Loyola-ICAM

College of Engineering and Technology (LICET)

(Autonomous)

Loyola Campus, Nungambakkam, Chennai – 600 034

Curriculum and Syllabi (R-2024)

B.E. COMPUTER SCIENCE AND ENGINEERING

Loyola-ICAM
College of Engineering and Technology (LICET)
(Autonomous)

CURRICULUM AND SYLLABI (R-2024)

CHOICE BASED CREDIT SYSTEM (CBCS)

B.E. COMPUTER SCIENCE AND ENGINEERING

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 form competent computing engineers who are motivated towards innovation and collaborative research, to serve the ever changing needs of the society.

Mission of the Department:

M1: To inculcate learnability skills in the student to acquire knowledge in the fundamentals of Computer Science and Engineering.

M2: To bring out the creativeness in the mind of the student leading to innovation and research.

M3: To develop professional skills and adaptiveness through collaborative activities.

M4: To create awareness on ethical values and involve the student to serve the societal needs.

Programme Educational Objectives:

PEO 1: Graduates will have successful careers in computer engineering fields.

PEO 2: Graduates will be able to pursue higher education in reputed institutions.

PEO 3: Graduates will adapt to rapidly changing work environment through effective communication, collaborative work and professionalism.

PEO 4: Graduates will engage in lifelong learning and prioritize ethical values for addressing the needs of the society.

Programme Outcomes:

PO1 – Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

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

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

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

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

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

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

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

PO9 – Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in

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

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

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

Programme Specific Outcomes:

PSO1 – Apply software engineering principles and practices for developing quality software for scientific and business applications.

PSO2 – Adapt to emerging Information and Communication Technologies (ICT) to innovate ideas and solutions to existing novel problems.

PSO3 – Attain excellence in emerging fields of Machine Learning and Data Science.

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CURRICULUM AND SYLLABI (R-2024)

CHOICE BASED CREDIT SYSTEM (CBCS)

B.E. COMPUTER SCIENCE AND ENGINEERING

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 L	T	P	Total Periods	Credits
THEORY COURSES								
1	MA24201	Probability and Queuing Theory	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 L	T	P	Total Periods	Credits
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	CS24301	Data Structures	PCC	3	0	0	3	3
4	CS24302	Database Management Systems	PCC	3	0	0	3	3
LABORATORY INTEGRATED THEORY COURSES								
5	CS24311	Digital Principles and Computer Organization	ESC	3	0	2	5	4
6	CS24312	Object Oriented Programming in JAVA	PCC	2	0	4	6	4
LABORATORY COURSES								
7	CS24321	Data Structures Laboratory	PCC	0	0	3	3	1.5
8	CS24322	Database Management Systems Laboratory	PCC	0	0	3	3	1.5
FORMATION COURSES								
9	FC24301	Soft Skills$	HSMC	2	0	0	2	1
10	BS24321	System Discovery and Analysis	BSC	0	0	2	2	0
			TOTAL	19	1	14	34	25

$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	CS24401	Operating Systems	PCC	3	0	0	3	3
3	CS24402	Microprocessors and Micro Controllers	PCC	3	0	0	3	3
LABORATORY INTEGRATED THEORY COURSES								
4	CS24411	Design and Analysis of Algorithms	PCC	3	0	2	5	4
5	CS24412	Object Oriented Software Engineering	PCC	3	0	2	5	4
6	CS24413	Foundations of Data Science	PCC	2	0	2	4	3
LABORATORY COURSES								
7	CS24421	Operating Systems Laboratory	PCC	0	0	3	3	1.5
8	CS24422	Microprocessors and Micro Controllers Laboratory	PCC	0	0	3	3	1.5
FORMATION COURSES								
9	HS24321	Communication Skills Building Laboratory$	HSMC	0	0	2	2	1
10	CS24423	Project Driven Learning$	EEC	0	0	2	2	1
			TOTAL	17	1	16	34	26

$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	CS24501	Theory of Computation	PCC	3	0	0	3	3
2	GE24501	Project Management and Operations Management	HSMC	2	0	0	2	2
LABORATORY INTEGRATED THEORY COURSES								
3	CS24511	Artificial Intelligence and Machine Learning	PCC	2	0	4	6	4
4	CS24512	Computer Networks	PCC	3	0	2	5	4
5		Professional Elective – I	PEC	-	-	-	4	3
6		Professional Elective – II	PEC	-	-	-	4	3
FORMATION COURSES								
7	FC24501	Universal Human Values and Service Learning$	HSMC	1	0	1*	1	1
8	BS24502	Logical Reasoning and Aptitude Training	BSC	2	0	0	2	1#
9	GE24503	Financial Literacy	HSMC	2	0	0	2	0
			TOTAL	15	0	6	30	20

$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	CS24601	Compiler Design	PCC	4	0	0	4	4
2	GE24502	Entrepreneurship and International Business Market	HSMC	2	0	0	2	2
LABORATORY INTEGRATED THEORY COURSES								
3	CS24611	Distributed and Cloud Computing	PCC	3	0	2	5	4
4	CS24612	Embedded Systems and IoT	PCC	3	0	2	5	4
5	CS24613	Internet Programming	PCC	3	0	2	5	4
6		Professional Elective – III	PEC	-	-	-	4	3
7		Professional Elective – IV	PEC	-	-	-	4	3
FORMATION COURSES								
8	GE24621	Interdisciplinary Project$	EEC	0	0	2	2	1
9	GE24622	Problem Solving Techniques	EEC	0	0	2	2	1#
			TOTAL	14	0	10	32	25

$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		Open Elective – I	OEC	3	0	0	3	3
2		Open Elective – II	OEC	3	0	0	3	3
3		Audit Courses	HSMC	2	0	0	2	0
4	GE24701	Working to Engineer a Better World	HSMC	2	0	0	2	2
LABORATORY INTEGRATED THEORY COURSES								
5	CS24711	Cryptography and Cyber Security	PCC	2	1	2	5	4
6		Professional Elective - V	PEC	2	0	2	4	3
7		Professional Elective - VI	PEC	2	0	2	4	3
LABORATORY COURSES								
8	CS24721	Professional Project - I	EEC	0	0	4	4	2
FORMATION COURSES								
9	CS24722	Internship$	EEC	-	-	-	-	2
			TOTAL	16	1	10	27	22

$Skill based courses

SEMESTER – VIII

S. No.	Course Code	Course Title	Category	Periods per week			Total Periods	Credits
				L	T	P		
LABORATORY COURSES								
1	CS24821	Professional Project – II	EEC	0	0	20	20	10
			TOTAL	0	0	20	20	10

Total Credits: 169

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 integral.

Suggested Activities:
- Evaluation of eigenvalues and eigenvectors using scientific tool
- Plotting and visualizing curves, and extreme values using a scientific tool
- Plotting and visualizing surfaces, and extreme values using a scientific tool
- Evaluation of line integrals using scientific tool
- Evaluation of multiple integrals using a scientific tool
- 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	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	-	-	-	-	-	-	2	-	-	-
CO2	3	2	1	1	2	-	-	-	-	-	-	2	-	-	-
CO3	3	2	1	1	2	-	-	-	-	-	-	2	-	-	-
CO4	3	2	1	1	2	-	-	-	-	-	-	2	-	-	-
CO5	3	2	1	1	2	-	-	-	-	-	-	2	-	-	-
CO6	3	2	1	1	2	-	-	-	-	-	-	2	-	-	-
Avg.	**3**	**2**	**1**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**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	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	1	-	-	-	2	-	-	-
CO2	2	2	1	-	-	-	-	1	-	-	-	2	-	-	-
CO3	2	1	1	-	-	-	-	1	-	-	-	2	-	-	-
CO4	2	2	1	-	-	-	-	1	-	-	-	2	-	-	-
CO5	2	2	1	-	-	-	-	1	-	-	-	2	-	-	-
CO6	2	2	1	-	-	-	-	1	-	-	-	2	-	-	-
Avg.	**2**	**1.8**	**1**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**2**	**-**	**-**	**-**

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	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	1	1	-	-	-	-	1	-	-	-
CO2	3	2	2	1	-	1	1	-	-	-	-	1	-	-	-
CO3	2	-	-	1	-	2	2	-	-	-	-	-	-	-	-
CO4	3	2	2	1	-	1	2	-	-	-	-	2	-	-	-
CO5	3	1	2	1	-	2	2	-	-	-	-	2	-	-	-
CO6	3	1	2	1	-	2	2	-	-	-	-	2	-	-	-
Avg.	**2.8**	**1.6**	**1.7**	**1**	**-**	**1.5**	**1.7**	**-**	**-**	**-**	**-**	**1.3**	-	-	-

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

			L	T	P	C
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	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	1	1	3	-	-	2	3	-	3	-	-	-
CO2	-	-	-	1	1	3	-	-	2	3	-	3	-	-	-
CO3	-	-	-	1	1	3	1	-	3	3	1	3	-	-	-
CO4	-	-	-	1	1	3	2	1	1	1	2	3	-	-	-
CO5	-	-	-	1	1	3	1	-	2	3	-	3	-	-	-
CO6	-	-	-	1	1	3	-	-	3	3	1	3	-	-	-
Avg.	**-**	**-**	**-**	**1**	**1**	**3**	**1.3**	**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 thinking, algorithmic problem solving and logical thinking, problem solving and decomposition, 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

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:

S.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	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	2	-	-	-	-	-	1	1	-	2	1
CO2	2	2	1	-	2	-	-	-	-	-	1	1	-	2	1
CO3	2	2	-	-	2	-	-	-	-	-	1	1	-	2	1
CO4	2	2	2	2	2	-	-	-	-	-	1	1	-	2	1
CO5	2	2	-	-	2	-	-	-	-	-	1	1	-	2	1
CO6	2	2	2	2	2	-	-	-	1	-	1	1	-	2	3
CO7	2	2	2	2	2	-	-	-	1	-	1	1	-	2	3
Avg.	**2**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**-**	**1**	**1**	**-**	**2**	**2**

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

			L	T	P	C
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	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	2	2	-	-	-	-	2	-	-	-
CO2	3	2	1	-	-	2	2	-	-	-	-	2	-	-	-
CO3	2	1	2	-	-	2	2	-	-	-	-	-	-	-	-
CO4	2	1	2	-	-	1	1	-	-	-	-	1	-	-	-
CO5	3	1	2	-	1	2	2	-	-	-	-	2	-	-	-
CO6	3	1	2	-	1	2	2	-	-	-	-	2	-	-	-
Avg.	**2.7**	**1.3**	**1.7**	**-**	**1**	**1.8**	**1.8**	**-**	**-**	**-**	**-**	**1.8**	**-**	**-**	**-**

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	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO3	2	-	-	-	2	-	-	-	2	-	-	-	-	-	-
CO4	2	-	-	-	1	-	-	-	2	-	-	-	-	-	-
CO5	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-
CO6	1	-	-	-	-	-	-	-	2	-	-	-	-	-	-
Avg.	**1.6**	**-**	**-**	**-**	**1.5**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**

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
  1)Strengths, 2)Limitations, 3)Characteristics, 4)Habits and Experiences
- Sense of SELF
  1)Self Awareness, 2)Self Image, 3)Self-esteem, 4)Self Love, 5)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	PO12	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.	**-**	**-**	**-**	**-**	**-**	**-**	**2.8**	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**

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

MA24201	**Probability and Queueing Theory**	**BSC**	**L**	**T**	**P**	**C**
			3	**1**	**0**	**4**

Course Objectives:

- To understand the basic concepts of probability, one- and two-dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real-life phenomenon
- To understand the basic concepts of random processes which are widely used in IT fields
- To understand the concept of queueing models and apply in engineering problems
- To understand the significance of advanced queueing models.

- To provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability – The axioms of probability – Conditional probability –Total Probability theorem – 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 (statement only)

UNIT III RANDOM PROCESSES 12

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations (statement only) – Limiting distributions

UNIT IV QUEUEING MODELS 12

Markovian queues – Birth and death processes – Single and multiple server queueing models – Little's formula - Queues with finite waiting rooms

UNIT V ADVANCED QUEUEING MODELS 12

Finite source models – M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and M/Ek/1 as special cases – Series queues – Open Jackson networks

Total Periods: 60

Course Outcomes:

On completion of the course, the students will be able to
CO1: To understand the concepts of probability and one-dimensional random variables
CO2: To apply standard distributions in real-life phenomena
CO3: To understand the concept of two-dimensional random variables
CO4: To understand and apply the concepts of stochastic process in real life scenario.
CO5: Acquire skills in analyzing queueing models
CO6: To understand and characterize phenomenon which evolve with respect to time in a probabilistic manner

Suggested Activities:
- Generate random variables using scientific tool
- Generate two-dimensional random variables using scientific tool
- Simulation of random processes using scientific tool
- Simulation of queueing models using scientific tool

Text Books:
1. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., "Fundamentals of Queueing Theory", Wiley Student 4th Edition, 2014.
2. Ibe, O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007.

References:
1. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.

2. Taha, H.A., "Operations Research", 9th Edition, Pearson India Education Services, Delhi, 2016.
3. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.
4. Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	2	2	-	-	-	-	-	-	2	-	-	1
CO2	3	2	2	2	2	-	-	-	-	-	-	2	-	-	1
CO3	3	2	2	2	2	-	-	-	-	-	-	2	-	-	1
CO4	3	2	2	2	2	-	-	-	-	-	-	2	-	-	1
CO5	3	2	2	2	2	-	-	-	-	-	-	2	-	-	1
CO6	3	2	2	2	2	-	-	-	-	-	-	2	-	-	1
Avg.	**3**	**2**	**2**	**2**	**2**	-	-	-	-	-	-	**2**	-	-	**1**

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: Demonstrate knowledge on C Programming constructs
CO2: Develop simple applications in C using basic 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.
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	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	1	2	1	1	1	2	-	3	2	1	2	2
CO2	2	2	2	1	2	1	1	1	2	-	3	3	1	2	2
CO3	2	3	2	1	2	1	1	1	2	-	3	2	1	2	2
CO4	3	2	2	1	3	1	1	1	2	-	3	3	1	2	2
CO5	2	3	3	1	2	1	2	1	2	-	3	2	1	2	2
CO6	2	2	3	2	1	2	-	-	2	-	2	2	1	2	2
Avg.	**2**	**2.3**	**2.3**	**1.2**	**2**	**1.2**	**1.2**	**1**	**2**	**-**	**2.8**	**2.3**	**1**	**2**	**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 tunneling. Scanning tunneling 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	PO12	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**	-	-	-	-	-	-	-	**1**	-	-	-

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. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

Special points applicable to Semester End 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	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	-	2	-	-	-	-	2	-	2	-	-	-
CO2	3	1	2	-	2	-	-	-	-	2	-	2	-	-	-
CO3	3	1	2	-	2	-	-	-	-	2	-	2	-	-	-
CO4	3	1	2	-	2	-	-	-	-	2	-	2	-	-	-
CO5	3	1	2	-	2	-	-	-	-	2	-	2	-	-	-
CO6	3	1	2	-	2	-	-	-	-	2	-	2	-	-	-
Avg.	**3**	**1**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**2**	**-**	**-**	**-**

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	PO12	PSO1	PSO2	PSO3
CO1	1	3	3	1	1	1	-	-	2	-	2	2	1	2	2
CO2	2	3	3	2	1	1	-	-	2	-	2	2	1	2	2
CO3	2	2	2	1	1	2	-	-	2	-	2	2	1	2	2
CO4	2	2	2	2	1	2	-	-	3	-	3	3	1	2	2
CO5	2	2	3	2	3	2	-	-	3	-	3	3	1	2	2
CO6	2	2	3	2	1	2	-	-	2	-	2	2	1	2	2
Avg.	**1.8**	**2.3**	**2.7**	**1.7**	**1.3**	**1.7**	**-**	**-**	**2.3**	**-**	**2.3**	**2.3**	**1**	**2**	**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 learn the basics of electronic components.
- To understand the internal structure and working of the measuring instruments.
- To construct a prototype circuit on a breadboard and verify.
- To understand the process behind the PCB fabrication.
- 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

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 resistor, capacitor, inductor, transistor and diode.
2. Introduction to CRO, DSO, MSO, FG and their working principles.
3. Circuit prototyping and verification.
4. Build a printed circuit board and verify the desired output.

Total Periods:30

Course Outcomes:

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

- **CO1:** Identify and describe the function of various electronic components, leading to successful application in circuit design.
- **CO2:** Accurately interpret and apply measurement data in practical scenarios.
- **CO3:** Build a prototype of a circuit and validate its output.
- **CO4:** Gain knowledge of PCB fabrication processes, including design, etching, and assembly.
- **CO5:** Understand the working of electrical switches, measuring instruments, and wiring layouts used in domestic applications and carry out basic electrical wiring work.
- **CO6:** 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	PO12	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	-	-	-	-	-
Avg.	**2**	**1**	**1**	**2**	**1**	**2**	**-**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**

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	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	-	-	-	-	2	-	-	1	-	-	-
CO2	2	2	1	3	-	-	-	-	2	-	-	1	-	-	-
CO3	2	2	1	3	-	-	-	-	2	-	-	1	-	-	-
CO4	2	2	1	3	-	-	-	-	2	-	-	1	-	-	-
CO5	2	2	1	3	-	-	-	-	2	-	-	1	-	-	-
Avg.	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**1**	**-**	**-**	**-**

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. https://www.interaction-design.org/
2. https://online.hbs.edu/
3. 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	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	-	1	1	-	-	3	-	-	-
CO2	-	-	-	-	-	2	-	-	-	-	-	3	2	-	-
CO3	-	-	-	-	-	2	-	2	2	2	-	3	2	-	-
CO4	-	-	-	-	-	2	-	-	-	-	-	3	2	-	-
CO5	-	-	-	-	-	2	-	2	2	2	-	3	-	-	-
CO6	-	-	-	-	-	3	-	2	3	2	2	3	2	-	-
Avg.	-	-	-	-	-	2.1	-	1.7	2	2	2	3	2	-	-

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	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	-	-	2	1	-	2	-	-	-
CO2	-	-	-	-	-	2	-	-	-	1	-	-	-	-	-
CO3	-	-	-	-	-	2	-	-	-	1	-	2	-	-	-
CO4	-	-	-	-	-	2	1	-	2	1	-	2	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	2	-	-	2	1	-	2	-	-	-
Avg.	-	-	-	-	-	**2**	**1**	-	**2**	**1**	-	**2**	-	-	-

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:

On completion of the course, the students will 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:

- Create logic puzzle incorporating quantifiers (∀, ∃).
- Solve the Tower of Hanoi puzzle with different disk counts.
- Model a city’s tourist spots and paths using a graph.

- 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	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	2	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	1	-	-	-	-	-	-	-	-	-	-	-
CO6	3	2	1	2	-	-	-	-	-	-	-	-	-	-	-
Avg.	**3**	**2**	**1**	**1.5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

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:

- Quiz

- Mind Mapping
- Group discussion
- Seminar
- Animated videos

Text Books:

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

References:

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

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	2	3	-	-	-	-	2			
CO2	2	1	-	-	-	2	3	-	-	-	-	2			
CO3	3	2	-	-	-	3	3	-	1	-	-	2			
CO4	3	2	1	-	-	2	2	-	1	-	-	2			
CO5	3	2	1	-	-	2	2	-	-	-	-	2			
CO6	3	2	1	-	-	2	2	-	1	-	-	2			
Avg.	**2.7**	**1.6**	**1**	**-**	**-**	**2.2**	**2.5**	**-**	**1**	**-**	**-**	**2**			

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

CS24301	Data Structures	PCC	L	T	P	C
			3	0	0	3

Course Objectives:

- To understand the concepts of ADTs.
- To learn linear data structures – stacks, and queues.
- To understand non-linear data structures – trees.
- To understand non-linear data structures – graphs.
- To understand sorting, searching and hashing algorithms.

UNIT I LINEAR DATA STRUCTURES – LIST 9

Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation —singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation.

UNIT II LINEAR DATA STRUCTURES – STACKS, QUEUES 9

Stack ADT – Operations – Applications: Evaluating arithmetic expressions, Conversion of Infix to postfix expression - Queue ADT – Operations - Circular Queue – Priority Queue - deQueue – applications of queues.

UNIT III NON LINEAR DATA STRUCTURES – TREES 9

Tree ADT – tree traversals - Binary Tree ADT – expression trees – applications of trees – binary search tree ADT – AVL Trees – B-Tree - B+ Tree – Heap: Introduction, Min Heap, Max Heap – Applications of heap.

UNIT IV NON LINEAR DATA STRUCTURES – GRAPHS 9

Definition – Representation of Graph – Types of graph - Breadth-first traversal - Depth-first traversal – Topological Sort – Bi-connectivity – Cut vertex – Euler circuits – Applications of graphs.

UNIT V SEARCHING SORTING AND HASHING TECHNIQUES 9

Searching – Interpolation search - Sorting - Merge Sort - Insertion sort - Shell sort – Radix sort – Heap sort. Hashing- Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

Total Periods: 45

Course Outcomes:

On completion of the course, the students will be able to
CO1: Apply the fundamental concepts of linear data structures to implement lists using arrays and linked list.
CO2: Implement stack and queue ADTs and demonstrate their use in real-time applications.
CO3: Construct and traverse various tree data structures including binary trees, AVL trees, and heaps.
CO4: Apply graph traversal and representation techniques to solve problems involving network analysis and pathfinding.
CO5: Implement and analyze searching and sorting algorithms to solve data organization and retrieval problems efficiently.
CO6: Apply hashing techniques to implement efficient data retrieval.

Suggested Activities:

- Engage in projects that involve implementing common data structures like linked lists, binary search trees, and heaps, as well as algorithms like sorting and graph traversal.

- Participate in coding challenges on platforms like HackerRank and LeetCode.
- Consider creating projects like a sorting visualizer, a maze solver, or a social media friend recommendation system.
- Create a tool that visually demonstrates the steps of different sorting algorithms (e.g., bubble sort, merge sort, quicksort).

Text Books:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.
2. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2011.

References:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983.
3. Stephen G. Kochan, "Programming in C", 3rd edition, Pearson Education.
4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, University Press, 2008.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	2	-	-	-	-	-	-	-	3	-	-
CO2	3	2	-	-	2	-	-	-	-	-	-	-	3	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-	-	3	2	-
CO4	3	2	2	2	2	-	-	-	-	-	-	-	3	2	-
CO5	3	3	3	2	3	-	-	-	-	-	-	-	3	3	2
CO6	3	2	2	-	3	-	-	-	-	-	-	-	3	3	3
Avg.	**3**	**2.2**	**2.3**	**2**	**2.3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2.5**	**2.5**

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:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2020.
2. 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												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	3	3	-	-	-	3	3	3	3	2	-	2
CO2	3	2	1	3	3	-	-	-	3	3	3	3	2	-	2
CO3	3	2	1	3	3	-	-	-	3	3	3	3	2	-	2
CO4	3	2	1	3	3	-	-	-	3	3	3	3	2	-	2
CO5	3	2	1	3	3	-	-	-	3	3	3	3	2	-	2
CO6	3	3	2	3	3	-	-	-	3	3	3	3	3	-	2
Avg.	**3**	**2**	**1**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**2**	**-**	**2**

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

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
Total Periods: 75

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

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.

Laboratory Requirements:

1. Digital Trainer Kit
2. ICs - OR,AND, NOT, NAND, XOR, 4 bit Adder, FFs
3. Connecting Wires

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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**	**1.5**	-	-	-	-	-	**1.5**	**1**	-	**1**	-	**2**	-

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 printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea() that prints the area of the given shape.
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 packages and generics
CO6: Apply Java 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	PO12	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**	**2.8**	-	**3**	-	-	-	-	-	-	**2**	**3**	**2**	-

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

CS24321	Data Structures Laboratory	PCC	L	T	P	C
			0	0	3	1.5

Course Objectives:

- To demonstrate array implementation of linear data structure algorithms.
- To implement the applications using Stack.
- To implement the applications using Linked list
- To implement Binary search tree and AVL tree algorithms.
- To implement the Heap algorithm.
- To implement Sorting, Searching and Hashing algorithms.

LIST OF EXPERIMENTS:

1. Implementation of singly, doubly and circular linked list.
2. Represent a polynomial as a linked list and write functions for polynomial addition.
3. Implement Stack and use it to covert, Infix to Postfix expression.
4. Array and linked list implementation of Queue ADTs.
5. Implementation of Stack using Queue and Queue using Stack.
6. Implement a double-ended queue (dequeue) where insertion and deletion operations are possible at both the ends.
7. Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
8. Implementation of Binary Search Trees.
9. Implementation of AVL Trees.
10. Implementation of Heaps using Priority Queues.
11. Implementation of Breadth first and Depth first traversal.
12. Implementation of Insertion sort, Merge sort and Heap sort.
13. Implement hashing using open addressing.

Total Periods: 45

Course Outcomes:

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

CO1: Implement Linear data structure algorithms.
CO2: Implement applications using Stacks and Linked lists
CO3: Implement Binary Search tree and AVL tree operations.
CO4: Implement graph algorithms.
CO5: Analyze the various searching and sorting algorithms.
CO6: Implement hashing algorithms.

References:

1. Fundamentals of Data structures in C, 2nd Edition, E.Horowitz, S.Sahni and Susan AndersonFreed, Universities Press.
2. Data structures A Programming Approach with C, D.S.Kushwaha and A.K.Misra, PHI.
3. Data structures: A Pseudo code Approach with C, 2nd edition, R.F.GilbergAndB.A.Forouzan, Cengage Learning.
4. Data structures and Algorithm Analysis in C, 2nd edition, M.A.Weiss, Pearson.

5. Data Structures using C, A.M.Tanenbaum,Y. Langsam, M.J.Augenstein, Pearson.
6. Data structures and Program Design in C, 2nd edition, R.Kruse, C.L.Tondo and B.Leung,Pearson

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. Dev C++ / Eclipse CDT / Code Blocks / CodeLite / equivalent open source IDE.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	2	1	-	-	-	-	2	1	2	2	2	2	3
CO2	3	3	1	1	-	-	-	-	1	1	1	3	1	2	2
CO3	2	1	3	1	-	-	-	-	1	1	2	3	3	3	3
CO4	3	1	3	3	-	-	-	-	1	2	3	3	2	1	2
CO5	3	2	1	1	2	-	-	-	3	3	3	1	3	1	3
CO6	2	1	2	1	1	-	-	-	1	2	1	1	2	1	3
Avg.	2	2	2	1	2	-	-	-	2	2	2	2	2	2	3

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												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	-	-	-	-	-	-	2	3	2	2
CO2	3	3	2	2	2	-	-	-	-	-	-	2	3	2	2
CO3	3	2	3	2	3	-	-	-	-	-	1	2	3	3	2
CO4	3	2	2	2	2	-	-	-	-	-	-	2	3	2	2
CO5	3	2	2	2	3	-	-	-	-	-	1	2	2	3	2
CO6	3	3	3	2	3	2	-	-	2	-	3	3	3	3	2
Avg.	3.0	2.3	2.3	2	2.5	2.0	-	-	2.0	-	1.7	2.2	2.8	2.5	2.0

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:

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

CO1: Demonstrate professionalism in meetings, telephone calls, and digital communication
CO2: Use appropriate body language, facial expressions, and gestures to enhance communication
CO3: Participate effectively in group discussions, debates, and structured dialogues
CO4: Apply job interview strategies, including answering behavioral questions using the STAR model
CO5: Write clear and professional business correspondence, including inquiries and job offers
CO6: 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 AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-
Avg.	-	-	-	-	-	-	-	-	**1**	**1**	-	-	-	-	-

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												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**1**	**1**	**1**	**-**	**-**	**-**

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

			L	T	P	C
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 DIOPHANTINE EQUATIONS, CONGRUENCES AND ITS CLASSICAL THEOREMS, MULTIPLICATIVE FUNCTIONS 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: 60

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
- Explore linear span and linear dependence graphically using Mathematical tool.
- Convert verbal description into linear transformation and represent those using matrices.
- Google Pagerank Algorithm.
- Fit a line to non-perfect data points using Mathematical tool.
- 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:

1. Kolman, B. Hill, D.R., ―Introductory Linear Algebra, Pearson Education, New Delhi, First Reprint, 2009.
2. Kumaresan, S., ―Linear Algebra – A Geometric Approach, Prentice – Hall of India, New Delhi, Reprint, 2010.
3. Lay, D.C., ―Linear Algebra and its Applications, 5th Edition, Pearson Education, 2015.
4. Strang, G., ―Linear Algebra and its applications, Thomson (Brooks/Cole), New Delhi, 2005.
5. Niven, I., Zuckerman.H.S., and Montgomery, H.L., ―An Introduction to Theory of Number, John Wiley and Sons , Singapore, 2004.
6. San Ling and Chaoping Xing, ―Coding Theory – A first Cours, Cambridge Publications, Cambridge, 2004.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	2	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	1	1	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	1	2	-	-	-	-	-	-	-	-	-	-	3
CO4	3	1	-	-	-	-	-	-	-	-	-	-	2	2	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	2	2	-
CO6	3	2	-	-	-	-	-	-	-	-	-	-	2	2	-
Avg.	**3**	**1.8**	**1**	**1.7**	-	-	-	-	-	-	-	-	**2**	**2**	**3**

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

CS24401	**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: Explain the structure and functionalities of modern operating systems and system calls.

CO2: Analyze process management techniques, multithreading and inter-process communication.
CO3: Evaluate various CPU scheduling algorithms and implement synchronization.
CO4: Design solutions for deadlock handling in concurrent systems.
CO5: Analyze 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												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	-	2	-	-	-	-	-	-	-	2	3	-	-
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	-	-
CO4	3	3	2	2	-	-	-	-	-	-	-	2	3	-	-
CO5	3	2	2	2	-	-	-	-	-	-	-	2	3	-	-
CO6	3	2	-	-	-	-	-	-	-	-	-	2	3	-	-
Avg.	**3**	**2.5**	**2**	**2**	-	-	-	-	-	-	-	**2**	**3**	-	-

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

CS24402	Microprocessor and Microcontrollers	PCC	L	T	P	C
			3	0	0	3

Course Objectives:

- To introduce the architecture, instruction set, and programming of the 8086 microprocessors.
- To explain the 8086-system bus structure, signal operations, timing, and multiprocessor configurations.
- To familiarize students with the architecture, addressing modes, and programming techniques of the 8051 microcontrollers.
- To impart knowledge on interfacing techniques and peripherals with 8051, including timers, ADC/DAC, sensors, and memory interfacing.
- To expose students to the concepts of advanced processors and microcontrollers, highlighting RISC and CISC architectures.
- To develop the ability to design and implement basic embedded system applications like traffic light control, washing machine control, and temperature monitoring.

UNIT I THE 8086 MICROPROCESSOR 9

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT II 8086 SYSTEM BUS STRUCTURE 9

8086 signals – Basic configurations – System bus timing –System design using 8086 – IO programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, closely coupled and loosely Coupled configurations

UNIT III 8051 MICROCONTROLLERS 9

Difference Between Microprocessor and Microcontroller-Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming

UNIT IV INTERFACING AND PROGRAMMING 8051 MICROCONTROLLER 9

Programming 8051 using SFRs- Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation.

UNIT V INTRODUCTION TO ADVANCED PROCESOSR AND SYSTEM DESIGN 9

Introduction to advanced processors and microcontrollers – Introduction to FPGA - Difference between RISC vs CISC. Case studies – Traffic light control, washing machine control, Temperature control system.

Periods: 45 Hours

Course Outcomes:

On completion of the course, the students will be able to
CO 1: Analyse the architecture, addressing modes, and instruction set of the 8086 microprocessor.

CO 2: Design and implement systems using 8086 microprocessors with proper bus structures and multiprocessor configurations.
CO 3: Write assembly language programs for the 8051-microcontroller using different addressing modes and SFRs.
CO 4: Interface 8051 microcontroller with peripherals like LCDs, keyboards, ADCs, DACs, sensors, and stepper motors.
CO 5: Differentiate between RISC and CISC processor architectures and explain their impact on system design.
CO 6: Develop basic embedded system solutions for real-world problems like traffic management, appliance control, and temperature regulation.

Text Books:

1. Krishna Kant, "MICROPROCESSORS AND MICROCONTROLLERS Architecture, programming and system design using 8085, 8086, 8051 and 8096". PHI 2007
2. Mohammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D.McKinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C, Second Edition, Pearson Education, 2008.

References:

1. Yu-Cheng Liu, Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family -Architecture, Programming and Design", Second Edition, Prentice Hall of India, 2007.
2. Doughlas V.Hall, "Microprocessors and Interfacing, Programming and Hardware:,TMH, 2012

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	3	-
CO2	3	3	2	2	-	-	-	-	-	-	-	-	2	3	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	2	-
CO4	3	2	3	2	2	-	-	-	-	-	-	-	2	3	-
CO5	3	2	-	-	-	-	-	-	-	-	-	1	2	3	-
CO6	3	3	3	3	2	2	-	-	2	2	2	2	2	3	-
Avg.	**3.00**	**2.33**	**2.67**	**2.33**	**2.00**	**2.00**	**-**	**-**	**2.00**	**2.00**	**2.00**	**1.50**	**2.2**	**2.8**	**-**

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

CS24411	**Design and Analysis of Algorithms**	**PCC**	**L**	**T**	**P**	**C**
			3	0	2	4

Course Objectives:

- To understand and apply algorithm analysis techniques.
- To critically analyze the efficiency of graph algorithms.
- To understand different algorithm design techniques.
- To solve programming problems using state space tree.
- To understand the concepts behind NP Completeness, Approximation algorithms.

UNIT I INTRODUCTION 9

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis

Framework – Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms – Master's Theorem.

UNIT II BRUTE FORCE AND GRAPH ALGORITHMS 9

Brute Force – Computation a^n – String Matching - Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem - Knapsack Problem - Assignment problem. Graph algorithms: Representations of graphs - Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm.

UNIT III ALGORITHM DESIGN TECHNIQUES 9

Divide and Conquer methodology: Finding maximum and minimum - Merge sort - Quick sort. Dynamic programming: Principle of Optimality - Elements of dynamic programming — Matrix-chain multiplication - Multi stage graph — Optimal Binary Search Trees. Greedy Technique: Elements of the greedy strategy - Activity-selection problem – Optimal Merge pattern — Huffman Trees.

UNIT IV STATE SPACE SEARCH ALGORITHMS 9

Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem – Graph colouring problem Branch and Bound: Solving 15-Puzzle problem - Assignment problem – Knapsack Problem - Travelling Salesman Problem.

UNIT V NP-COMPLETE AND APPROXIMATION ALGORITHM 9

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation – Lower - Bound arguments - NP-algorithms - NP-hardness and NP-completeness – SAT. Approximation Algorithms for NP-Hard problems – Travelling Salesman problem – Knapsack problem.

Total Periods: 45

LIST OF EXPERIMENTS:

1. Implement linear search and binary search. Determine the time required to search for an element. Repeat the experiment for different values of n, the number of elements in the list to be searched and plot a graph of the time taken versus n.
2. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.
3. Sort a given set of elements using the Merge sort and Quick sort methods and determine the time required to sort the elements. Repeat the experiment for different values of n, the number of elements in the list to be sorted and plot a graph of the time taken versus n.
4. From a given vertex in a weighted connected graph, develop a program to find the shortest paths to other vertices using Dijkstra's algorithm.
5. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
6. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
7. Implement optimal binary search tree using Dynamic programming.
8. Implement activity selection problems using Greedy technique.
9. Implement N Queens problem using Backtracking.

10. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem, instance using any approximation algorithm and determine the error in the approximation.

Periods: 30

Total Periods: 75

Course Outcomes:

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

CO1: Analyze the efficiency of algorithms using various frameworks.
CO2: Apply graph algorithms to solve problems and analyze their efficiency.
CO3: Make use of algorithm design techniques like dynamic programming and greedy techniques to solve problems
CO4: Use the state space tree method for solving problems.
CO5: Analyze the efficiency of various NP problems.
CO6: Solve problems using approximation algorithms.

Suggested Activities

- Write code for various algorithms using your preferred programming language (e.g., Java, Python, C++, C).
- Create visual representations of algorithms in action (e.g., sorting, searching) to aid understanding.
- Participate in coding platforms (e.g., HackerRank, LeetCode) to solve algorithmic problems.
- Apply algorithm design principles to practical projects like developing a recommendation system, building a search engine, or implementing a data compression algorithm.
- Participate in algorithm design and analysis contests to enhance problem-solving skills.

Text Books:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2007.

References:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", Third Edition, PHI Learning Private Limited, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.
3. Harsh Bhasin, "Algorithms Design and Analysis", Oxford university press, 2016.
4. S. Sridhar, "Design and Analysis of Algorithms", Oxford university press, 2014.
5. http://nptel.ac.in/

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. Dev C++ / Eclipse CDT / Code Blocks / CodeLite / equivalent open source IDE

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	2	3
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2	3
CO3	3	3	3	2	2	-	-	-	-	-	-	2	2	2	3
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	2	2
CO5	3	3	2	2	-	-	-	-	-	-	-	2	2	1	3
CO6	3	3	2	2	1	-	-	-	-	-	-	2	2	1	3
Avg.	**3.0**	**3.0**	**2.5**	**2.0**	**1.7**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2.0**	**1.7**	**2.8**

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

CS24412	**Object Oriented Software Engineering**	**PCC**	**L**	**T**	**P**	**C**
			3	0	2	4

Course Objectives:

- Understand foundational software engineering principles and lifecycle models.
- Apply Agile Methodologies for iterative software development.
- Model system requirements and behaviour using UML diagrams.
- Design software solutions using standard Design Patterns, with Java-based examples.
- Manage software projects with industry-standard practices.
- Understand the basics of DevOps as part of modern project management approaches.

UNIT I SOFTWARE ENGINEERING PRINCIPLES AND MODELS 6

Overview of Software Engineering - Software Development Life Cycle (SDLC) Models: Waterfall, Incremental, Spiral, V-Model - Modern Practices: Agile and Lean Software Development - Principles of Good Software Engineering: Modularity, Reusability, Maintainability and Scalability.

UNIT II AGILE SOFTWARE DEVELOPMENT 9

Agile Manifesto and Principles - Scrum Framework: Roles, Artifacts, Events - Kanban and Lean Software Development - Extreme Programming (XP) Practices (TDD, Pair Programming) - Agile Estimation Techniques: Story Points, Planning Poker - Agile Metrics: Velocity, Burn-down and Burn-up Charts - Case Study: Simulating an Agile Sprint

UNIT III REQUIREMENTS MODELING USING UML 10

Introduction to Requirement Elicitation - Preparing Software Requirements Specifications (SRS) - Introduction to UML (Unified Modeling Language) - Use Case Diagrams for Requirements Capture - Structural Modeling: Class Diagrams, Object Diagrams - Behavioral Modeling: Sequence Diagrams, Activity Diagrams, State Machine Diagrams - Tools for UML Modeling.

UNIT IV SOFTWARE DESIGN PATTERNS USING JAVA 11

Introduction to Design Principles: SOLID Principles - Overview of Design Patterns: Creational Patterns: Singleton, Factory Method - Structural Patterns: Adapter, Façade - Behavioral Patterns: Observer, Strategy - Architectural Pattern: Model-View-Controller (MVC) – Publish-Subscribe Pattern - Application of Patterns in Java - Hands-on Case Study: Applying patterns to a mini project

UNIT V SOFTWARE TESTING AND PROJECT MANAGEMENT 9

Introduction to Software Testing - Levels of Testing: Unit, Integration, System, Acceptance - Types of Testing: Manual, Automation, Regression, Performance - Test Case Design Techniques - Software Project Management Basics - Project Planning and Scheduling (Work Breakdown Structure, Gantt Charts) - Risk Management - JIRA for Project Management

Periods: 45

LIST OF EXPERIMENTS:

1. Identify a real-world problem statement and Create a Software Requirements Specification (SRS) document.
2. Develop a Use Case diagram representing the main functionalities of the system.
3. Create a UML Class Diagram identifying important classes, attributes, methods, and relationships.
4. Design Sequence Diagrams for at least two important system use cases.
5. Create a State Diagram for a key entity in the system
6. Structure the project based on the Model–View–Controller (MVC) architectural pattern.
7. Code the Model classes handling business logic and data management.
8. Code the View components (UI screens).
9. Code the Controller classes handling interaction between Model and View.
10. Integrate all components, perform basic testing, and demonstrate the working application.

Periods: **30**

Total Periods: 75

Course Outcomes:

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

CO1: Understand and apply software engineering lifecycle models and principles.
CO2: Implement Agile methodologies (Scrum, Kanban, XP) in software development.
CO3: Analyze and model system requirements using UML diagrams.
CO4: Design software systems using appropriate design patterns with Java implementations.
CO5: Apply basic project management techniques and risk management.
CO6: Apply fundamental software testing principles to design effective test cases and perform various levels of testing.

Suggested Activities

- SDLC Model Pitch
- Agile Scrum Simulation
- Form teams and assign simple real-world problems
- Mini Project Management Plan

- Identify test scenarios, design test cases and execute unit, integration, and system tests for a simple web based application

Text Books:

1. Roger S. Pressman, Object-Oriented Software Engineering: An Agile Unified Methodology, First Edition, Mc Graw-Hill International Edition, 2014.
2. Craig Larman, Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, 3rd Edition, Pearson, 2005.

References:

1. Eric Freeman, Elisabeth Robson, Head First Design Patterns*,* 2nd Edition, O'Reilly Media, 2020.
2. Ken Schwaber, Jeff Sutherland, The Scrum Guide*,* November 2020.
3. Bob Hughes, Mike Cotterell, Rajib Mall, Software Project Management*,* 6th Edition, McGraw Hill, 2017.
4. Sommerville, Ian, Software Engineering, 10th Edition, Pearson Education, 2015.

Laboratory Requirements:

1. INTEL based desktop PC with min. 16 GB RAM and 512 GB SSD
2. UML Modelling Tools – ArgoUML/StarUML
3. Java Development Kit (JDK) — Version 17 or above
4. Integrated Development Environment (IDE) – Eclipse/ IntelliJ IDEA Community Edition/VS Code

MAPPING OF COs WITH POs AND PSOs

COs	**POs**												**PSOs**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	-	-	-	-	-	-	-	-	-	2	3	-	-
CO2	3	3	3	-	3	-	-	-	2	2	2	2	3	3	-
CO3	3	3	3	2	-	-	-	-	2	2	-	2	3	2	-
CO4	3	2	3	-	3	-	-	-	2	2	-	2	3	2	-
CO5	2	2	2	-	-	-	-	-	2	2	2	2	3	-	-
CO6	3	2	2	2	3	-	-	-	2	2	-	2	3	2	-
Avg.	**2.8**	**2.3**	**2.6**	**2**	**3**	**-**	**-**	**-**	**2**	**2**	**2**	**2**	**3**	**2.3**	**-**

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 PREPARATION 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: Define the data science process
CO2: Understand different types of data description for data science process
CO3: Gain knowledge on relationships between data
CO4: Use the Python Libraries for Data Wrangling
CO5: Apply visualization Libraries in Python to interpret and explore data
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. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (Unit I)
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. (Units III and IV)
3. 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.

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	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	2	3
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	2	3
CO3	3	3	-	2	-	-	-	-	-	-	-	-	2	2	3
CO4	3	3	2	2	3	-	-	-	-	-	-	-	2	3	3
CO5	3	3	2	2	3	-	-	-	-	2	-	-	2	3	3
CO6	3	3	3	3	3	-	-	-	-	3	-	3	3	3	3
Avg.	**3**	**2.7**	**2.3**	**2.3**	**3**	**-**	**-**	**-**	**-**	**2.5**	**-**	**3**	**2.2**	**2.5**	**3**

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												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	1	3	1	1	-	-	-	1	3	3	3	2	-	-
CO2	3	1	1	2	2	-	-	-	3	2	1	1	3	-	-
CO3	3	3	2	1	2	-	-	-	3	3	1	2	2	-	-
CO4	1	2	2	3	2	-	-	-	3	1	3	1	2	-	-
CO5	2	2	1	1	3	-	-	-	1	2	2	3	1	-	-
CO6	2	2	2	1	3	-	-	-	2	2	2	3	1	-	-
Avg.	**2.3**	**1.8**	**1.8**	**1.5**	**2.2**	**-**	**-**	**-**	**2.2**	**2.2**	**2.0**	**2.2**	**1.8**	**-**	**-**

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

CS24422	**Microprocessor and Microcontrollers Lab**	**PCC**	**L**	**T**	**P**	**C**
			0	0	3	1.5

Course Objectives:

- To introduce the architecture and operation of the 8086 microprocessor and develop assembly language programs for basic arithmetic, logical operations, and data conversion techniques.
- To explore advanced programming techniques using the 8086 microprocessor, including string manipulation, byte search, and number sorting algorithms.
- To introduce the 8051 microcontroller, its architecture, and programming concepts with a focus on arithmetic and logical operations.
- To provide hands-on experience with 8051 microcontroller interfacing, including ADC, DAC, display/keypad, and stepper motor interfacing.
- To develop real-time embedded systems by simulating applications like traffic light controllers and designing system solutions.
- To enhance problem-solving skills by integrating microcontrollers with various peripherals to design and implement real-world embedded systems.

LIST OF EXPERIMENTS:

Experiments using 8086:

1. Arithmetic and Logical operations
2. Code conversion
3. BCD conversion
4. String manipulation
5. Search the byte of number
6. Number sorting (Ascending and Descending)

Experiments using 8051:

1. Arithmetic and logical operations
2. Find the Square and cube for the given number
3. Unpacked BCD to ASCII

Interface Experiments using 8051:

1. ADC Interface
2. DAC interface
3. Display and keypad interface
4. Stepper motor interface
5. Traffic light controller interface

Total Periods: 45

Course Outcomes:

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

CO1: Demonstrate the ability to write assembly language programs for basic arithmetic, logical, and data conversion tasks using the 8086 microprocessor.
CO2: Design and implement advanced 8086 microprocessor programs for string manipulation, number searching, and sorting.
CO3: Program the 8051 microcontroller for arithmetic and logical operations, and handle data conversion tasks like BCD to ASCII.
CO4: Interface external devices like ADC, DAC, displays, keypads, and stepper motors with the 8051 microcontroller and program them effectively.
CO5: Design embedded systems and real-time applications such as traffic light controllers and temperature control systems using microcontrollers.
CO6: Integrate 8051 microcontroller with various peripherals to solve complex problems and demonstrate real-time system design and implementation.

References:

1. Krishna Kant, “MICROPROCESSORS AND MICROCONTROLLERS Architecture, programming and system design using 8085, 8086, 8051 and 8096”. PHI 2007
2. Mohammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D.McKinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C, Second Edition, Pearson Education, 2008.

Laboratory Requirements:

1. 8086 trainer kit- 15
2. 8051 trainer kit -15
3. Interface kit- ADC,DAC, Stepper motor, Keyboard and display interface,traffic light – 3 no’s each.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	2	2	-	-	-	-	-	-	-	-	-	-
CO5	3	3	3	2	2	2	-	-	2	2	-	2	-	-	-
CO6	3	3	3	2	2	2	-	-	2	2	-	3	-	-	-
Avg.	**3**	**3**	**2.5**	**2**	**2**	**2**	**-**	**-**	**2**	**2**	**-**	**2.5**	**-**	**-**	**-**

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:
On completion of the course, the students will be able to
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:
1. 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.
2. Group Discussion
3. 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.
4. Developing a Professional Profile
   - Assignment: LinkedIn Challenge
   - 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												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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.	-	1	-	1	-	1	-	1	1	1	1	1	-	-	-

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

			L	T	P	C
CS24423	**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

- Creating a Low-Fidelity Prototype (Paper/Digital Mockups)
  - Tools: Figma
- Building a Minimum Viable Product (MVP)
- Testing & Refining the Prototype Based on Feedback
- Implementing Core Functionalities of the Solution
- Code/Design Review & Iteration

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

CO1: Finalize a well-defined problem statement and identify key stakeholders
CO2: Develop a structured project plan, defining goals, tech stack, and execution roadmap
CO3: Build a functional prototype with key features working
CO4: Establish clear performance benchmarks, conduct thorough testing, and optimize their project for efficiency, usability, and scalability.
CO5: Successfully present and deploy their projects
CO6: 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												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	-	-	2	-	1	2	2	2	2	3	2	-
CO2	2	2	3	1	2	-	-	-	2	2	3	2	3	3	-
CO3	3	3	3	2	3	-	-	-	2	2	2	2	3	3	2
CO4	3	3	3	3	3	-	-	-	-	-	2	2	3	2	2
CO5	2	2	2		2	1	-	1	3	3	2	2	2	2	1
CO6	3	3	3	2	3	2	-	1	3	3	3	3	3	3	2
Avg.	**2.7**	**2.5**	**2.7**	**2.0**	**2.6**	**1.7**	**-**	**1.0**	**2.4**	**2.4**	**2.3**	**2.2**	**2.8**	**2.5**	**1.8**

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