a Compelling Pitch (Storytelling, Business Model)
    - Tools: Business Model Canvas, Pitch Deck Templates (Canva, Google Slides)
- Creating a Demo
- Pitching & Receiving Feedback from Mentors/Peers
- Deploying/Publishing the Project
    - Tools: GitHub Pages
- Showcasing the Final Product & Reflection

Periods: 30

Course Outcomes:

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

- Finalize a well-defined problem statement and identify key stakeholders
- Develop a structured project plan, defining goals, tech stack, and execution roadmap
- Build a functional prototype with key features working
- Establish clear performance benchmarks, conduct thorough testing, and optimize their project for efficiency, usability, and scalability.
- Successfully present and deploy their projects
- Demonstrate end-to-end project development skills**,** integrating problem-solving, technical implementation, optimization, and presentation to create impactful solutions

Learning Links:

1. Miro Basics
2. Lucidchart Tutorials
3. Figma Wireframing Guide
4. Trello Agile Basics
5. GitHub Basics
6. GitHub Pages Deployment

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2			2	1	2	2	2	2
CO2	2	2	3	1	2	-		2	2	3	2
CO3	3	3	3	2	3	-		2	2	2	2
CO4	3	3	3	3	3	-				2	2
CO5	2	2	2		2	1	1	3	3	2	2
CO6	3	3	3	2	3	2	1	3	3	3	3
Avg.	**2.7**	**2.5**	**3**	**2**	**3**	**1.7**	**1**	**2.4**	**2.4**	**2.3**	**2.2**

1 - low, 2 - medium, 3 - high, '-"- no correlation

IT24501	**Computer Networks**	**PCC**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:

- To understand the layered architecture and protocol functions in computer networks
- To learn the operation of Transport and network layer protocols, including addressing and routing
- To analyze routing algorithms and various routing protocols used in networking
- To comprehend the working of key application layer protocols for communication and network services
- To familiarize with data link and physical layer protocols including media access control and transmission techniques

UNIT I INTRODUCTION AND APPLICATION LAYER 9

Data Communication and Networks Overview– Network Types and Protocol Layering Concepts – TCP/IP Protocol suite – OSI Model – Introduction to Sockets - Application Layer protocols: HTTP – FTP – Email protocols (SMTP - POP3 - IMAP - MIME) – DNS – SNMP

UNIT II TRANSPORT LAYER 9

Introduction - Transport-Layer Protocols: UDP – TCP: Connection Management – Flow control - Congestion Control - Congestion avoidance (DECbit, RED) – SCTP – Quality of Service

UNIT III NETWORK LAYER 9

Switching Techniques: Circuit Switching-Packet Switching-Message Switching- Internet protocol - IPV4 – IP Addressing – Subnetting, CIDR - IPV6, ARP, RARP, ICMP, DHCP

UNIT IV ROUTING 9

Introduction to Routing- Routing algorithms: Distance Vector Routing- Link State Routing – Path vector routing - Unicast Routing protocols: RIP- OSPF- BGP - Multicast Routing: DVMRP – PIM-Hybrid Routing: EIGRP-Routing Security

UNIT V DATA LINK AND PHYSICAL LAYERS 9

Data Link Layer – Framing- Error control – Data-Link Layer Protocols – HDLC – PPP - Media Access Control – Ethernet Basics – CSMA/CD – Virtual LAN – Wireless LAN (802.11) - Physical Layer: Data and Signals- Transmission media

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to
CO 1: Describe the different layers of computer networks and their main functions.
CO 2: Explain how data is transferred using transport layer protocols like TCP and UDP.
CO 3: Identify how IP addressing and device discovery work in networks.
CO 4: Compare different routing methods to determine how data finds the best path.
CO 5: Summarize key application layer protocols used for web, email, and other network services.
CO 6: Illustrate the basic concepts of data link and physical layer protocols including Ethernet and wireless networks.

Suggested Activities
- Engage in a project where students simulate a small computer network using tools like Cisco Packet Tracer or GNS3, including IP addressing, routing, and application layer communication (e.g., HTTP, DNS).

- Develop a tool or web app that demonstrates how data flows through each layer of the OSI or TCP/IP model. Include animations for: Encapsulation/decapsulation, Protocol headers, Real-life examples (like browsing a website or sending an email)
- Create a command-line or web-based tool that takes an IP address and subnet mask as input and returns: Network address, Broadcast address, Number of usable hosts, First and last host addresses
- Build a simple Python-based DNS resolver that simulates the query process from the local cache to the root server.
- Design a simple email client that mimics SMTP, POP3, and IMAP behavior. This could include sending/receiving dummy emails to visualize how application layer protocols interact.
- Make a mini tool (command-line or GUI) that performs basic network troubleshooting tasks: Ping, Traceroute, DNS lookup, Port scanning
- Smart Home Network Design (simulate routing, wireless, and IP configuration for IoT devices)

Text Books:

1. Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022.
2. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021.

References:

1. Andrew S Tanenbaum, Nick Feamster and David J Wetherall, “Computer Networks”, Sixth Edition, Pearson Education, 2022.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Sixth Edition, Morgan Kaufmann Publishers Inc., 2022.
3. William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2017.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3	1	2	1	-	2	-	1	3
CO2	3	3	2	3	1	-	-	-	-	1	3
CO3	3	3	3	3	1	-	-	2	-	-	3
CO4	3	3	3	3	1	-	-	1	3	1	3
CO5	3	3	2	3	1	2	-	2	-	2	3
CO6	3	2	2	2	1	1	-	1	1	1	3
Avg.	3	3	3	3	1	1	-	2	2	1	3

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

GE24501	PROJECT MANAGEMENT AND OPERATIONS MANAGEMENT	PCC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the fundamental concepts, roles, and lifecycle of project management
- To equip learners with planning, scheduling, and control techniques
- To introduce software project management methodologies and modern development frameworks
- To provide knowledge of operations management principles
- To familiarize students with quality management practices and sustainable operational strategies

UNIT I Fundamentals of Project Management **6**

Understanding Project Management – Project Management Role – Classification of Projects – Product Vs Project Management – Project Lifecycle – Project Risk Management – Case Studies: LP Manning Corporation and Project Firecracker

UNIT II Project Planning, Scheduling and control **6**

Project planning process and Work Breakdown Structure (WBS) – Project scheduling techniques: Gantt chart, PERT, CPM – Resource allocation – Project budgeting and cost estimation – Project Management Information Systems (PMIS) and software tools (MS Project, Primavera)

UNIT III Software Project Management and process models **6**

Software Process Models : Waterfall Model, Prototyping Model, RAD Model, Incremental Model, Spiral Model, Agile Fundamentals - Scrum Framework

UNIT IV Operations Management and inventory control **6**

Production systems, Classification of Production systems, Operations system, Operations Management - Definition, Objectives, Strategic role of operations, Strategic Planning, Inventory control or management - Inventory, Objectives of inventory control, benefits, techniques (EOQ, JIT, ABC analysis)

UNIT V Quality management and Sustainable Operations **6**

Quality Management: Preventive Vs Breakdown maintenance for Quality – Techniques for measuring quality - Supply chain management – Lean operations and Six Sigma overview - Quality management concepts – TQM, ISO standards, Indian standards, Kaizen, 5S

Periods: 30 PERIODS

Course Outcomes:

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

CO1: To comprehend the fundamental concepts of project management, including project lifecycle and risk management
CO2: Apply project planning and scheduling techniques such as WBS, Gantt charts, PERT, and CPM
CO3: Analyze and compare various software process models including Waterfall, Spiral, Agile, and Scrum frameworks.
CO4: Apply operations management principles and inventory control techniques such as EOQ, JIT, and ABC analysis in practical scenarios.

CO5: Evaluate quality management practices using tools such as TQM, Six Sigma, Kaizen, and ISO standards
CO6: Design and develop integrated solutions by combining project management, operations strategies, and quality frameworks

Suggested Activities

- Interactive lectures and discussions
- Case studies from engineering and industrial projects
- Hands-on workshops on PERT/CPM using software tools
- Group projects on planning and evaluating an engineering project
- Industry expert talks on project execution and operations excellence

Text Books:

1. Kerzner, H. (2018). Project Management: A Systems Approach to Planning, Scheduling and Controlling. Wiley.
2. Chandra, Prasanna. (2017). Projects: Planning, Analysis, Selection, Financing, Implementation and Review. McGraw Hill Education.
3. Anil Kumar, S. & Suresh, N. (2018). Operations Management. New Age International Publishers.
4. Robert Hughes and Mike Cotterell (2009). Software Project Management. McGraw-Hill Higher Education.

References:

1. Dale H. Besterfiled, Carol B.Michna, Glen H. Bester field, MaryB.Sacre, Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.
2. Gray, C. F., & Larson, E. W. (2020). Project Management: The Managerial Process. McGraw Hill Education.
3. Jack R. Meredith & Samuel J. Mantel. (2019). Project Management: A Managerial Approach. Wiley India.
4. Bhavesh. M Patel, Sandhya Rai, J.S Chandan, Dr. A. Nag, Project Management, Vikas Publishing House, New Delhi, 2020.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	3			
CO2	3	3	2	2	-	-	-	-	-	-	3			
CO3	3	3	2	2	-	-	-	-	-	-	3			
CO4	3	3	2	2	-	-	-	-	-	-	3			
CO5	3	3	2	2	-	-	-	-	-	-	3			
CO6	3	3	3	2	-	-	-	-	-	-	3			
Avg.	3	3	2	2	-	-	-	-	-	-	3			

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

IT24411	Software Engineering	PCC	L	T	P	C
			3	0	2	4

Course Objectives:

- Understand the fundamental concepts, layered technology, and process frameworks in software engineering.
- Explore software process models and agile methodologies for effective project management.
- Analyze and specify software requirements through structured documentation and modeling.
- Apply architectural and design principles using UML and software design patterns.
- Develop and evaluate testing strategies, coding standards, and maintenance processes.
- Integrate software engineering tools and documentation techniques through hands-on project development.

UNIT I INTRODUCTION TO SOFTWARE ENGINEERING 10

The evolving role and changing nature of software - Software engineering as a layered technology – process framework- Software Project Management: life cycle activities, project initiation (Project Charter, Scope, Objectives)- Process Models: Waterfall, Incremental, Evolutionary, Unified Process- Agile methodologies: XP, Scrum – comparison with traditional models -Overview of UML and its role across software processes

UNIT II SOFTWARE REQUIREMENTS 9

Functional and Non-functional requirements - User, System, and Interface specifications -Software Requirements Specification (SRS) document - Requirements Engineering Process: Feasibility study, Elicitation, Analysis, Validation, Management - Cost and Effort Estimation: COCOMO I, COCOMO II, LOC, Function Point Metrics - UML Diagrams for Requirements Modeling: Use Case Diagrams, Activity Diagrams

UNIT III SOFTWARE DESIGN AND UML MODELING 10

Design fundamentals, design concepts, and design heuristics- Design models: Data design, architectural design, interface design, component-level design - Architectural styles and patterns - UML in Design: Class Diagram, Object Diagram, Sequence Diagram, Collaboration Diagram, State chart Diagram, Component Diagram, Deployment Diagram.

UNIT IV SOFTWARE CONSTRUCTION AND TESTING 7

Coding Standards, Frameworks, and Code Documentation **-** Code Review Techniques: Desk checks, Walkthroughs, Inspections -Testing Strategies: Unit, Integration, Validation, System Testing - Black-box and White-box Testing Approaches - Debugging and Test Automation Overview

UNIT V PRODUCT AND RISK MANAGEMENT 9

Product Release Management - Software Risk Management: Reactive vs Proactive risk strategies - Risk Identification, Analysis, Projection, and Refinement - RMMM (Risk Mitigation, Monitoring, and Management) Plan - Software Maintenance and Reengineering Concepts - Software Configuration Management and Version Control Tools

Total Periods: 45

LIST OF EXPERIMENTS:

1. Identify the Software Project, Create Business Case, and Problem Statement
2. Analyse Stakeholders and Select Appropriate Process Model
3. Identify Requirements and Prepare SRS Document
4. Project Planning: Scope, Roles, Effort Estimation
5. Work Breakdown Structure and Risk Identification Plan
6. System Architecture, Use Case and ER Diagrams
7. Data Flow Diagram (DFD) and Class Diagram
8. Sequence, Collaboration, Activity, and State Chart Diagrams
9. Component and Deployment Diagrams
10. UI/UX Prototype Design
11. Sample Code Implementation
12. Master Test Plan and Test Case Design
13. Manual Testing and Debugging
14. User Manual and Cost-Effort Analysis

Total Periods: 30

Course Outcomes:

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

CO1: Identify the process of project life cycle model and process
CO2: Analyse and translate end-user requirements into system and software requirements
CO3: Identify and apply appropriate software architectures and UML design patterns for high-level system design
CO4: Develop test plans and incorporate suitable testing strategies
CO5: Examine risk strategies and maintenance measures in software projects
CO6: Prepare comprehensive project documentation including SRS, design models, test plans, and cost–effort analysis through laboratory exercises.

Suggested Activities

- Analyze real-world software projects (e.g., online banking, e-commerce systems) to identify suitable process models.
- To develop Use Case, Class, and Sequence Diagrams for a sample system (e.g., Library Management).
- Students can prepare a mini test plan and identify black-box vs white-box test cases for a module.
- Hands-on use of tools like StarUML, Lucidchart, or Visual Paradigm for design and documentation.

Text Books:

1. Roger S. Pressman, *Software Engineering – A Practitioner's Approach*, 9th ed., McGraw Hill, 2023
2. Ian Sommerville, *Software Engineering*, 8th ed., Pearson Education, 2010
3. Rajib Mall, *Fundamentals of Software Engineering*, 4th ed., PHI Learning, 2014

References:

1. Ramesh Gopalaswamy, *Managing Global Projects*, Tata McGraw Hill, 2005
2. Ashfaque Ahmed, *Software Project Management: A Process-Driven Approach*, CRC Press, 2012
3. Walker Royce, *Software Project Management*, Pearson Education, 1999
4. Jim Smith, *Agile Project Management: Creating Innovative Products*, Pearson, 2008

MAPPING OF COs WITH POs AND PSOs

COs	POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-"- no correlation

CS24511 Artificial Intelligence and Machine Learning PCC L T P C

3 0 2 4

Course Objectives:

- Master fundamental AI principles, including intelligent agents, state-space search, and adversarial problem-solving.
- Understand core machine learning paradigms: supervised, unsupervised, and ensemble techniques.
- Build a theoretical and practical foundation in deep learning, including ANNs, CNNs, and LSTMs.
- Acquire practical skills for building and optimizing models using pipelines, validation, and hyperparameter tuning.
- Develop applied problem-solving skills by implementing and evaluating AI/ML algorithms on real-world datasets.

UNIT I FOUNDATIONS OF AI & INTELLIGENT AGENTS 11

Agents - Concept of Agents, PEAS, Types of agents; Problem Solving with Search Algorithms - Formulating problems, state-space search, Uninformed Search, Informed Search - Heuristics, Greedy Best-First Search, A* Search; Adversarial Search - Minimax algorithm, Alpha-Beta Pruning; Constraint Satisfaction Problems – eg. Cryptarithmetic.

UNIT II SUPERVISED LEARNING 11

Regression - Simple Linear Regression, Multiple Linear Regression, Regression Metrics - Mean Absolute Error (MAE), Mean Squared Error (MSE), and R-squared; Classification - Logistic Regression, Classification Metrics - Confusion Matrix, Precision, Recall, F1-Score, ROC/AUC; Naive Bayes classifier, Decision Trees, K-Nearest Neighbours, Support Vector Machines.

UNIT III ENSEMBLE TECHNIQUES & OPTIMIZATION 7

Ensemble Techniques, Random Forest, Gradient Boosting; Model Validation - Bias and Variance - overfitting and underfitting - K-Fold Cross Validation; Hyperparameter Tuning: GridSearchCV and RandomizedSearchCV

UNIT IV UNSUPERVISED LEARNING & DIMENSIONALITY REDUCTION 9

Unsupervised Learning : Clustering Algorithms - K- Means, Hierarchical Clustering; Association Rules –Apriori Algorithm; Dimensionality Reduction – Curse of dimensionality, Principal Component Analysis,Singular Value Decomposition (SVD)

UNIT V NEURAL NETWORKS 7

Neural Networks Basics –Perceptron – Multilayer perceptron – Activation Functions - Back Propagation – Deep Neural Networks – Hyperparameter tuning – Batch Normalization - Softmax Regression – Softmax classifier – Optimizers - Adam, SGD; Regularization and Dropout.

Total Periods: 45

LIST OF EXPERIMENTS:

1. Implement the A* search algorithm to find the shortest path in a grid.
2. Build an unbeatable AI for Tic-Tac-Toe using the Minimax algorithm.
3. Build and compare Linear Regression and Multiple Linear Regression. Evaluate with R^2 and MSE. Dataset: Boston Housing or California Housing dataset.
4. Build Decision trees and Random forests
5. Build a Support Vector Machine model.
6. Use K-Means (and the Elbow method) to cluster data. Analyze how their results differ. Dataset: Mall_Customers.csv.
7. Implement Principal component analysis
8. Build Deep learning NN models

Total Periods: 30

Course Outcomes:

On completion of the course, the students will be able to
CO1: Formulate and solve problems using informed and adversarial search algorithms.
CO2: Build, train, and evaluate supervised models using relevant performance metrics.
CO3: Implement and compare high-performance ensemble models like Random Forest and Gradient Boosting.
CO4: Construct and tune a scikit-learn Pipeline incorporating dimensionality reduction and clustering.
CO5: Design, build, and train a complete Convolutional Neural Network (CNN) for image classification, applying appropriate optimizers and regularization techniques.
CO6: Implement and apply advanced deep learning architectures, including LSTMs for sequential data analysis and transfer learning for computer vision tasks.

Suggested Activities
- Analyze real-world software projects (e.g., online banking, e-commerce systems) to identify suitable process models.
- To develop Use Case, Class, and Sequence Diagrams for a sample system (e.g., Library Management).
- Students can prepare a mini test plan and identify black-box vs white-box test cases for a module.
- Hands-on use of tools like StarUML, Lucidchart, or Visual Paradigm for design and documentation.

Text Books:
1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow (3rd Edition) by Aurélien Géron, O'Reilly Media.
2. Artificial Intelligence: A Modern Approach (4th Edition) by Stuart Russell and Peter Norvig, Pearson.

References:
1. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville, MIT Press.

2. Speech and Language Processing (3rd Ed.) by Dan Jurafsky and James. H. Martin, Pearson.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	1	2	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-"- no correlation

IT24521	**Networks Laboratory**	**PCC**	**L**	**T**	**P**	**C**
			0	**0**	**4**	**2**

Course Objectives:

- Learn how to create network programs using TCP and UDP sockets.
- Use tools like Wireshark to look at and understand network traffic.
- Practice simulating important network processes like flow control and congestion control.
- Understand and simulate network protocols like ARP, RARP, and routing protocols (RIP, OSPF).
- Set up and test different network devices like routers, switches, and hubs using simulations.

LIST OF EXPERIMENTS:

1. Practice different network commands like tcpdump, netstat, ifconfig, ping, nslookup and traceroute available in Windows and Linux Operating Systems
2. Program using TCP Sockets(echo client & server, Chat, Date & Time server/client)
3. Program using UDP Sockets(Simple DNS)
4. Analyze the Network traffic using Packet Analyser (Wireshark) and understand the various protocol headers
5. Simulate TCP flow control and congestion control mechanism using NS2/NS3/OPNET
6. Write a code simulating ARP /RARP protocols
7. Simulation of Distance Vector/ Link State Routing algorithm
8. Configure Dynamic Routing mechanism using RIP and OSPF protocols
9. Configure the network devices such as Router, Switch, Hub, Bridge, and Repeater by simulation
10. Simulation of an error correction code (like CRC)

Total Periods: 45

Course Outcomes:

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

CO1: Build basic network applications like chat programs and echo servers using TCP and UDP.
CO2: Capture and study network data to see how different protocols work.
CO3: Simulate how networks control data flow and handle congestion.
CO4: Write simple programs to show how ARP and RARP work.
CO5: Simulate routing methods and set up dynamic routing using RIP and OSPF.
CO6: Configure and test different network devices in a simulated environment.

References:

1. Behrouz A. Forouzan, Data Communications and Networking with TCP/IP Protocol Suite, Sixth Edition TMH, 2022.
2. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Featuring the Internet, Eighth Edition, Pearson Education, 2021.
3. Andrew S Tanenbaum, Nick Feamster and David J Wetherall, “Computer Networks”, Sixth Edition, Pearson Education, 2022.
4. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Sixth Edition, Morgan Kaufmann Publishers Inc., 2022.
5. William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2017.

Laboratory Requirements:

1. Intel-based PC with minimum 8 GB RAM, 500 GB storage, Windows 10 or Ubuntu 20+, VirtualBox or VMware
2. Use IDEs like Netbeans or Eclipse, network simulators (NS2/NS3/OPNET), Wireshark, and basic network tools for programming and analysis.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	1	2	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

FC24501	**Universal Human Values and Service Learning**	**HSMC**	**L**	**T**	**P**	**C**
			1	**0**	**1**	**2**

Course Objectives:

- To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

UNIT I **Introduction-Basic Human Aspiration, its fulfillment through All-encompassing Resolution** **3**

The basic human aspirations and their fulfillment through Right understanding and Resolution, Right understanding and Resolution as the activities of the Self, Self being central to Human Existence; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution

UNIT II **Right Understanding (Knowing)- Knower, Known & the Process** **3**

The domain of right understanding starting from understanding the human being (the knower, the experiencer and the doer) and extending up to understanding nature/existence – its interconnectedness and co-existence; and finally understanding the role of human beings in existence (human conduct).

UNIT III **Understanding Human Being** **3**

Understanding the human being comprehensively as the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Basis for harmony/contradiction in the self.

UNIT IV **Understanding Nature and Existence** **3**

A comprehensive understanding (knowledge) about the existence, Nature being included; the need and process of inner evolution (through self-exploration, selfawareness and self-evaluation), particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).

UNIT V **Understanding Human Conduct, All-encompassing Resolution & Holistic Way of Living** **3**

Understanding Human Conduct, different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with Allencompassing Resolution covering all four dimensions of human endeavor viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from Self to Nature and entire Existence

Outreach Activities **15**

- **Introduction to Service Learning (SL)** - Concept and meaning of Service Learning - History and Evolution of Service Learning - Dynamics of Service Learning - Understanding the idea of learning through service.
- **Understanding the process of Urbanization**- Process of Urbanization - Characteristics and issues of Urban Poor - Urban Social Problems - Slums: Types, Living Conditions, Challenges.
- **Cura personalis** - Identifying groups in the community such as women-children-youth-elders and persons with disabilities-Equipping with the skills to address issues such as Education, health, sanitation, Environment & livelihood issues.
- **Community Program Planning**: Identifying an issue - Need analysis - brainstorming solutions to the issues - content creation - tool selection - venue arrangements - resource mobilization - budgeting - implementation of the planned activity - documentation and reflection guided by the principle of Magis.

Total Periods: 30

Course Outcomes:

At the end of the course, the students will be able to

1. Evaluate the significance of value inputs in formal education and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Analyze the value of harmonious relationship based on trust and respect in their life and profession
4. Examine the role of a human being in ensuring harmony in society and nature.
5. Apply the understanding of ethical conduct to formulate the strategy for ethical life and profession.
6. Recognize the socio-economic conditions of the urban poor and the importance of urbanization.
7. Analyse the socio-economic conditions in the slums and compare it to the larger state and national level realities.
8. Identify the community needs
9. Implement a simple community outreach activity and prepare documentation and present reflections based on the field experience.

Suggested Activities

- Classroom discussions
- Self-assessment
- Peer assessment
- Socially relevant project
- Group Activities

Text Books:

1. R R Gaur, R Asthana, G P Bagaria, 2019 (2nd Revised Edition), A Foundation Course in Human Values and Professional Ethics. ISBN 978-93-87034-47-1, Excel Books, New Delhi.
2. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing, New Delhi, 2022.

References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986.
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya EkParichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
9. E G Seebauer& Robert L. Berry, 2000, Fundamentals of Ethics for Scientists &Engineers, Oxford University Press
10. M Govindrajran, S Natrajan& V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008. Science & Humanism – towards a unified worldview, P. L. Dhar & R. R. Gaur (1990), Commonwealth Publishers, New Delhi

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	3	-	-	-	-		
CO2	-	-	-	-	-	-	3	3	-	-	-	-		
CO3	-	-	-	-	-	-	3	3	3	3	-	-		
CO4	-	-	-	-	-	-	3	3	-	3	-	3		
CO5	-	-	-	-	-	-	3	3	-	-	-	3		
CO6	-	-	-	-	-	-	-	3	-	-	-	-		
Avg.	-	-	-	-	-	-	3	3	3	3	-	3		

1 - low, 2 - medium, 3 - high, '-' - no correlation

BS24502	Logical Reasoning and Aptitude Training	BSC	L	T	P	C
			2	0	0	1

Course Objectives:

- To develop foundational knowledge and skills in averages, percentages.
- To develop foundational knowledge and skills in problems on ages, ratios and proportions, time and work.
- To enable students to apply quantitative reasoning techniques to solve practical problems involving boats & streams, pipes & cisterns, trains.
- To enhance logical reasoning skills from series, venn diagrams, tables and graphs.
- To enhance logical reasoning skills and critical thinking.

UNIT I	QUANTITATIVE APTITUDE I	6

- **Averages:** Properties of Averages- Weighted Averages - Problems on Averages - Averages of Averages
- **Percentage:** Percentage Increase and Decrease - Finding Percentages - Percentage Change - Successive Percentage Changes - Percentage Comparisons
- **Permutations and Combinations:** Selection - Ordering - Arrangements

UNIT II	QUANTITATIVE APTITUDE II	6

- **Problems on Ages:** Formulating Equations Based on Age Statements - Solving Single-variable Age Problems - Solving Multi-variable Age Problems - Age Differences - Sum of Ages - Average Age - Age Ratios - Age Problems Involving Future and Past Scenarios
- **Ratios & Proportions:** Comparing Ratios - Proportions - Compound Ratios - Ratio and Proportion in Real-life Applications
- **Time & Work:** Work and Time Relationship - Work Efficiency - Combined Work - Work Rate - Fractional Work - Work and Wages - Real-life Applications

UNIT III	QUANTITATIVE APTITUDE III	6

- **Boats & Streams:** Speed of Boat in Still Water - Speed of Stream or Current - Upstream and Downstream Concepts - Relative Speed - Calculating Efficiency

- **Pipes & Cisterns:** Inlet and Outlet Pipes - Individual Rates of Pipes - Combined Efficiency - Problems Involving Leakage or Partials - Alternative Filling Scenarios - Pipes with Different Capacities - Applications in Real-life Scenarios
- **Problems on Trains:** Relative Speed of Trains - Crossing and Overtaking Problems - Meetings and Passing - Time and Distance Problems - Platform and Bridge Problems - Average Speed of Trains.

UNIT IV	**LOGICAL REASONING I**	**6**

- **Series:** Alphabet and Number Series - Odd Man Out Series – Puzzles and Patterns - Blood Relations - - Directional Sense Test.
- **Venn Diagrams:** Using Venn Diagrams for Logical Reasoning - Diagrammatic Representation of Data - Real-life Applications
- **Data-Interpretation and Data-Sufficiency:** Introduction to Data Interpretation - Types of Charts and Graphs - Calculations and Approximations - Percentage Calculations - Comparison and Analysis – Problem Solving Techniques

UNIT V	**LOGICAL REASONING II**	**6**

- **Non-verbal reasoning:** Pattern Recognition - Analogy and Classification - Series Completion - Spatial Orientation and Visualization - Cube and Dice Problems - Mirror and Water Image Problems - Analytical Reasoning with Diagrams
- **Syllogisms:** Types of Syllogisms - Categorical Syllogisms - Venn Diagram Representation - Rules of Inference - Types of Validity - Formal vs Informal Fallacies - Conditional Syllogistic Reasoning
- **Critical Thinking:** Understanding Arguments - Argument Structure - Logical Fallacies - Evidence and Reasoning - Counter arguments and Rebuttal - Assumptions and Implications - Creative Thinking - Contextual Understanding - Practice and Application

Total Periods: 30

Course Outcomes:

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

- Apply different techniques to solve problems including averages and percentages.
- Solve quantitative problems including ages, ratios and proportions, time and work.
- Solve quantitative problems, including boats & streams, pipes & cisterns and trains.
- Apply logical reasoning and draw conclusions from series, venn diagrams, tables and graphs.
- Apply logical reasoning, analyse information and draw conclusions.

Suggested Activities

- Mock test
- Skill Rack Practices
- Case Study Analysis**.**

Text Books:

1. Dr R S Aggarwal, “Quantitative Aptitude for Competitive Examinations”, S Chand and Company Ltd., 2025.
2. Dr R S Aggarwal, “A Modern Approach to Logical Reasoning”, S Chand and Company Ltd., 2022.

3. S. Sridhar, “Design and Analysis of Alogorithms”2nd Edition, Oxford University Press 2024.
4. Nishit K Sinha, “Quantitative Aptitude for the CAT” , 6th Edition, Pearson Publication 2024.
5. Abhijit Guha, “Quantitative Aptitude for all Competitive Examination”, 7th Edison, Mc Graw Hill Education 2020.
6. FACE, “ Aptipedia: Aptitude Encyclopaedia” 2nd Edition, Wiley India Pvt. Ltd., 2017.

References:

1. Arun Sharma, “Quantitative Aptitude for the CAT” 10th edition, Mc Graw-Hill Publishing, 2022.
2. Praveen R V, “Quantitative Aptitude and Reasoning”, 3rd edition, PHI Learning Pvt. Ltd., 2016.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	-	-	-	-	-	1			
CO2	3	3	1	-	-	-	-	-	1	-	2			
CO3	3	3	1	-	-	-	-	-	1	-	2			
CO4	2	3	-	2	2	-	-	-	1	-	1			
CO5	1	3	-	-	2	1	-	1	2	2	1			
Avg.	**2.4**	**2.8**	**1**	**2**	**1.6**	**1**		**1**	**1.25**	**2**	**1.4**			

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

GE24503	**Financial literacy**	**HSMC**	**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**

Course Objectives:

- Develop financial awareness among engineering students.
- Enable students to make informed decisions regarding personal finance, savings and investments.
- Equip learners with the skills to manage budgets, taxes, credit and debt efficiently.
- Provide knowledge on digital financial systems, fintech applications and entrepreneurship finance.
- Foster responsible financial behaviour and ethical decision-making.

UNIT I Introduction to Financial Literacy and Money Management 6

Meaning, need and importance of financial literacy - Basic financial concepts: income, expenses, assets, liabilities, cash flow - Financial goals and planning process - Budgeting for Skilled Money Management - Time value of money and inflation

UNIT II Banking and Digital Financial Systems 6

Process of Opening Bank Accounts - Types of bank accounts and their operation - Cheques, demand drafts, ATM, debit and credit cards - Digital banking: UPI, Internet banking, mobile banking, NEFT, RTGS, IMPS - Digital payment security and cyber safety - Role of RBI, NPCI and SEBI

UNIT III Saving and Investment Options 6

Difference between saving and investment - Risk and return concepts - Types of investment avenues: bank deposits, mutual funds, stocks, bonds, PPF, NPS, insurance, gold bonds, real estate - Government Schemes for Various Savings & Investment Options - Introduction to capital markets - Systematic Investment plan and portfolio diversification

UNIT IV Credit, Loans and Taxation 6

Concept of credit - Types of loans: education loan, vehicle loan, home loan, personal loan, Gold Loan - Understanding credit cards and managing debt - Credit score and its importance - Basics of taxation: income tax structure in India, PAN, TDS, filing IT returns - Tax Exemptions and Deductions

UNIT V Financial Planning, Entrepreneurship and Ethical Finance 6

Components of comprehensive financial planning - Retirement planning and insurance planning - Financial aspects of entrepreneurship and start-ups - Costing, pricing and break-even analysis for small businesses - Sustainable and ethical financial practices

Periods: 30 PERIODS

Course Outcomes:

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

CO1: Understand the fundamentals of personal and business finance.

CO2: Prepare personal budgets and financial plans.

CO3: Evaluate different saving and investment options.

CO4: Use digital tools and platforms for financial transactions and management.

CO5: Apply basic financial principles in entrepreneurial or career settings.

CO6: Effectively manage personal finances using financial literacy and planning skills.

Suggested Activities

- Hands-on sessions on budgeting and investment planning using Excel or Google Sheets/ Create a Daily Spending Diary/ Conduct a Money Management SWOT Analysis
- Mock Account Opening Activity/ Digital Payment Demonstration: Hands-on demo of UPI, NEFT, IMPS and online payment apps (without real transactions)
- Analysis of the Government Schemes/ Create a mock investment portfolio/ Review on FinTech innovations and investment apps

- Demonstrate mock IT return filing using a sample Form 16 and income data/ Compare education, housing and vehicle loans from 2–3 banks, highlighting interest rates, EMIs and eligibility.
- Create a personal financial plan including budgeting, insurance, investments and retirement goals/ Mini Start-Up Simulation: Groups design a simple business idea and calculate costing, pricing and break-even point using realistic figures.

Text Books:

1. Shalu Garg, "Personal Financial Planning", Sultan Chand & Sons, Educational Publishers New Delhi, First Edition: 2024.
2. Jack R. Kapoor, Les R. Dlabay, Robert J. Hughes, Melissa M. Hart, "Personal Finance", 14th edition, McGraw Hill LLC, 2023.
3. Financial Education Booklet, Securities and Exchange Board of India (SEBI), Mumbai, November 2020.
4. Banking Theory and Practice, Mahesh Kumar Sarva, Excel Books Private Limited, New Delhi.

References:

1. "Principles and Practices of Banking" – Indian Institute of Banking & Finance (IIBF)
2. Financial Education Handbook For New Entrants at Workplace, National Centre for Financial Education (NCFE), First Edition September 2024.
3. Tulsi Bharatbhai Raval, "Financial Planning", Study Guide Educational Publication, December 2021.
4. National Finance Olympiad, "Personal Finance Handbook", Pockvue Solutions Pvt. Ltd., Ed. 1, 2024 - 2025

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	3	-	-	-	1	-	2	-	3	3	-	-	-
CO2	-	3	-	-	2	1	-	-	2	3	3	-	-	-
CO3	-	3	-	-	3	1	2	-	2	3	3	-	-	-
CO4	-	-	-	-	3	1	2	2	2	3	3	-	-	-
CO5	-	-	-	-	2	1	2	2	2	3	3	-	-	-
CO6	-	2	-	-	-	1	2	3	2	3	3	-	-	-
Avg.	**-**	**2.75**	**-**	**-**	**2.5**	**1**	**2**	**2.25**	**2**	**3**	**3**	**-**	**-**	**-**

IT24601	Full Stack Web Development	PCC	L	T	P	C
			3	0	0	3

Course Objectives:

- Understand the architecture, components, and workflow of modern full stack web applications.
- Develop server-side applications using Node.js and Express.
- Design and integrate NoSQL databases using MongoDB.
- Build interactive client-side applications using Angular and React.
- Implement RESTful APIs and deploy complete MERN/MEAN stack applications.

UNIT I INTRODUCTION TO FULL STACK DEVELOPMENT 9

Web development overview – Client–Server model – Browser, Web Server, and Backend Services – MVC and MVVM architectures – Frontend vs Backend vs Full Stack – Overview of modern stacks: MEAN and MERN – Role of Node.js, Express, Angular, React, and MongoDB – RESTful architecture – Version control with Git and GitHub.

UNIT II SERVER-SIDE DEVELOPMENT WITH NODE.JS 9

Node.js environment setup – Asynchronous programming and event-driven architecture – Modules and NPM – File system and path modules – Handling HTTP requests and responses – REST API creation using Express – Middleware and routing – Error handling and logging

UNIT III DATABASES AND MONGODB 9

NoSQL overview – Comparison with relational databases – MongoDB installation and configuration – Data modeling with documents and collections – CRUD operations – Indexing and Aggregation – Authentication and authorization – Connecting MongoDB with Node.js – Building a complete data-driven backend.

UNIT IV FRONTEND DEVELOPMENT WITH ANGULAR 9

Angular framework overview – TypeScript basics – Components, templates, and modules – Data binding and directives – Services and dependency injection – Routing and navigation – HTTP client and consuming REST APIs – Form handling and validation – Application structure and build process.

UNIT V FRONTEND DEVELOPMENT WITH REACT 9

Introduction to React – JSX syntax – Components, props, and state – Hooks and lifecycle methods – React Router for navigation – Integrating RESTful APIs – Modularization and Webpack – Redux basics for state management – Building and deploying a MERN stack application.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to
CO1: Explain the architecture and workflow of full stack web applications.
CO2: Develop and deploy server-side web applications using Node.js and Express.
CO3: Design and manage databases using MongoDB and integrate them with backend systems.
CO4: Build dynamic and responsive frontend interfaces using Angular.
CO5: Develop and deploy modern React-based full stack applications (MERN stack).

Suggested Activities

- Mini REST API Development with Node.js and Express.
- Debugging and Error-Handling Activity
- Students develop a basic Angular/React frontend to fetch and display data from the backend REST API.

Text Books:

1. Brad Dayley, Brendan Dayley, Caleb Dayley, Node.js, MongoDB and Angular Web Development, 2nd Ed., Addison-Wesley, 2018.
2. Vasan Subramanian, Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, 2nd Ed., Apress, 2019.

References:

1. Chris Northwood, *The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer*, Apress, 2018.
2. Kirupa Chinnathambi, *Learning React: A Hands-On Guide to Building Web Applications Using React and Redux*, Addison-Wesley, 2018

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	1	2	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-"- no correlation

GE24502	**Entrepreneurship and International Business Market**	**HSMC**	**L**	**T**	**P**	**C**
			2	**0**	**0**	**2**

Course Objectives:

- Introduce the fundamental concepts of entrepreneurship, entrepreneurial traits, creativity and innovation.
- Develop the ability to generate, evaluate and transform innovative ideas into feasible business plans.
- Explain the legal forms of business organization and the importance of intellectual property rights for entrepreneurs.
- Impart knowledge on the nature of international entrepreneurship and strategies for entering and operating in global markets.
- Explain the principles of international entrepreneurship and the dynamics of international trade and foreign exchange markets.

UNIT I Fundamentals of Entrepreneurship 6

Concept and importance of entrepreneurship - Characteristics and types of entrepreneurs - Entrepreneurship vs. Intrapreneurship - Creativity and Entrepreneurship - Innovation - Types of Innovation - Entrepreneurial innovation. Entrepreneurial ecosystem – Components: Angels, Venture Capitalists, Maker Spaces, Incubators, Accelerators, Investors; Sources of finance – bootstrapping, venture capital, angel investors, government grants, crowdfunding; Stages of entrepreneurial process.

UNIT II Idea to Business Plan 6

Sources of new ideas - Techniques for generating ideas - Steps involved in assessing the business potential of an idea - Preparing a Business Plan - Pitching a Business Plan - Steps in Setting up a Small Business Enterprise.

UNIT III Legal Aspects of Business 6

Forms of Business Entity - Requirements for incorporation of a private or a public limited company - Introduction to Intellectual Property Rights: Patents, Trademarks, Copyright, Geographical Indication (GI), International Patents - IPRs and their importance - Importance of IP for start-ups. Patents - Types of Patents - Criteria for Patentability - Patent Process - Patent Infringement.

UNIT IV International Entrepreneurship 6

Nature of International Entrepreneurship - International Vs Domestic Entrepreneurship - Foreign Market Selection - Entrepreneurial Entry Strategies - Barriers to International Trade.

UNIT V International Trade and Foreign Exchange Markets 6

Interventionist and Free Trade Theories - Foreign Exchange - Aspects of Foreign Exchange Market - Major Foreign Exchange Markets - Foreign Exchange Trading Process.

Periods: 30 PERIODS

Course Outcomes:

On completion of the course, the students will be able to
CO1: Analyze entrepreneurial traits and apply creativity and innovation in entrepreneurial contexts.
CO2: Create viable business plans by generating, evaluating and developing entrepreneurial ideas.
CO3: Apply knowledge of business structures and protect innovations using intellectual property rights.
CO4: Analyze international business environments and formulate strategies for entering and sustaining in global markets.
CO5: Interpret trade theories, explain foreign exchange market operations and evaluate their impact on international business decisions.
CO6: Understand entrepreneurship concepts and apply them in domestic and international business contexts

Suggested Activities
- Business Ideation using Design Thinking/ Brainstorming innovative product/service ideas using mind-mapping or SCAMPER technique.
- Develop a mini business plan and pitch the plan/ Review and critique of a real-world business plan (available from start-up incubators).

- Patent infringement case study/ Role-play on registering a company and selecting appropriate legal structure.
- Study of an Indian company's international expansion/ Market research exercise: Identify potential foreign markets for a product/service.
- Analysis of real-world trade agreements and their impact on a business (e.g., India–US trade relations)/ Study of a company affected by currency fluctuations in international operations.

Text Books:

1. Arya Kumar (2012). *Entrepreneurship: Creating and leading an entrepreneurial organization*. Pearson Education, Inc.
2. Khanka, S. S. (2026). *Entrepreneurial development*. S. Chand & Company Ltd.
3. Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2020). Entrepreneurship. McGraw Hill Education.
4. Daniels, J. D., Radebaugh, L. H., & Sullivan, D. P. (2021). International Business: Environments and Operations. Pearson Education.
5. Kuratko, D. F. (2019). Entrepreneurship: Theory, Process and Practice. Cengage Learning.

References:

1. Rajeev Roy, Entrepreneurship, 3rd Edition Oxford

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	1	1	-	-	-	1	-	1	1	1	-	-	-
CO2	-	1	1	-	-	-	-	-	1	2	1	-	-	-
CO3	-	1		-	-	1	3	-	1	-	1	-	-	-
CO4	-	1	1	-	-	1	-	-	1	2	1	-	-	-
CO5	-	1		-	-	1	-	-	1	2	1	-	-	-
CO6	-	1	1	-	-	1	1	-	1	2	1	-	-	-
Avg.	-	1	1	-	-	1	1.7	-	1	1.8	1	-	-	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

CS24612	Embedded Systems and IoT	PCC	L	T	P	C
			3	0	2	4

Course Objectives:

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing, I/O devices to the processor.
- To introduce the evolution of the Internet of Things (IoT).
- To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open
- platform.
- To apply the concept of Internet of Things in real world scenario

UNIT I 8-BIT EMBEDDED PROCESSOR 9

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling

UNIT II EMBEDDED C PROGRAMMING 9

Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III IOT AND ARDUINO PROGRAMMING 9

Introduction to the Concept of IoT Devices – IoT Devices Versus Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output from Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS 9

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V APPLICATIONS DEVELOPMENT 9

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

Total Periods: 45

LIST OF EXPERIMENTS:

1. Write 8051 Assembly Language experiments using simulator.
2. Test data transfer between registers and memory.
3. Perform ALU operations.
4. Write Basic and arithmetic Programs Using Embedded C.
5. Introduction to Arduino platform and programming
6. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth)
7. Introduction to Raspberry PI platform and python programming
8. Interfacing sensors with Raspberry PI
9. Communicate between Arduino and Raspberry PI using any wireless medium
10. Setup a cloud platform to log the data
11. Log Data using Raspberry PI and upload to the cloud platform
12. Design an IOT based system

Total Periods: 30

Course Outcomes:

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

CO1: Understand the internal architecture, instruction set, and working principles of 8-bit embedded processors.

CO2: Develop programs in Embedded C for microcontrollers involving I/O interfacing, timers, and interrupt handling.
CO3: Demonstrate the integration of sensors and actuators with Arduino for real-time applications.
CO4: Compare various IoT communication models, APIs, and protocols used in embedded IoT systems.
CO5: Build and interface IoT applications using open platforms such as Arduino and Raspberry Pi.
CO6: Design, implement, and evaluate an end-to-end IoT system for real-world problems.

Suggested Activities

- Develop Embedded C programs for basic I/O interfacing (LED blinking, keypad scanning, LCD display).
- Compare IoT communication protocols (ZigBee, Bluetooth, Wi-Fi, GSM) using datasheets and practical demos.
- Implement IoT applications using Arduino and Raspberry Pi (e.g., temperature monitoring, light automation).
- Encourage students to explore open-source IoT development platforms.

Text Books:

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2014
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

References:

1. Michael J. Pont, "Embedded C", Pearson Education, 2007.
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.
3. Andrew N Sloss, D. Symes, C. Wright, "Arm System Developer's Guide", Morgan Kauffman/ Elsevier, 2006.
4. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	1	2	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-"- no correlation

PCS2401	**Exploratory Data Analysis**	**PEC**	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**

Course Objectives:

- To outline an overview of exploratory data analysis.
- To implement data visualization using Matplotlib.

- To perform univariate data exploration and analysis.
- To apply bivariate data exploration and analysis.
- To use Data exploration and visualization techniques for multivariate and time series data.

UNIT I EXPLORATORY DATA ANALYSIS 6

EDA fundamentals – Understanding data science – Significance of EDA – Making sense of data – Comparing EDA with classical and Bayesian analysis – Software tools for EDA – Visual Aids for EDA- Data transformation techniques-merging database, reshaping and pivoting, Transformation techniques.

UNIT II EDA USING PYTHON 6

Data Manipulation using Pandas – Pandas Objects – Data Indexing and Selection – Operating on Data – Handling Missing Data – Hierarchical Indexing – Combining datasets – Concat, Append, Merge and Join – Aggregation and grouping – Pivot Tables – Vectorized String Operations.

UNIT III UNIVARIATE ANALYSIS 6

Introduction to Single variable: Distribution Variables – Numerical Summaries of Level and Spread – Scaling and Standardizing – Inequality.

UNIT IV BIVARIATE ANALYSIS 6

Relationships between Two Variables – Percentage Tables – Analysing Contingency Tables – Handling Several Batches – Scatterplots and Resistant Lines.

UNIT V MULTIVARIATE AND TIME SERIES ANALYSIS 6

Introducing a Third Variable – Causal Explanations – Three-Variable Contingency Tables and Beyond – Fundamentals of TSA – Characteristics of time series data – Data Cleaning – Time-based indexing – Visualizing – Grouping – Resampling.

Periods: 30

LIST OF EXPERIMENTS:

1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Perform exploratory data analysis (EDA) with datasets like email data set. Export all your emails as a dataset, import them inside a pandas data frame, visualize them and get different insights from the data.
3. Working with Numpy arrays, Pandas data frames, Basic plots using Matplotlib.
4. Explore various variable and row filters in R for cleaning data. Apply various plot features in R on sample data sets and visualize.
5. Perform Time Series Analysis and apply the various visualization techniques.
6. Perform Data Analysis and representation on a Map using various Map data sets with Mouse Rollover effect, user interaction, etc.
7. Build cartographic visualization for multiple datasets involving various countries of the world; states and districts in India etc.
8. Perform EDA on Wine Quality Data Set.
9. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report.

Periods: 30

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to:
CO1: Understand the fundamentals of exploratory data analysis.
CO2: Implement the data visualization using Matplotlib.
CO3: Perform univariate data exploration and analysis.
CO4: Apply bivariate data exploration and analysis.
CO5: Use Data exploration and visualization techniques for multivariate and time series data.
CO6: Perform Exploratory Data Analysis for the real time scenarios.

Suggested Activities:

- Hands-on / Lab Activities
- Mini Project

TextBooks:

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python",Packt Publishing, 2020. (Unit 1)
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data", First Edition, O Reilly, 2017. (Unit 2)
3. Catherine Marsh, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008. (Unit 3,4,5)

References:

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

MAPPING OF Cos WITH Pos AND PSOs

COs	POs										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	1	1	2	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2402	Recommender Systems	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the foundations and taxonomy of recommender systems.
- To explore the role of machine learning and data mining techniques in recommender systems.
- To study various recommendation approaches such as content-based, collaborative filtering, and hybrid methods.
- To design and implement a recommender system.
- To understand evaluation metrics and attack-resilient recommendation models.

UNIT I INTRODUCTION TO RECOMMENDER SYSTEMS 6

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)

UNIT II CONTENT-BASED RECOMMENDATION SYSTEMS 6

High-level architecture of content-based systems - Item profiles, Representing item profiles, Methods for learning user profiles, Similarity-based retrieval, and Classification algorithms.

UNIT III COLLABORATIVE FILTERING METHODS 6

A systematic approach, Nearest-neighbor collaborative filtering (CF), user-based and item-based CF, components of neighborhood methods (rating normalization, similarity weight computation, and neighborhood selection

UNIT IV ATTACK-RESISTANT RECOMMENDER SYSTEMS 6

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 6

Evaluating Paradigms – User Studies – Online and Offline evaluation – Goals of evaluation design – Design Issues – Accuracy metrics – Limitations of Evaluation measures

Periods: 30

LIST OF EXPERIMENTS:

1. Implement Data similarity measures using Python
2. Implement dimension reduction techniques for recommender systems
3. Implement user profile learning
4. Implement content-based recommendation systems
5. Implement collaborative filter techniques
6. Create an attack for tampering with recommender systems
7. Implement accuracy metrics like Receiver Operated Characteristic curves

Periods: 30
Total Periods: 60

Course Outcomes:

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

CO1: Understand the basic concepts of recommender systems.
CO2: Implement machine-learning and data-mining algorithms in recommender systems data sets.
CO3: Implementation of Collaborative Filtering in carrying out performance evaluation of recommender systems based on various metrics.
CO4: Design and implement a simple recommender system.
CO5: Learn about advanced topics of recommender systems.
CO6: Learn about advanced topics of recommender systems applications.

Suggested Activities

- Practical learning – Implement Data similarity measures.
- External Learning – Singular Value Decomposition (SVD) applications
- Assignment on content-based recommendation systems
- Assignment of learning user profiles
- Practical learning – Implement collaborative filtering concepts
- Assignment of security aspects of recommender systems
- Group Discussion on attacks and their mitigation
- Study of the impact of group attacks
- Group Discussion on goals of evaluation design
- Study of accuracy metrics

Text Books:

1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.
2. Dietmar Jannach, Markus Zanker, Alexander Felfernig, Gerhard Friedrich, Recommender Systems: An Introduction, Cambridge University Press, 2011.

References:

1. Francesco Ricci, Lior Rokach, Bracha Shapira, Recommender Systems Handbook, 1st Edition, Springer, 2011.
2. Jure Leskovec, Anand Rajaraman, Jeffrey David Ullman, Mining of Massive Datasets, 3rd Edition, Cambridge University Press, 2020.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	1	2	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2403	**Text and Speech Analysis**	**PEC**	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**

Course Objectives:

- Understand natural language processing basics
- Apply classification algorithms to text documents
- Build question-answering and dialogue systems
- Develop a speech recognition system
- Develop a speech synthesize

UNIT I NATURAL LANGUAGE BASICS 6

Foundations of natural language processing – Language Syntax and Structure- Text Preprocessing and Wrangling – Text tokenization – Stemming – Lemmatization – Removing stop-words – Feature Engineering for Text representation – Bag of Words model- Bag of N-Grams model – TF-IDF model

UNIT II TEXT CLASSIFICATION 6

Vector Semantics and Embeddings -Word Embeddings - Word2Vec model – Glove model – FastText model – Overview of Deep Learning models – RNN – Transformers – Overview of Text summarization and Topic Models

UNIT III QUESTION ANSWERING AND DIALOGUE SYSTEMS 6

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 TEXT-TO-SPEECH SYNTHESIS 6

Overview. Text normalization. Letter-to-sound. Prosody, Evaluation. Signal processing - Concatenative and parametric approaches, WaveNet and other deep learning-based TTS systems

UNIT V AUTOMATIC SPEECH RECOGNITION 6

Speech recognition: Acoustic modelling – Feature Extraction - HMM, HMM-DNN systems

Periods: 30

LIST OF EXPERIMENTS:

1. Create Regular expressions in Python for detecting word patterns and tokenizing text
2. Getting started with Python and NLTK - Searching Text, Counting Vocabulary, Frequency Distribution, Collocations, Bigrams
3. Accessing Text Corpora using NLTK in Python
4. Write a function that finds the 50 most frequently occurring words of a text that are not stop words.
5. Implement the Word2Vec model
6. Use a transformer for implementing classification
7. Design a chatbot with a simple dialog system
8. Convert text to speech and find accuracy
9. Design a speech recognition system and find the error rate

Periods: 30
Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Explain NLP foundations, text preprocessing, and text representation techniques.
CO2: Apply embeddings and deep learning models for text classification and summarization. **CO3:** Analyze and build question-answering and dialogue systems.
CO4: Demonstrate text-to-speech synthesis concepts and deep learning–based TTS models.
CO5: Apply acoustic modelling and feature extraction techniques for ASR systems.
CO6: Integrate deep learning methods to develop end-to-end text and speech applications.
Suggested Activities:

- Flipped classroom
- Quiz
- Development of simple chatbots
- Mini Project

Text Books:

1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition”, Third Edition, 2022.

References:

1. Dipanjan Sarkar, "Text Analytics with Python: A Practical Real-World approach to Gaining Actionable insights from your data", APress,2018.
2. Tanveer Siddiqui, Tiwary U S, "Natural Language Processing and Information Retrieval", Oxford University Press, 2008.
3. Lawrence Rabiner, Biing-Hwang Juang, B. Yegnanarayana, "Fundamentals of Speech Recognition" 1st Edition, Pearson, 2009.
4. Steven Bird, Ewan Klein, and Edward Loper, "Natural language processing with Python", O'REILLY.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	1	2	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2404	**Healthcare Analytics**	**PEC**	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**

Course Objectives:

- To impart the fundamental concepts of healthcare data analytics.
- To provide knowledge about healthcare data sources and their management.
- To familiarize students with advanced data analytics for healthcare.
- To introduce the principles of IoT-based healthcare data analytics.
- To develop the ability to apply analytics in practical healthcare systems.
- To equip students with hands-on skills in healthcare data analysis and visualization tools.

UNIT I INTRODUCTION 6

Introduction to Healthcare Data Analytics – Healthcare Data Sources and Basic Analytics – Electronic Health Records (EHR): Components, Standards, and Coding Systems – Biomedical Image Analysis: Imaging Modalities, Object Detection, Image Segmentation, Image Registration, Feature Extraction – Sensor Data Mining in Medical Informatics: Scope, Challenges, and Applications.

UNIT II HEALTHCARE DATA SOURCES 6

Biomedical Signal Analysis: Types of Biomedical Signals – ECG Signal Analysis – Denoising of Signals – Multivariate Biomedical Signal Analysis – Cross-Correlation Analysis – Connectivity Analysis – Genomic Data for Personalized Medicine: Data Generation Methods, Standards, and Computational Genomics Studies.

UNIT III ADVANCED DATA ANALYTICS FOR HEALTHCARE 6

Statistical Prediction Models – Clinical Prediction and Survival Models: Evaluation and Validation – Temporal Data Mining for Healthcare: Association and Pattern Mining – Sensor Data Analytics – Temporal Modeling Methods – Visual Analytics for Healthcare: Medical Data Visualization and Visual Analytics Applications.

UNIT IV HEALTH IOT DATA ANALYTICS 6

Internet of Things (IoT) in Healthcare – IoT Healthcare Architecture – Characteristics of IoT Health Data – Data Analytics using IoT – Computational Intelligence and Machine Learning in IoT for Healthcare Applications – Challenges and Future Scope.

UNIT V APPLICATIONS AND PRACTICAL SYSTEMS FOR HEALTHCARE 6

Data Analytics for Pervasive Health: Supporting Infrastructure and Technologies – Basic and Advanced Analytic Techniques – Applications in Healthcare – Fraud Detection in Healthcare – Data Analytics for Pharmaceutical Discoveries – Clinical Decision Support Systems.

Periods: 30

LIST OF EXPERIMENTS:

1. Exploring Healthcare Datasets – Loading and Cleaning EHR Data.
2. Preprocessing and Normalizing Biomedical Signal Data (e.g., ECG).
3. Image Preprocessing and Segmentation in Biomedical Imaging.
4. Exploratory Data Analysis (EDA) on Genomic Data.
5. Predictive Modeling for Patient Readmission using Statistical Methods.
6. IoT Health Sensor Data Acquisition and Analysis.
7. Machine Learning Model for Disease Prediction (Classification).
8. Visual Analytics of Healthcare Data using Python/R.
9. Designing a Healthcare Dashboard using Tableau or Power BI.
10. Mini Project: Case Study on Real Healthcare Dataset Integration and Insights.

Periods: 30
Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to CO1: CO1: Describe the basics of healthcare data analytics.
CO2: Explain the major sources of healthcare data.
CO3: Apply advanced data analytics techniques for healthcare data.
CO4: Implement IoT-based analytics models in healthcare contexts.
CO5: Develop and evaluate practical data-driven systems for healthcare applications.
CO6: Demonstrate visualization and predictive analysis using healthcare datasets.

Suggested Activities:

- Hands-on
- Mini Project
- Case Study
- Implementation Demo

Text Books:

1. Chandan K. Reddy and Charu C. Aggarwal, Healthcare Data Analytics, 1st Edition, CRC Press, 2020.
2. Sanjay Kumar Singh et al., IoT-Based Data Analytics for the Healthcare Industry:

Techniques and Applications, Elsevier, Academic Press, 2020.
3. Nilanjan Dey et al., Healthcare Data Analytics and Management, 1st Edition, Elsevier, Academic Press, 2018.

References:

1. Prasant Kumar Pattnaik, Suneeta Mohanty, Satarupa Mohanty, Smart Healthcare Analytics in IoT Enabled Environment, Springer, 2020.
2. Sanket Shah, Healthcare Analytics: A Comprehensive Guide, Kindle Edition, 2020.
3. Amira Ashour & Simon Fong, Medical Data Analytics for Healthcare Applications, Springer, 2019.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	1	2	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2405	**Business Analytics**	**PEC**	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**

Course Objectives:

- To understand the Analytics Life Cycle.
- To comprehend the process of acquiring Business Intelligence
- To understand various types of analytics for Business Forecasting
- To model the supply chain management for Analytics.
- To apply analytics for different functions of a business

UNIT I INTRODUCTION TO BUSINESS ANALYTICS 6

Analytics and Data Science – Analytics Life Cycle – Types of Analytics – Business Problem Definition
– Data Collection – Data Preparation – Hypothesis Generation – Modeling – Validation and Evaluation
– Interpretation – Deployment and Iteration

UNIT II BUSINESS INTELLIGENCE 6

Data Warehouses and Data Mart - Knowledge Management –Types of Decisions - Decision Making Process - Decision Support Systems – Business Intelligence – OLAP – Analytic functions

UNIT III BUSINESS FORECASTING 6

Introduction to Business Forecasting and Predictive analytics - Logic and Data Driven Models – Data Mining and Predictive Analysis Modelling –Machine Learning for Predictive analytics.

UNIT IV HR & SUPPLY CHAIN ANALYTICS 6

Human Resources – Planning and Recruitment – Training and Development - Supply chain network - Planning Demand, Inventory and Supply – Logistics – Analytics applications in HR & Supply Chain - Applying HR Analytics to make a prediction of the demand for hourly employees for a year

UNIT V MARKETING & SALES ANALYTICS 6

Marketing Strategy, Marketing Mix, Customer Behaviour – Selling Process – Sales Planning – Analytics applications in Marketing and Sales - Predictive analytics for customers' behaviour in marketing and sales.

Periods: 30

LIST OF EXPERIMENTS:

Text Books:

1. R. Evans James, Business Analytics, 2nd Edition, Pearson, 2017
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, 2nd Edition, Wiley, 2016
3. Philip Kotler and Kevin Keller, Marketing Management, 15th edition, PHI, 2016
4. VSP RAO, Human Resource Management, 3rd Edition, Excel Books, 2010.
5. Mahadevan B, "Operations Management -Theory and Practice",3rd Edition, Pearson Education,2018.

References:

1. Decision Support and Business Intelligence Systems, 11th Edition, Pearson Education.
2. Business Analytics: Methods, Models, and Decisions, 3rd Edition, Pearson Education.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	1	2	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2406 Image and Video Analytics PEC L T P C

2 0 2 3

Course Objectives:

- To understand the basic concepts and principles of image and video analytics.
- To learn preprocessing techniques for enhancing image quality and feature extraction.
- To explore object detection and classification using traditional and deep learning approaches.
- To study various face and gesture recognition techniques using neural network models.
- To gain insights into video analytics and its applications in intelligent surveillance systems.
- To provide hands-on experience with real-time image and video datasets for analytical model development.

UNIT I INTRODUCTION 6

Computer Vision – Image representation and image analysis tasks – Image representations – digitization
– properties – colour images – Data structures for Image Analysis – Levels of image data representation
– Traditional and Hierarchical image data structures.

UNIT II IMAGE PRE-PROCESSING 6

Local pre-processing – Image smoothing – Edge detectors – Zero-crossings of the second derivative – Scale in image processing – Canny edge detection – Parametric edge models – Edges in multispectral images – Local pre-processing in frequency domain – Line detection by local pre-processing operators – Image restoration.

UNIT III OBJECT DETECTION USING MACHINE LEARNING 6

Object detection – Object detection methods – Deep-Learning frameworks for object detection – Bounding box approach – Intersection over Union (IoU) – Deep Learning architectures: R-CNN, Faster R-CNN, YOLO – Salient features – Loss functions – YOLO architectures.

UNIT IV FACE RECOGNITION AND GESTURE RECOGNITION 6

Face Recognition – Introduction – Applications – Process of Face Recognition – DeepFace solution by Facebook – FaceNet for Face Recognition – Implementation using FaceNet – Gesture Recognition techniques using CNN and RNN.

UNIT V VIDEO ANALYTICS 6

Video Processing – Use-cases of video analytics – Vanishing gradient and exploding gradient problem – ResNet architecture – ResNet and skip connections – Inception Network – GoogleNet architecture – Improvements in Inception v2 – Video analytics using ResNet and Inception v3 – Applications in surveillance and smart cities.

Periods: 30

LIST OF EXPERIMENTS:

1. Write a program that computes the T-pyramid of an image.
2. Write a program that derives the quad tree representation of an image using the homogeneity criterion of equal intensity
3. Develop programs for the following geometric transforms: (a) Rotation (b) Change of scale (c) Skewing (d) Affine transform calculated from three pairs of corresponding points (e) Bilinear transform calculated from four pairs of corresponding points.
4. Develop a program to implement Object Detection and Recognition
5. Develop a program for motion analysis using moving edges, and apply it to your image sequences.
6. Develop a program for Facial Detection and Recognition
7. Write a program for event detection in video surveillance system

Periods: 30
Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Understand the fundamentals of image and video analytics.
CO2: Apply processing and enhancement techniques for image analytics.
CO3: Implement object detection models using machine learning and deep learning frameworks.
CO4: Analyze and perform face and gesture recognition using deep learning.
CO5: Develop and evaluate video analytics models for real-world applications.
CO6: Design and execute mini-projects using real-time image and video data.

Suggested Activities:

- Hands-on
- Mini Project
- Case Study
- Implementation Demo

Text Books:

1. Milan Sonka, Vaclav Hlavac, Roger Boyle, "Image Processing, Analysis, and Machine Vision", 4nd edition, Thomson Learning, 2013.
2. Vaibhav Verdhan,(2021, "Computer Vision Using Deep Learning Neural Network Architectures with Python and Keras", Apress 2021(UNIT-III,IV and V)

References:

1. Richard Szeliski, "Computer Vision: Algorithms and Applications", Springer Verlag London Limited, 2011.
2. Caifeng Shan, FatihPorikli, Tao Xiang, Shaogang Gong, "Video Analytics for Business Intelligence", Springer, 2012.
3. D. A. Forsyth, J. Ponce, "Computer Vision: A Modern Approach", Pearson Education, 2003.
4. E. R. Davies, "Computer & Machine Vision", Fourth Edition, Academic Press, 2012.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	1	2	-	-	-	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**		**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2407	**Computer Vision**	**PEC**	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**

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.
- To understand image-based rendering and recognition.\

UNIT I INTRODUCTION TO IMAGE FORMATION AND PROCESSING 6

Computer Vision – Geometric primitives and transformations – Photometric image formation – The digital camera – Point operators – Linear filtering – More neighbourhood operators – Fourier transforms – Pyramids and wavelets – Geometric transformations – Global optimization.

UNIT II FEATURE DETECTION, MATCHING AND SEGMENTATION 6

Points and patches – Edges – Lines – Segmentation – Active contours – Split and merge – Mean shift and mode finding – Normalized cuts – Graph cuts and energy-based methods.

UNIT III FEATURE-BASED ALIGNMENT & MOTON ESTIMATION 6

2D and 3D feature-based alignment – Pose estimation – Geometric intrinsic calibration – Triangulation – Two-frame structure from motion – Factorization – Bundle adjustment – Constrained structure and motion – Translational alignment – Parametric motion – Spline-based motion – Optical flow – Layered motion.

UNIT IV 3D RECONSTRUCTION 6

Shape from X – Active range finding – Surface representations – Point-based representations – Volumetric representations – Model-based reconstruction – Recovering texture maps and albedos.

UNIT V IMAGE-BASED RENDERING AND RECOGNITION 6

View interpolation – Layered depth images – Light fields and Lumi graphs – Environment mattes – Video-based rendering – Object detection – Face recognition – Instance recognition – Category recognition – Context and scene understanding – Recognition databases and test sets.

Periods: 30

LIST OF EXPERIMENTS:

1. OpenCV Installation and working with Python
2. Basic Image Processing - loading images, Cropping, Resizing, Thresholding, Contour analysis, Bolb detection
3. Image Annotation – Drawing lines, text circle, rectangle, ellipse on images
4. Image Enhancement - Understanding Color spaces, color space conversion, Histogram equialization, Convolution, Image smoothing, Gradients, Edge Detection
5. Image Features and Image Alignment – Image transforms – Fourier, Hough, Extract ORB Image features, Feature matching, cloning, Feature matching based image alignment
6. Image segmentation using Graphcut / Grabcut
7. Camera Calibration with circular grid
8. Pose Estimation
9. 3D Reconstruction – Creating Depth map from stereo images
10. Object Detection and Tracking using Kalman Filter, Camshift

Periods: 30
Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Understand basic knowledge, theories, and methods in image processing and computer vision.
CO2: Implement basic and some advanced image processing techniques in OpenCV.
CO3: Apply 2D image alignment and feature extraction techniques.
CO4: Perform image segmentation and motion estimation using computer vision algorithms.
CO5: Apply 3D image reconstruction techniques.
CO6: Design and develop innovative image processing and computer vision applications.
Suggested Activities:

- Hands-on / Lab Activities
- Mini Project

- Case studies
- Assessment Activities

Text Books:

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer Texts in Computer Science, Second Edition, 2022.
2. D. A. Forsyth & J. Ponce, Computer Vision: A Modern Approach, Pearson Education, Second Edition, 2015.

References:

1. Richard Hartley & Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004.
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
3. E. R. Davies, Computer and Machine Vision, Fourth Edition, Academic Press, 2012.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	0	0	0	1	0	2	2	2	3
CO2	3	2	2	2	3	0	0	0	1	0	2	3	2	3
CO3	3	3	3	2	3	0	0	0	1	0	2	3	3	3
CO4	3	3	2	3	3	1	0	0	1	0	3	3	3	3
CO5	3	2	2	3	3	0	0	0	1	0	3	3	3	3
CO6	3	2	3	2	3	2	1	3	2	3	3	3	3	3
Avg.	**3.0**	**2.3**	**2.2**	**2.2**	**2.8**	**0.5**	**0.2**	**0.5**	**1.2**	**0.5**	**2.5**	**2.8**	**2.7**	**3.0**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2408	Big Data Analytics	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand big data.
- To learn and use NoSQL big data management.
- To learn map reduce analytics using Hadoop and related tools.
- To work with map reduce applications
- To understand the usage of Hadoop related tools for Big Data Analytics

UNIT I UNDERSTANDING BIG DATA 5

Introduction to big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data applications– big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics

UNIT II NOSQL DATA MANAGEMENT 7

Introduction to NoSQL – aggregate data models – key-value and document data models – relationships – graph databases – schema less databases – materialized views – distribution models – master-slave replication – consistency - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients

UNIT III MAP REDUCE APPLICATIONS 6

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNIT IV BASICS OF HADOOP 6

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures - Cassandra – Hadoop integration.

UNIT V HADOOP RELATED TOOLS 6

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

Periods: 30

LIST OF EXPERIMENTS:

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files
3. Implement of Matrix Multiplication with Hadoop Map Reduce
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Installation of Hive along with practice examples.
6. Installation of HBase, Installing thrift along with Practice examples
7. Practice importing and exporting data from various databases.

Periods: 30
Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Describe big data and use cases from selected business domains
CO2: Explain NoSQL big data management.
CO3: Install, configure, and run Hadoop and HDFS.
CO4: Perform map-reduce analytics using Hadoop
CO5: Use Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.
CO6: Apply big data technologies to solve real-world data analytics problems.

Suggested Activities:

- Hands-on / Lab Activities
- Mini Projects
- Case Studies

Text Books:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
   Sadalage, Pramod J. "NoSQL distilled", 2013

References:

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012. 126
2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
3. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
4. Alan Gates, "Programming Pig", O'Reilley, 2011.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	2	2	3	1	3	3
CO2	3	3	2	3	2	-	-	-	2	2	3	2	3	2
CO3	3	3	3	2	3	-	-	-	2	2	1	2	3	3
CO4	2	3	3	3	3	-	-	-	2	2	3	3	3	2
CO5	3	3	3	3	3	-	-	-	3	1	3	3	2	3
CO6	3	3	3	3	3	-	-	-	2	2	3	3	3	3
Avg.	2.8	3	2.8	2.8	2.8	-	-	-	2.2	1.8	2.7	2.3	2.8	2.7

1 - low, 2 - medium, 3 - high, '-' - no correlation

PIT2401	Java Programming for Web Applications	PCC	L	T	P	C
			2	0	2	3

Course Objectives:

- Understand the architecture and workflow of Java-based web applications.
- Develop dynamic and interactive web pages using Servlets and JSP.
- Integrate databases using JDBC for persistent data storage.
- Apply MVC and JavaBeans for modular design.
- Explore enterprise frameworks like Spring Boot for scalable web development.
- Deploy and maintain Java web applications using modern testing and deployment tools.

UNIT I JAVA WEB FUNDAMENTALS 6

Overview of Java EE / Jakarta EE architecture -Web application structure and deployment - HTTP protocol and request–response cycle -Introduction to Servlets: lifecycle, structure, configuration- Environment setup: JDK, Tomcat, IDE (Eclipse/IntelliJ).

UNIT II SERVLETS AND SESSION MANAGEMENT 6

ServletRequest and ServletResponse objects - Handling forms (GET & POST methods) - Session management using Cookies and HttpSession - RequestDispatcher and Filters (overview) - File upload/download operations

UNIT III JSP AND MVC DESIGN 6

JSP lifecycle and structure - Scripting elements and directives - Implicit objects and Expression Language (EL) - JSP Standard Tag Library (JSTL) - MVC pattern using Servlets and JSP

UNIT IV JDBC AND JAVABEANS INTEGRATION 6

JDBC architecture and drivers- Establishing DB connections (MySQL/Oracle) - CRUD operations using Prepared Statement - Connection pooling and transaction concepts - JavaBeans for reusable components - Integrating JDBC with JSP and Servlets

UNIT V FRAMEWORKS, REST APIS & DEPLOYMENT 6

Introduction to Spring and Spring Boot - Dependency Injection (IoC) concepts - Creating RESTful APIs using Spring Boot - JSON data exchange and API testing with Postman - Deployment using WAR/JAR files and version control (Git) - Overview of CI/CD and cloud hosting for Java web apps.

Periods: 30 PERIODS

Course Outcomes:

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

CO1: Describe the architecture, lifecycle, and components of Java web applications.
CO2: Develop Servlets to handle client requests, sessions, and file operations.
CO3: Design and implement dynamic web pages using JSP and MVC patterns.
CO4: Apply JDBC and JavaBeans for database-driven web applications.
CO5: Demonstrate the use of Spring Boot and RESTful APIs for enterprise-level web solutions.
CO6: Deploy, test, and manage Java web applications on servers or cloud platforms using version control and DevOps principles.

Practical Exercises: 30 PERIODS

1. Install JDK, Tomcat, and Eclipse/IntelliJ. Create a simple "Hello Web" Servlet and deploy it on Tomcat.
2. Develop a Servlet to collect form input (e.g., student details) using GET and POST, and display the response dynamically.
3. Implement login/logout functionality using HttpSession and Cookies.
4. Create JSP pages with scripting elements, implicit objects, and directives to display personalized content.
5. Build a mini MVC web app (e.g., login/feedback) using Servlet as controller, JSP as view, and JavaBeans as model.
6. Connect to MySQL and perform CRUD operations (insert, update, delete, view) via Servlet/JSP interface.
7. Create a simple RESTful API for managing student data using GET, POST, PUT, and DELETE operations.
8. Develop a small-scale data-driven web application (e.g., Library System, Student Portal, or Product Catalog) and deploy it on Tomcat or Spring Boot.

Suggested Activities:

1. Quizzes & Polls
2. Think–Pair–Share
3. Collaborative Debugging Sessions

Text Books:

1. Herbert Schildt, **"Java: The Complete Reference"**, McGraw-Hill Education, 2022.
2. Budi Kurniawan, **"Servlets and JSP: A Tutorial"**, Brainy Software, 2015.
3. Craig Walls, **"Spring in Action"**, Manning Publications, 2018.

References:

1. Marty Hall & Larry Brown, "Core Servlets and JSP: Core Technologies (2nd Edition)", Pearson Education (Prentice Hall), 2003.

2. Eric Freeman & Elisabeth Robson, “Head First Servlets and JSP (2nd Edition)”, O’Reilly Media, 2008.
3. Rod Johnson, “Expert One-on-One J2EE Development without EJB”, Wiley (Wrox), 2004.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	1	-	2	2	2	2	2
CO2	3	3	3	-	2	-	2	1	-	2	3	2	3	3
CO3	3	2	3	-	2	-	2	2	-	2	3	2	3	3
CO4	3	2	3	-	2	-	2	1	1	3	3	2	3	3
CO5	3	3	3	2	3	-	2	2	2	3	3	2	3	3
CO6	2	2	1	-	3	-	3	2	-	3	3	3	2	3
Avg.	2.8	2.3	2.3	2.0	2.3	-	2.2	1.5	1.5	2.5	2.8	2.2	2.7	2.8

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

PCS2410	App Development	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To learn development of native applications with basic GUI Components
- To develop cross-platform applications with event handling
- To develop applications with location and data storage capabilities
- To develop web applications with database access

UNIT I FUNDAMENTALS OF MOBILE APP DEVELOPMENT AND INTRODUCTION TO MODERN APP DEVELOPMENT **6**

Evolution of Mobile and Web Applications - App Architecture: Client-Server Model, Frontend, Backend, API, and Database Integration- Native vs Cross-Platform vs Progressive Web Apps (PWA) vs Hybrid Applications- Responsive Web Design Principles- Overview of Development Tools (Android Studio, VS Code, Expo, Flutter SDK).

UNIT II NATIVE APP DEVELOPMENT **6**

Introduction to Native App Development -Kotlin and Java for Android Studio- Android App Components & UI Design- Data Storage and Device Features- Introduction to iOS App Development- Swift and Xcode IDE.

UNIT III CROSS-PLATFORM APP DEVELOPMENT USING FLUTTER AND REACT NATIVE **6**

Introduction to Cross-Platform App Development- Introduction to Flutter- Flutter UI Components and Layout- State Management in Flutter, Introduction to React Native - React Native Components and UI- State and Props in React Native.

UNIT IV HYBRID AND PROGRESSIVE WEB APP DEVELOPMENT WITH API INTEGRATION **6**

Introduction to Hybrid App Development (Web view and Native app Wrapper)- Building Hybrid Apps (Ionic or Cordova)- Progressive Web Apps (PWA)- API and Backend Integration (REST APIs and HTTP methods), basics of JSON.

UNIT V NON-FUNCTIONAL CHARACTERISTICS AND PERFORMANCE EVALUATION OF APP FRAMEWORKS **6**

Introduction to Non-Functional Characteristics- Build and Runtime Performance- Debugging and Testing Capabilities- Maintainability, Scalability & Ease of Development- UI/UX Consistency, Reusability & Time to Market.

Periods: 30

LIST OF EXPERIMENTS:

1. Design a web application for a simple expense manager which allows entering expenses and income on each day and displays category wise weekly income and expenses.
2. Develop an GUI application that uses Layout Managers and event Listeners.
3. Develop a library application using Kotlin/Java that makes use of SQLite for displaying books available, books lend and books reserved.
4. Using react native, build a cross-platform application for a BMI calculator.
5. Develop a cross-platform application using Flutter to currency using live exchange rates from https://freecurrencyapi.com/.
6. Design and develop a cross-platform application for day-to-day task (to-do) management with data persistence even after app closing.
7. Design and develop an application using Cordova for a user login screen with username, password, reset button and a submit button. Also, include header image and a label. Use layout managers.
8. Develop a hybrid mobile application using Apache Cordova that fetches the user's current location and displays nearby restaurants, hospitals, and ATMs using a public places API (OpenStreetMap, Foursquare Places API)
9. Build a progressive web application for an e-commerce website.

Course Outcomes:

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

CO1: Understanding of app ecosystems, architectures, platforms, and essential tools
CO2: Develop simple Android applications using Kotlin/Java and insight of iOS app development tools CO3: Develop cross-platform applications with location and data storage capabilities.
CO4: Build basic multi-screen apps with responsive UI
CO5: Build basic hybrid/PWA apps, and integrate them with APIs CO6: Evaluate app quality through non-functional parameters

Suggested Activities:

- Build Online Banking web application to retrieve account information of customers and process transactions process transaction utilizing APIs.
- Build apps for specific platforms (iOS with Swift/Objective-C, Android with Java/Kotlin) to leverage device features (Accelerometer, Vibrator, Light sensor) and provide optimal performance and user experience.
- Develop web applications to demonstrate a native app-like experience through modern web capabilities, including offline functionality, push notifications, and home screen installation, accessible via a web browser.
- Design and develop a cross-platform mobile application that integrates a public API (such as weather or news) to fetch and display real-time data.

- Develop a lightweight mobile application that measures and compares performance metrics (build size, load time) across two frameworks like Flutter and React Native.

Text Books:

1. Dawn Griffiths, "Head First Android Development", O'Reilly,1st Edition, 2015
2. Raymond K. Camden, "Apache Cordova in Action", Manning, 2015.
3. Anthony Accomazzo, Houssein Djirdeh, Sophia Shoemaker, Devin Abbott, "Full Stack React Native: Create Beautiful Mobile Apps with JavaScript and React Native", Full Stack Publishing, 2019.
4. Thomas Bailey, Alessandro Biessek – Flutter for Beginners: Cross-platform mobile development from Hello World to app release with Flutter 3.10+ and Dart 3.x, 2023.

References:

1. John Horton, Android Programming for Beginners, Packt Publishing, 2nd Edition, 2018
2. Shaun Lewis and Mike Dunn, "Native Mobile Development", 2019.
3. Pawan Lingras, Matt Triff and Rucha Lingras, "Building Cross-Platform Mobile and Web Apps for Engineers and Scientists: An Active Learning Approach", 2016.
4. John M Wargo, "Apache Cordova 4 Programming", 2015.
5. Daniel Ward, "React Native Cookbook", Packt Publishing, 2nd Edition, 2019.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	2	3	-	-	1	1	2	1	2	3	-
CO2	2	1	3	2	2	-	-	3	2	2	3	3	2	-
CO3	2	2	2	1	2	-	-	1	1	1	1	1	1	-
CO4	1	3	1	1	3	-	-	1	1	3	2	1	3	-
CO5	1	1	3	1	3	-	-	1	1	2	1	3	2	-
CO6	1	1	3	1	3	2	1	1	1	2	1	3	2	-
Avg.	1.5	1.7	2.2	1.3	2.7	2.0	1.0	1.3	1.2	2.0	1.5	2.2	2.2	-

1 - low, 2 - medium, 3 - high, '-' - no correlatin

PCS2412	UI and UX Design	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To provide a sound knowledge in UI and UX
- To understand the need for UI and UX
- To understand the various Research Methods used in Design
- To explore the various Tools used in UI and UX
- Creating a wireframe and prototype

UNIT I FOUNDATIONS OF DESIGN 6

UI vs. UX Design - Core Stages of Design Thinking - Divergent and Convergent Thinking – Brainstorming and Game storming - Observational Empathy.

UNIT II FOUNDATIONS OF UI DESIGN 6

Visual and UI Principles - UI Elements and Patterns - Interaction Behaviours and Principles – Branding -Style Guides.

UNIT III FOUNDATIONS OF UX DESIGN 6

Introduction to User Experience - Why You Should Care about User Experience – Understanding User Experience - Defining the UX Design Process and its Methodology - Research in User Experience Design - Tools and Method used for Research - User Needs and its Goals - Know about Business Goals.

UNIT IV WIREFRAMING, PROTOTYPING AND TESTING 6

Sketching Principles - Sketching Red Routes - Responsive Design – Wireframing – Creating Wireflows -Building a Prototype - Building High-Fidelity Mockups - Designing Efficiently with Tools - Interaction Patterns- Conducting Usability Tests - Other Evaluative User Research Methods - Synthesizing Test Findings -Prototype Iteration.

UNIT V RESEARCH, DESIGNING, IDEATING, & INFORMATION ARCHITECTURE 6

Identifying and Writing Problem Statements - Identifying Appropriate Research Methods – Creating Personas - Solution Ideation - Creating User Stories - Creating Scenarios - Flow Diagrams – Flow Mapping - Information Architecture.

Periods:30

LIST OF EXPERIMENTS:

1. Identifying and Writing Problem Statements
2. Hands on Design Thinking Process for a new product
3. Brainstorming feature for proposed product
4. Exploring various open-source collaborative interface Platform
5. Exploring various UI Interaction Patterns
6. Developing an interface with proper UI Style Guides
7. Developing Wire flow diagram for application using open-source software
8. Designing a Responsive layout for a societal application
9. Defining the Look and Feel of the new Project
10. Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)
11. Identify a customer problem to solve and conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping
12. Sketch, design with popular tool and build a prototype and perform usability testing and identify improvements

Periods: 30
Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Build UI for user Applications
CO2: Evaluate UX design of any product or application CO3: Demonstrate UX Skills in product development CO4: Implement Sketching principles
CO5: Create Wireframe and Prototype
CO6: Apply design thinking principles to Build UI for applications

Suggested Activities

- Pitching design ideas and solution
- Brainstorming and ideation
- Visual design exercises with animation and transition
- Creating interactive prototype using any open-source software

TEXT BOOK:

1. Joel Marsh, "UX for Beginners", O'Reilly, 2022.
2. Jon Yablonski, "Laws of UX using Psychology to Design Better Product & Services", O'Reilly 2021.

References:

1. Jenifer Tidwell, Charles Brewer, Aynne Valencia, "Designing Interface" 3 rd Edition, O'Reilly 2020.
2. Steve Schoger, Adam Wathan "Refactoring UI", 2018.
3. Steve Krug, "Don't Make Me Think, Revisited: A Commonsense Approach to Web & Mobile", Third Edition, 2015.
4. https://www.nngroup.com/articles/
5. https://www.interaction-design.org/literature

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	3	1	-	-	3	3	2	1	2	1	-
CO2	2	3	1	3	2	-	-	1	2	2	2	2	1	-
CO3	1	3	3	2	2	-	-	2	3	1	2	2	1	-
CO4	1	2	3	3	1	-	-	3	2	1	3	2	1	-
CO5	1	2	3	2	1	-	-	2	1	1	1	2	1	-
CO6	1	2	3	2	1	1	1	2	1	1	1	2	1	-
Avg.	1.5	2.2	2.3	2.5	1.3	1.0	1.0	2.2	2.0	1.3	1.7	2.0	1.0	-

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2409	Cloud Application Development	PCC	L	T	P	C
			2	0	2	3

Course Objectives:

- Provide a strong foundation in the core concepts, service models (IaaS, PaaS, SaaS), and architectural principles of modern cloud-native application development.
- Develop practical, hands-on proficiency in using key services on Amazon Web Services (AWS) and Microsoft Azure for computing, storage, database, and application integration.
- Impart the skills necessary to design, develop, and deploy a secure, scalable, and cost-effective full-stack application on a major cloud platform.
- Provide an understanding of modern development practices, including containerization with Docker, serverless computing, and automated CI/CD pipelines.
- Cultivate the ability to analyze and evaluate trade-offs between different cloud services and architectures, enabling informed decision-making for real-world projects.

UNIT I LOCAL DEVELOPMENT TO CLOUD NATIVE 6

Introduction - Cloud for Developers - The Serverless & Container Mindset. Tools Setup: Git, VS Code, Docker, Cloud CLIs. IAM for Developers: Setting up secure credentials for your apps. Deploying functions to AWS Lambda and Azure Functions.

UNIT II BUILDING THE BACKEND: APIS & DATA 6

Serverless APIs: Creating RESTful endpoints with API Gateway (AWS) and API Management (Azure). Databases for Apps: Using DynamoDB (AWS) and Cosmos DB (Azure) for NoSQL. Using RDS (AWS) and Azure SQL Database for SQL. Connecting functions to databases.

UNIT III FRONTEND, AUTHENTICATION & ASYNCHRONOUS PROCESSING 6

Static Web Hosting: Deploying a React/Angular/vanilla JS frontend to S3 + CloudFront (AWS) and Blob Storage + CDN (Azure). Authentication: Integrating Cognito (AWS) and Azure Active Directory B2C. Asynchronous Tasks: Using SQS (AWS) and Service Bus (Azure) for decoupling services.

UNIT IV CONTAINERS & CI/CD 6

Containerization Deep Dive: Dockerfiles, multi-stage builds. Serverless Containers: Deploying with AWS Fargate and Azure Container Instances (ACI). Automated Deployment: Building a CI/CD pipeline from GitHub to the cloud using GitHub Actions.

UNIT V INTEGRATION & MONITORING 6

Connecting the Dots: Building a complete data processing pipeline (file upload -> trigger function -> process data -> store in DB). Observability: Adding logging and monitoring with CloudWatch (AWS) and Azure Monitor. Cost Control for Developers: Understanding and optimizing your application's cloud bill. Building the Capstone Project.

Periods: 30

LIST OF EXPERIMENTS:

1. Foundations - Set up accounts, install CLIs, configure IAM roles for development.
2. Serverless Hello World - Write and deploy a "Hello World" function in Python/Node.js on Lambda & Azure Functions.
3. Serverless API - Create a CRUD API for a "To-Do" list using API Gateway + Lambda and Azure API Management + Azure Functions.
4. NoSQL Data Layer - Integrate the API from Lab 3 with DynamoDB and Cosmos DB.
5. Frontend & Auth - Deploy a static frontend, integrate it with the API, and add a simple login using Cognito & Azure AD B2C.
6. Async Messages - Modify the "To-Do" app to process new items asynchronously via SQS and Service Bus.
7. Containerize an App - Dockerize an existing monolithic application.
8. Deploy Containers - Push the Docker image to ECR & Azure Container Registry and deploy it using Fargate & ACI.
9. CI/CD Pipeline - Automate the deployment of the containerized app using GitHub Actions.
10. Capstone Project
    Students (in groups of 2-3) must choose ONE of the following application types, implement it, and deploy it on one of the two cloud platforms. The project must integrate at least four distinct cloud services.
    Project Choices:
    a. Serverless Image Processing Portal: A web app where users can upload images. Upon upload, a serverless function automatically generates a thumbnail and stores both images. The frontend displays the gallery of processed images.
    *Suggested Services: S3/Blob Storage, Lambda/Azure Functions, DynamoDB/Cosmos DB, SNS/Event Grid.
    b. Real-Time Polling/Voting Application: A web app that allows users to create polls and vote in real-time. The frontend should update results without requiring a page refresh.
    *Suggested Services: API Gateway/APIM, Lambda/Azure Functions, DynamoDB/Cosmos DB, WebSockets (API Gateway WebSocket/ Azure Web PubSub).

c. Document Processing Pipeline: An application that accepts document uploads (e.g., resumes), extracts text and key metadata, and stores the results in a searchable database.
*Suggested Services: S3/Blob Storage, Lambda/Azure Functions, Textract/Azure Form Recognizer, RDS/Azure SQL, SQS/Service Bus.

Periods: 30
Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Analyze the core services of AWS and Azure to select appropriate cloud-native solutions for given application requirements.
CO2: Design and develop serverless backends and APIs by leveraging cloud functions, databases, and integration services.
CO3: Implement secure and scalable cloud-based data storage and retrieval solutions using managed SQL and NoSQL database services.
CO4: Containerize a monolithic application using Docker and deploy it using serverless container orchestration services.
CO5: Build and deploy a full-stack cloud application by integrating multiple services and configuring automated CI/CD pipelines.
CO6: Evaluate the architectural, cost, and security trade-offs of implementation choices on AWS and Azure platforms.

Suggested Activities:
- Hands-on Activities
- Mini Project

Case Studies

Text Books:
1. Cloud Native Development Patterns and Best Practices, John Gilbert, Packt Publishing, 1st Edition, 2018.
2. Serverless Architectures on AWS: With examples using AWS Lambda, Peter Sbarski, Yan Cui, Manning Publications, 2nd Edition, 2022.
3. The Docker Book: Containerization is the New Virtualization, James Turnbull, James Turnbull, 2024.

References:
1. Architecting Cloud Native .NET Applications for Azure, Microsoft (Rob Vettor, et al.), Microsoft Press / O'Reilly Media, 1st Edition, 2024
2. AWS Certified Solutions Architect Study Guide: Associate SAA-C03 Exam, Ben Piper, David Clinton, Sybex,4th Edition, 2022.
3. Learn Azure in a Month of Lunches, Iain Foulds, Manning Publications, 1st Edition, 2020.

MAPPING OF COs WITH POs AND PSOs

COs	PO											PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	-
CO2	3	2	3	-	3	-	-	-	-	-	-	3	3	-
CO3	3	2	3	-	3	-	-	-	-	-	-	3	2	-
CO4	2	-	2	-	3	-	-	-	-	-	-	2	2	-
CO5	3	3	3	2	3	2	-	2	2	2	2	3	3	-
CO6	-	3	3	-	-	3	-	-	-	2	3	2	3	-
Avg.	**2.8**	**2.6**	**2.7**	**2.0**	**3.0**	**2.5**	**-**	**2.0**	**2.0**	**2.0**	**2.5**	**2.6**	**2.7**	**-**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PIT2402	Database Technologies for Web Applications	PCC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the concepts and architecture of distributed databases.
- To learn the features and operations of NoSQL databases like MongoDB, Cassandra, and Hive.
- To study advanced databases such as spatial, temporal, active, and mobile databases.
- To design and use document databases using XML and JSON.
- To understand and build applications using graph databases and Cypher queries.

UNIT I DISTRIBUTED DATABASES 6

Distributed Systems – Introduction – Architecture; Distributed Database Concepts – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing.

UNIT II NOSQL DATABASES 6

NoSQL – CAP Theorem – Sharding – Document based - MongoDB Operation: Insert, Update, Delete, Query, Indexing, Application, Replication, Sharding, Deployment – Using MongoDB with PHP / JAVA/ Python – Cassandra: Data Model – Key Space – Table Operations – CRUD Operations – CQL Types – HIVE : Data types – Database Operations – Partitioning – HiveQL.

UNIT III ADVANCED DATABASE SYSTEMS 6

Spatial Databases: Spatial Data Types – Spatial Relationships – Spatial Data Structures – Spatial Access Methods – Temporal Databases: Overview – Active Database – Deductive Databases – Recursive Queries in SQL – Mobile Databases: Location and Handoff Management – Mobile Transaction Models – Concurrency - Transaction Commit Protocols – Multimedia Databases

UNIT IV DOCUMENT DATABASES 6

XML Database: XML – XML Schema – XML DOM – XSL – XSLT – XPath and XQuery – JSON Document Databases – Document (MongoDB) Data Model - JSON and BSON– Polymorphic Schemas – Using MongoDB Shell – Basic Querying – Create and Insert – Creating Collections – Update and Delete.

UNIT V GRAPH DATABASES 6

Introduction to Graph Databases – The Power of Graph Databases – Data Modeling with Graphs – Querying Graphs – Introduction to Cypher – CQL Clauses – Write Clause – Read Clause – General Clauses – CQL Functions – Building a Graph Database application.

Periods: 30 PERIODS

Course Outcomes:

On completion of the course, the students will be able to
CO1: Design a distributed database system and execute distributed queries.
CO2: Implement NoSQL database systems and manipulate the data associated with it.
CO3: Disseminate knowledge on advanced database system concepts.

CO4: Create real time applications using Spatial, temporal and Mobile Databases.
CO5: Design and develop document databases using XML /JSON databases.
CO6: Build a simple real time application using graph databases and execute queries on it.

Practical Exercises:
1. Create a distributed database using horizontal and vertical fragmentation in any DBMS.
2. Creation of distributed queries using the fragmented data created.
3. Create a document-based database using MongoDB and manipulate the data.
4. Create a document database using Cassandra and manipulate the data.
5. Create a database to store multimedia elements and perform data retrieval operations.
6. Create a temporal database and explore the usage of temporal queries in it.
7. Creation of an XML document and validate it using an XML schema.
8. Given JSON and BSON document database and manipulate the data.
9. Create a simple Recommendation engine in E commerce use graph database.
10 Develop a social media application using Graph database.

30 PERIODS

Text Books:

1. Henry F. Korth, Abraham Silberschatz, S. Sudharshan, “Database System Concepts”, Sixth Edition, McGraw-Hill, 2011.
2. R. Elmasri, S. B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education/Addison Wesley, 2017.

References:

1. C. J. Date, A. Kannan, S. Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.
2. Brad Dayley, “Teach Yourself NoSQL with MongoDB in 24 Hours”, Sams, 2014.
3. Shashank Tiwari, “Professional NoSQL”, O’Reilly Media, 2011.
4. Vijay Kumar, “Mobile Database Systems”, John Wiley, 2006.
5. Ian Robinson, Jim Webber and Emil Eifrem, "Graph Databases”, O’Reilly Media, Second Edition, 2015
6. Elliotte Rusty Harold, W. Scott Means, “XML in a Nutshell“,O’Reilly Media, Thir Edition, 2004.
7. Shakuntala Gupta Edward (Author), Navin Sabharwal, “Practical MongoDB: Architecting, Developing, and Administering MongoDB”, APRESS, First Edition, 2018.

MAPPING OF COs WITH POs AND PSOs

COs	POs										
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	3	3	-	-	-	2	2	3
CO2	3	3	3	3	2	-	-	-	2	2	3
CO3	3	3	3	2	3	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	2	2	3
CO5	3	3	3	3	3	-	-	-	3	2	3
CO6	3	3	3	3	3	-	-	-	2	2	3
Avg.	3	3	3	2.8	2.8	-	-	-	2.2	2	2.8

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

PIT2403	Web Security and Privacy	PCC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the fundamentals of web application security
- To focus on wide aspects of secure development and deployment of web applications and fundamentals of privacy
- To learn how to build secure APIs
- To learn the basics of vulnerability assessment and penetration testing
- To get an insight about Hacking techniques and Tools

UNIT I FUNDAMENTALS OF WEB SECURITY 6

The history of Software Security-Recognizing Web Application Security Threats, Web Application Security, Authentication and Authorization, Secure Socket layer, Transport layer Security, Session Management-Input Validation

UNIT II SECURE DEVELOPMENT, DEPLOYMENT AND PRIVACY PROTECTION 6

Web Applications Security - Security Testing, Security Incident Response Planning, The Microsoft Security Development Lifecycle (SDL), OWASP Comprehensive Lightweight Application Security Process (CLASP), The Software Assurance Maturity Model (SAMM), The Web's War on Your Privacy, Privacy-Protecting Techniques, Backups and Antitheft, Web Server Security, Physical Security for Servers, Host Security for Servers, Securing Web Applications.

UNIT III SECURE API DEVELOPMENT 5

API Security- Session Cookies, Token Based Authentication, Securing Natter APIs: Addressing threats with Security Controls, Rate Limiting for Availability, Encryption, Audit logging, Securing service-to-service APIs: API Keys , OAuth2, Securing Microservice APIs: Service Mesh, Locking Down Network Connections, Securing Incoming Requests.

UNIT IV SECURITY RE-ENGINEERING AND VULNERABILITY ASSESSMENT 6

Vulnerability Assessment Lifecycle – Vulnerability Assessment Tools: Cloud-based, Host-based, Network-based, and Database-based Scanners – Types of Penetration Tests: External Testing, Internal Testing, Wireless Testing, Mobile Testing – Security Re-engineering for Databases: Concepts and Techniques – Database Watermarking for Copyright Protection – Trustworthy Records Retention – Damage Quarantine and Recovery in Data Processing Systems

UNIT V HACKING TECHNIQUES AND TOOLS 6

Social Engineering, Injection, Cross-Site Scripting(XSS), Broken Authentication and Session Management, Cross-Site Request Forgery, Security Misconfiguration, Insecure Cryptographic Storage, Failure to Restrict URL Access, Tools: Comodo, OpenVAS, Nexpose, Nikto, Burp Suite, etc.

Periods: 30 PERIODS

Course Outcomes:

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

CO1: Understanding the basic concepts of web application security and the need for it
CO2: Be acquainted with the process for secure development and deployment of applications.
CO3: Implement privacy-protecting and server security measures in secure application deployment.

CO4: Acquire the skill to develop secure APIs and integrate token-based authentication and service-to-service security.
CO5: Appreciate the importance of carrying out vulnerability assessment and penetration testing.
CO6: Acquire the skill to think like a hacker and use hacker toolsets

Practical Exercises: 30 PERIODS

1. Install wireshark and explore the various protocols
   a. Analyze the difference between HTTP vs HTTPS
   b. Analyze the various security mechanisms embedded with different protocols.
2. Identify the vulnerabilities using OWASP ZAP tool
3. Create simple REST API using python for following operation.
   a. GET
   b. PUSH
   c. POST
   d. DELETE
4. Install Burp Suite to do following vulnerabilities:
   a. SQL injection
   b. cross-site scripting (XSS)

5.Attack the website using Social Engineering method

1. Install Wireshark and explore the various protocols
   a. Analyze the difference between HTTP vs HTTPS.
   b. Analyze the various security mechanisms embedded with different protocols.
2. Use Wireshark to examine encryption and data transfer security
   a. Capture and analyze encrypted and unencrypted traffic.
   b. Compare packet structures for secure (HTTPS) and insecure (HTTP) sessions.
3. Identify the vulnerabilities using OWASP ZAP tool
4. Perform security testing using OWASP ZAP
   a. Analyze Cross-Site Scripting (XSS) and SQL Injection vulnerabilities.
   b. Validate fixes and verify secure configurations after remediation.
5. Create a simple REST API using Python to Implement GET and POST operations and Test responses using browser or API tools.
6. Create REST API to Implement PUSH and DELETE operations and Test API endpoints using Postman or curl commands.
7. Install and configure Burp Suite for vulnerability testing
   a. Capture and analyze web requests and responses.
   b. Identify SQL Injection vulnerabilities in a sample application.
8. Perform Cross-Site Scripting (XSS) and Demonstrate XSS vulnerability using Burp Suite.
9. Attack the website using Social Engineering method

Text Books:

1. Andrew Hoffman, Web Application Security: Exploitation and Countermeasures for Modern Web Applications, First Edition, 2020, O'Reilly Media, Inc.
2. Web Security, Privacy and Commerce Simson G Arfinkel, Gene Spafford, O'Reilly
3. Bryan Sullivan, Vincent Liu, Web Application Security: A Beginners Guide, 2012, The McGrawHill Companies.
4. Neil Madden, API Security in Action, 2020, Manning Publications Co., NY, USA.

References:

4. Michael Cross, Developer's Guide to Web Application Security, 2007, Syngress Publishing, Inc.
5. Ravi Das and Greg Johnson, Testing and Securing Web Applications, 2021, Taylor & Francis Group, LLC.
6. Prabath Siriwardena, Advanced API Security, 2020, Apress Media LLC, USA.
7. Malcom McDonald, Web Security for Developers, 2020, No Starch Press, Inc.

8. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey, and Terron Williams Grey Hat Hacking: The Ethical Hacker's Handbook, Third Edition, 2011, The McGraw-Hill Companies

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	1	-	1	-	1	-	3	1	1
CO2	3	3	2	2	3	1	1	1	1	2	2	3	2	3
CO3	3	3	3	2	3	1	1	1	1	2	2	3	3	3
CO4	3	3	3	2	3	1	-	1	1	2	2	3	3	3
CO5	3	3	2	3	2	1	1	1	1	1	2	3	3	2
CO6	3	3	3	2	2	1	1	1	1	1	2	3	3	2
Avg.	3.0	2.8	2.3	2.0	2.3	1.0	0.8	1.0	0.8	1.5	1.7	3.0	2.5	2.3

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2415	DevOps	PEC	L	T	P	C
			2	0	2	3

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)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

UNIT I INTRODUCTION TO DEVOPS 6

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE 6

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.

UNIT III CONTINUOUS INTEGRATION USING JENKINS 6

Install & Configure Jenkins, Jenkins Architecture Overview, Creating and Running a Simple Jenkins Job, Essential Plugins (Git and Maven Plugin), Configuring Jenkins with Git and Maven - Introduction to SonarQube - Integrating Jenkins with SonarQube for a Basic Code Quality Scan.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 6

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 6

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file

Periods: 30

LIST OF EXPERIMENTS:

1. Problem Identification and Software Requirement Specification (SRS) Development.
2. Web Application Development using MVC Architecture and Spring Boot Framework
3. Install Git version control system and configure with GitHub
4. Installation and build using Maven
5. Installation and build using Gradle
6. Create a Maven build pipeline in Azure
7. Run regression test using Maven build pipeline in Azure
8. Installation and Configuration of Jenkins and creating a workspace
9. Install Jenkins in cloud and create CI/CD pipeline and deploy in cloud
10. Install and configure Ansible
11. Create an Ansible playbook for a simple web application infrastructure

Periods: 30
Total Periods: 60

Course Outcomes:

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

CO1: Understand different actions performed through Version control tools like Git.
CO2: Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle
CO3: Ability to Install, configure, and manage Jenkins with Java, Git, and Maven for CI/CD automation
CO4: Perform integration and use key Jenkins plugins to enhance job execution and reporting
CO5: Ability to do configuration management using Ansible
CO6: Understand to leverage Cloud-based DevOps tools using Azure DevOps

Suggested Activities:

- Hand-on activities
- Case Studies
- In-Class activities
- Project

Text Books:

1. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and Command Line”, Kindle Edition, 2014

References:

1. Mitesh Soni, “Hands-On Azure Devops: Cicd Implementation for Mobile, Hybrid, And Web Applications Using Azure Devops and Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback”, 2020.
2. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015.
3. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
4. Mariot Tsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.
5. https://www.jenkins.io/user-handbook.pdf

6. https://maven.apache.org/guides/getting-started/

Laboratory Requirements:

1. Java JDK 21 or above, Maven v3.9 or above, Gradle v8 or above.
2. Jenkins (latest LTS version).
3. SonarQube Server (Community Edition) and SonarScanner CLI.
4. Azure DevOps Organization (Student / Free Tier) with Pipeline Access.
5. Ansible v2.15 or above with YAML support.
6. Visual Studio Code and Git Version Control System

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	-	-	-	-	-	-	2	3	3
CO2	3	3	3	2	3	-	-	-	-	-	-	2	3	3
CO3	3	3	3	2	3	-	-	-	-	-	-	2	3	3
CO4	3	3	3	2	3	-	-	-	-	-	-	2	3	3
CO5	3	3	3	2	3	-	-	-	-	-	-	2	3	3
CO6	3	3	3	2	3	-	-	-	-	-	-	2	2	2
Avg.	**3.0**	**3.0**	**3.0**	**2.0**	**3.0**	-	-	-	-	-	-	**2.0**	**2.8**	**2.8**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2413	Software Testing and Automation	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the basics of software testing
- To learn how to do the testing and planning effectively
- To build test cases and execute them
- To focus on wide aspects of testing and understanding multiple facets of testing
- To get an insight about test automation and the tools used for test automation

UNIT I FOUNDATIONS OF SOFTWARE TESTING 6

Why do we test Software? Black-Box Testing and White-Box Testing, Software Testing Life Cycle, V- model of Software Testing, Program Correctness and Verification, Reliability versus Safety, Failures, Errors and Faults (Defects), Software Testing Principles, Program Inspections, Stages of Testing: Unit Testing, Integration Testing, System Testing

UNIT II TEST PLANNING 6

The Goal of Test Planning, High Level Expectations, Intergroup Responsibilities, Test Phases, Test Strategy, Resource Requirements, Tester Assignments, Test Schedule, Test Cases, Bug Reporting, Metrics and Statistics.

UNIT III TEST DESIGN AND EXECUTION 6

Test Objective Identification, Test Design Factors, Requirement identification, Testable Requirements, Modeling a Test Design Process, Modeling Test Results, Boundary Value Testing, Equivalence Class Testing, Path Testing, Data Flow Testing, Test Design Preparedness Metrics, Test Case Design Effectiveness, Model-Driven Test Design, Test Procedures, Test Case Organization and Tracking, Bug Reporting, Bug Life Cycle.

UNIT IV ADVANCED TESTING CONCEPTS 6

Performance Testing: Load Testing, Stress Testing, Volume Testing, Fail-Over Testing, Recovery Testing, Configuration Testing, Compatibility Testing, Usability Testing, Testing the Documentation, Security testing, Testing in the Agile Environment, Testing Web and Mobile Applications.

UNIT V TEST AUTOMATION AND TOOLS 6

Automated Software Testing, Automate Testing of Web Applications, Selenium: Introducing Web Driver and Web Elements, Locating Web Elements, Actions on Web Elements, Different Web Drivers, Understanding Web Driver Events, Testing: Understanding Testing.xml, Adding Classes, Packages, Methods to Test, Test Reports.

Periods: 30

LIST OF EXPERIMENTS:

1. Develop the test plan for testing an e-commerce web/mobile application (www.amazon.in).
2. Design the test cases for testing the e-commerce application
3. Test the e-commerce application and report the defects in it.
4. Develop the test plan and design the test cases for an inventory control system.
5. Execute the test cases against a client server or desktop application and identify the defects.
6. Test the performance of the e-commerce application.
7. Automate the testing of e-commerce applications using Selenium.
8. Integrate TestNG with the above test automation.
9. Mini Project:
   i) Build a data-driven framework using Selenium and TestNG
   ii) Build Page object Model using Selenium and TestNG
   iii) Build BDD framework with Selenium, TestNG and Cucumber

Periods: 30
Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Understand the basic concepts of software testing and the need for software testing
CO2: Design Test planning and different activities involved in test planning
CO3: Design effective test cases that can uncover critical defects in the application CO4: Carry out advanced types of testing
CO5: Automate the software testing using Selenium and TestNG
CO6: Analyze software testing standards, documentation practices, and metrics to ensure quality and continuous improvement in software development.

Suggested Activities:

- Hands-on
- In-Class Activities
- Mini Project

Text Books:

1. Yogesh Singh, “Software Testing”, Cambridge University Press, 2012
2. Unmesh Gundecha, Satya Avasarala, "Selenium WebDriver 3 Practical Guide" – Second Edition, 2018

References:

1. Glenford J. Myers, Corey Sandler, Tom Badgett, “The Art of Software Testing”, John Wiley & Sons, Inc., 2012
2. Ron Patton, “Software Testing”, Sams Publishing, 2006
3. Paul C. Jorgensen, “Software Testing: A Craftsman’s Approach”, Taylor & Francis Group, 2014
4. Carl Cocchiaro, “Selenium Framework Design in Data-Driven Testing”, Packt Publishing, 2018
5. Elfriede Dustin, Thom Garrett, Bernie Gauf, “Implementing Automated Software Testing”, Pearson Education, Inc. – 2009
6. Satya Avasarala, “Selenium WebDriver Practical Guide”, Packt Publishing, 2014
7. Varun Menon, “TestNG Beginner's Guide”, Packt Publishing, 2013

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	1	2	-	-	1	1	3	2	3	2	3
CO2	2	3	1	1	1	-	-	2	2	1	2	1	2	3
CO3	2	2	1	3	1	-	-	1	3	1	2	2	3	2
CO4	2	1	3	2	1	-	-	1	1	1	2	3	1	2
CO5	2	2	1	3	1	-	-	1	3	2	1	2	1	3
CO6	1	1	3	2	3	3	-	1	3	2	2	2	3	2
Avg.	2.0	2.0	1.8	2.0	1.5	3.0	-	1.2	2.2	1.7	1.8	2.2	2.0	2.5

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

PIT2404	Distributed Computing	PCC	L	T	P	C
			3	0	0	3

Course Objectives:

- To introduce the computation and communication models of distributed systems
- To illustrate the issues of synchronization and collection of information in distributed systems
- To describe distributed mutual exclusion and distributed deadlock detection techniques
- To elucidate agreement protocols and fault tolerance mechanisms in distributed systems
- To explain the cloud computing models and the underlying concepts

UNIT I INTRODUCTION 8

Introduction: Definition-Relation to Computer System Components – Motivation – Message - Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication – Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models of Communication Networks – Global State of a Distributed System

UNIT II LOGICAL TIME AND GLOBAL STATE 10

Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks – Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication – Synchronous Program Order on Asynchronous System – Group Communication – Causal Order – Total Order; Global State and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels.

UNIT III DISTRIBUTED MUTEX AND DEADLOCK 10

Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart- Agrawala's Algorithm — Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model

UNIT IV CONSENSUS AND RECOVERY 10

Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure-Free System(Synchronous and Asynchronous) – Agreement in Synchronous Systems with Failures; Checkpointing and Rollback Recovery: Introduction – Background and Definitions – Issues in Failure Recovery – Checkpoint-based Recovery – Coordinated Checkpointing Algorithm -- Algorithm for Asynchronous Checkpointing and Recovery

UNIT V CLOUD COMPUTING 7

Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing – Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application Services

Periods: 45 PERIODS

Course Outcomes:

On completion of the course, the students will be able to
CO1: Explain the foundations of distributed systems
CO2: Solve synchronization and state consistency problems
CO3: Analyze and apply distributed mutual exclusion algorithmss
CO4: Detect and model deadlocks in distributed environments
CO5: Apply working model of consensus and reliability of distributed systems
CO6: Explain the fundamentals of cloud computing

Text Books:

5. Kshemkalyani Ajay D, Mukesh Singhal, "Distributed Computing: Principles, Algorithms and Systems", Cambridge Press, 2011.
6. Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating systems", Mc-Graw Hill Publishers, 1994.

References:

1. George Coulouris, Jean Dollimore, Time Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
2. Pradeep L Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
3. Tanenbaum A S, Van Steen M, "Distributed Systems: Principles and Paradigms", Pearson Education, 2007
4. Liu M L, "Distributed Computing: Principles and Applications", Pearson Education, 2004.
5. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, 2003.

6. Arshdeep Bagga, Vijay Madisetti, " Cloud Computing: A Hands-On Approach", Universities Press, 2014.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	3	3	1	-	-	2	1	3	3	1	1	1
CO2	1	3	2	1	2	-	-	2	2	3	2	1	3	3
CO3	3	3	1	2	2	-	-	2	2	1	1	1	3	3
CO4	3	3	1	2	2	-	-	2	2	1	1	1	2	3
CO5	1	2	2	3	1	-	-	3	3	2	1	1	2	3
CO6	3	3	1	2	3	-	-	3	3	3	1	1	1	1
Avg.	2.2	2.7	1.7	2.2	1.8	-	-	2.3	2.2	2.2	1.5	1.0	2.0	2.3

1 - low, 2 - medium, 3 - high, '-' - no correlation

PIT2405	Cloud Computing and Virtualization	PCC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the concepts and architecture of virtualization technologies.
- To explore the role of hypervisors and virtual machines in cloud infrastructure.
- To study containerization and orchestration tools for cloud-native applications.
- To analyze virtualization platforms and their deployment in cloud environments.
- To provide hands-on experience in virtual machine and container management.

UNIT I INTRODUCTION TO VIRTUALIZATION 6

Definition and types of virtualization – Benefits and challenges – Virtualization vs. emulation vs. containerization – Role of virtualization in cloud computing – Overview of virtualization layers.

UNIT II VIRTUAL MACHINE ARCHITECTURE 6

Virtual Machine Monitor (VMM) – Hypervisors: Type 1 and Type 2 – CPU, memory, and I/O virtualization – VM lifecycle – Resource allocation and scheduling.

UNIT III VIRTUALIZATION TECHNOLOGIES 6

Overview of VMware, Hyper-V, KVM, Xen – Comparison of virtualization platforms – Storage virtualization – Network virtualization – Security and isolation in virtual environments.

UNIT IV CONTAINERIZATION AND ORCHESTRATION 6

Introduction to containers – Docker architecture – Container vs. VM – Dockerfile and image creation – Container orchestration using Kubernetes – Microservices deployment.

UNIT V VIRTUALIZATION IN CLOUD INFRASTRUCTURE 6

Virtualization in IaaS, PaaS, SaaS – Elasticity and scalability – Performance tuning and monitoring – Case studies: AWS EC2, Azure VMs, Google Compute Engine – Trends in virtualization.

Periods: 30 PERIODS

Course Outcomes:

On completion of the course, the students will be able to
CO1: Understand the principles and architecture of virtualization.
CO2: Analyze the functioning of hypervisors and virtual machines.
CO3: Apply containerization techniques for cloud-native applications.
CO4: Evaluate virtualization platforms and their deployment strategies.
CO5: Demonstrate practical skills in managing virtual machines and containers.
CO6: Assess virtualization performance and integration in cloud infrastructure.

Practical Exercises:
1. Installation and configuration of VirtualBox/VMware
2. Creation and management of virtual machines
3. Snapshot and cloning operations
4. Installation of KVM or Xen on Linux
5. Installation and basic usage of Docker
6. Docker image creation using Dockerfile
7. Multi-container deployment using Docker Compose
8. Container networking and volume management
9. Installation and configuration of Minikube
10. Application deployment on Kubernetes
11. Scaling and rolling updates in Kubernetes
12. Performance monitoring of virtual machines
13. Comparison of VM and container resource usage
14. Launching virtual machines on cloud platforms (AWS/Azure)
15. Mini project: Virtualized deployment of a sample web application

30 PERIODS

Text Books:

7. Matthew Portnoy, Virtualization Essentials, 2nd Edition, Wiley, 2016.
8. Nigel Poulton, Docker Deep Dive, 4th Edition, Independently Published, 2020.
9. Kelsey Hightower, Brendan Burns, Joe Beda, Kubernetes Up & Running, 2nd Edition, O'Reilly Media, 2019.

References:

5. Nick Marshall, Mastering VMware vSphere 7, Packt Publishing, 2020.
6. Rajkumar Buyya, James Broberg, Andrzej Goscinski, Cloud Computing: Principles and Paradigms, Wiley, 2011.
7. Dr. Balwinder Singh Sodhi, Topics in Virtualization and Cloud Computing, IIT Ropar Lecture Series, 2021.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	3	2	-
CO2	3	3	2	-	2	-	-	-	-	-	-	3	2	-
CO3	2	3	3	2	3	-	-	-	2	2	-	3	3	2
CO4	2	3	2	2	3	2	-	-	2	2	2	3	3	2
CO5	2	2	3	2	3	2	-	-	2	2	2	3	3	3
CO6	2	2	3	3	3	2	-	-	2	2	2	3	3	3
Avg.	2.3	2.5	2.3	2.3	2.8	2.0	-	-	2.0	2.0	2.0	3.0	2.7	2.5

1 - low, 2 - medium, 3 - high, '-' - no correlation

PIT2406	Information Storage and Management	PCC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the fundamental concepts of information storage, retrieval, and management in enterprise environments.
- To explore different storage architectures and networked storage technologies.
- To learn about data protection, backup, and disaster recovery mechanisms.
- To study cloud storage, virtualization, and security mechanisms for data.
- To develop hands-on skills in managing and securing enterprise storage systems.

UNIT I INTRODUCTION TO STORAGE SYSTEMS 6

Data and Information – Evolution of Storage Technology – Data Center Infrastructure – Key Components (Servers, Networks, Storage Arrays) – Storage Architecture and Devices – Storage Performance Metrics – Direct Attached Storage (DAS) and Network Attached Storage (NAS).

UNIT II STORAGE NETWORKING AND VIRTUALIZATION 6

Storage Area Networks (SAN) – Components and Topologies – Fibre Channel and iSCSI – Storage Virtualization – Thin Provisioning – Virtual Machine File System (VMFS) – Benefits and Challenges of Virtualization.

UNIT III DATA PROTECTION AND BACKUP STRATEGIES 6

Data Availability and Reliability – Backup and Recovery Methods – Snapshot, Cloning, Mirroring – Data Deduplication – Replication Techniques – Archive and Retention Policies – Disaster Recovery Principles.

UNIT IV CLOUD STORAGE AND SECURITY 6

Cloud Computing Overview – Cloud Storage Models (Public, Private, Hybrid) – Storage as a Service (STaaS) – Access Protocols (REST, SOAP) – Data Security Challenges in Cloud – Encryption, Authentication, and Access Control – Data Governance.

UNIT V STORAGE MANAGEMENT AND MONITORING 6

Information Lifecycle Management (ILM) – Storage Management Processes – Storage Resource Management (SRM) Tools – Capacity Planning – Performance Tuning – Monitoring and Troubleshooting – Emerging Trends: Software-defined Storage, Object Storage, and Green Data Centers.

Suggested Activities:

- Practical: Use monitoring tools to analyze disk performance.
- Group Discussion: The future of software-defined storage.
- Practical: Demonstrate cloud storage setup using AWS S3 or Google Cloud Storage.
- Practical: Simulate SAN configuration using open-source tools.

PRACTICAL EXERCISES

1. Identify and configure storage devices and file systems.
2. Implement RAID levels using simulation tools.
3. Configure a basic NAS and SAN setup.
4. Perform data backup and recovery using open-source software.
5. Demonstrate virtualization of storage using VirtualBox or VMware.

6. Create and manage cloud storage using AWS S3 or Azure Blob.
7. Simulate data replication and snapshot management.
8. Monitor disk usage and generate performance reports.

Periods: 30 PERIODS

Course Outcomes:

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

CO1: Understand the fundamental concepts, components, and architecture of information storage systems.
CO2: Analyze various storage networking technologies such as DAS, NAS, and SAN for enterprise applications.
CO3: Apply suitable data protection, backup, and recovery techniques to ensure business continuity.
CO4: Implement cloud-based and virtualized storage solutions securely using modern tools and platforms.
CO5: Evaluate storage performance using monitoring tools and analyze optimization strategies.
CO6: Demonstrate teamwork, documentation, and communication skills through practical implementation and reporting of storage management tasks.

Practical Exercises:

1. Identify and configure storage devices and file systems.
2. Implement RAID levels using simulation tools.
3. Configure a basic NAS and SAN setup.
4. Perform data backup and recovery using open-source software.
5. Demonstrate virtualization of storage using VirtualBox or VMware.
6. Create and manage cloud storage using AWS S3 or Azure Blob.
7. Simulate data replication and snapshot management.
8. Monitor disk usage and generate performance reports.

30 PERIODS

Text Books:

1. EMC Education Services, *Information Storage and Management: Storing, Managing, and Protecting Digital Information*, Wiley India, 2nd Edition, 2012.
2. Robert Spalding, *Storage Networks: The Complete Reference*, McGraw-Hill, 2003.

References:

7. Tom Clark, *Designing Storage Area Networks*, Addison-Wesley, 3rd Edition, 2007.
8. Richard Barker and Paul Massiglia, *Storage Networks Explained*, Wiley, 2002.
9. Chris Evans, *Data Storage Networking: Real World Skills for Storage and SAN Professionals*, Cisco Press, 2011.

MAPPING OF COs WITH POs AND PSOs

COs	POs								PSOs					
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	1	-	-	-	-	-	-	3	2	2
CO2	3	3	2	2	3	-	-	-	-	-	-	3	3	2
CO3	3	3	2	2	2	2	1	-	1	-	-	2	3	3
CO4	3	2	3	2	3	2	1	2	1	1	-	3	3	2
CO5	3	3	3	3	3	2	2	-	2	2	2	2	3	3
CO6	2	1	2	2	2	1	1	1	3	3	2	3	2	3
Avg.	2.8	2.3	2.1	2.2	2.3	1.7	1.2	1.5	1.7	2	2	2.6	2.6	2.5

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2417	Data Warehousing and Data Mining Techniques	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the fundamental concepts of data warehousing and data mining.
- To learn data preprocessing and integration techniques for analytical modeling.
- To explore association rule mining and pattern discovery methods.
- To study classification and clustering algorithms for predictive analysis.
- To understand implementation using modern data analytics and visualization tools.
- To analyze real-world case studies applying mining techniques for decision support systems.

UNIT I INTRODUCTION TO DATA WAREHOUSING AND DATA MINING 6

Data Warehouse – Evolution, Components, and Architecture – Data Mart – OLAP and OLTP systems – ETL Process – Data Cube and Multidimensional Models – Data Warehouse Design – Star and Snowflake Schemas – Introduction to Data Mining – Knowledge Discovery Process – Data Objects and Attributes – Types of Data – Data Mining Functionalities.

UNIT II DATA PREPROCESSING AND INTEGRATION 6

Data Cleaning, Integration, and Transformation – Handling Missing and Noisy Data – Data Reduction: Attribute and Instance Reduction – Data Discretization and Concept Hierarchy Generation – Data Integration using SQL and Python – Feature Engineering for Machine Learning Models.

UNIT III ASSOCIATION AND PATTERN DISCOVERY 6

Basic Concepts of Association Rule Mining – Market Basket Analysis – Apriori Algorithm – FP-Growth Algorithm – Mining Multi-level and Multidimensional Association Rules – Constraint-based Association Mining – Correlation Analysis – Sequential Pattern Mining – Evaluation of Discovered Patterns.

UNIT IV CLASSIFICATION AND CLUSTERING 6

Classification: Decision Tree Induction – Bayesian Classification – k-Nearest Neighbor – Support Vector Machines – Ensemble Methods (Random Forest, Gradient Boosting) – Model Evaluation Metrics – Clustering: K-Means, Hierarchical Clustering, DBSCAN – Cluster Validity and Interpretation – Applications in AI, Healthcare, and Business.

UNIT V APPLICATIONS AND MODERN DATA MINING TOOLS 6

Applications of Data Mining: Web Mining, Text Mining, and Social Media Mining – Data Mining in E-commerce and Business Analytics – Integration with Big Data Frameworks (Hadoop, Spark MLlib) – Data Visualization for Mining Results – Case Studies using Python, Tableau, and Power BI – Ethics and Privacy in Data Mining.

Periods: 30

LIST OF EXPERIMENTS:

1. Perform data preprocessing including cleaning, integration, transformation, and normalization using Python (Pandas, NumPy).
2. Design and implement a data warehouse schema (Star and Snowflake) using SQL with dimension and fact tables.
3. Execute OLAP operations – roll-up, drill-down, slice, dice, and pivot – using SQL or BI tools.
4. Implement Apriori algorithm for association rule mining using Python or Weka.
5. Perform FP-Growth algorithm for frequent pattern mining and compare performance with Apriori.
6. Apply Decision Tree classification on a dataset and evaluate accuracy metrics.
7. Implement Naïve Bayes and k-Nearest Neighbour classifiers for predictive analytics.
8. Conduct Clustering analysis using K-Means and DBSCAN algorithms with visualization.
9. Perform Text or Web Mining using TF-IDF, tokenization, and generate visual insights.
10. Create an interactive dashboard or visualization report using Tableau, Power BI, or Python (Matplotlib/Seaborn).

Periods: 30
Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Describe data warehousing architecture, design, and implementation principles.
CO2: Apply preprocessing and integration techniques for preparing analytical datasets.
CO3: Use association and pattern discovery techniques to uncover hidden insights.
CO4: Implement supervised and unsupervised learning methods for classification and clustering.
CO5: Apply mining techniques using modern tools like Python, SQL, and visualization platforms.
CO6: Analyze and evaluate real-world business and AI applications using data mining models.

Suggested Activities:

- Hands-on / In-class Activities
- Mini Project
- Case Studies

Text Books:

1. Jiawei Han, Micheline Kamber, Jian Pei, Data Mining: Concepts and Techniques, 4th Edition, Morgan Kaufmann, 2022.
2. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Introduction to Data Mining, Pearson Education, 2019.

References:

1. Alex Berson and Stephen J. Smith, Data Warehousing, Data Mining and OLAP, Tata McGraw Hill, 2017.
2. G. K. Gupta, Introduction to Data Mining with Case Studies, PHI Learning, 2018.
3. Ian H. Witten, Eibe Frank, Mark A. Hall, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufmann, 2016.
4. Charu C. Aggarwal, Data Mining: The Textbook, Springer, 2015.
5. Benjamin Bengfort, Rebecca Bilbro, Applied Text Analysis with Python, O'Reilly, 2021.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3

CO1	3	2	2	2	2	-	-	-	-	-	-	2	1	-
CO2	2	3	3	3	2	-	-	-	-	-	-	2	2	-
CO3	3	3	3	3	2	-	-	-	-	-	-	3	2	-
CO4	3	3	3	3	3	-	-	-	-	-	-	3	3	-
CO5	3	3	3	3	3	-	-	-	-	3	-	3	3	-
CO6	3	3	3	2	3	-	-	-	-	3	-	3	3	-
Avg.	**2.8**	**2.8**	**2.8**	**2.7**	**2.5**	**-**	**-**	**-**	**-**	**3**	**-**	**2.7**	**2.3**	**-**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2420	**SECURITY AND PRIVACY IN CLOUD**	**PEC**	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**

Course Objectives:

- To Introduce Cloud Computing terminology, definition & concepts
- To understand the security design and architectural considerations for Cloud
- To understand the Identity, Access control in Cloud
- To follow best practices for Cloud security using various design patterns
- To be able to monitor and audit cloud applications for security

UNIT I FUNDAMENTALS OF CLOUD SECURITY CONCEPTS 7

Overview of cloud security- Security Services - Confidentiality, Integrity, Authentication, Nonrepudiation, Access Control - Basic of cryptography - Conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II SECURITY DESIGN AND ARCHITECTURE FOR CLOUD 6

Security design principles for Cloud Computing - Comprehensive data protection - End-to-end access control - Common attack vectors and threats - Network and Storage - Secure Isolation Strategies - Virtualization strategies
- Inter-tenant network segmentation strategies - Data Protection strategies: Data retention, deletion and archiving procedures for tenant data, Encryption, Data Redaction, Tokenization, Obfuscation, PKI and Key

UNIT III ACCESS CONTROL AND IDENTITY MANAGEMENT 6

Access control requirements for Cloud infrastructure - User Identification - Authentication and Authorization - Roles-based Access Control - Multi-factor authentication - Single Sign-on, Identity Federation - Identity providers and service consumers - Storage and network access control options - OS Hardening and minimization
- Verified and measured boot - Intruder Detection and prevention

UNIT IV CLOUD SECURITY DESIGN PATTERNS 6

Introduction to Design Patterns, Cloud bursting, Geo-tagging, Secure Cloud Interfaces, Cloud Resource Access Control, Secure On-Premise Internet Access, Secure External Cloud

UNIT V MONITORING, AUDITING AND MANAGEMENT 5

Proactive activity monitoring - Incident Response, monitoring for unauthorized access, malicious traffic, abuse of system privileges - Events and alerts - Auditing – Record generation, Reporting and Management, Tamper- proofing audit logs, Quality of Services, Secure Management, User management, Identity management, Security Information and Event Management

Periods: 30

LIST OF EXPERIMENTS:

1. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim
2. simulate resource management using cloud sim
3. simulate log forensics using cloud sim
4. simulate a secure file sharing using a cloud sim
5. Implement data anonymization techniques over the simple dataset (masking, k-anonymization, etc)
6. Implement any encryption algorithm to protect the images
7. Implement any image obfuscation mechanism
8. Implement a role-based access control mechanism in a specific scenario
9. Implement an attribute-based access control mechanism based on a particular scenario
10. Develop a log monitoring system with incident management in the cloud

Periods: 30
Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Understand the fundamental concepts of cloud security, including confidentiality, integrity, authentication, and access control.
CO2: Analyze security design principles and architectures for securing cloud infrastructure, data, and virtualization environments.
CO3: Apply identity and access management techniques such as RBAC, MFA, and SSO for secure cloud operations.
CO4: Implement and evaluate cloud security design patterns for ensuring secure data communication and cloud resource access.
CO5: Develop and simulate secure mechanisms for data protection, encryption, and intrusion prevention in cloud environments.
CO6: Monitor, audit, and manage cloud security events using proactive incident response and logging techniques.

Suggested Activities:
- Mini Project
- Assignments
- Group Activities
- Hands-on
- Tools Exposure

Text Books:

1. Raj Kumar Buyya, James Broberg, Andrzej Goscinski, “Cloud Computing”, Wiley, 2013
2. Dave Shackleford, “Virtualization Security”, SYBEX (A Wiley Brand), 2013
3. Mather, Kumaraswamy, Latif, “Cloud Security and Privacy”, O’Reilly, 2011

References:

1. Mark C. Chu-Carroll, “Code in the Cloud, CRC Press, 2011
2. RajkumarBuyya, Christian Vechhiola, S. ThamaraiSelvi, “Mastering Cloud Computing Foundations and Applications Programming”, McGraw Hill Education, 2013

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	1	-	-	-	2	-	2	3	2	2
CO2	3	3	2	2	2	-	-	-	2	-	3	3	3	2
CO3	2	3	3	2	3	-	-	1	2	-	2	3	3	2
CO4	2	3	3	3	3	-	-	1	3	-	3	3	3	3
CO5	3	3	3	3	3	-	-	2	2	-	3	3	3	3
CO6	2	3	2	3	3	2	-	1	3	-	3	3	3	3
Avg.	2.5	2.8	2.3	2.6	2.5	2.0		1.3	2.3		2.7	3.0	2.8	2.5

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2422	Software Defined Networks	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the need for SDN and its data plane operations
- To understand the functions of control plane
- To comprehend the migration of networking functions to SDN environment
- To explore various techniques of network function virtualization
- To comprehend the concepts behind network virtualization

UNIT I SDN: INTRODUCTION 6

Evolving Network Requirements – The SDN Approach – SDN architecture - SDN Data Plane, Control plane and Application Plane

UNIT II SDN DATA PLANE AND CONTROL PLANE 6

Data Plane functions and protocols - OpenFLow Protocol - Flow Table - Control Plane Functions - Southbound Interface, Northbound Interface – SDN Controllers - Ryu, OpenDaylight, ONOS - Distributed Controllers

UNIT III SDN APPLICATIONS 6

SDN Application Plane Architecture – Network Services Abstraction Layer – Traffic Engineering – Measurement and Monitoring – Security – Data Center Networking

UNIT IV NETWORK FUNCTION VIRTUALIZATION 6

Network Virtualization - Virtual LANs – OpenFlow VLAN Support - NFV Concepts – Benefits and Requirements – Reference Architecture

UNIT V NFV FUNCTIONALITY 6

NFV Infrastructure – Virtualized Network Functions – NFV Management and Orchestration – NFV Use cases – SDN and NFV

Periods: 30

LIST OF EXPERIMENTS:

1. Introduction to Mininet Environment. Setup your own virtual SDN lab
   i) Virtualbox/Mininet Environment for SDN - http://mininet.org
   ii) https://www.kathara.org
   iii) GNS3
2. Create a simple mininet topology with SDN controller and use Wireshark to capture and visualize the OpenFlow messages such as OpenFlow FLOW MOD, PACKET IN, PACKET OUT etc
3. Create a SDN application that uses the Northbound API to program flow table rules on the switch for various use cases like L2 learning switch, Traffic Engineering, Firewall etc.
4. Implement Flow Rules using OpenFlow Controller (Ryu/POX/Floodlight)
5. Design and Deploy a Simple SDN Application (Firewall / Load Balancer)
6. Configure an SDN topology to implement network slicing or tenant isolation using OpenFlow VLAN Support.
7. Deploy a fundamental network function (e.g., a simple Web Proxy or NAT VNF) as a Docker container on a Mininet host.
8. Create a simple end-to-end network service chain with two Virtualized Network Functions (VNFs)
9. Install the open-source MANO (OSM) platform and use its components to onboard and orchestrate a complex network service consisting of multiple VNFs
10. Case Study / Mini Project: Real-Time SDN-Based Traffic Control

Periods: 30
Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Describe the motivation behind SDN.
CO2: Identify the functions of the data plane and control plane. CO3: Design and develop network applications using SDN. CO4: Orchestrate network services using NFV.
CO5: Explain various use cases of SDN and NFV.
CO6: Evaluate SDN–NFV integration for research and emerging networks.

Suggested Activities:

- Hands-On Activities
- Group Discussion
- Case Study
- Mini Project

Text Books:

1. William Stallings, “Foundations of Modern Networking: SDN, NFV, QoE, IoT and Cloud”, Pearson Education, 1st Edition, 2015.

References:

1. Ken Gray, Thomas D. Nadeau, “Network Function Virtualization”, Morgan Kauffman, 2016.
2. Thomas D Nadeau, Ken Gray, “SDN: Software Defined Networks”, O’Reilly Media, 2013.
3. Fei Hu, “Network Innovation through OpenFlow and SDN: Principles and Design”, 1st Edition, CRC Press, 2014.
4. Paul Goransson, Chuck Black Timothy Culver, “Software Defined Networks: A Comprehensive Approach”, 2nd Edition, Morgan Kaufmann Press, 2016.
5. Oswald Coker, Siamak Azodolmolky, “Software-Defined Networking with OpenFlow”, 2nd Edition, O’Reilly Media, 2017.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	-	-	-	-	1	-	3	2	-
CO2	3	3	2	-	2	-	-	-	-	-	1	2	2	-
CO3	3	3	3	2	3	-	-	-	1	2	2	3	3	2
CO4	2	2	3	1	3	-	-	-	-	1	3	2	3	1
CO5	2	2	2	-	2	1	-	-	1	2	2	2	2	1
CO6	3	3	3	2	3	2	1	-	3	3	3	3	3	2
Avg.	2.7	2.5	2.6	1.7	2.5	1.5	1.0	-	1.7	1.8	2.2	2.5	2.5	1.5

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2424	Fog and Edge Computing	PEC	L	T	P	C
			3	0	0	3

Course Objectives:

- To understand the fundamentals of edge computing architecture and its distinction from cloud computing.
- To explore edge devices, fog nodes, and communication protocols used in edge environments.
- To design and implement edge-based applications for real-time data processing.
- To analyze security, privacy, and resource management challenges in edge computing.
- To apply edge computing concepts in IoT, smart systems, and industrial applications.
- To develop innovation and research skills in emerging edge and fog computing technologies.

UNIT I INTRODUCTION TO FOG COMPUTING 9

Introduction to Fog Computing, Limitation of Cloud Computing, Differences between Cloud and Fog Computing, Advantages, Business Models, Architecture, Opportunities and Challenges.

UNIT II CHALLENGES IN FOG RESOURCES 9

Taxonomy and Characteristics, Resource Scheduling, Resource Management Challenge, Optimization Challenges, Miscellaneous Challenges.

UNIT III IOT AND FOG 9

Programming Paradigms, Research Challenges and Research Directions, Fog Protocols, Management and Orchestration of Network Slices in 5G, Fog, Edge and Clouds, Data Management and Analysis in Fog Computing, Case Studies.

UNIT IV INTRODUCTION TO EDGE COMPUTING 9

Origins of Edge, Edge Helping Low-End IoT Nodes, Architecture, Edge Processing, Edge Helping Higher-Capability IoT Nodes, Case Study: Raspberry Pi as an Edge Computing Device.

UNIT V APPLICATIONS OF FOG AND EDGE COMPUTING 9

Mobile Offloading, Edge Helping the Cloud, Edge for Augmented Reality, Data Processing on the Edge, Dispersed Learning with Edge/Fog Computing, Video Analytics on the Edge, Edge Computing Applications.

Periods: 45 PERIODS

Course Outcomes:

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

CO1: Understand the fundamentals of edge computing architecture and its relationship with cloud and fog computing.
CO2: Design and implement edge-based data processing pipelines using edge devices and protocols.
CO3: Analyze real-time data management and offloading strategies in edge computing environments.
CO4: Understand the security challenges and resource management techniques in edge computing.
CO5: Apply edge computing principles to IoT, smart city, and industrial automation use cases.
CO6: Demonstrate innovation and research orientation in edge and fog computing technologies.

Suggested Activities:

- Hands-on / Practical Activities
- Mini Projects / Innovation Activities
- Collaborative / Skill Development
- Research & Higher Learning
- Ethics & Societal Relevance

Textbooks:

1. Buyya, Rajkumar, and Satish Narayana Srirama, "Fog and Edge computing: Principles and Paradigms", 1st edition, John Wiley & Sons, USA, 2019
2. Wei Change and Jie Wu, "Fog/Edge Computing for Security, Privacy and Applications", Springer, 2021.

References:

1. Bahga, Arshdeep, and Vijay Madisetti, "Cloud computing: A hands-on approach, CreateSpace Independent Publishing Platform", USA, 2nd edition, 2014.
2. OvidiuVermesan, Peter Friess, "Internet of Things –From Research and Innovation to Market Deployment", 1st edition, River Publishers, 2014

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2	-
CO2	3	2	2	-	3	-	-	-	-	-	-	3	2	-
CO3	3	2	-	2	-	-	-	-	-	-	-	-	2	-
CO4	-	2	-	-	-	-	-	-	-	-	-	-	2	3
CO5	-	-	2	2	3	-	-	-	-	-	-	-	3	3
CO6	-	-	2	-	-	-	2	3	2	2	-	-	-	3
Avg.	1.5	1.7	1.3	0.7	1.3	-	0.3	0.5	0.3	0.3	-	0.8	2.2	1.5

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2421	STORAGE TECHNOLOGIES	PEC	L	T	P	C
			3	0	0	3

Course Objectives:

- Characterize the functionalities of logical and physical components of storage
- Describe various storage networking technologies
- Identify different storage virtualization technologies
- Discuss the different backup and recovery strategies
- Understand common storage management activities and solutions

UNIT I STORAGE SYSTEMS 9

Introduction to Information Storage: Digital data and its types, Information storage, Key characteristics of data center and Evolution of computing platforms. Information Lifecycle Management. Third Platform Technologies: Cloud computing and its essential characteristics, Cloud services and cloud deployment models, Big data analytics, Social networking and mobile computing, Characteristics of third platform infrastructure and Imperatives for third platform transformation. Data Center Environment: Building blocks of a data center, Compute systems and compute virtualization and Software-defined data center.

UNIT II INTELLIGENT STORAGE SYSTEMS AND RAID 5

Components of an intelligent storage system, Components, addressing, and performance of hard disk drives and solid-state drives, RAID, Types of intelligent storage systems, Scale-up and scale-out storage Architecture.

UNIT III STORAGE NETWORKING TECHNOLOGIES AND VIRTUALIZATION 13

Block-Based Storage System, File-Based Storage System, Object-Based and Unified Storage. Fibre Channel SAN: Software-defined networking, FC SAN components and architecture, FC SAN topologies, link aggregation, and zoning, Virtualization in FC SAN environment. Internet Protocol SAN: iSCSI protocol, network components, and connectivity, Link aggregation, switch aggregation, and VLAN, FCIP protocol, connectivity, and configuration. Fibre Channel over Ethernet SAN: Components of FCoE SAN, FCoE SAN connectivity, Converged Enhanced Ethernet, FCoE architecture.

UNIT IV BACKUP, ARCHIVE AND REPLICATION 12

Introduction to Business Continuity, Backup architecture, Backup targets and methods, Data deduplication, Cloud-based and mobile device backup, Data archive, Uses of replication and its characteristics, Compute based, storage-based, and network-based replication, Data migration, Disaster Recovery as a Service (DRaaS)

UNIT V SECURING STORAGE INFRASTRUCTURE 6

Information security goals, Storage security domains, Threats to a storage infrastructure, Security controls to protect a storage infrastructure, Governance, risk, and compliance, Storage infrastructure management functions, Storage infrastructure management processes.

Total Periods: 45

Course Outcomes:

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

CO1: Understand the fundamentals of information storage management, including storage system components, functions, and cloud infrastructure models.

CO2: Demonstrate the use of advanced intelligent storage systems and analyze various RAID levels

for performance and reliability.
CO3: Explain different storage networking architectures such as DAS, NAS, and SAN, and evaluate their suitability for specific applications.
CO4: Apply concepts of storage virtualization and data management techniques in enterprise and cloud environments.
CO5: Examine disaster recovery strategies and remote replication technologies for ensuring business continuity.
CO6: Analyze the security challenges in storage systems and implement appropriate data protection and access control measures.

Text Books:

1. J. Tate, P. Beck, H. H. Ibarra, S. Kumaravel, and L. Miklas, "Introduction to Storage Area Networks, 9th ed., IBM Redbooks, 2017.
2. U. Troppens, R. Erkens, W. Mueller-Friedt, R. Wolafka, and N. Haustein, "Storage Networks Explained*"*, 2nd ed., Wiley, 2009.

References:

1. "EMC Education Services, Information Storage and Management: Storing, Managing and Protecting Digital Information in Classic, Virtualized and Cloud Environments", 2nd ed., Wiley, 2012.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	-	2	-	-	-	-	-	2	3	3	-
CO2	3	2	2	1	2	-	-	-	-	-	2	2	2	-
CO3	2	3	3	-	3	-	-	-	1	-	2	3	3	1
CO4	2	2	2	-	2	-	-	-	-	1	3	2	2	-
CO5	2	2	2	-	3	-	-	-	1	1	2	2	3	-
CO6	3	3	3	2	3	1	1	1	3	2	3	3	3	2
Avg.	2.5	2.3	2.5	1.5	2.5	1.0	1.0	1.0	1.7	1.3	2.3	2.5	2.7	1.5

1 - low, 2 - medium, 3 - high, '-' - no correlation

PIT2407	Cyber Security	PCC	L	T	P	C
			2	0	2	3

Course Objectives:

- To learn cybercrime and cyberlaw.
- To understand the cyber-attacks and tools for mitigating them.
- To understand information gathering.
- To learn how to detect a cyber-attack.
- To learn how to prevent a cyber-attack.

UNIT I INTRODUCTION 6

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes- **Types of Cybercriminals**– A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

UNIT II ATTACKS AND COUNTERMEASURES 6

OWASP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Countermeasures.

UNIT III RECONNAISSANCE 6

Harvester – Whois – Netcraft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

UNIT IV INTRUSION DETECTION 6

Signature-based vs Anomaly-based detection - Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort.

UNIT V INTRUSION PREVENTION 6

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations –Intrusion Prevention Systems – Example Unified Threat Management Products.

Total Periods: 30

PRACTICAL EXERCISES:

15. Install Kali Linux on Virtual box
16. Explore Kali Linux and bash scripting
17. Perform open-source intelligence gathering using Netcraft, Whois Lookups, DNS Reconnaissance, Harvester and Maltego
18. Understand the nmap command d and scan a target using nmap
19. Install metasploitable2 on the virtual box and search for unpatched vulnerabilities
20. Use Metasploit to exploit an unpatched vulnerability
21. Install Linus server on the virtual box and install ssh
22. Use Fail2banto scan log files and ban Ips that show the malicious signs
23. Launch brute-force attacks on the Linux server using Hydra.
24. Perform real-time network traffic analysis and data pocket logging using Snort
25. **Demonstrate AI-generated phishing email detection using a pre-trained NLP classifier**

Total Periods: 30

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Apply fundamental concepts of cyber security, cybercrime, and cyber laws to analyze security requirements.
CO2: Apply knowledge of cyber attacks, threats, and vulnerabilities to identify system weaknesses.
CO3 Apply reconnaissance and information gathering techniques using appropriate tools.
CO4: Apply scanning and enumeration techniques to assess network and system security.
CO5: Apply intrusion detection mechanisms using IDS tools and techniques.
CO6: Apply intrusion prevention and firewall techniques to secure systems and networks.

Suggested Activities

- Hands-on demonstration on tools like Nmap, Wireshark, Metasploit, and Snort.
- Basic ethical hacking challenges could be conducted on Password cracking, SQL injection simulation and Network scanning tasks
- Presentation of case studies on cybercrime laws and legal actions in India.
- Poster / Infographic Presentation on Topics like Cyber hygiene, Social engineering awareness, OWASP Top 10 vulnerabilities

Text Books:

4. Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021
5. Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011
6. https://owasp.org/www-project-top-ten/

References:

5. David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones & Bartlett Learning Publishers, 2013
6. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011
7. Kimberly Graves, "CEH Official Certified Ethical hacker Review Guide", Wiley Publishers, 2007
8. William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015
9. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", No Starch Press, 2014

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	2	-	2	-	-	-	2	-	-
CO2	3	3	-	2	2	2	-	-	-	-	-	3	2	-
CO3	2	3	-	3	3	-	-	-	-	-	-	3	2	-
CO4	2	3	-	3	3	-	-	-	-	-	-	3	2	-
CO5	2	3	-	3	3	2	-	-	-	-	-	3	3	-
CO6	2	3	2	2	3	3	-	2	-	-	2	3	3	2
Avg.	2.3	2.8	2	2.6	2.8	2.3		2			2	2.8	2.4	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2425	Ethical Hacking	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the basics of computer-based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilities.

UNIT I INTRODUCTION 6

Ethical Hacking Overview - Role of Security and Penetration Testers - Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing - Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security.

UNIT II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS 6

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS 6

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities – Vulnerabilities of Embedded OS - Vulnerability Testing: Building Test Applications, Test Case Design, and Execution

UNIT IV SYSTEM HACKING 6

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade

UNIT V NETWORK PROTECTION SYSTEMS 6

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

30 PERIODS

LIST OF EXPERIMENTS:

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP
2. Practice the basics of reconnaissance.
3. Using FOCA / SearchDiggity tools, extract metadata and expand the target list.
4. Aggregates information from public databases using online free tools like Paterva’s Maltego.
5. Information gathering using tools like Robtex.
6. Scan the target using tools like Nessus.
7. View and capture network traffic using Wireshark.
8. Automate dig for vulnerabilities and match exploits using Armitage Kali or Backtrack Linux, Metasploitable, Windows XP

30 PERIODS
TOTAL PERIODS: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Understand the basics of computer-based vulnerabilities.
CO2: Understand different footprinting, reconnaissance, and scanning methods.
CO3: Analyze enumeration techniques and vulnerability assessment methods.
CO4: Analyze hacking techniques used in web and wireless applications.
CO5: Understand network protection mechanisms and security measures.
CO6: Apply ethical hacking tools to identify and expose system vulnerabilities.

Suggested Activities:
- Case study
- Group discussion
- Hands-on session
- Role-play activity
- Demo

Textbooks:

1. Thomas Wilhelm and Patrick Engebretson, "The Basics of Hacking and Penetration Testing", SYNGRESS, Elsevier, 3rd Edition, 2026.
2. Georgia Weidman, "Penetration Testing: A Hands-On Introduction to Hacking", No Starch Press, 2024.
3. Dafydd Stuttard & Marcus Pinto, "The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws", John Wiley & Sons, 2nd Edition, 2020.

References:
1. David Kennedy, Jim O'Gorman, Devon Kearns, Mati Aharoni, "Metasploit: The Penetration Tester's Guide", No Starch Press, 2023.
2. Allen Harper, Shon Harris, "Gray Hat Hacking: The Ethical Hacker's Handbook", 6th Edition, McGraw Hill, 2022.
3. Yuri Diogenes and Erdal Ozkaya, "Cybersecurity – Attack and Defense Strategies", 3rd Edition, Packt Publishing, 2022.
4. Donovan Martin, "Hacking: Learn the Basics of Ethical Hacking and Penetration Testing", Independently Published, 2019.
5. Jon Erickson, "Hacking: The Art of Exploitation", 2nd Edition, No Starch Press, 2020.

Web References:
- https://www.kali.org/docs/
- https://attack.mitre.org/
- https://www.sans.org/security-resources/
- https://www.eccouncil.org/train-certify/certified-ethical-hacker-ceh/
- http://www.tenable.com/products/nessus.
- http://www.wireshark.org.
- https://www.blackhatethicalhacking.com/tools/armitage/

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	-	1	-	-	-	2	2	2	-
CO2	3	3	-	2	3	-	1	-	-	-	2	2	3	-
CO3	3	3	2	3	3	-	1	-	-	-	2	3	3	-
CO4	2	3	2	2	3	-	2	-	-	-	2	3	3	-
CO5	3	3	3	2	3	2	2	-	-	-	2	3	2	-
CO6	3	3	3	3	3	1	3	2	2	1	3	3	3	1
Avg.	**2.83**	**2.83**	**2.5**	**2.4**	**2.83**	**1.5**	**1.67**	**2**	**2**	**1**	**2.17**	**2.67**	**2.67**	**1**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2428	Modern Cryptography	PEC	L	T	P	C
			3	0	0	3

Course Objectives:

- To learn about Modern Cryptography.
- To focus on how cryptographic algorithms and protocols work and how to use them.
- To build a Pseudorandom permutation.
- To construct Basic cryptanalytic techniques.
- To provide instruction on how to use the concepts of block ciphers and message authentication codes.

UNIT I INTRODUCTION 9

Basics of Symmetric Key Cryptography, Basics of Asymmetric Key Cryptography, Hardness of Functions. Notions of Semantic Security (SS) and Message Indistinguishability (MI): Proof of Equivalence of SS and MI, Hard Core Predicate, Trap-door permutation, Goldwasser-Micali Encryption, Goldreich-Levin Theorem: Relation between Hardcore Predicates and Trap-door Predicates.

UNIT II MATHEMATICAL FOUNDATION 9

Probability and Information Theory – Basic Calculation – Finite Probability Space and Random Variables – The Weak Law of Large Numbers – Birthday Paradox – Information Theory – Redundancy in Natural Language – Number Theory – Euler's Phi Function – Quadratic Residues – Modular Square Roots – Blum Integers – Coin-Tossing Algorithms – Monte Carlo and Las Vegas Algorithms

UNIT III AUTHENTICATION AND CRYPTOGRAPHIC PROTOCOLS 9

Authentication and Notions – Authentication Techniques – Password-based Authentication – Authenticated Key Exchange – Attacks on Authentication Protocols – SSH Remote Login Protocol –Directory-Based Authentication – Non-Directory Based Authentication – Cryptographic Protocols – Identification Schemes – Commitment Schemes – Electronic Elections – Digital Cash

UNIT IV RANDOM ORACLES 9

One-way functions - Discrete Exponential Function – Uniform Sampling Algorithms – Modular Powers and Squaring - Formal Definition of One-way function – Hard- Core Predicates - Bit Security - Exp Family - Square Family – RSA Bit – ElGamal Bit – Rabin Bit – Discrete Logarithm Bit – Pseudo-random Generators (PRG) - Yao's Theorem

UNIT V PROVABLE SECURITY ENCRYPTION AND DIGITAL SIGNATURE 9

Introduction – Provably Security Encryption: Secrecy and Probabilistic Attacks – Public Key One Time Pads – Passive Eaversdroppers – Chosen-Cipher Attacks – Unconditional Security of Cryptosystems - Provably Security Digital Signature: Attacks and Level of Security – Claw-Free Pairs and Collision Resistant Hash functions – Authentication-Tree-Based Signatures – A State-Free Signature Scheme – Provable Security for ElGamal-family Signatures.

45 PERIODS

Course Outcomes:

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

CO1: Understand the fundamentals of symmetric and asymmetric cryptography
CO2: Interpret the basic principles of cryptography and general cryptanalysis.
CO3: Analyse and apply core mathematical concepts relevant to cryptographic systems.
CO4: Analyse authentication techniques and cryptographic protocols to identify attacks and their countermeasures in real-world systems
CO5: Apply one-way functions for the construction of secure cryptographic protocols.
CO6: Analyse provable security models for encryption and digital signature schemes

Suggested Activities:

- Cryptography Algorithm Implementation
- Simulation on Attacks
- Case Study on Security Breaches
- Mini Project
- Research Paper Writing

Textbooks:

1. Hans Delfs and Helmut Knebl, Introduction to Cryptography: Principles and Applications, Springer Verlag, 2nd edition, 2007
2. Wenbo Mao, Modern Cryptography, Theory and Practice, Pearson Education (Low Priced Edition), 2003

References:

1. ShaffiGoldwasser and MihirBellare, Lecture Notes on Cryptography, Available at http://citeseerx.ist.psu.edu/.
2. OdedGoldreich, Foundations of Cryptography, CRC Press (Low Priced Edition Available), Part 1 and Part 23
3. William Stallings, "Cryptography and Network Security: Principles and Practice", PHI 3rd Edition, 2006.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	-	-	1	-	-	-	-	-	1	2	1	-
CO2	2	2	-	-	1	-	-	-	-	-	1	2	1	-
CO3	3	3	1	2	2	-	-	-	-	-	1	3	2	1
CO4	2	3	2	2	2	1	1	-	1	-	1	3	2	-
CO5	3	2	2	1	3	-	-	-	-	-	1	3	3	-
CO6	2	3	2	2	2	1	1	-	1	-	2	2	2	-
Avg.	2.5	2.3	1.75	1.75	1.8	1	1	-	1	-	1.67	2.5	1.8	1

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2427	Social Network Security	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the concepts of Semantic Web, Social Web, and their applications.
- To learn ontology-based knowledge representation and Semantic Web technologies.
- To analyze social network communities and human behavior in online social environments.

- To understand community detection, privacy, trust, and data management in social networks.
- To learn graph-based visualization techniques and network analysis measures for social networks.

UNIT I INTRODUCTION 6

Introduction to Semantic Web: Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis.

UNIT II MODELLING, AGGREGATING, AND KNOWLEDGE REPRESENTATION 6

Ontology and its role in the Semantic Web: Ontology-based knowledge representation – Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modelling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 6

Extracting evolution of Web Community from a Series of Web Archive, Detecting communities in social networks, Definition of community, Evaluating communities, Methods for community detection and mining, Applications of community mining algorithms, Tools for detecting communities social network infrastructures and communities, Decentralized online social networks – Multi-Relational characterization of dynamic social network communities.

UNIT IV PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES 6

Understanding and predicting human behavior for social communities, User data Management, Inference and Distribution, Enabling new human experiences, Reality mining, Context, Awareness, Privacy in online social networks, Trust in online environment, What is Neo4j, Nodes, Relationships, Properties.

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS 6

Graph theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – Visualizing online social networks, visualizing social networks with matrix-based representations – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare – Collaboration networks – Co-Citation networks.

30 PERIODS

LIST OF EXPERIMENTS:

- Design a social media application incorporating network analysis features such as friend recommendations and community detection
- Analyze a real-world social network dataset using key measures such as degree, betweenness and closeness centrality using Network
- Create and query an RDF-based knowledge graph representing social individuals and their relationships using Apache Jena
- Detect and evaluate communities in a social network dataset using Louvain and Girvan-

Newman algorithms
- Create a Network model, read and write data, and find Friend of Friends using Neo4j
- Implement secure search and a Privacy detector in a social media environment
- Perform data mining on a social network dataset — collect, store and analyse patterns such as clustering and community structure
- Visualize a social network using Node-Edge diagrams and Matrix representations using Gephi or D3.js

30 PERIODS
TOTAL PERIODS: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Understand the fundamentals of Semantic Web, Social Networking, and Social Network Analysis techniques.
CO2: Analyze security and privacy issues in social networks and apply secure knowledge representation techniques.
CO3: Apply data extraction, community mining, and data mining techniques to analyze patterns
CO4: Analyze human behavior prediction in social communities using Graph Theory and Neo4j.
CO5: Apply data warehousing and network analysis techniques to social network applications and visualizations.
CO6: Apply access control, identity management, and trust mechanisms in online social network environments.

Suggested Activities:
- Group Discussion
- Mini Project
- Guest Lecture
- Hand-on Session
- Real-time Case Studies

Textbooks:

1. Peter Mika,"Social Networks and the Semantic Web", First Edition, Springer 2007.
2. BorkoFurht, "Handbook of Social Network Technologies and Application", First Edition, Springer, 2010.
3. Jérôme Baton, Rik Van Bruggen, "Learning Neo4j 3.x", Second Edition, Packt publishing, 2018.
4. David Easley, Jon Kleinberg, Networks, Crowds, and Markets: Reasoning about a Highly Connected World‖, First Edition, Cambridge University Press, 2010.

References:

1. Easley D. Kleinberg J., Networks, Crowds, and Markets, "Reasoning about a Highly Connected World", Cambridge University Press, 2010.
2. Jackson, Matthew O., "Social and Economic Networks", Princeton University Press, 2008.
3. GuandongXu,Yanchun Zhang and Lin Li, "Web Mining and Social Networking Techniques and applications", First Edition, Springer, 2011.
4. Dion Goh and Schubert Foo, "Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively", IGI Global Snippet, 2008.
5. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modeling", IGI Global Snippet, 2009.
6. John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web‖, Springer, 2009

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	–	–	–	–	–	–	–	–	1	2	2	–
CO2	2	2	–	1	–	2	2	–	–	–	1	2	3	–
CO3	2	3	2	2	3	–	–	–	–	–	1	3	3	1
CO4	2	3	1	2	2	–	–	–	–	–	1	2	3	2
CO5	2	1	–	–	–	–	–	–	–	–	1	2	2	–
CO6	2	2	2	1	2	2	2	–	–	–	1	3	3	–
Avg.	2.00	2.00	1.67	1.50	2.33	2.00	2.00	–	–	–	1.00	2.33	2.67	1.50

1 - low, 2 - medium, 3 - high, '-' - no correlation

PIT2408	Information Retrieval Techniques	PCC	L	T	P	C
			3	0	0	3

Course Objectives:

- To understand the basics of information retrieval with pertinence to modeling, query operations and indexing
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of information retrieval giving emphasis to multimedia IR, web search.
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the concepts of digital libraries

UNIT I INTRODUCTION **9**

Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval –Retrieval Evaluation – Open-Source IR Systems–History of Web Search – Web Characteristics–The impact of the web on IR —IR Versus Web Search–Components of a Search engine.

UNIT II MODELING **9**

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing.

UNIT III INDEXING **9**

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency.

UNIT IV EVALUATION AND PARALLEL INFORMATION RETRIEVAL **9**

Traditional Effectiveness Measures – Statistics in Evaluation – Minimizing Adjudication Effect – Nontraditional Effectiveness Measures – Measuring Efficiency – Efficiency Criteria –Queueing

Theory – Query Scheduling – Parallel Information Retrieval – Parallel Query Processing — **Indexing and Searching Parallel and Distributed IR** - MapReduce

UNIT V SEARCHING THE WEB 9

Searching the Web –Structure of the Web –IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Digital Libraries.

Total Periods: 45

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Understand the fundamental concepts of information retrieval systems and web search processes.

CO2: Implement various IR models (Boolean, Vector, Probabilistic) for document representation and ranking.

CO3: Demonstrate indexing and query processing techniques for efficient information retrieval.

CO4: Analyze the effectiveness and efficiency of IR systems using evaluation metrics.

CO5: Utilize web search techniques such as crawling, indexing, and link analysis.

CO6: Examine IR techniques used in multimedia retrieval and digital libraries.

Suggested Activities

- Students could create diagrams for IR architecture and components.
- Implement TF-IDF and cosine similarity using Python.
- Compare IR models using Precision, Recall, F1-score.
- Design a simple search engine with ranking.

TEXT BOOKS:

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, "Introduction to Information Retrieval", Cambridge University Press, First South Asian Edition, 2008.
2. Ricardo Baeza-Yates, Berthier Ribeiro-Neto, "Modern Information Retrieval: The Concepts and Technology behind Search", Addison-Wesley, ACM Press Books Series, Second Edition, 2011.

REFERENCES:

1. Stefan Büttcher, Charles L. A. Clarke, Gordon V. Cormack, "Information Retrieval: Implementing and Evaluating Search Engines", The MIT Press, Cambridge, Massachusetts, 2016.
2. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, “Introduction to Information Retrieval, Cambridge University Press, First South Asian Edition, 2008.
3. Jimmy Lin, Rodrigo Nogueira, Andrew Yates, "Pretrained Transformers for Text Ranking: BERT and Beyond", Morgan & Claypool Publishers, Synthesis Lectures on Human Language Technologies,2021.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	-	-	-	-	-	-	2	-	-
CO2	3	3	-	2	3	-	-	-	-	-	-	3	2	-
CO3	3	3	-	3	3	-	-	-	-	-	-	3	2	-
CO4	2	3	-	3	2	-	-	-	-	-	-	3	2	-
CO5	2	3	2	2	3	-	-	-	-	-	-	3	3	-
CO6	2	2	2	2	2	-	-	-	-	-	2	3	3	2

Avg.	**2.5**	**2.7**	**2**	**2.4**	**2.5**	**-**	**-**	**-**	**-**	**-**	**2**	**2.8**	**2.4**	**2**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2432	**Cryptocurrency and Blockchain Technologies**	**PEC**	**L**	**T**	**P**	**C**
			2	**0**	**2**	**3**

Course Objectives:

- To understand the basics of Blockchain
- To learn Different protocols and consensus algorithms in Blockchain
- To learn the Blockchain implementation frameworks
- To understand the Blockchain Applications
- To experiment the Hyperledger Fabric, Ethereum networks

UNIT I INTRODUCTION TO BLOCKCHAIN 7

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

UNIT II BITCOIN AND CRYPTOCURRENCY 6

Basics of cryptocurrency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts, Bitcoin P2P Network, Transactions in Bitcoin Network, Block Mining, Block propagation and block relay

UNIT III BITCOIN CONSENSUS 6

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW, Bitcoin PoW, Attacks on PoW, monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases.

UNIT IV HYPERLEDGER FABRIC & ETHEREUM 6

Architecture of Hyperledger fabric v2.5- chaincode-pluggable consensus-Raft. Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity and use cases.

UNIT V BLOCKCHAIN APPLICATIONS 5

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study.

30 PERIODS

LIST OF EXPERIMENTS:

1. Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.
2. Create and deploy a blockchain network using Hyperledger Fabric SDK using Java/python 3.x.Set up and initialize the channel, install and instantiate chaincode, and perform invoke and query on your blockchain network.
3. Create an Interactive app to test the blockchain network and protocols. Execute transactions

and requests.

4. Deploy an asset-transfer app using blockchain. Learn app development within a Hyperledger Fabric network.
5. Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabric to track and trace member rewards.
6. Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chaincode while storing results and data in the starter plan.

30 PERIODS
TOTAL PERIODS: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Understand the fundamentals of blockchain models.
CO2: Analyze the working of bitcoin cryptosystem.
CO3: Analyze the consensus mechanisms and their associated challenges.
CO4: Implement Hyperledger Fabric v2.5 and compare its performance with Ethereum.
CO5: Develop and deploy smart contracts and decentralized applications (DApps) using tools such as Solidity.
CO6: Identify and evaluate the major research challenges and technical gaps existing between theory and practice in real time use cases (healthcare,finance,supplychain etc.).

Suggested Activities:

- Mini Project: Design a conceptual blockchain-based solution
- Literature review on recent blockchain trends
- Quiz/Debate on blockchain vs traditional systems
- Case study on blockchain in supply chain or banking
- Group discussion on public vs permissioned blockchains

Textbooks:

1. Andreas M. Antonopoulo, Mastering Bitcoin-programming the open Blockchain, O'Reilly,2nd edition,2017.
2. Bashir and Imran, "Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks", Packt Publishing Ltd., 2017.

References:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.
2. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing, 2018.
3. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020.
4. Nitin Gaur et al., Hands-On Blockchain with Hyperledger, Packt Publishing, 2018.
5. Andreas M. Antonopoulos and Gavin Wood, Mastering Ethereum: Building Smart Contracts and DApps, O'Reilly Media, 2018.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	1	2	1	-
CO2	3	3	1	1	-	-	-	-	-	-	-	2	2	-

CO3	2	3	2	2	-	-	-	-	-	-	-	3	2	-
CO4	2	2	3	2	3	-	-	1	1	-	-	3	3	-
CO5	2	2	3	1	3	1	1	2	2	1	-	3	3	1
CO6	2	3	2	3	2	3	2	2	2	1	2	3	3	1
Avg.	**2.33**	**2.50**	**2.20**	**1.80**	**2.67**	**2.00**	**1.50**	**1.67**	**1.67**	**1.00**	**1.50**	**2.67**	**2.33**	**1.00**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2429	**Security and Trust in IoT**	**PEC**	**L**	**T**	**P**	**C**
			3	**0**	**0**	**3**

Course Objectives:

- To understand the security challenges and threat landscape in IoT systems
- To study privacy preservation mechanisms in IoT applications
- To analyze trust models and authentication techniques in IoT
- To explore data security and secure communication protocols
- To examine governance, policy and social aspects of IoT security

UNIT I THREATS AND ATTACKS IN IoT 9

IoT architecture – Phases of IoT system – Introduction to Operational Technology (OT) – Convergence of IoT and OT – IoT as interconnection of threats – Classification of attacks: phase-based, architecture-based and component-based attacks – Network robustness and defense mechanisms – Sybil attack detection – Malware propagation in IoT – Attack vectors in smart home systems.

UNIT II PRIVACY PRESERVATION IN IoT 9

Privacy issues in IoT – Privacy preservation in data dissemination – Privacy in smart buildings – Location privacy in IoT systems – Lightweight privacy protection schemes – Privacy in participatory sensing and wearable IoT applications.

UNIT III TRUST AND AUTHENTICATION IN IoT 9

Trust concepts and trust models – Trust-based architectures in IoT – Self-organising trust systems – Access control mechanisms – Prevention of unauthorised access to sensor data – Authentication techniques in IoT – Device and identity authentication – Trust management in industrial IoT environments.

UNIT IV IoT DATA SECURITY 9

Computational security in IoT – Security in data processing – Privacy-preserving data aggregation – Secure path generation – Security protocols for IoT access networks – IoT communication security protocols: MQTT, CoAP, DTLS, TLS – Data transmission and storage security – Secure communication in industrial IoT systems.

UNIT V GOVERNANCE, POLICY, AND SOCIAL ASPECTS 9

User-centric privacy and trust frameworks – Governance models in IoT – Policy-based approaches for informed consent – Legal and regulatory issues in IoT – Security impact of IoT on mobile networks – Operational technology governance – Challenges in OT and IoT integration – Security

and compliance issues in industrial IoT environments.

45 PERIODS

Course Outcomes:
On completion of the course, the students will be able to
CO1: Explain IoT architecture, system phases, and fundamental security requirements.
CO2: Identify and analyze various security threats, attacks, and vulnerabilities in IoT systems.
CO3: Apply privacy preservation techniques for secure data handling in IoT applications.
CO4: Analyze trust models, authentication mechanisms, and access control strategies in IoT.
CO5: Evaluate data security techniques, secure communication protocols, and defense mechanisms in IoT.
CO6: Examine governance models, policy frameworks, and social aspects of IoT security.

Suggested Activities:
- Case Study
- Tool Demo
- Group Discussion
- Mini Project
- Seminar

Textbooks:
1. Fei Hu (Ed.), Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, CRC Press, 2016.

References:
1. Brian Russell, Drew Van Duren, “Practical Internet of Things Security”, Packt Publishing, 2016
2. S. Sicari et al., “Security, Privacy and Trust in Internet of Things”, Computer Networks Journal (Elsevier), 2015
3. William Stallings, “Cryptography and Network Security”, Pearson, 2017
4. NIST (National Institute of Standards and Technology), “Guidelines for IoT Security”, NIST, 2018

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	2	2	2	-
CO2	2	3	-	2	-	1	-	-	-	-	2	2	3	-
CO3	2	2	3	-	2	1	-	-	-	-	2	3	3	-
CO4	2	3	2	-	2	1	1	-	-	-	2	3	3	-
CO5	2	2	2	2	3	1	-	-	-	-	2	3	3	-
CO6	-	2	-	-	-	3	3	-	2	1	2	2	3	1
Avg.	2.00	2.40	2.33	2.00	2.33	1.40	2.00	-	2.00	1.00	2.00	2.60	3.00	1.00

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

PCS2434 Augmented Reality/Virtual Reality PEC L T P C

2 0 2 3

Course Objectives:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT I INTRODUCTION 7

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies- Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System.

UNIT II VR MODELING 6

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT III VR PROGRAMMING 6

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D.

UNIT IV APPLICATIONS 6

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V AUGMENTED REALITY 5

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation Navigation-Wearable devices

30 PERIODS

LIST OF EXPERIMENTS:

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling the camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled

mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
9. Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
10. Develop simple MR enabled gaming applications.

30 PERIODS
TOTAL PERIODS: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Explain the fundamental concepts of Virtual Reality (VR) and Augmented Reality (AR), including system components and technologies.
CO2: Understand and describe various input/output devices, tracking systems, and sensors used in AR/VR environments.
CO3: Apply modeling techniques such as geometric, kinematic, and physical modeling for designing virtual environments.
CO4: Analyze VR programming concepts using toolkits, scene graphs, and development platforms.

CO5: Evaluate human factors, safety issues, and diverse application areas of AR/VR in real-world scenarios.
CO6: Design and develop AR/VR applications using appropriate tools and technologies for different domains.

Suggested Activities:
- Assignment: Study different AR technologies and present findings.
- Case Study: Analyze real-world VR modeling.
- Tool Comparison: Compare World Toolkit and Java 3D features.
- Mini Project: Build a basic interactive VR environment.
- Assignment: Study popular VR SDKs (Unity, Unreal Engine).
- Role Play: Simulate VR usage in different domains (business, training).
- Survey Activity: Collect user feedback on VR usability.
- Computer Vision Demo: Object detection using OpenCV.
- Mini Project: Develop a simple AR-based educational app.
- Presentation: Study wearable AR devices (HoloLens, smart glasses).

Textbooks:

1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create compelling VR experiences for mobile”, Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles & Practice”, Addison Wesley, 2016
3. John Vince, “Introduction to Virtual Reality”, Springer-Verlag, 2004.
4. William R. Sherman, Alan B. Craig, “Understanding Virtual Reality – Interface, Application, Design”, Morgan Kaufmann, 2003
5. Micheal Lanham, “Learn ARCore – Fundamentals of Google ARCore”, 1st Edition, Packt Publishing, 2018.
6. Alan B. Craig, “Understanding Augmented Reality: Concepts and Applications”, Morgan Kaufmann, 2013.

References:

1. Paul Mealy, John Carucci, "Virtual & Augmented Reality for Dummies", 1st Edition, For Dummies, 2017.
2. Tomas Akenine-Möller, Eric Haines, "Real-Time Rendering", 4th Edition, A K Peters/CRC Press, 2018.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	–	2	2	2	–
CO2	3	2	–	–	3	–	–	–	–	–	2	2	3	–
CO3	3	2	3	2	3	–	–	–	–	–	2	3	3	–
CO4	3	3	2	3	3	–	–	–	–	–	3	3	3	1
CO5	2	3	2	2	2	3	2	–	–	–	3	2	3	1
CO6	3	3	3	3	3	2	2	2	2	1	3	3	3	2
Avg.	**2.83**	**2.50**	**2.50**	**2.50**	**2.67**	**2.50**	**2.00**	**2.00**	**2.00**	**1.00**	**2.50**	**2.50**	**2.83**	**1.33**

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2435	Game Development	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- Understand 2D & 3D game development fundamentals
- Learn game design principles and mechanics
- Develop games using Pygame
- Explore game engines (Godot & Unity)
- Build a complete playable game

UNIT I GAME GRAPHICS AND FUNDAMENTALS 6

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT II GAME DESIGN PRINCIPLES 6

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT III GAME ENGINE DESIGN 6

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT IV GAMING PLATFORMS AND FRAMEWORKS 6

Introduction to game development frameworks – Pygame architecture and features – Game development using Pygame– Overview of game engines – Godot engine architecture: scenes, nodes and scripting – Unity engine fundamentals: GameObjects, components and basic scripting – Mobile

game development concepts – Single-player and multiplayer game overview – Comparison of game development platforms and tools.

UNIT V GAME DEVELOPMENT 6

Developing 2D and 3D interactive games– Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling– Overview of Isometric and Tile Based arcade Games – Puzzle Games.

30 PERIODS

LIST OF EXPERIMENTS:

1. Installation of a game engine, e.g., Unity, Unreal Engine, familiarization of the GUI.
2. Write a program to implement a game loop and rendering mechanism using Pygame.
3. Write a program to implement player movement and input handling using Pygame.
4. Write a program to implement sprite-based animation in a game environment.
5. Write a program to implement collision detection between game objects.
6. Write a program to implement basic game logic with scoring and levels.
7. Write a program to implement simple game AI for enemy movement.
8. Develop a 2D interactive game using Pygame.
9. Implement a simple game scene using Godot engine.
10. Design a level with user interface elements using Godot.
11. Implement a simple interactive game using Unity.

30 PERIODS
TOTAL PERIODS: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Comprehend the fundamental concepts of game development.
CO2: Apply game design principles in developing interactive applications**.**
CO3: Analyze the architecture and implement AI and interactive systems.
CO4: Develop interactive 2D games using Pygame
CO5: Design and develop game environments using modern game engines such as Godot and Unity.
CO6: Build a complete playable 2D and 3D interactive games.

Suggested Activities:

- Develop a simple 2D game prototype using Pygame demonstrating player interaction and game logic.
- Design a Game Design Document (GDD) for a proposed game including storyline, characters, and level structure.
- Create a basic interactive scene using a game engine such as Godot or Unity.

References:

1. David H. Eberly, “3D Game Engine Design: A Practical Approach to Real-Time Computer Graphics”, Second Edition, CRC Press,2006.
2. Jung Hyun Han, “3D Graphics for Game Programming”, Chapman and Hall/CRC, 2011.
3. Al Sweigart, Making Games with Python & Pygame, CreateSpace Independent Publishing, 2012.
4. John P. Doran, *Unity Game Development Blueprints*, Packt Publishing, 2014.
5. Ryan Henson Creighton, Unity 3.x Game Development by Example Beginner's Guide**,**

Packt Publishing, 2011.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	1	-
CO2	2	3	2	-	-	1	-	-	1	-	-	2	2	-
CO3	2	3	2	1	2	-	-	-	-	-	-	3	2	-
CO4	3	2	3	1	3	-	-	-	1	-	-	3	2	-
CO5	2	2	3	1	3	-	-	1	1	-	-	3	3	1
CO6	3	3	3	2	3	1	1	2	2	2	1	3	3	1
Avg.	2.50	2.50	2.60	1.25	2.75	1.00	1.00	1.50	1.25	2.00	1.00	2.67	2.17	1.00

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2437	Quantum Computing	PEC	L	T	P	C
			3	0	0	3

Course Objectives:

- To provide introduction to quantum computation and quantum mechanics.
- To design and construct quantum circuits using quantum gates.
- To convert classical algorithms into quantum algorithms.
- To understand quantum machine learning concepts.
- To apply quantum computing concepts for solving real-world problems.
- To develop innovation and research skills in emerging quantum technologies.

UNIT I INTRODUCTION TO QUANTUM COMPUTING 9

Quantum Computing Basics – Limitations of Classical Computing – Principles of Quantum Mechanics – Qubits and Quantum States – Bloch Sphere Representation – Superposition and Measurement – Postulates of Quantum Mechanics – Classical Computing vs Quantum Computing.

UNIT II QUANTUM SYSTEMS AND CIRCUITS 9

Matrices and Linear Algebra for Quantum Computing – Unitary Matrices – Quantum Postulates – Tensor Products – Hilbert Space – Quantum Gates – Single Qubit Systems – Multi Qubit Systems – Quantum Circuit Design and Representation.

UNIT III QUANTUM ALGORITHMS 9

Deutsch-Jozsa Algorithm – Grover's Search Algorithm – Shor's Factoring Algorithm – Quantum Fourier Transform (QFT) – Applications and Advantages of Quantum Algorithms.

UNIT IV QUANTUM INFORMATION & QUANTUM MACHINE LEARNING 9

Bell States and Quantum Entanglement – No Cloning Theorem – Basics of Quantum Machine Learning – Comparison of Classical Machine Learning and Quantum Machine Learning – Applications of Quantum AI and Intelligent Systems.

UNIT V QUANTUM PROGRAMMING, POST-QUANTUM SECURITY AND FUTURE TRENDS **9**

Introduction to Qiskit and Quantum Programming Tools – Quantum Simulators – Executing Programs on Real-Time Quantum Computers – Benchmarking and Comparing Experimental Quantum Computing Setups – Introduction to Post-Quantum Cryptography and Post-Quantum Management – Security Challenges in the Quantum Era – Implications of AI Advancements in Quantum Computing – Future Trends and Emerging Applications of Quantum Technologies.

Periods: 45 PERIODS

Course Outcomes:

On completion of the course, the students will be able to
CO1: Understand the basic principles of quantum computation and quantum mechanics.
CO2: Design quantum circuits using quantum gates.
CO3: Analyse the behaviour of basic quantum algorithms.
CO4: Understand the difference between classical and quantum machine learning.
CO5: Apply quantum computing concepts to real-world problems using tools like Qiskit.
CO6: Demonstrate innovation and research orientation in quantum technologies.

Suggested Activities:
- Hands-on / Practical Activities
- Mini Projects / Innovation Activities
- Collaborative / Skill Development
- Research & Higher Learning
- Ethics & Societal Relevance

Textbooks:

1. Sutor, R. S., Dancing with Qubits, 2nd Edition, Packt Publishing, 2024.
2. Nielsen, M. A., & Chuang, I. L., Quantum Computation and Quantum Information, 10th Anniversary Edition, Cambridge University Press, 2010.
3. McMahon, D., Quantum Computing Explained, 1st Edition, Wiley-Interscience / IEEE Computer Society, 2008.

References:

1. Benenti, G., Casati, G., & Strini, G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts; Vol. II: Basic Tools and Special Topics, World Scientific, 2004.
2. Pittenger, A. O., An Introduction to Quantum Computing Algorithms, 1st Edition, Birkhäuser, 2000.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	2	-
CO2	3	2	2	-	3	-	-	-	-	-	-	3	2	-
CO3	3	2	-	2	-	-	-	-	-	-	-	-	2	-
CO4	-	2	-	-	-	-	-	-	-	-	-	-	2	3
CO5	-	-	2	2	3	-	-	-	-	-	-	-	3	3
CO6	-	-	2	-	-	-	2	3	2	2	-	-	-	3
Avg.	1.5	1.7	1.3	0.7	1.3	-	0.3	0.5	0.3	0.3	-	0.8	2.2	1.5

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2433	Robotic Process Automation and Intelligent Agents	PEC	L	T		C
			3	0	0	3

Course Objectives:

- To understand the basic concepts of robotic process automation.
- To expose the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the exception handling, debugging, and logging operations in RPA.
- To learn to deploy and maintain the software bot.

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 9

Emergence and Evolution of Robotic Process Automation (RPA), Differentiating RPA from Traditional Automation, Benefits and Challenges of RPA, Application Areas of RPA, Components and Architecture of RPA, RPA Platforms and Tools, Templates, User Interface, Domains in Activities, Workflow Files, Industry Use Cases and Trends in RPA.

UNIT II AUTOMATION PROCESS ACTIVITIES 9

Sequence, Flowchart, and Control Flow – Sequencing the Workflow, Activities, and Decision-Making using Control Flow. Data Manipulation – Variables, Collections, Arguments, Data Tables, Clipboard Management, and File Operations. Controls – Finding controls, waiting for controls, acting on controls, UiExplorer, and handling events. Recording Mouse and Keyboard Actions, Scraping Data from Websites, and Writing to CSV - Introduction to Process Mining. Comparative Study of RPA and Intelligent Agents.

UNIT III INTRODUCTION TO AGENTIC AI AND AGENT DEVELOPMENT 9

Introduction to Agentic AI, Evolution of Intelligent Agents, Characteristics of AI Agents, Types of Agents – Reactive, Deliberative, Goal-Based and Autonomous Agents. RPA vs AI Agents, Agent Architectures and Workflows, Fundamentals of Agent Development, Prompt Engineering for Agents, Multi-Agent Systems, Overview of Google Agent Development Concepts and Frameworks.

UNIT IV AGENT DESIGN, INTEGRATION AND MAINTENANCE 9

Design and Development of AI Agents, Agent Integration with Applications and APIs, Context Management, Memory and Tool Usage in Agents, Exception Handling in Agents, Logging and Debugging Techniques, Agent Monitoring, Error Reporting, Security and Ethical Considerations in Agent Systems. Code Management and Maintenance – Reusability, Templates, Workflow Nesting, State Machines and Version Control for Agents.

UNIT V DEPLOYMENT, ORCHESTRATION AND FUTURE TRENDS 9

Deployment of Bots and AI Agents, Publishing and Managing Updates, Orchestration Servers, Controlling and Monitoring Bots and Agents, License Management, Cloud-Based Agent Deployment, Open-Source RPA and Agent Frameworks, Maintenance of Intelligent Agents, Human-in-the-Loop Systems, Future Trends in RPA and Agentic AI, Generative AI Integration, Enterprise AI Agents and Emerging Industry Applications.

45 PERIODS

Course Outcomes:

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

CO1: Understand the basics of RPA, its tools and applications.
CO2: Create automation workflows using RPA activities and controls.
CO3: Explain the concepts of Agentic AI and intelligent agents.
CO4: Develop and integrate AI agents with applications and APIs.
CO5: Apply debugging, security and maintenance techniques for bots and agents.
CO6: Deploy and manage bots and AI agents using orchestration platforms and cloud environments.

Suggested Activities:

- Case Study Discussion
- Group Presentation
- Data Handling Task
- Mini Project

Textbooks:

1. Alok Mani Tripathi, "Learning Robotic Process Automation: Create Software Robots and Automate Business Processes with the Leading RPA Tool", UiPath, Packt Publishing, 2018
2. Tom Taulli, "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress, 2020

References:

1. Frank Casale, Rebecca Dilla, Heidi Jaynes, Lauren Livingston – Introduction to Robotic Process Automation: A Primer – Institute of Robotic Process Automation; Amazon Asia-Pacific Holdings Private Limited – 2018
2. Richard Murdoch – Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant – Amazon Asia-Pacific Holdings Private Limited – 2018
3. A. Gerardus Blokdyk – Robotic Process Automation (RPA): A Complete Guide – 5STARCooks (independently published) – 2020

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	1	-	-	-	-	-	2	2	2	–
CO2	2	3	3	-	3	-	-	2	-	-	2	3	2	–
CO3	2	2	3	2	3	-	-	2	-	-	2	3	3	–
CO4	2	3	2	2	3	-	-	1	-	-	2	3	2	–
CO5	2	2	3	-	3	1	-	2	-	2	2	3	3	–
CO6	1	2	-	-	-	3	2	-	2	1	3	2	3	1
Avg.	2.00	2.33	2.75	2.00	2.60	2.00	2.00	1.75	2.00	1.50	2.17	2.67	2.50	1.00

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2440	Knowledge Engineering	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the basics of Knowledge Engineering
- To discuss methodologies and modeling for Agent Design and Development
- To design and develop ontologies.
- To apply reasoning with ontologies and rules.
- To understand learning and rule learning.
- To apply rule learning techniques for problem solving.

UNIT I REASONING UNDER UNCERTAINTY 6

Introduction – 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.

UNIT II METHODOLOGY AND MODELLING 6

Conventional Design and Development – Development tools and Reusable Ontologies – Graph based Modelling – Agent Design and Development using Learning Technology – Problem Solving through Analysis and Synthesis – Inquiry-driven Analysis and Synthesis – Evidence-based Assessment – Believability Assessment – Drill-Down Analysis, Assumption-based Reasoning, and What-If Scenarios

UNIT III ONTOLOGIES – DESIGN AND DEVELOPMENT 6

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 REASONIING WITH ONTOLOGIES AND RULES 6

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 6

Machine Learning – Concepts – Generalization and Specialization Rules – Types – Formal definition of Generalization. Modelling, Learning and Problem Solving – Rule learning and Refinement – Overview – Rule Generation and Analysis – Hypothesis Learning.

Periods: 30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Perform operations with Evidence Based Reasoning.
2. Perform Evidence based Analysis.
3. Perform operations on Probability Based Reasoning.
4. Perform Believability Analysis.
5. Implement Rule Learning and refinement.
6. Perform analysis based on learned patterns.
7. Construction of Ontology for a given domain.

Course Outcomes:

On completion of the course, the students will be able to CO1:
Understand the basics of Knowledge Engineering
CO2: Apply methodologies and modelling for Agent Design and Development.
CO3: Design and develop ontologies
CO4: Apply reasoning with ontologies and rules.
CO5: Explain fundamental concepts of machine learning
CO6: Apply rule learning techniques and perform hypothesis generation for problem solving

Suggested Activities:

- Group Discussion like generalization vs specialization with examples.
- Mini Project e.g. Builds a simple rule-based classifier.
- Think-Pair-Share - Students can explain abductive reasoning with examples.
- Flipped classroom on certain topics like Rule Learning etc.

Textbooks:

1. Gheorghe Tecuci, Dorin Marcu, Mihai Boicu, David A. Schum, Knowledge Engineering Building Cognitive Assistants for Evidence-based Reasoning, Cambridge University Press, First Edition, 2016.

References:

1. Ronald J. Brachman, Hector J. Levesque: Knowledge Representation and Reasoning, Morgan Kaufmann, 2004.
2. Ela Kumar, Knowledge Engineering, I K International Publisher House, 2018.
3. John F. Sowa: Knowledge Representation: Logical, Philosophical, and Computational Foundations, Brooks/Cole, Thomson Learning, 2000.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	1	1	1	1	-	1	2	1	2	1	1	1
CO2	3	2	3	2	2	-	-	2	1	2	1	3	3	1
CO3	2	2	3	2	2	-	-	3	2	2	2	3	2	3
CO4	2	2	3	1	1	-	-	2	2	2	2	2	1	1
CO5	2	2	3	1	1	-	-	2	1	1	1	2	1	1
CO6	3	3	2	3	2	1	1	1	1	1	3	2	3	3
Avg.	2.5	2	2.5	1.6	1.5	1	1	1.8	1.5	1.5	1.8	2.1	1.8	1.6

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2441	Soft Computing	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To introduce the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience.
- To provide the mathematical background for carrying out the optimization associated with neural network learning.
- To learn various evolutionary Algorithms.
- To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
- To introduce case studies utilizing the above and illustrate the Intelligent behavior of programs based on soft computing.

UNIT I INTRODUCTION TO SOFT COMPUTING AND FUZZY LOGIC 6

Introduction - Fuzzy Logic - Fuzzy Sets, Fuzzy Membership Functions, Operations on Fuzzy Sets, Fuzzy Relations, Operations on Fuzzy Relations, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems.

UNIT II NEURAL NETWORKS 6

Supervised Learning Neural Networks – Perceptron - Backpropagation -Multilayer Perceptron – Unsupervised Learning Neural Networks – Kohonen Self-Organizing Networks.

UNIT III META HEURISTIC ALGORITHMS 6

Chromosome Encoding Schemes -Population initialization and selection methods – Evaluation function - Genetic operators- Cross over – Mutation - Fitness Function – Maximizing function – Optimization Algorithms: Particle Swarm Optimization and Ant Colony Optimization.

UNIT IV NEURO FUZZY MODELLING 6

ANFIS architecture – hybrid learning – ANFIS as universal approximator – Coactive Neuro fuzzy modelling – Framework – Neuron functions for adaptive networks – Neuro fuzzy spectrum – Analysis of Adaptive Learning Capability.

UNIT V APPLICATIONS 6

Modeling a two-input sine function - Printed Character Recognition – Fuzzy filtered neural networks – Plasma Spectrum Analysis – Hand written neural recognition - Soft Computing for Color Recipe Prediction.

Total Periods: 30

PRACTICAL EXERCISES:

1. Implementation of fuzzy control/ inference system
2. Programming exercise on classification with a discrete perceptron
3. Implementation of XOR with backpropagation algorithm
4. Implementation of self-organizing maps for a specific application
5. Programming exercises on maximizing a function using Genetic algorithm
6. Implementation of two input sine function
7. Implementation of three input non-linear function
8. Implementation of Particle Swarm Optimization for Benchmark Function Minimization

Total Periods: 60

Course Outcomes:

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

CO1: Apply the fundamental concepts of fuzzy to solve real-world problems

CO2: Analyse fuzzy logic operations and reasoning mechanisms to design effective decision-making systems

CO3: Apply supervised and unsupervised neural network models for pattern recognition.

CO4: Analyse the working of genetic algorithms to optimize engineering problems.

CO5: Apply neuro-fuzzy modelling techniques to develop adaptive and intelligent systems

CO6: Apply soft computing techniques in real world applications

Suggested Activities:

- Design a simple fuzzy inference system
- ANFIS Modeling Activity
- Case Study Discussion
- Mini Project
- Research Paper Writing

Text Books:

1. Sajang, J.-S. R., Sun, C.-T., & Mizutani, E. (1997). Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence. Upper Saddle River, NJ, Prentice Hall,1997
2. Himanshu Singh, Yunis Ahmad Lone, Deep Neuro-Fuzzy Systems with Python With Case Studies and Applications from the Industry, Apress, 2020

References:

1. Roj Kaushik and Sunita Tiwari, Soft Computing-Fundamentals Techniques and Applications, 1st Edition, McGraw Hill, 2018.
2. S. Rajasekaran and G.A.V.Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.
3. Samir Roy, Udit Chakraborthy, Introduction to Soft Computing, Neuro Fuzzy and Genetic Algorithms, Pearson Education, 2013.
4. S.N. Sivanandam, S.N. Deepa, Principles of Soft Computing, Third Edition, Wiley India Pvt Ltd, 2019. 5. R.Eberhart, P.Simpson and R.Dobbins, “Computational Intelligence - PC Tools”, AP Professional, Boston, 1996

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	-	2	-	-	-	-	-	1	2	2	1
CO2	2	3	2	1	2	-	-	-	1	-	1	2	2	1
CO3	3	2	2	2	3	-	-	-	-	-	1	3	3	3
CO4	2	3	2	2	2	-	-	-	-	-	1	2	3	2
CO5	3	2	2	2	3	-	-	-	-	-	2	3	3	3
CO6	3	2	2	2	3	1	1	-	1	-	2	3	3	2
Avg.	2.67	2.3	1.8	1.8	2.5	1	1	-	1	-	1.3	2.5	2.67	2

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

PCS2442	Neural Networks and Deep Learning	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To understand the basics in deep neural networks
- T understand the basics of associative memory and unsupervised learning networks
- To apply CNN architectures of deep neural networks
- To analyze the key computations underlying deep learning, then use them to build and train deep neural networks for various tasks.
- To apply autoencoders and generative models for suitable applications.

UNIT I INTRODUCTION 6

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: Biological neuron -An Introduction Evolution of Neural Networks- Important Terminologies of ANNs, Learning rules: Hebbian, Perceptron, Competitive leaning rules- Linear & Non-Linear Activation functions -Supervised Learning Network - basic Supervised Learning Neural Network models: McCulloch Pitts, Perceptron, Adaline, Madaline, RBF

UNIT II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS 6

Hebbian & Outer Product Rule -Training Algorithms for Pattern Association-Auto associative Memory Network-Hetero associative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Adaptive Resonance Theory Network.

UNIT III THIRD-GENERATION NEURAL NETWORKS 6

Spiking Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation – Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation,

UNIT IV DEEP FEEDFORWARD NETWORKS 6

History of Deep Learning- Gradient Learning – Chain Rule and Backpropagation – overfitting, underfitting, Bias and Variance, Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets.

UNIT V RECURRENT NEURAL NETWORKS 6

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders

Total Periods: 30 PERIODS

LAB EXPERIMENTS: **Total Periods:** 30 PERIODS

1. Implement simple vector addition in TensorFlow.
2. Implement a regression model in Keras.
3. Implement a perceptron, in TensorFlow/Keras Environment.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement Hopfield, SOM, ART in TensorFlow/Keras
6. Implement an Image Classifier using CNN in TensorFlow/Keras.
7. Improve the Deep learning model by fine tuning hyper parameters.
8. Implement a Transfer Learning concept in Image Classification.

9. Using a pre trained model on Keras for Transfer Learning
10. Perform Sentiment Analysis using RNN
11. Implement an LSTM based Autoencoder in TensorFlow/Keras.
12. Image generation using GAN

Additional Experiments:

13. Train a Deep learning model to classify a given image using pre trained model
14. Recommendation system from sales data using Deep Learning
15. Implement Object Detection using CNN
16. Implement any simple Reinforcement Algorithm for an NLP problem

TOTAL: 60 PERIODS

Course Outcomes:

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

CO1: Apply Convolution Neural Network for image processing.
CO2: Understand the basics of associative memory and unsupervised learning networks.
CO3: Apply CNN and its variants for suitable applications.
CO4: Analyze the key computations underlying deep learning and use them to build and train deep neural networks for various tasks.
CO5: Understanding the basics of Recurrent Neural Network
CO6: Apply autoencoders and generative models for suitable applications.

Textbooks:

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021.

References:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017.
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018.
4. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
5. Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020
6. Deep Learning with Python, François Chollet, Manning Shelter Island,2017.
7. S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, FuzzyLogic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017.
8. Pro Deep Learning with TensorFlow, Santanu Pattanayak, Apress,2017
9. James A Freeman, David M S Kapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Addison Wesley, 2003.

MAPPING OF COs WITH POs AND PSOs

COs	Pos											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	3	2	3	1	-	2	1	-	-	2	2	1
CO2	3	1	2	1	-	-	-	-	1	2	2	-	1	-
CO3	3	3	3	3	3	1	-	2	1	-	-	2	2	1
CO4	3	3	3	3	3	-	-	2	-	2	3	2	2	2
CO5	1	1	3	2	3	-	-	2	-	-	-	1	1	-
CO6	2	2	2	2	1	-	-	2	2	1	2	3	2	-
Avg.	2.5	2	2.7	2.2	2.6	1		2	1.3	1.7	2.3	2	1.7	1.3

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2443	Pattern Recognition Techniques	PEC	L	T	P	C
			3	0	0	3

Course Objectives:

- To understand the fundamentals of Pattern recognition
- To impart knowledge on various clustering techniques
- To study about feature extraction and selection
- To explore different classification models
- To understand Fuzzy Pattern Classifiers and application

UNIT I PATTERN CLASSIFIER 9

Overview of Pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach– Non-Parametric techniques, Perceptron Algorithm-LMSE Algorithm- Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II CLUSTERING 9

Clustering Concept – Hierarchical Clustering Procedures – Partitional Clustering, k- means algorithm – Clustering of Large Data Sets – EM Algorithm – Grid Based Clustering– Density Based Clustering.

UNIT III FEATURE EXTRACTION AND SELECTION 9

Entropy Minimization – KL Transforms – Regression-Linear, Non-linear and Logistic, Prediction, Feature Selection through Functions Approximation – Binary Feature Selection – Dimensionality Reduction Techniques – Principal Component Analysis.

UNIT IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE 9

State Machines – Hidden Markov Models: Maximum Likelihood for the HMM, Forward- Backward Algorithm, Sum and Product Algorithm for the HMM, Extensions of the Hidden Markov Model – Support Vector Machines: Maximum Margin Classifiers, Relevance Vector Machines.

UNIT V RECENT ADVANCES AND APPLICATIONS 9

Fuzzy Classification: Fuzzy Set Theory, Fuzzy and Crisp Classification, Fuzzy Clustering, Fuzzy Pattern Recognition-Application of PR in image segmentation, ECG signal classification, Fingerprint recognition, Case Study: Real-time Pattern Analysis Applications.

Periods: 45 PERIODS

Course Outcomes:

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

CO1: Provide basic knowledge about the fundamentals of pattern recognition and its applications.
CO2 Understand about unsupervised algorithms suitable for pattern classification. CO3 Familiarize with the feature selection algorithms and methods of implementing them in applications.
CO4 Learn about the basis of algorithms used for training and testing the dataset. CO5 Learn basic fuzzy system and neural network architectures,
CO6: Familiarize applications in pattern recognition, image processing, and computer vision.

Suggested Activities:

- Plot and analyze discriminant functions for 2-class problems
- Study clustering behaviour on large datasets
- Mini experiment: Change number of clusters and observe results
- Compare model performance with and without feature selection
- Calculate: Entropy and information gain for sample data
- Simulate a simple Hidden Markov Model (e.g., weather prediction)
- Visualize: Maximum margin hyperplane
- Perform fuzzy clustering (conceptual / simple coding)
- Case study on Fingerprint recognition

Textbooks:

1. Bishop, C. M., "Pattern Recognition and Machine Learning", Springer, 2010.
2. Andrew Webb, "Statistical Pattern Recognition", Arnold publishers, London, Second edition, 2002.

References:

1. Murthy, M. N., & Susheela Devi, V., "Pattern Recognition", Springer, 2011.
2. Duda, R. O., Hart, P. E., & Stork, D. G., "Pattern Classification", 2nd Edition, John Wiley & Sons, 2001.
3. Theodoridis, S., & Koutroumbas, K., "Pattern Recognition", 4th Edition, Academic Press, 2008.
4. Friedman, M., & Kandel, A., "Introduction to Pattern Recognition: Statistical, Structural, Neural and Fuzzy Logic Approaches", World Scientific Publishing Co. Ltd., 2020.
5. Beyerer, J., Richter, M., & Nagel, M., "Pattern Recognition", Springer, 2018.
6. Dougherty, G., "Pattern Recognition and Classification", Springer, 2013.
7. Singh, H., "Practical Machine Learning and Image Processing", Apress, 2019.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	2	1	-
CO2	3	2	2	2	1	-	-	-	-	-	-	2	2	-
CO3	3	3	2	2	2	-	-	-	-	-	-	3	2	1
CO4	3	3	2	2	2	-	-	-	-	-	-	3	2	1
CO5	2	2	2	2	2	1	-	-	1	1	-	3	3	2
CO6	2	2	3	2	2	1	-	-	2	2	1	3	3	2
Avg.	2.7	2.3	2.0	1.8	1.5	0.3	-	-	0.5	0.5	0.2	2.7	2.2	1.0

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2444	Reinforcement Learning	PEC	L	T	P	C
			3	0	0	3

Course Objectives:

- Introduce a range of topics related to Reinforcement Learning and probability concepts.
- Gain knowledge on the Markov Decision Process.
- Understand the Q-Learning and SARSA methods.
- Know about the Deep Learning in Reinforcement Learning.
- Gain knowledge on Policy Gradient Methods.

UNIT I BASICS OF REINFORCEMENT LEARNING 9

Introduction to Reinforcement Learning–Elements of Reinforcement Learning– Scope – History of Reinforcement Learning– The Agent-Environment Interface – Examples of Reinforcement Learning – Why Study Reinforcement Learning – Challenges in Reinforcement Learning – Multi-arm Bandit Problem.

UNIT II MARKOV DECISION PROCESSES AND DYNAMIC PROGRAMMING 9

Overview of Markov Chain - Overview of Markov Decision Process – Model Reinforcement Learning Problem using MDP – Markov Process – Markov Chain – Markov Decision Process – Alternative Bellman Equations for value functions – Optimal policy and optimal value functions – Using Dynamic programming to solve RL problems – Policy Evaluation – Policy Improvement – Policy Iteration – Value Iteration.

UNIT III MONTE CARLO AND TEMPORAL DIFFERENCING 9

Monte Carlo Introduction – Policy Evaluation – Incremental Update – Exploration Vs Exploitation – Policy Improvement – Temporal Differencing Learning – TD Policy Evaluation – Epilon-Greedy policy – On policy Vs Off-policy – Q-Learning – SARSA Learning – Double Q-Learning – Applications of Q-Learning – Grid Problems - N-Step Bootstrapping.

UNIT IV VALUE FUNCTION APPROXIMATION 9

Linear value function approximation – Challenge of Large-scale MDP – Value Function approximations – Stochastic Gradient Descent – Linear value and non-linear value approximation – Deep neural nets – Naïve Deep-Q Learning – Experience Replay – DQN for Games – DQN with Double-Q learning – Prioritized experience Replay – Advantage Function and Duelling Network Architecture.

UNIT V ADVANCED DEEP REINFORCEMENT LEARNING 9

Policy Gradient Methods – Policy-Based methods – Policy Gradient – REINFORCE – Baseline – Actor Critic Methods -Problems with Continuous Action space – Problems with Standard Methods – Policy Performance Bounds – Proximal Policy Optimization -Latest Trends – Distributed Reinforcement Learning – Curiosity Driven Exploration – Random network Distillation – Planning with AlphaZero.

Periods: 45 PERIODS

Course Outcomes:

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

CO 1: Understand different terminologies of RL and Concepts of Probability. CO 2: Illustrate the Markov Decision Process and Bellman Equation for learning.
CO 3: Apply dynamic programming techniques to the Markov decision process and Monte Carlo methods
CO 4: Implement Time difference learning for real-world problems
CO 5: Apply Approximation methods of learning and Q-learning technique
CO 6: Apply probabilistic concepts and reinforcement learning techniques to implement optimal

decision-making models for solving real-world sequential problems

Suggested Activities:

- Model a real-world problem
- Build a simple Deep Q-Network (DQN) using Python libraries
- Mini Project: Build an RL-based solution

Textbooks:

1. Richard S.Sutton and Andrew G.Barto, Reinforcement learning: An introduction, Second Edition, MIT Press, 2019.
2. Michael Hu, The Art of Reinforcement Learning – Fundamentals, Mathematics and Implementations with Python, Apress, 2024.

References:

1. Sudharsan Ravichandiran, Deep Reinforcement Learning with Python, Second Edition, Packet Publishing, Birmingham, 2020.
2. Csaba Szepesvari, Algorithms for Reinforcement Learning (Synthesis Lectures on Artificial Intelligence & Machine Learning), Morgan & Claypool Publishers, 2010.
3. Laura Graesser and Wah Loon Keng, Foundations of Deep Reinforcement learning: theory and Practice in Python, Pearson India, New Delhi, 2022.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	2	-	-	3
CO2	3	2	1	1	2	-	-	-	-	-	2	-	-	3
CO3	3	3	2	2	2	-	-	-	-	-	2	2	2	3
CO4	3	3	2	2	3	-	-	-	-	-	2	2	2	3
CO5	3	3	2	2	3	-	-	-	-	-	2	2	2	3
CO6	3	3	3	3	3	2	1	2	2	2	3	3	3	3
Avg.	3	2.7	1.8	1.8	2.5	2	1	2	2	2	2.2	2.2	2.2	3

1 - low, 2 - medium, 3 - high, '-' - no correlation

PCS2445	Cognitive Science	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- To know the theoretical background of cognition.
- To understand the link between cognition and computational intelligence
- To explore probabilistic programming language.
- To study the computational inference models of cognition.
- To study the computational learning models of cognition.

UNIT I PHILOSOPHY, PSYCHOLOGY AND NEUROSCIENCE 6

Philosophy: Mental-physical Relation – From Materialism to Mental Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science – Science of Information Processing –Cognitive Neuroscience – Perception – Decision – Learning and Memory – Language Understanding and Processing.

UNIT II COMPUTATIONAL INTELLIGENCE 6

Machines and Cognition – Artificial Intelligence – Architectures of Cognition – Knowledge Based Systems – Logical Representation and Reasoning – Logical Decision Making – Learning – Language – Vision.

UNIT III PROBABILISTIC PROGRAMMING LANGUAGE 6

WebPPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations –Enumeration

UNIT IV INFERENCE MODELS OF COGNITION 6

Generative Models – Conditioning – Causal and statistical dependence – Conditional dependence – Data Analysis – Algorithms for Inference.

UNIT V LEARNING MODELS OF COGNITION 6

Learning as Conditional Inference – Learning with a Language of Thought – Hierarchical Models– Learning (Deep) Continuous Functions – Mixture Models.

Total Periods: 30

PRACTICAL EXERCISES: Total Periods: 30

1. Demonstration of Mathematical functions using Web PPL.
2. Implementation of reasoning algorithms.
3. Developing an application system using generative model.
4. Developing an application using conditional inference learning model.
5. Application development using hierarchical model.
6. Application development using Mixture model.

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Understand the underlying theory behind cognition.
CO2: Connect to the cognition elements computationally.
CO3: Implement mathematical functions through WebPPL.
CO4: Develop applications using cognitive inference model.
CO5: Develop applications using cognitive learning model.
CO6: Apply computational techniques and probabilistic programming to implement functional models of human cognitive processes

Suggested Activities

- Think–Pair–Share Sessions
- Study real-world cognitive phenomena
- Mini Coding Tasks
- Tool Exploration

TEXT BOOKS:

1. Vijay V Raghavan,Venkat N.Gudivada, VenuGovindaraju, C.R. Rao, Cognitive Computing: Theory and Applications: (Handbook of Statistics 35), Elsevier publications,2016.
2. Judith Hurwitz, Marcia Kaufman, Adrian Bowles, Cognitive Computing and Big Data Analytics, Wiley Publications, 2015

3. Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”,The MIT Press, 1999.
4. Jose Luis Bermúdez, Cognitive Science -An Introduction to the Science of the Mind, Cambridge University Press 2020

REFERENCES:

1. Noah D. Goodman, Andreas Stuhlmuller, “The Design and Implementation of Probabilistic Programming Languages”, Electronic version of book, https://dippl.org/.
2. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016, https://probmods.org/.

MAPPING OF COs WITH POs AND PSOs

COs	POs											PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	1	-	-	-	-	2	-	1	2
CO2	3	2	2	1	1	-	-	-	-	-	2	1	2	2
CO3	3	2	2	2	3	-	-	-	-	-	2	2	2	2
CO4	3	3	3	3	3	1	-	1	1	1	3	3	3	3
CO5	3	3	3	3	3	1	-	1	1	1	3	3	3	3
CO6	3	3	3	3	3	2	1	2	2	2	3	3	3	3
Avg.	3	2.5	2.2	2.2	2.2	1	1	1.3	1.3	1.3	2.5	2.4	2.3	2.5

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

PCS2446	Ethics and AI	PEC	L	T	P	C
			2	0	2	3

Course Objectives:

- Study the morality and ethics in AI
- Learn ae Ethical initiatives in the field of artificial intelligence
- Study about AI standards and Regulations
- Study about social and ethical issues of Robot Ethics
- Study about AI and ethics – challenges and opportunities

UNIT I INTRODUCTION 6

Definition of morality and ethics in AI – Impact on society – Impact on human psychology – Impact on the legal system – Impact on the environment and the planet – Impact on trust.

UNIT II ETHICAL INITIATIVES IN AI 6

International ethical initiatives—ethical harms and concerns—case study: healthcare robots, autonomous vehicles, warfare, and weaponization.

UNIT III AI STANDARDS AND REGULATION 6

Model Process for Addressing Ethical Concerns During System Design – Transparency of Autonomous Systems Data Privacy Process - Algorithmic Bias Considerations - Ontological Standard for Ethically Driven Robotics and Automation Systems.

UNIT IV **ROBOETHICS: SOCIAL AND ETHICAL IMPLICATIONS OF ROBOTICS** **6**

Robot-Roboethics- Ethics and Morality- Moral Theories-Ethics in Science and Technology - Ethical Issues in an ICT Society- Harmonization of Principles- Ethics and Professional Responsibility- Roboethics Taxonomy.

UNIT V **AI AND ETHICS – CHALLENGES AND OPPORTUNITIES** **6**

Challenges – Opportunities – Ethical issues in artificial intelligence- Societal Issues Concerning the Application of Artificial Intelligence in Medicine- decision-making role in industries-National and International Strategies on AI.

Total Periods: 30

PRACTICAL EXERCISES: Total Periods: 30

1. Recent case study of ethical initiatives in healthcare, autonomous vehicles, and defense.
2. Exploratory data analysis on a 2-variable linear regression model
3. Experiment with the regression model without a bias and with bias
4. Classification of a dataset from the UCI repository using a perceptron with and without bias
5. Case study on ontology where ethics is at stake
6. Identification of optimisation in AI affecting ethics

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: Learn about morality and ethics in AI
CO2: Acquire the knowledge of real time application ethics, issues and its challenges.
CO3: Understand the ethical harms and ethical initiatives in AI
CO4: Learn about AI standards and Regulations like AI Agent, Safe Design of Autonomous and Semi-Autonomous Systems
CO5: Understand the concepts of Roboethics and Morality with professional responsibilities.
CO6: Learn about the societal issues in AI with National and International Strategies on AI
Suggested Activities

- Hands-on demonstration on tools like Nmap, Wireshark, Metasploit, and Snort.
- Basic ethical hacking challenges could be conducted on Password cracking, SQL injection simulation, and Network scanning tasks
- Presentation of case studies on cybercrime laws and legal actions in India.
- Poster / Infographic Presentation on Topics like Cyber hygiene, Social engineering awareness, OWASP Top 10 vulnerabilities

TEXT BOOKS:

1. Y. Eleanor Bird, Jasmin Fox-Skelly, Nicola Jenner, Ruth Larbey, Emma Weitkamp and Alan Winfield," The ethics of artificial intelligence: Issues and initiatives", EPRS | European Parliamentary Research Service, Scientific Foresight Unit (STOA), PE 634.452 – March 2020
2. Patrick Lin, Keith Abney, George A Bekey," Robot Ethics: The Ethical and Social Implications of Robotics", The MIT Press- January 2014.

REFERENCES:

1. Towards a Code of Ethics for Artificial Intelligence (Artificial Intelligence: Foundations, Theory, and Algorithms) by Paula Boddington, November 2017.
2. Mark Coeckelbergh," AI Ethics", The MIT Press Essential Knowledge series, April 2020

WEB LINK:

1. https://sci-hub.mksa.top/10.1007/978-3-540-30301-5_65
2. https://www.scu.edu/ethics/all-about-ethics/artificial-intelligence-and-ethics-sixteen-challenges-and-opportunities/
3. https://www.weforum.org/agenda/2016/10/top-10-ethical-issues-in-artificial-intelligence/
4. https://sci-hub.mksa.top/10.1159/000492428

MAPPING OF COs WITH POs AND PSOs

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CO2	2	1	1	2	1	-	-	1	2	1	1	3	3	1
CO3	2	3	1	1	3	-	-	2	1	1	2	3	2	2
CO4	3	1	3	3	2	-	-	2	2	3	1	2	1	3
CO5	3	1	1	3	3	-	-	2	3	3	3	1	3	3
CO6	3	1	1	3	3	-	-	2	3	3	3	1	3	3
Avg.	2.7	1.5	1.7	2.5	2.2	-	-	1.7	2.2	2.0	1.8	2.4	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation