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St. JOSEPH'S COLLEGE OF ENGINEERING
(An Autonomous Institution)
St. Joseph's Group of Institutions
OMR, Chennai - 119

B. Tech ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CURRICULUM AND SYLLABI

REGULATIONS – 2025

(Applicable to the students admitted in the AY 2026-2027)

VISION AND MISSION OF THE DEPARTMENT

VISION

To become an outstanding department that provides state-of-the-art professional resources and empowers our students to transform into impactful global leaders in the field of Artificial Intelligence and Data Science.

MISSION

Domain-specific excellence: To equip our students with Engineering knowledge and domain-specific skills to understand, analyze, and develop AI-based processes through cutting-edge research and Innovations.

Domain-specific solutions: To excel our students in Computational principles and Data Science and derive actionable foresight and hindsight to solve real-world problems in engineering and business, with high professional standards.

Domain-specific social impact: To promote sustained knowledge advancement in AI and Data Science, and empower our students to solve complex societal challenges.

PROGRAMME EDUCATIONAL OBJECTIVES

PEO1: Graduates to exploit the knowledge of basic science, mathematics, statistics, and data science to build systems that require management and analysis of large volumes of real time data.

PEO2: To enrich the graduates with technical and professional skills to apply the concept of Artificial Intelligence to develop elegant solutions for the complex problems in various domains.

PEO3: To enable the graduates to think logically, pursue lifelong learning, and pioneering research in the field of Artificial Intelligence and Data Science to create disruptive and sustainable solutions for the real world issues.

PEO4: To inculcate ethical attitude, social responsibilities, and soft skills to work as a team to solve social, business and environmental problems.

PROGRAMME OUTCOMES (POs):

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

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

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

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

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

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

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

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

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

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

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

PROGRAMME SPECIFIC OUTCOMES(PSOs)

PSO1: Understand, Analyze, evolve and develop AI based efficient domain specific processes for effective decision making in several domains such as business, IT and governance.
PSO2: Able to arrive at actionable foresight, insight, hindsight from data for solving business and engineering problems by applying mathematical, statistical and computational principles.
PSO3: Create, select and apply the theoretical knowledge of AI and Data Analytics along with practical industrial tools and techniques to manage and solve societal problems.

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Curriculum Articulation Matrix

YEAR	SEM	COURSE TITLE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
YEAR 1	SEM 1	Matrices and Calculus	✓	✓	✓	✓	✓						✓
		Applied Physics	✓	✓		✓	✓						✓
		Fundamentals of IoT	✓	✓	✓	✓	✓	✓					✓
		Problem Solving and Programming in C	✓	✓	✓		✓						✓
		Artificial Intelligence and Computational Thinking	✓	✓	✓		✓						✓
		Heritage of Tamils							✓		✓		✓
		Professional English - I (Lab Integrated)							✓	✓	✓		
		Physics Laboratory	✓	✓	✓	✓	✓			✓	✓	✓	✓
		C Programming Laboratory	✓	✓	✓		✓			✓	✓	✓	✓
		Software Training Course – I					✓					✓	✓
		Aptitude Training Course – I	✓	✓							✓	✓	✓
	SEM 2	Linear Algebra	✓	✓	✓	✓	✓						✓
		Semiconductors and Nanoelectronic Devices	✓	✓		✓	✓						✓
		Foundations of Python	✓	✓	✓		✓						✓
		Digital Principles and Logic Design	✓	✓	✓	✓	✓						✓
		Tamils and Technology							✓		✓		✓
		Professional English - II (Lab Integrated)					✓			✓	✓	✓	
		Python Programming Laboratory	✓	✓	✓	✓	✓			✓	✓	✓	✓
		Digital Design Laboratory	✓	✓	✓	✓	✓			✓	✓	✓	✓
		Communication Skills Enhancement					✓			✓	✓	✓	✓
		Aptitude Training Course – II											

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YEAR	SEM	COURSE TITLE	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
YEAR 2	SEM 3	Mathematics of Discrete Structures	✓	✓	✓	✓							✓
		Data Structures	✓	✓	✓	✓	✓						✓
		Computer Architecture	✓	✓	✓	✓	✓						✓
		Database Design and Management	✓	✓	✓	✓	✓					✓	✓
		Essentials of Data Science	✓	✓	✓	✓	✓			✓	✓	✓	✓
		Operating Systems (Lab Integrated)	✓	✓	✓	✓	✓				✓	✓	✓
		Data Structures Laboratory	✓	✓	✓	✓	✓			✓	✓	✓	✓
		Database Design and Management Laboratory	✓	✓	✓	✓	✓			✓	✓	✓	✓
		Soft Skills and Professional Communications					✓			✓	✓	✓	✓
	SEM 4	Probability Theory and Statistics	✓	✓	✓	✓	✓				✓		✓
		Design and Analysis of Algorithms	✓	✓	✓	✓	✓					✓	✓
		Computer Networks	✓	✓	✓	✓	✓					✓	✓
		Data Exploration and Visualization	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Machine Learning and Generative AI	✓	✓	✓	✓	✓					✓	✓
		Environmental Science and Sustainability					✓	✓					✓
		Advanced Artificial Intelligence (Lab Integrated)	✓	✓	✓	✓	✓					✓	✓
		Data Exploration and Visualization Laboratory	✓	✓	✓	✓	✓			✓	✓	✓	✓
		Machine Learning and Generative AI Laboratory	✓	✓	✓	✓	✓			✓	✓	✓	✓
		Data Structures Training (C & Java)	✓	✓	✓		✓			✓	✓	✓	✓

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Semester – I							
S.No	**Course Code**	**Course Name**	**Course Type** **T / LIT / L**	**Periods / Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.	MA25C01	Matrices and Calculus	T	3-1-0	4	4	ESC
2.	PH25C06	Applied Physics	T	3-0-0	3	3	ESC
3.	EC25C01	Fundamentals of IoT	T	3-0-0	3	3	ESC
4.	CS25C01	Problem Solving and Programming in C	T	3-0-0	3	3	ESC
5.	CS25C03	Artificial Intelligence and Computational Thinking	T	3-1-0	4	4	ESC
6.	GE25C01	Heritage of Tamils	T	1-0-0	1	1	HSMC
7.	EN25C09	Professional English - I (Lab Integrated)	LIT	2-0-2	4	3	HSMC
8.	PH25C11	Physics Laboratory	L	0-0-3	3	1.5	ESC
9.	CS25C11	C Programming Laboratory	L	0-0-3	3	1.5	ESC
10.	SD25C02	Software Training Course – I	L	0-0-2	2	0	SDC
11.	SD25C03	Aptitude Training Course – I	L	0-0-2	2	0	SDC
				Total	32	24	

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Semester – II							
S.No	**Course Code**	**Course Name**	**Course Type T / LIT / L**	**Periods / Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.	MA25C04	Linear Algebra	T	3-1-0	4	4	ESC
2.	PH25C02	Semiconductors and Nanoelectronic Devices	T	3-0-0	3	3	ESC
3.	AL25201	Foundations of Python	T	3-0-0	3	3	PCC
4.	CS25202	Digital Principles and Logic Design	T	3-0-0	3	3	PCC
5.	GE25C02	Tamils and Technology	T	1-0-0	1	1	HSMC
6.	EN25C10	Professional English - II (Lab Integrated)	LIT	2-0-2	4	3	HSMC
7.	AL25211	Python Programming Laboratory	L	0-0-3	3	1.5	PCC
8.	CS25212	Digital Design Laboratory	L	0-0-3	3	1.5	PCC
9.	SD25C07	Communication Skills Enhancement	L	0-0-2	2	0	SDC
10.	SD25C08	Aptitude Training Course – II	L	0-0-2	2	0	SDC
				Total	28	20	

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Semester – III							
S.No	**Course Code**	**Course Name**	**Course Type** T / LIT / L	**Periods / Week**		**Credits**	**Category**
				L-T- P	**TCP**		
1.	MA25301	Mathematics of Discrete Structures	T	3-1-0	4	4	ESC
2.	CS25301	Data Structures	T	3-0-0	3	3	PCC
3.	CS25302	Computer Architecture	T	3-0-0	3	3	PCC
4.	IT25301	Database Design and Management	T	3-0-0	3	3	PCC
5.	AD25301	Essentials of Data Science	T	3-0-0	3	3	PCC
6.	CS25308	Operating Systems (Lab Integrated)	LIT	2-0-2	4	3	PCC
7.	CS25311	Data Structures Laboratory	L	0-0-3	3	1.5	PCC
8.	IT25311	Database Design and Management Laboratory	L	0-0-3	3	1.5	PCC
9.	SD25C11	Soft Skills and Professional Communications	L	0-0-2	2	0	SDC
				Total	28	22	

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Semester – IV							
S.No	Course Code	Course Name	Course Type T / LIT / L	Periods / Week		Credits	Category
				L-T- P	TCP		
1.	MA25401	Probability Theory and Statistics	T	3-1-0	4	4	ESC
2.	CS25401	Design and Analysis of Algorithms	T	3-0-0	3	3	PCC
3.	CS25402	Computer Networks	T	3-0-0	3	3	PCC
4.	AD25401	Data Exploration and Visualization	T	3-0-0	3	3	PCC
5.	AD25402	Machine Learning and Generative AI	T	3-0-0	3	3	PCC
6.	AC25C01	Environmental Science and Sustainability	T	2-0-0	2	0	AC
7.	AD25408	Advanced Artificial Intelligence (Lab Integrated)	LIT	2-0-2	4	3	PCC
8.	AD25411	Data Exploration and Visualization Laboratory	L	0-0-3	3	1.5	PCC
9.	AD25412	Machine Learning and Generative AI Laboratory	L	0-0-3	3	1.5	PCC
10.	SD25C16	Data Structures Training (C & Java)	L	0-0-2	2	0	SDC
				Total	30	22	

CHAIRPERSON-BoS

DEAN -ACADEMICS

Dr. G. SREEKUMAR M.Sc., M.Tech., PhD
DEAN - Academics
St. Joseph's College of Engineering
OMR, Chennai - 600 119, India.

PRINCIPAL

Dr. VADDI SESHAGIRI RAO, M.E., M.B.A., Ph.D.
PRINCIPAL
St. JOSEPH'S COLLEGE OF ENGINEERING
(AN AUTONOMOUS INSTITUTION)
OLD MAMALLAPURAM ROAD,
CHENNAI - 600 119.

SEMESTER I

MA25C01	**MATRICES AND CALCULUS**	**L**	**T**	**P**	**C**
	(Common to all Branches and M.TECH(CSE))	3	1	0	4

OBJECTIVES

- To achieve conceptual understanding and to retain the best traditions of traditional calculus.
- To provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions.
- To use matrix algebra to solve real-world engineering problems.
- To learn about ordinary differential equations which plays an important role in the understanding of science and engineering.

UNIT – I MATRICES **9 + 3**

Characteristic equation –Eigenvalues and Eigenvectors of a real matrix- Properties of Eigenvalues and Eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT – II CALCULUS OF ONE VARIABLE **9 + 3**

Limit of a function - Continuity - Derivatives - Differentiation rules – Interval of increasing and decreasing functions – Maxima and Minima - Intervals of concavity and convexity.

UNIT – III CALCULUS OF SEVERAL VARIABLES **9 + 3**

Partial differentiation – Homogeneous functions and Euler‘s theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor‘s series for functions of two variables – Maxima and minima of functions of two variables – Lagrange‘s method of undetermined multipliers.

UNIT – IV MULTIPLE INTEGRALS **9 + 3**

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

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UNIT – V ORDINARY DIFFERENTIAL EQUATIONS 9 + 3

Higher order linear differential equations with constant coefficients - Method of variation of parameters– Homogenous equation of Euler‘s and Legendre‘s type - System of simultaneous linear differential equation with constant co-efficient.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, New Delhi, 45th Edition, 2024.
2. James Stewart, "Calculus: Early Transcendental", Cengage Learning, 7th Edition, New Delhi,2015

REFERENCE BOOKS:

1. Erwin Kreyszig "Advanced Engineering Mathematics", Wiley India Pvt Ltd., New Delhi, 2015.
2. Greenberg M.D., “Advanced Engineering Mathematics”, Pearson Education2nd Edition, 5th Reprint, Delhi, 2009.
3. Jain R.K. and Iyengar S.R.K., “Advanced Engineering Mathematics”,Narosa Publications, 5th Edition, New Delhi, 2017.
4. Narayanan S. and Manicavachagom Pillai T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Peter V.O’Neil, “Advanced Engineering Mathematics”, Cengage Learning India Pvt., Ltd, 7th Edition, New Delhi , 2012.
6. Ramana B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Co. Ltd., 11th Reprint, New Delhi, 2010.
7. T. Veerarajan. Engineering Mathematics – I, McGraw Hill Education; First edition 2017.

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COURSE OUTCOMES

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

CO1 Analyze matrices using eigenvalues and eigenvectors and classify quadratic forms for engineering applications.

CO2 Apply the concepts of limits, continuity, and differentiation to analyze functions and determine maxima and minima.

CO3 Analyze functions of several variables and evaluate their partial derivatives for engineering Applications

CO4 Evaluate double and triple integrals and apply multiple integration techniques to solve engineering problems.

CO5 Solve ordinary differential equations using appropriate analytical techniques and apply them to engineering problems.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	0	0	0	0	0	0	3	2	2
CO2	3	3	3	2	2	0	0	0	0	0	1	3	2	2
CO3	3	3	3	2	2	0	0	0	0	0	1	3	2	0
CO4	3	3	3	2	1	0	0	0	0	0	1	3	2	0
CO5	3	3	3	3	1	0	0	0	0	0	1	3	2	0

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PH25C06	APPLIED PHYSICS	L	T	P	C
	(Common to all U.G. Branches and M. Tech (CSE)-5 years Int.)	3	0	0	3

OBJECTIVES

- To provide students with a fundamental understanding of LASER, nonlinear optics and their technological applications.
- To import knowledge in fibre optics, remote sensing, and their applications in various fields.
- To equip students with an understanding of the principles and importance of quantum physics.
- To introduce the fundamentals of ultrasonics and their applications in different fields.
- To familiarize students with various instrumentation techniques used for material analysis and characterization.

UNIT – I LASER AND NONLINEAR OPTICS 9

Introduction to LASER - Stimulated Absorption, Spontaneous and Stimulated emission- Conditions for laser- Einstein's A & B coefficients - Semiconductor laser – Applications: Defence and Biomedical, AI in photonics. Nonlinear Optics: Nonlinear optical phenomena - Nonlinear optical materials – Applications: Frequency doubling and mixing - Second Harmonic Generation (SHG) Optical Parametric Amplification - Optical Parametric Generation (OPG) - Optical Parametric Oscillators (OPO) – Construction and working.

UNIT – II FIBER OPTICS AND REMOTE SENSING 9

Introduction – Principle - Light propagation through fibre - Numerical Aperture - Acceptance angle - Modes and configuration – Losses – Applications - Communication system with block diagram – Endoscopy - Remote sensing - Active and Passive Remote sensing- Components of remote sensing – RADAR – Block diagram - Cell phone reception.

UNIT – III QUANTUM MECHANICS 9

Introduction to black-body radiation – Wien's law - Rayleigh Jeans' law - Planck's radiation law - Scattering of radiation as particles - Compton Effect theory and experimental verification. Wave-particle dualism – de-Broglie hypothesis – Heisenberg uncertainty principle (Qualitative) - Concept of the wave function and its physical significance - Schrodinger's wave equation: time-independent and time-dependent equations - Application of Schrodinger's wave equation: Particle in a one-dimensional rigid box – Tunnelling (Qualitative).

UNIT – IV ULTRASONICS AND NON-DESTRUCTIVE TESTING 9

Ultrasonics – Production - Magnetostriction and Piezoelectric methods – Properties of ultrasonics – Acoustic Grating - Non-Destructive Testing (NDT) – Liquid penetrant method – Ultrasonic testing – Ultrasonic flaw detector - Principle, transmission and pulse echo method, data representation A scan, B scan and C scan – Applications: SONAR, Ultrasonic welding and cleaning –Ultrasonics in Medicine – Sonography – Measurement of velocity of blood flow using Doppler effect.

UNIT – V SOLID STATE PHYSICS AND INSTRUMENTATION FOR MATERIAL ANALYSIS 9

Introduction to materials and Techniques - Classification of solids – Space lattice – Basis and Unit cell – primitive and nonprimitive unit cell – Lattice parameter - Seven crystal systems - Bravais lattices – structural study of different crystals (Qualitative) – Bragg's law – X ray diffraction: Rotating crystal method – Powder method – AI based structural determination - Optical and Electron Microscopes - Scanning Electron Microscope – Transmission Electron Microscope - Spectroscopy: UV-VIS, Fourier transform infrared spectroscopy.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. "Engineering Physics". Oxford University Press, 2024.
2. "An Introduction to Lasers Theory and Applications" by M N Avadhanulu, S.Chand & Company Ltd.,
3. Gaur, R.K. & Gupta, S.L. "Engineering Physics". Dhanpat Rai Publishers, 2024.
4. Pandey, B.K. & Chaturvedi, S. "Engineering Physics". Cengage Learning India, 2022

REFERENCE BOOKS:

1. Thyagarajan, K and Ghatak, A., "Lasers: Fundamentals and Applications", Laxmi Publications, (Indian Edition), 2019.
2. "Engineering Physics" M.N. Avadhanulu, P.G. Kshirsagar , S.Chand & Company Ltd. 2019
3. David J. Griffiths, Darrell F. Schroeter "Introduction to Quantum Mechanics" 2024.
4. Elmer A. Rosauer "Instruments for Materials Analysis" 1981.

COURSE OUTCOMES

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

CO1 Explain the principles of LASER and nonlinear optics and their technological applications.

CO2 Apply the concepts of fibre optics and remote sensing in various scientific and engineering fields.

CO3 Demonstrate the fundamental concepts and significance of quantum physics.

CO4 Explain the basics of ultrasonic and analyse their applications in different fields.

CO5 Analyse various instrumentation techniques used for material characterization and analysis.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	2	1	0	1	1	1	2	2	2	2
CO2	3	3	2	2	3	2	0	1	1	1	2	2	3	3
CO3	3	2	0	1	1	1	0	1	1	1	2	2	3	2
CO4	3	3	1	2	2	2	0	1	1	1	2	1	2	2
CO5	3	3	2	3	3	1	0	1	1	1	2	1	3	3

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EC25C01	FUNDAMENTALS OF IoT	L	T	P	C
(Common to B.E. ECE, CSE, EEE, ADS, AML, CSE-AML, CSBS, Cybersecurity, B Tech. IT & M Tech. CSE)		3	0	0	3

OBJECTIVES

- To introduce the fundamental concepts of the Internet of Things (IoT), including its architecture, components, communication layers and associated challenges.
- To provide knowledge of various sensors and actuators used in IoT systems and their working principles.
- To develop basic programming skills using Arduino IDE for interfacing simple input/output devices.
- To familiarize students with embedded controllers, their architecture and interfacing techniques for IoT applications.
- To expose students to real-world IoT applications in domains such as smart cities, healthcare, agriculture and industrial systems.

UNIT – I INTRODUCTION TO IoT **9**

IoT Fundamentals – Definition, Types of IoT, Characteristics of IoT, Key Components of IoT, IoT Architecture and Protocols – Physical Layer, Network Layer, Data Processing Layer, Application Layer, Design and Security Challenges in IoT.

UNIT – II SENSORS AND ACTUATORS IN IoT **9**

Introduction of Sensors, Working and Types – Analog and Digital Sensors – Temperature and Humidity Sensor, Light Sensors, Motion Sensors, Gas Detection Sensors, Soil Moisture Sensors. Introduction of Actuators, Working and Types – LED, LCD, Buzzer, Potentiometer, Relay, DC Motor and Servo Motor.

UNIT – III PROGRAMMING WITH ARDUINO **9**

Introduction to Arduino Boards and its Types – Arduino UNO Pin Diagram, Arduino IDE – Sketch Structure, Data Types & Built in Constants, Operators, Control Statements and Loops, Library Functions, Interfacing of simple I/O Devices with Arduino.

UNIT – IV IoT CONTROLLERS AND INTERFACING **9**

Architecture of ESP32 & ESP8266 – Comparison, Interfacing of simple I/O Devices with ESP32 and ESP8266, Introduction to Cloud platforms for IoT.

UNIT – V APPLICATIONS OF IoT **9**

Smart City Infrastructure - Smart Healthcare Systems - Smart Agriculture Systems - Smart Home & Building Automation – Industrial IoT in Predictive Maintenance and Supply Chain - Case Study

TOTAL: 45 PERIODS

TEXT BOOKS:

1. "IoT Fundamentals with a Practical Approach" By Neera Batra, Sonali Goyal ISBN 9781032309705, 2024, CRC Press
2. "Internet of Things: A Hands-On Approach" – Arshdeep Bahga, Vijay Madisetti, Universities Press 2015

REFERENCE BOOKS:

1. Massimo Banzi, Getting Started with Arduino, 3rd Edition, Make Community, LLC, 2015.
2. Jeremy Blum, Exploring Arduino: Tools and Techniques for Engineering Wizardry, 2nd Edition, John Wiley & Sons, 2019.
3. Neil Cameron, Electronics Projects with the ESP8266 and ESP32: Building Web Pages, Applications, and WiFi Enabled Devices, 1st Edition, Apress, 2020.
4. https://github.com/connectIOT/iottoolkit
5. https://www.arduino.cc
6. http://www.zettajs.org
7. https://onlinecourses.swayam2.ac.in/e-learning/preview/arp19_ap52

COURSE OUTCOMES

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

CO1	Summarize the concepts of IoT, its architecture, components, communication layers and associated design and security challenges
CO2	Explain various sensors and actuators, their working principles and their role in IoT systems.
CO3	Develop basic programs using Arduino IDE and interface simple I/O devices for IoT applications.
CO4	Articulate interfacing of IoT embedded controllers and their architecture, connectivity in IoT systems.
CO5	Apply IoT concepts for real-world applications such as smart cities, healthcare, agriculture and industrial systems.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	1	1	1	0	0	0	1	0	1	0
CO2	3	2	1	1	0	1	0	0	0	0	1	0	0	0
CO3	3	2	3	2	3	0	1	2	1	1	1	1	2	0
CO4	3	2	3	2	3	1	1	0	1	0	1	1	2	2
CO5	3	2	2	2	2	3	2	2	2	2	2	1	3	2

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CS25C01	PROBLEM SOLVING AND PROGRAMMING IN C	L	T	P	C
	(Common to All branches & M.Tech (CSE))	3	0	0	3

OBJECTIVES

- To understand problem solving and learn the basics of C programming and control statements.
- To understand loop control and how to use arrays and strings.
- To explore functions, recursion, and pointers in C.
- To study structures, unions, and data management.
- To learn how to use macros and work with files in C.

UNIT – I PROBLEM SOLVING AND BASICS OF C PROGRAMMING 9

Introduction to Algorithms- Building blocks of algorithms - Algorithmic problem-solving steps-Simple Strategies and notation for developing algorithms - Control flow, Flow charts, Pseudocodes, Programming languages - Introduction to programming paradigms –- Structure of C program - C programming: Data Types - Constants - Keywords - Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements - Decision making statements - Switch statement.

UNIT – II LOOP CONTROL STATEMENTS AND ARRAYS 9

Iteration statements: For, while, Do-while statements, nested loops, break & continue statements - Introduction to Arrays: Declaration, Initialization - One-dimensional array - Two- dimensional arrays – Searching and sorting in Arrays – Strings – string handling functions - array of strings.

UNIT – III FUNCTIONS AND POINTERS 9

Modular programming - Function prototype - function definition - function call - Built-in functions – Recursion – Recursive functions - Pointers - Pointer increment - Pointer arithmetic- Parameter passing - Pass by value - Pass by reference - pointer and arrays - dynamic memory allocation with malloc/calloc.

UNIT – IV STRUCTURES AND UNION 9

Storage class - Structure and union - Features of structures - Declaration and initialization of structures – Self-referential structure - Array of structures - Pointer to structure - Structure and functions – Typedef - Bit fields - Enumerated data types - Union.

UNIT – V MACROS AND FILE PROCESSING 9

Preprocessor directives – Simple and Conditional macros with and without parameters - Files -Types of file processing: Sequential and Random access – File operations – read, write & seek– Command Line Argument.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Kernighan, B.W and Ritchie, D.M, "The C Programming language", Second Edition, Pearson Education, 2015.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.

REFERENCE BOOKS:

1. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013.
2. Ashok N Kamthane, Programming in C, Pearson, Third Edition, 2020
3. Reema Thareja, Programming in C, Oxford University Press, Third Edition, 2023
4. Paul Deitel and Harvey Deitel, How to Program, Ninth edition, Pearson Publication 2022.
5. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C"' McGraw- Hill Education, 1996

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COURSE OUTCOMES

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

CO1 Select algorithmic solutions to simple computational problems and write C programs using basic constructs.

CO2 Design searching and sorting algorithms using arrays and strings.

CO3 Implement modular applications using Functions and pointers.

CO4 Build and execute applications using structures and Unions.

CO5 Solve real world problem using files.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	1	1	0	0	0	0	0	1	1	2	1
CO2	2	1	1	1	2	1	0	0	0	0	2	1	3	1
CO3	1	1	1	1	2	0	0	0	0	0	1	1	2	2
CO4	1	2	1	1	1	1	0	0	0	0	2	1	2	2
CO5	2	2	1	1	1	0	0	0	0	0	1	1	3	2

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CS25C03	ARTIFICIAL INTELLIGENCE AND COMPUTATIONAL THINKING	L	T	P	C
	(Common to CSE, IT, ADS, AML, CSBS, CSE(Cyber),CSE(AML), M.Tech (CSE), ECE)	3	1	0	4

OBJECTIVES

- To develop a foundational understanding of computing systems
- To enhance computational thinking skills for designing step-by-step algorithmic solutions.
- To provide a foundational understanding of Artificial Intelligence and quality of data in building AI systems.
- To develop a basic understanding of database concepts, data operations, visualization techniques, and the use of AI tools for analyzing and interpreting data.
- To introduce the foundations of Machine Learning

UNIT – I FUNDAMENTALS OF COMPUTING SYSTEMS 9+3

Basics of Computing Systems – Evolution of Computing Systems – Components of a Computer System – Hardware and Software Fundamentals – Operating Systems and Application Software – Role of Computers in Modern Applications- Understanding How Software Solves Problems – Logical Thinking and Reasoning Skills – Steps in Solving Computational Problems

UNIT – II COMPUTATIONAL THINKING AND ALGORITHMIC REASONING 9+3

Introduction to Computational Thinking – Decomposition of Complex Problems – Pattern Recognition Techniques – Abstraction and Modeling – Algorithmic Thinking – Problem Formulation and Analysis – Designing Step-by-Step Solutions – Decision Making- Computational Thinking in Everyday Life – Computational Thinking for AI Applications

UNIT – III ARTIFICIAL INTELLIGENCE AND DATA FUNDAMENTALS 9+3

Introduction to Artificial Intelligence – Need and growth of AI – AI in daily life – AI vs Machine Learning vs Deep Learning – Applications of AI – Fundamentals of Data – Types of Data (Numerical, Categorical, Text, Image) – Structured and Unstructured Data – Data Formats – Data Lifecycle (Collection, Storage, Processing, Usage) – Data Quality (Missing, Duplicates, Inconsistencies) – Data as input for AI systems

UNIT – IV WORKING WITH DATA 9+3

Basic database concepts – Fundamental data operations – Searching, Sorting, Filtering, Grouping – Introduction to data tools – Spreadsheets – Data visualization techniques (Bar charts, Line charts, Pie charts) – Interpreting data (Trends, Comparisons, Patterns) – Common issues in data handling (misleading visualizations, incorrect interpretations) – Using AI tools for data tasks (data summarization, insight generation, trend explanation)

UNIT – V INTRODUCTION TO MACHINE LEARNING 9+3

Machine Learning Modelling Process: Feature Engineering, Model Selection, Training of Models, Model Validation, and Prediction of New Observations. Types of Machine Learning: Supervised Learning for Classification and Regression, Unsupervised Learning for Clustering and Association Analysis, and Semi-Supervised Learning.

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Reema Thareja, S Sumathi, L Sherly Puspha Annabel, “Artificial Intelligence and Computational Thinking”, Oxford University Press,2026
2. Dr. Jean-Claude Franchitti Kernighan, “Introduction to Computer Science”, Rice University, 2023.
3. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016.
4. Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Manning Publications Co., 2016. ISBN: 9781617292037.

REFERENCE BOOKS:

1. Melanie Michell, “Artificial Intelligence: A guide for thinking humans”, Kindle Edition, 2019

COURSE OUTCOMES

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

CO1 Summarize the foundations of computing systems and analyze the role in computational problem solving.

CO2 Examine the computational thinking concepts to analyze problems and design stepwise solutions

CO3 Identify AI concepts, and analyze different types and quality of data as inputs for AI systems

CO4 Apply fundamental data operations, create and interpret visualizations, and use AI tools to generate insights from data.

CO5 Evaluate the fundamentals of Machine Learning and apply supervised, unsupervised, and semi-supervised learning techniques for data analysis and prediction.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	1	1	1	1	1	0	0	0	0	0	1	1	1	1
CO2	2	2	2	2	1	0	0	0	0	0	1	1	2	1
CO3	1	1	1	1	1	0	0	0	0	0	1	2	2	2
CO4	1	1	1	1	2	0	0	0	0	0	1	2	2	2
CO5	2	1	1	1	2	2	0	2	0	0	1	2	2	2

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GE25C01 **தமிழர் மரபு**

L	T	P	C
1	0	0	1

(Common to all B.E / B. Tech and M. Tech (CSE-Integrated))

நோக்கங்கள்:

- தமிழ் மொழியின் தொன்மை, செம்மொழித் தன்மை, தமிழ் இலக்கிய மரபின் சிறப்புகளை மாணவர்கள் அறியச் செய்தல் மற்றும் சங்க இலக்கியம் முதல் நவீன இலக்கியம் வரை தமிழின் இலக்கிய வளர்ச்சியையும், தமிழறிஞர்கள் மற்றும் கவிஞர்களின் பங்களிப்புகளையும் புரிந்துகொள்ளச் செய்தல்.
- தமிழர்களின் கலை, சிற்பம், ஓவியம், இசை, கைவினைப் பொருட்கள் மற்றும் கோவில் சார்ந்த பண்பாட்டு மரபுகளை மாணவர்கள் அறிந்து மதிக்க வழிவகுத்தல்.
- நாட்டுப்புறக் கலைகள், வீர விளையாட்டுகள் மற்றும் பாரம்பரிய வாழ்க்கை முறைகள் குறித்து விழிப்புணர்வை ஏற்படுத்துதல்.
- தமிழர்களின் திணைக் கோட்பாடு, சுற்றுச்சூழல் அறிவு, கல்வி, நகர நாகரிகம், வாணிபம் மற்றும் கடல் கடந்த சாதனைகள் பற்றிய அறிவை வளர்த்தல்.
- இந்திய விடுதலைப் போராட்டம், சுயமரியாதை இயக்கம் மற்றும் இந்தியப் பண்பாட்டிற்கு தமிழர்களின் பங்களிப்புகளை மாணவர்கள் புரிந்துகொள்ள உதவுதல் மற்றும் கல்வெட்டுகள், கையெழுத்துப் பிரதிகள், அச்சு வரலாறு மற்றும் சித்த மருத்துவம் போன்ற தமிழர் அறிவுசார் மரபுகளை அறிமுகப்படுத்துதல்.

அலகு 1 **மொழி மற்றும் இலக்கியங்கள்** **3**

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

அலகு 2 **மரபு - பாறை ஓவியங்கள் முதல் தவீன ஓவியங்கள் வரை – சிற்பக்கலை** **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, நாதஸ்வரம் - தமிழர்களின் சமூக, பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு 3 **நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்** **3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியாகூத்து, ஒயிலாட்டம், தோல் பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்

அலகு 4 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 5 இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் 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: 15 PERIODS

TEXT BOOKS:

1. தமிழக வரலாறு மக்களும் பண்பாடும் – டாக்டர் கே.கே. பிள்ளை. (வெளியீடு தமிழ்நாடுபாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. தபொருநை – 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.

COURSE OUTCOMES

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

CO1 பழந்தமிழ் இலகியங்களின் சிறப்பு, இந்திய மொழிக்குடும்பங்களின் வரலாறு ஆகியவற்றை மாணவர்கள் அறிதல்.

CO2 நடுகல் முதல் நவீன ஓவியங்கள் மற்றும் இசைக்கருவிகளின் சிறப்பை உணர்தல்,.

CO3 நாட்டுப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகளின் வரலாறு ஆகியவற்றை தெரிந்து கொள்ளுதல்

CO4 பழந்தமிழரின் திணைக்கோட்பாடு, எழுத்தறிவு மற்றும் கல்வி அறிவு முதலானவற்றின் சிறப்பை உணர்தல்

CO5 இந்திய விடுதைப்போரில் தமிழர்களின் பங்கு மற்றும் சுயமரியாதை இயக்க சிந்தனைகள் குறித்தும் மாணவர்கள் தெரிந்து கொள்ளுதல்

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	0	0	0	0	0	0	3	0	0	0	0	1	0	0
CO2	0	0	0	0	0	0	0	0	3	0	0	1	0	0
CO3	0	0	0	0	0	0	0	0	0	0	3	1	1	1
CO4	0	0	0	0	0	0	3	0	0	0	0	2	0	1
CO5	0	0	0	0	0	0	0	3	0	0	0	3	0	2

ST. JOSEPH'S COLLEGE OF ENGINEERING CHENNAI - 600 119 You Choose, We Do It

GE25C01	HERITAGE OF TAMILS	L	T	P	C
	(Common to all B.E / B. Tech and M. Tech (CSE-Integrated))	1	0	0	1

OBJECTIVES

- Introduce students to the antiquity, richness, and classical status of the Tamil language, literature and familiarize students with the major literary traditions of Tamil, including Sangam literature, epics, Bhakti literature, and modern literary developments.
- Enable students to understand the cultural heritage of Tamils through art, sculpture, architecture, handicrafts, music, and temple traditions.
- Create awareness about Tamil folk arts, martial arts, traditional games, and their role in preserving Tamil culture.
- Provide knowledge of the Thinai concept, ecological wisdom, educational practices, trade, urbanization, and maritime achievements of ancient Tamils.
- Highlight the contributions of Tamils to Indian civilization, the freedom movement, social reforms, indigenous medicine, and cultural development and develop an understanding of Tamil historical sources such as inscriptions, manuscripts, and the evolution of Tamil printing.

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, Leatherpuppetry, 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: 15 PERIODS

TEXT-CUM-REFERENCE BOOKS:

1. தமிழக வரலாறு மக்களும் பண்பாடும் – டாக்டர் கே.கே. பிள்ளை. (வெளியீடு தமிழ்நாடுபாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. தபொருநை – 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.

COURSE OUTCOMES

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

CO1 Illustrate about the special features of ancient Tamil literature and the history of Indian language families.

CO2 Summarize the splendor of paintings and musical instruments from the Hero Stone to modern times.

CO3 Explain about the history of folk arts and martial arts.

CO4 Describe the importance of the ancient Tamils & thinai concept, philosophy of religion, educational knowledge, literacy, etc..

CO5 Recognize the students aware of the role of Tamils in the Indian freedom struggle and the ideas of the self-respect movement

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	0	0	0	0	0	0	3	0	0	0	0	1	0	0
CO2	0	0	0	0	0	0	0	0	3	0	0	1	0	0
CO3	0	0	0	0	0	0	0	0	0	0	3	1	1	1
CO4	0	0	0	0	0	0	3	0	0	0	0	2	0	1
CO5	0	0	0	0	0	0	0	3	0	0	0	3	0	2

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EN25C09	PROFESSIONAL ENGLISH I (LAB INTEGRATED)	L	T	P	C
	(Common to All Branches & M.Tech (CSE))	2	0	2	3

OBJECTIVES

- To improve the communicative competence of learners
- To learn to use basic grammatic structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals. rewrite it and rephrase it.

UNIT – I SHARING INFORMATION RELATED TO ONESELF/FAMILY & FRIENDS 6

Listening - Listening to people talk about their past, listening to a description of a transportation system, listening to people talk about capsule hotels, Listening to descriptions of foods

Speaking - Introducing yourself; talking about yourself; exchanging personal information; remembering your childhood; asking about someone's childhood, Talking about transportation and transportation problems; evaluating city services; asking for and giving information, Describing positive and negative features; making comparisons; talking about lifestyle changes; expressing wishes, Talking about food; expressing likes and dislikes; describing a favorite snack; giving step-by-step instructions

Writing / Reading - Writing a paragraph about your childhood, reading about the life of a Mexican painter, Writing an online post on a community message board about a local issue, Reading about the happiest cities in the world, Writing an email comparing two living spaces, Reading about living without money, Writing a recipe, Reading about the history of pizza.

Grammar - Past tense; used to for habitual actions, Expressions of quantity with count and non-count nouns: too many, too much, fewer, less, more, not enough; indirect questions from Wh-questions, Evaluations and comparisons with adjectives: not . . . enough, too, (not) as . . . as; evaluations and comparisons with nouns: not enough . . ., too much/many . . ., (not) as much/many . . . as; wish, Simple past vs. present perfect; sequence adverbs: first, then, next, after that, finally

UNIT – II GENERAL READING AND FREE WRITING 6

Listening - Listening to travel advice, Listening to the results of a survey about family life, Listening to a radio program; listening to people give suggestions for using technology, Listening to a description of Carnival in Brazil

Speaking - Describing vacation plans; giving travel advice; planning a vacation, Making requests; agreeing to and refusing requests; complaining; apologizing; giving excuses, Describing technology; giving instructions; giving suggestions, Describing holidays, festivals, customs, and special events.

Writing/ Reading - Writing an email with travel suggestions, Reading about unusual vacations, Writing a message making a request, Reading about unusual hotel requests, Writing a message asking for specific favors, Reading about the sharing, Writing an entry on a travel website about a cultural custom, Reading about interesting New Year's customs

Grammar - Future with be going to and will; modals for necessity and suggestion: must, need to, (don't) have to, ought to, -'d better, should (not), Two-part verbs; will for responding to requests; requests with modals and Would you mind . . . ?, Infinitives and gerunds for uses and purposes; imperatives and infinitives for giving suggestions, Relative clauses of time; adverbial clauses of time: when, after, before

UNIT – III GRAMMAR AND LANGUAGE DEVELOPMENT 6

Listening – Listening to people talk about changes, Listening to people talk about their job preferences, Listening to descriptions of monuments; listening for information about a country, Listening to stories about unexpected experiences.

Speaking - Talking about change; comparing time periods; describing possible consequences, Describing abilities and skills; talking about job preferences; describing personality traits, Talking about landmarks and monuments; describing countries; discussing facts, Describing recent past events and experiences; discussing someone's activities lately.

Writing / Reading - Writing a paragraph describing a person's past, present, and possible future, Reading about a town's attempt to attract new residents, Writing a an online cover letter for a job application, Reading about understanding cultural differences in an international company, Writing an introduction to an online city guide, Reading about unusual museums, Writing a description of a recent experience, Reading about an unusual rock band

Grammar - Time contrasts; conditional sentences with if clauses, Gerunds; short responses; clauses with because, Passive with by (simple past); passive without by (simple present), Past continuous vs. simple past; present perfect continuous

UNIT – IV READING AND LANGUAGE DEVELOPMENT 6

Listening - Listening for opinions; listening to a movie review, Listening to people talk about the meaning of signs, Listening to people talk about predicaments; listening to a call-in radio show, Listening for excuses

Speaking - Describing movies and books; talking about actors and actresses; asking for and giving reactions and opinions, Interpreting body language; explaining gestures and meanings; describing acceptable and prohibited behavior in different situations; asking about signs and their meaning, Speculating about past and future events; describing a predicament; giving advice and suggestions, Reporting what people said; making polite request; making invitation and excuses.

Writing / Reading - Writing a movie review, Reading about unpleasant experiences actors put themselves through, Writing a list of rules, Reading about idioms and their meaning, Writing a blog post asking for advice, Reading an online, Writing a report about people's responses to a survey, Reading about taking a sick day advice forum

Grammar - Participles as adjectives; relative pronouns for people and things, Modals and adverbs: might, may, could, must, maybe, perhaps, probably, definitely; permission, obligation, and prohibition, Unreal conditional sentences with if clauses; past modals, Reported speech: requests and statements.

UNIT – V EXTENDED SKILL PRACTICE 6

Listening practice through worksheets (with audio – in class)
Grammar practice through worksheets*
Vocabulary practice through worksheets*
Writing practice through worksheets, Speaking Skill Practice (in class)
10-minute conversation practice sessions (with guidance from Placement Test)

Lab Component 30

Getting started: Talk about communication
Listening - Three monologues: Online friendships; At the flower shop; Conversation: learning vocabulary
Speaking - Things you have done recently, Learning a foreign language; Giving and responding to opinions; Ways of learning vocabulary
Reading - Article: But are they real friends?; Article: Can you really learn a language in 22 hours? Article: What kind of learner are you?
Writing - A guide; Introducing a purpose; Referring pronouns
Grammar - Subject and object questions; Present simple and present continuous Vocabulary - Gradable and extreme adjectives
Pronunciation - Word stress: extreme adjectives; Word groups Everyday English - Giving and responding to opinions.
Getting started - Talk about relationship

Listening - Two monologues: being a twin, a mistake; Conversation: great-grandparents Speaking - The story of a friendship; Family traditions; Reacting to what people say; Telling a story; A member of your family

Reading - Article: 60 years and 1,000 miles: How a word game brought two unlikely people together; Article: Twin tales; An email about how great-grandparents met

Writing - A biography; Describing time Grammar - Narrative tenses; used to, usually Vocabulary – Relationships. Multi-word verbs

Pronunciation - Linking sounds, Sentence stress: multi-word verbs, Stress in word groups Everyday English - Telling a story

Getting started - Talk about endangered animals

Listening - Conversation: an environmental project; Interview: inventions inspired by nature; Talking about possible jobs; Monologue: rescuing whales

Speaking - Predictions about the future; The best place to experience natural beauty; Giving reasons, results and examples; Giving yourself time to think; A quiz about whales

Reading - Web page: The Whitley Fund for Nature; Article: Animals have adapted to survive everywhere; An essay about water pollution

Writing - A discussion essay; Organising an essay; Signposting language Grammar - Future forms; Zero and first conditionals

Vocabulary – Environmental issues; The natural world

Pronunciation - Sound and spelling: a; Consonant clusters; Voiced and unvoiced consonants Everyday English - Giving reasons, results and examples

Getting started: Talk about ideal houses

Listening - Four monologues: describing buildings; Conversation: comparing life in a town and a city; Visiting a friend's family; Conversation: a holiday in Florida

Speaking - Describing buildings; Talking about where you live; Making offers and requests and asking for permission; Imagining people's feelings; A recent holiday

Reading - Web page: A more personal place to stay; Web page: Five reasons why small towns are better than cities; Article: Top five things to do … in and around Miami, Florida; A note

Writing - A note with useful information; Offering choices Grammar - Modals of deduction; Quantifiers Vocabulary – Buildings; Verbs and prepositions

Pronunciation - Modal verbs; Sentence stress: verbs and prepositions; Sounding polite Everyday English - Making offers and requests and asking for permission

TOTAL: 30+30 PERIODS

TEXT BOOKS:

1. Interchange Level 2 - 5th edition published by Cambridge University Press & Assessment
2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

1. Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd
3. English for Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi, 2003.

COURSE OUTCOMES

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

CO1 Use appropriate words in a professional context.
CO2 Understanding of basic grammatical structures and use them in right context
CO3 Infer the denotative and connotative meanings of technical texts
CO4 Explain the definitions, descriptions, narrations and essays on various topics
CO5 Identify topics and formulate questions for productive inquiry

Mapping of COs with POs and PSOs

COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	0	2	1	1	1	1	2	3	2
CO2	2	1	1	1	1	0	2	1	1	1	1	2	2	2
CO3	2	2	2	1	1	0	2	1	1	1	1	3	2	3
CO4	2	2	1	1	1	0	2	1	1	1	1	2	2	2
CO5	1	1	2	1	1	0	1	1	1	1	1	3	3	3

PH25C11	PHYSICS LABORATORY	L	T	P	C
(Common to B.E. CSE, CSE(CYBER), CSE(AML), EEE, ECE, B.Tech. ADS, AML, CS-BS, IT and M.Tech. CSE (5 years Int.))		0	0	3	1.5

OBJECTIVES

- To provide hands-on experience in the operation and application of modern experimental instruments such as lasers, optical fibres, spectrometers, ultrasonic interferometers, Hall effect setups, XRD systems, and semiconductor characterization devices.
- To enable students to determine important physical parameters including wavelength, particle size, numerical aperture, acceptance angle, Hall coefficient, energy band gap, Fermi energy, lattice cell parameters, and Planck's constant through experimental investigations.
- To develop an understanding of optical, electronic, thermal, semiconductor, and crystallographic phenomena by correlating theoretical concepts with practical observations.
- To train students in acquiring, analysing, and interpreting experimental data, performing calculations, and evaluating the accuracy and reliability of measured results.
- To enhance problem-solving, technical reporting, laboratory safety awareness, and teamwork skills necessary for scientific research and engineering applications.

LIST OF EXPERIMENTS

(A minimum of 12 experiments to be performed from the given list)

1. Determination of Numerical aperture, acceptance angle of an optical fibre
2. Determination of groove width of a CD using laser.
3. Determination of wavelength using a laser.
4. Determination of particle size using a laser.
5. Determination of velocity of ultrasonic waves in a liquid and compressibility of the liquid- Ultrasonic Interferometer
6. Determination of wavelength of mercury spectra using Spectrometer and grating.
7. To study the V- I characteristics of a solar cell using different intensities
8. To determine Planck's constant using LEDs of different wavelengths
9. To determine the Hall coefficient of a semiconductor using the Hall effect setup
10. Determination of energy band gap of the semiconductor.
11. To study the V- I characteristics of a photo diode using LED
12. Determination of Lattice Cell Parameter Using X-Ray Diffraction data.
13. To study the characteristics of a Light Dependent Resistor (LDR) under varying light intensities
14. To determine Stefan's constant using the radiation method
15. To determine the Fermi energy of graphite using temperature-dependent electrical measurements.
16. To verify the truth tables of AND, OR, and NOT gates using ICs.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1 Demonstrate experiments to determine optical properties and characteristics using laser and fibre optics techniques.

CO2 Analyse ultrasonic wave behaviour and determine liquid properties using ultrasonic and related experimental methods.

CO3 Investigate the electrical and optical characteristics of semiconductor devices under different conditions.

CO4 Apply advanced experimental techniques to analyse material properties, crystal structure, and thermal/electrical behaviour.

CO5 Verify and interpret logic operations using digital ICs and understand basic digital system behaviour.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	3	3	1	0	1	1	0	2	2	3	2
CO2	3	3	1	3	2	2	0	1	1	0	2	2	3	2
CO3	3	3	1	3	2	2	0	1	1	0	2	2	3	3
CO4	3	3	2	3	3	2	0	2	1	0	2	3	3	3
CO5	3	2	1	3	3	1	0	1	1	0	2	2	2	3

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CS25C11	C PROGRAMMING LABORATORY	L	T	P	C
	(Common to All branches & M.Tech (CSE))	0	0	3	1.5

OBJECTIVES

- To analyse problems and design solutions using algorithms, flowcharts, and pseudocode.
- To apply the concepts of looping and arrays.
- To apply the concepts of functions and pointers.
- To apply structures and union concepts.
- To integrate structures, pointers, and file handling concepts to design and develop a simple real-world C programming applications.

LIST OF EXPERIMENTS

1. Write algorithm, draw flowchart and write pseudo code for a real life or scientific or technical problems
2. Programs using decision making and branching statements
3. Programs using for, while, do-while loops and nested loops.
4. Programs using arrays and operations on arrays.
5. Programs implementing searching and sorting using arrays
6. Programs implementing string operations on arrays
7. Programs using functions and recursion
8. Programs using pointers & strings with pointers
9. Programs using Dynamic Memory Allocation
10. Programs using Structures & Unions
11. Programs using pointers to structures and self-referential structures.
12. Programs to handle file operations
13. Programs to handle file with structure
14. Programs using Preprocessor directives, Macros and command line arguments
15. Programs for File Processing using Sequential and Random Access
16. Integrated Mini Project using Structures, Pointers and File Handling techniques.

TOTAL: 45 PERIODS

LAB REQUIREMENTS: (For a batch of 30 students)

Processors: Intel Core i5, i7, or newer. Operating systems: Ubuntu or any Linux distribution, GCC (GNU Compiler Collection)

COURSE OUTCOMES

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

CO1 Analyze problem-solving concepts and decision-making techniques

CO2 Apply looping constructs and array manipulations

CO3 Experiment the concepts of functions and pointers

CO4 Implement structure and union concepts.

CO5 Articulate file handling techniques.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1	2	0	0	0	0	0	2	2	3	1
CO2	3	2	2	0	3	0	0	0	0	0	2	1	3	1
CO3	3	2	2	0	3	0	0	0	0	0	2	1	2	2
CO4	3	2	2	0	3	0	0	0	0	0	2	1	2	2
CO5	3	2	3	1	3	1	1	1	1	1	3	1	3	2

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SD25C02	SOFTWARE TRAINING COURSE – I	L	T	P	C
	(Common to all Branches and M.TECH(CSE))	0	0	2	0

OBJECTIVES

- To develop fundamental programming skills in C by introducing program structure, data types, operators, expressions, input/output, and compilation and execution.
- To develop logical and problem-solving skills using decision-making statements, loops, functions, and recursion.
- To build proficiency in arrays, strings, pointers, structures, and unions for solving programming problems efficiently.
- To introduce file handling and dynamic memory management for developing practical C applications.
- To develop placement-oriented programming skills through mathematical problems, pattern printing, matrix operations, searching, sorting, and coding challenges.
- To apply programming concepts to practical applications through mini projects such as student record management, library management, banking systems, and file-based applications.

TOPIC – 1 INTRODUCTION TO C PROGRAMMING

Subtopics / Concepts:

- Structure of C Program
- Compilation & Execution
- Keywords, Identifiers, Data Types
- Input/Output (scanf, printf)
- Type Casting

Advanced / Placement-Level Problems:

- Basic programming and format programs

TOPIC – 2 OPERATORS AND EXPRESSIONS

Subtopics / Concepts:

- Arithmetic, Relational, Logical
- Bitwise Operators
- Conditional Operator
- Operator Precedence

Advanced / Placement-Level Problems:

- Write a program to swap two numbers without using a third variable.
- Compute sum of digits using only arithmetic operators.
- Convert temperature between Celsius and Fahrenheit.

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TOPIC – 3 CONTROL STRUCTURES

Subtopics / Concepts:

- Decision Making: if, switch
- Loops: for, while, do-while
- Jump statements (break, continue, goto)

Advanced / Placement-Level Problems:

- Find if a number is odd/even using bitwise operator.
- Count set bits in an integer.
- Perform XOR swapping without using extra variables.
- Print all Armstrong numbers between two intervals.
- Generate Fibonacci series up to N.
- Find LCM and GCD of two numbers.

TOPIC – 4 FUNCTIONS AND RECURSION

Subtopics / Concepts:

- Function Declaration & Definition
- Recursion
- Call by Value/Reference
- Storage Classes

Advanced / Placement-Level Problems:

- Find factorial using recursion.
- Generate nth Fibonacci using recursion.
- Implement power function without using pow().

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TOPIC – 5 ARRAYS AND STRINGS

Subtopics / Concepts:

- 1D, 2D Arrays
- Searching (Linear/Binary)
- Sorting (Bubble, Insertion, Selection)
- String Functions (strlen, strcmp, strcat)
- Character Arrays

Advanced / Placement-Level Problems:

- Find second largest element in array.
- Remove duplicates from array.
- Reverse a string without using built-in functions.
- Check if two strings are anagrams.
- Sort array using Bubble/Quick Sort.

TOPIC – 6 POINTERS

Subtopics / Concepts:

- Pointer Basics
- Pointer Arithmetic
- Pointers and Arrays
- Pointers to Functions
- Dynamic Memory (malloc, calloc, realloc, free)

Advanced / Placement-Level Problems:

- Reverse array using pointers.
- Find length of string using pointer.
- Allocate dynamic memory for matrix and find its transpose.
- Implement function pointer for arithmetic operations.

TOPIC – 7 STRUCTURES AND UNIONS

Subtopics / Concepts:

- Structure Declaration
- Nested Structures
- Array of Structures
- Pointer to Structure
- Union vs Structure

Advanced / Placement-Level Problems:

- Store and display N employee records.
- Find highest marks student using array of structures.
- Simulate library system using structures.
- Demonstrate memory sharing in union.

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TOPIC – 8 FILE HANDLING

Subtopics / Concepts:

- fopen, fclose
- Reading/Writing (fprintf, fscanf, fgetc, fputc)
- Random Access (fseek, ftell)
- Error Handling

Advanced / Placement-Level Problems:

- Copy contents from one file to another.
- Count lines, words, and characters in a file.
- Append student records to a file.
- Merge two text files into one.

TOPIC – 9 PREPROCESSOR AND DYNAMIC MEMORY

Subtopics / Concepts:

- #define, #include
- Macros, Conditional Compilation
- Memory Allocation
- Header Files

Advanced / Placement-Level Problems:

- Create a macro to find max of three numbers.
- Implement dynamic array using malloc.
- Demonstrate memory leak detection.

TOPIC – 10 ADVANCED CONCEPTS

Subtopics / Concepts:

- Command Line Arguments
- Enumerations
- Typedef
- Bit Fields
- Volatile and Const Qualifiers

Advanced / Placement-Level Problems:

- Sum of numbers using command line arguments.
- Demonstrate enum for menu-driven program.
- Bit-field representation for memory optimization.

TOPIC – 11 PROBLEM SOLVING & LOGICAL THINKING

Subtopics / Concepts:

- Mathematical Problems
- Pattern Printing
- Matrix Operations
- Searching and Sorting Practice

Advanced / Placement-Level Problems:

- Print spiral matrix pattern.
- Find saddle point in a matrix.
- Generate Pascal's Triangle.
- Sort words in a sentence alphabetically.

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TOPIC – 12 MINI PROJECTS & CODING CHALLENGES

Subtopics / Concepts:

- Student Record Management
- Library System
- Banking System
- Quiz Game
- File-based Projects

Advanced / Placement-Level Problems:

- Library Management System.
- Banking System with File I/O.
- Student Record Management using Structure & File.
- Word Count Tool like Linux wc.

TOTAL : 30 PERIODS

COURSE OUTCOMES

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

CO1 Explain and apply the fundamental syntax, data types, operators, expressions, and input/output operations of the C programming language.

CO2 Develop C programs using decision-making, looping, functions, and recursion to solve computational and mathematical problems.

CO3 Implement programs using arrays, strings, pointers, structures, and unions to manage and manipulate data effectively.

CO4 Develop C programs using file handling and dynamic memory allocation for storing, processing, and managing data.

CO5 Apply problem-solving and logical-thinking techniques to solve real world programming problems involving patterns, matrices, searching, sorting, bitwise operations structures and file handling.

Mapping of COs with POs and PSOs

COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	3	0	0	0	0	0	2	1	2	1
CO2	3	3	2	1	3	0	0	1	0	0	3	2	3	2
CO3	3	3	3	1	3	0	0	0	0	0	3	2	3	2
CO4	3	3	3	2	3	1	0	1	0	0	3	2	3	2
CO5	3	3	3	2	3	2	1	3	2	3	3	3	3	3

SD25C03	APTITUDE TRAINING COURSE – I	L	T	P	C
	(Common to all Branches and M.TECH(CSE))	0	0	2	0

OBJECTIVES

- To build strong fundamentals in Quantitative Aptitude & Reasoning.
- To develop analytical and logical problem-solving skills.
- To strengthen competitive exam readiness through structured practice.
- To enhance speed and accuracy in solving aptitude-based problems.
- To apply mathematical and reasoning concepts to real-world and placement scenarios.

UNIT – I NUMBER SYSTEM **6**

- Introduction to Numbers, Types of Numbers, Number Line, Classification: Even/Odd, Prime/Composite, Co-primes.
- Divisibility Rules
- HCF & LCM (methods & word problems)
- Puzzle Practice Questions

UNIT – II COMMERCIAL MATHEMATICS **6**

- Percentage Concepts, increase/decrease, successive change, comparison, real-life applications and Practice Questions

UNIT – III RATIO, PROPORTION **6**

- Ratio & Proportion (properties, variations)
- Puzzle Practice Questions

UNIT – IV AVERAGES, AGES & APPLICATIONS **6**

- Averages (weighted, replacement cases)
- Ages (equations, ratio-based problems)
- Practice Questions – Topic-wise and mixed tests 4

UNIT – V LOGICAL REASONING **6**

- Series & Sequences (number, alphabet)
- Odd man out (number, alphabet, alphanumeric, missing/wrong term)
- Coding–Decoding (letter, number, symbol, substitution, advanced)
- Direction Sense (Basics)
- Puzzle Practice Questions

TOTAL: 30 PERIODS

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COURSE OUTCOMES

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

CO1 Summarise fundamentals of quantitative aptitude & Number System

CO2 Apply shortcuts & formulas to solve percentages and commercial math problems

CO3 Analyze complex problems in ratios and proportion

CO4 Analyze complex problems in averages, ages and application

CO5 Create solutions to competitive exam-style and real-life logical reasoning problems

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	1	1	1	1	1	0	2	2	2	1
CO2	3	3	2	2	2	1	1	1	1	0	2	2	3	2
CO3	3	2	3	2	2	1	1	1	1	1	2	2	3	2
CO4	3	2	2	3	2	1	1	1	1	1	2	2	3	2
CO5	3	2	2	2	3	1	1	1	1	1	3	3	3	3

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SEMESTER II

MA25C04	LINEAR ALGEBRA	L	T	P	C
	(Common to ADS, AML and CSE(AML))	3	1	0	4

OBJECTIVES

- To test the consistency and solve the system of linear equations
- To find the basis and dimension of vector space
- To obtain the matrix of linear transformation and its eigenvalues and eigenvectors
- To find orthonormal basis of inner product space and find least square approximation
- To find eigenvalues of a matrix using numerical techniques and perform matrix decomposition.

UNIT – I MATRICES AND SYSTEM OF LINEAR EQUATIONS 9+3

Matrices - Row echelon form - Rank - System of linear equations - Consistency - Gauss elimination method - Gauss Jordon method.

UNIT – II VECTOR SPACES 9+3

Vector spaces, Subspaces, Linear combinations, Linear independence and linear dependence, Bases and dimensions.

UNIT – III LINEAR TRANSFORMATION 9+3

Linear transformation - Rank space and null space - Rank and nullity - Dimension theorem - Matrix representation of linear transformation - Eigenvalues and eigenvectors of linear transformation.

UNIT – IV INNER PRODUCT SPACES 9+3

INNER product and norms - Properties - Orthogonal, Orthonormal vectors - Gram Schmidtorthonormalization process - Least square approximation

UNIT – V EIGEN VALUE PROBLEMS AND MATRIX DECOMPOSITION 9+3

Eigen value Problems: Power method, Jacobi rotation method - Singular value decomposition - QR decomposition.

TOTAL: 60 PERIODS

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TEXT BOOKS:

1. Friedberg S.H, Insel A.J. and Spence L, Linear Algebra, Fifth edition, Pearson, 2018
2. Burden R. and Faires J.D. Numerical Analysis, tenth edition, Brooks/Cole, 2015.
3. Strang G, Linear algebra for everyone, Wellesley Cambridge press, 2020.

REFERENCE BOOKS:

1. Seymour Libschutz and Marc Lipson, Linear Algebra, Sixth edition, McGraw Hill Education India private limited, New Delhi, 2017.
2. Iyengar S.R.K. and Jain R.K., Numerical Methods, Third edition, New age international publications, 2012.
3. Kumaresan S, Linear Algebra - A geometric approach, Prentice Hall of India, New Delhi, Reprint, 2010.
4. Sundarapandian V, Numerical Linear Algebra, Prentice Hall of India, New Delhi, 2008.
5. Bernard Kolman and David R. Hill, Introductory Linear Algebra, Pearson Educations, New Delhi, First Reprint, 2009.

COURSE OUTCOMES

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

CO1 Analyze the consistency of systems of linear equations and solve them using appropriate matrix methods

CO2 Determine the basis and dimension of vector spaces and interpret their fundamental properties.

CO3 Construct the matrix representation of linear transformations and compute their eigenvalues and eigenvectors.

CO4 Construct an orthonormal basis for inner product spaces and apply least-square approximation techniques to solve problems.

CO5 Compute eigenvalues using numerical techniques and apply appropriate matrix decomposition methods to solve engineering problems.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	2	0	0	0	0	0	0	3	3	3
CO2	3	3	2	2	1	0	0	0	0	0	0	2	2	2
CO3	3	3	3	2	2	0	0	0	0	0	1	2	2	2
CO4	3	3	3	2	2	0	0	0	0	0	1	2	2	2
CO5	3	3	3	3	3	1	1	0	0	1	2	2	3	3

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PH25C02	SEMICONDUCTORS AND NANOELECTRONIC DEVICES	L	T	P	C
	(Common to B.E. CSE, CSE (CYBER), CSE (AML), B.Tech. ADS, AML, CS-BS, IT and M.Tech. CSE (5 Years Int.))	3	0	0	3

OBJECTIVES

- To understand the essential principles of physics in semiconductor device and AI based applications.
- To have the necessary understanding on magnetic and optical properties of materials and its applications.
- To grasp the basics of quantum structures and their impact on nano devices.
- To acquire the basic knowledge of digital logic levels and AI based applications in digital circuits
- To introduce the basics of quantum computing through a practical approach.

UNIT – I CONDUCTORS AND SEMICONDUCTORS 9

Introduction – theory of solids - success and failures of Quantum free electron theory (Qualitative) – Fermi distribution function – Density of energy states – Band theory (Qualitative) – effective mass of electrons and holes - Bloch theorem - Types of semiconductors - Carrier concentration of electrons and holes in Intrinsic and Extrinsic (N type and P type) semiconductors (derivation) - Hall effect - determination of Hall co-efficient (derivation), Applications of Hall effect based on Artificial Intelligence.

UNIT – II MAGNETISM AND OPTOELECTRONICS 9

Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility - Magnetic material classification: Diamagnetism – Para magnetism – Ferromagnetism – Antiferromagnetism – Ferrimagnetism – Photo current in a P-N diode – solar cell – Light Dependent Resistor – Light Emitting Diode – Organic LED –Photodetectors : Avalanche and PIN photodetectors- Optical data storage : Holography - Cloud storage

UNIT – III NANO DEVICES 9

Quantum confinement -Quantum structures - Density of states in quantum well, quantum wire and quantum dot structure-Carbon nanotubes-Fabrication-Properties and applications - Nano electronics: Single electron Tunnelling - Coulomb Blockade - Single Electron Transistor (SET) -Quantum dot laser. Applications: Nanoelectromechanical Systems (NEMS) in data storage- Microelectromechanical Systems (MEMS) in GPS navigation system.

UNIT – IV DIGITAL ELECTRONICS 9

Introduction to number system – Binary, Decimal, Octal and Hexadecimals - conversion between number systems – Basic logic gates: OR, AND , NOT, NAND and NOR gates – Boolean expression and Truth table – microwave generation – cavity magnetron – Memory storage devices – Random Access Memory and Read Only Memory. Decoders - Encoders-Multiplexers-Microprocessors (8085)-Application of AI in digital electronics – Integrated Circuit inspection, Printed Circuit Board inspection.

UNIT - V APPLIED QUANTUM COMPUTING 9

Magnetic semiconductors – dilute magnetic semiconductors – spintronics - Spintronic devices: Spin valve, Spin LED, Spin FET- Quantum cellular automata (QCA) – Quantum system for information processing- Quantum states- classical bits- Quantum bits (Qubits) – C-NOT gate-multiple Q-bits-Bloch sphere-Quantum gates - Advantages and disadvantages of quantum computing over classical computing - Qubit Quantum computing – the role of Quantum computing in advancing Artificial intelligence.

TOTAL: 45 PERIODS

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TEXT BOOKS:

1. Basic digital electronics, January 2017 , by M.V. Subramanyam Bhupesh Bhatia
2. S.O. Kasap. Principles of Electronic Materials and Devices, McGraw-Hill Education (Indian Edition), 2020.
3. Parag K. Lala, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition), 2020.

REFERENCE BOOKS:

1. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition, 2019.
2. Y.B.Band and Y.Avishai, Quantum Mechanics with Applications to Nanotechnology and Information Science, Academic Press, 2013.
3. V.V.Mitin, V.A. Kochelap and M.A.Stroscio, Introduction to Nanoelectronics, Cambridge Univ.Press, 2008.
4. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson Education (Indian Edition) 2009.

COURSE OUTCOMES

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

CO1 Illustrate quantum and band theories, energy band structures and semiconductor applications in AI.

CO2 Explain magnetic and optical properties of materials and their applications in data storage.

CO3 Implement the idea of engineered nanomaterials that are safer and more sustainable alternative.

CO4 Describe the functioning of digital logic levels and AI applications in IC and PCB digital circuits.

CO5 Evaluate the fundamental principles of physics for solving complex problems efficiently.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	2	1	0	0	0	0	2	2	2	2
CO2	3	2	1	2	2	1	0	0	0	0	2	1	1	1
CO3	3	2	2	2	2	1	0	0	0	0	2	2	2	2
CO4	3	2	2	1	3	1	0	0	0	0	2	2	2	2
CO5	3	2	2	2	3	1	1	1	1	0	3	2	2	3

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AL25201	FOUNDATIONS OF PYTHON	L	T	P	C
	(Common to AML, ADS, EEE, Mechatronics, Biotech & Chemical)	3	0	0	3

OBJECTIVES

- To write simple Python programs using basic syntax, data types, operators, and input/output operations.
- To use decision statements, loops, and functions to solve problems and organize code.
- To work with Python data structures like lists, tuples, dictionaries, and sets to store and manipulate data.
- To manipulate strings and perform file operations like reading, writing, and managing files.
- To use object-oriented programming principles like classes, inheritance, and operator overloading in Python.

UNIT – I BASICS OF PYTHON PROGRAMMING 9

Features of Python – History of Python – Future of Python – Literal Constants -Variables and Identifiers – Data Types – Input Operation – Comments – Reserved Words – Indentation – Operators and Expressions – Expressions in Python – Operations on Strings – Other data types – Type Conversion.

UNIT - II DECISION CONTROL STATEMENTS, FUNCTIONS 9

DECISION CONTROL STATEMENTS: Introduction – Conditional branching statement-If-Statement – If-else statement – Nested If statement – If-elif-else statement – Basic Loop structures – While Loop - For Loop – Selecting an appropriate loop – Nested Loops - Break statement – Continuous statement –Pass statement – Else statement used with loops. FUNCTIONS – Need for function – Definition – Function Call - Variable Scope and Life time – Return statement – More on defining functions – Lambda functions – Recursive functions.

UNIT - III LISTS, TUPLES, DICTIONARIES AND SETS 9

List – Access values in List – Updating Values – Nested List – Cloning – Basic List operations – List methods – Using List as Stack – List as Queue – Looping in List. Tuple – Creating tuple –Accessing Values – Updating tuple – deleting elements in tuple – Basic Tuple operations – Tuple Assignment- Tuple returning multiple values – Nested Tuples – Tuple Methods. Dictionaries: Creating a Dictionary – Accessing Values – Adding and modifying an Item – deleting Items – Sorting Items in Dictionary – Looping over a Dictionary- Nested Dictionaries – Built-In Dictionary functions and methods – String formatting with Dictionaries. Sets- Creating a Set-Set operations.

UNIT – IV STRINGS AND FILE HANDLING 9

STRINGS: Concatenation, Appending and Multiplying Strings – Immutability – String formatting – Built-In String Methods and functions – Slice Operation – Comparing Strings – Iterating String - String Module – Regular Expressions. FILE HANDLING: File Path - Types of files – Opening and closing - Reading and Writing – File Positions – Renaming and Deleting Files.

UNIT – V OBJECT ORIENTED PROGRAMMING IN PYTHON 9

CLASSES AND OBJECTS: Defining classes – Creating Objects –Data Abstraction and Hiding – Class Method and self-Argument - The __init__() Method - Class and Object Variables – The__del__() Method – Other special methods – public and private data members. Private Methods – Calling a Class Method from another Class Method – Class Methods - Static Methods – INHERITANCE: Inheriting classes- Types of Inheritance. OPERATOR OVERLOADING: Introduction – Implementing operator overloading – Reverse Adding – Overriding__getitem__() and __setitem__() Methods – Overriding the in operator – Overriding the __call__() Method.

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TOTAL: 45 PERIODS

TEXT BOOKS:

1. Reema Thareja, “Python Programming using Problem Solving Approach”, Oxford University Press, 3rd edition, 2025.

REFERENCE BOOKS:

1. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python Revised and updated for Python 3.2, Network Theory Ltd., 2011A.
2. Mastrodomenico, R, "The Python Book", United Kingdom: Wiley, 2022

COURSE OUTCOMES

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

CO1 Demonstrate proficiency in using python's basic syntax, data types, operators, and input/output operations to write simple programs.

CO2 Apply decision control statements and loops, and define functions to solve problems and improve code modularity.

CO3 Utilize Python's built-in data structures, including lists, tuples, dictionaries, and sets, to efficiently store, manipulate, and access data.

CO4 Develop programs on string manipulation and perform file handling operations, including reading, writing, and managing file data in python.

CO5 Apply object-oriented programming principles such as classes, objects, inheritance, and operator overloading to design and implement python programs.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	1	2	2	0	1	0	1	2	1	2	2
CO2	3	3	3	1	2	2	0	1	0	1	2	2	2	2
CO3	3	3	3	1	2	2	0	1	0	1	2	2	2	2
CO4	3	3	3	1	2	2	0	1	0	1	2	2	2	2
CO5	3	3	3	1	2	2	0	1	0	1	2	2	2	2

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CS25202	DIGITAL PRINCIPLES AND LOGIC DESIGN	L	T	P	C
	(Common to CSE, CSBS, ADS, AML and M.Tech(CSE))	3	0	0	3

OBJECTIVES

- To design digital circuits using simplified Boolean functions
- To analyze and design combinational circuits
- To analyze and design synchronous and asynchronous sequential circuits
- To understand Programmable Logic Devices
- To write HDL code for combinational and sequential circuits.

UNIT – I BOOLEAN ALGEBRA AND LOGIC GATES 9

Number Systems – Arithmetic Operations – Binary Codes– Boolean Algebra – Theorems and Properties of Boolean Algebra – Boolean Functions – Canonical and Standard Forms – Simplification of Boolean Functions using Karnaugh Map – NAND and NOR Implementations.

UNIT – II COMBINATIONAL LOGIC 9

Combinational Circuits – Analysis and Design Procedures – Binary Adder / Subtractor – Decimal Adder – Carry look ahead adder - Binary Multiplier – Magnitude Comparator – Decoders – Encoders – Multiplexers – De Multiplexer - Introduction to HDL – HDL Models of Combinational circuits

UNIT – III SYNCHRONOUS SEQUENTIAL LOGIC 9

Sequential Circuits – Storage Elements: Latches, Flip–Flops - Analysis of Clocked Sequential Circuits – State Reduction and Assignment – Design Procedure – Registers and Counters – HDL Models of Sequential Circuits.

UNIT – IV ASYNCHRONOUS SEQUENTIAL LOGIC 9

Analysis and Design of Asynchronous Sequential Circuits – Reduction of State and Flow Tables – Race-free State Assignment – Hazards.

UNIT – V MEMORY AND PROGRAMMABLE LOGIC 9

Memory Decoding – Error Detection and Correction – ROM – Programmable Logic Array – Programmable Array Logic – Sequential Programmable Devices

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Morris R Mano, Michael D Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and SystemVerilog", 6th Edition, Pearson Education, 2017.
2. S Salivahanan, S Arivazhagan, "Digital Circuits and Design", 5th edition, Oxford University Press, 2018.

REFERENCE BOOKS:

1. G K Kharate, "Digital Electronics", Oxford University Press, 2010.
2. John F Wakerly, "Digital Design Principles and Practices", 5th Edition, Pearson Education, 2017.
3. Charles H Roth Jr, Larry L Kinney, "Fundamentals of Logic Design", 6th Edition, Cengage Learning, 2013.
4. Donald D Givone,"Digital Principles and Design", Tata Mc Graw Hill, 2003.
5. Thomas L Floyd, "Digital Fundamentals", 11th edition, Pearson Education, 2017

COURSE OUTCOMES

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

CO1 Solve Boolean functions using Kmap
CO2 Correlate and construct Combinational Circuits
CO3 Illustrate and construct Synchronous Sequential Circuits
CO4 Analyze and construct Asynchronous Sequential Circuits
CO5 Build various memories and Boolean functions using Programmable Logic Devices

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	1	2	0	0	0	0	0	2	1	2	1
CO2	3	3	3	2	3	0	0	0	0	0	2	2	2	2
CO3	3	3	3	2	3	0	0	0	0	0	2	2	2	2
CO4	3	3	3	3	3	0	0	0	0	0	2	2	2	2
CO5	3	2	3	2	3	0	0	0	0	1	3	2	2	2

GE25C02	**தமிழரும் தொழில்நுட்பமும்**	L	T	P	C
	(Common to All B.E / B.Tech & M.Tech (CSE-Integrated))	1	0	0	1

நோக்கங்கள்:

- பழந்தமிழர்களின் நெசவு, பானை மற்றும் தொடர்புடைய தொழில்நுட்ப வளர்ச்சிகளை மாணவர்களுக்கு அறிமுகப்படுத்துதல்.
- சங்க காலம் முதல் பிற்காலம் வரை தமிழர்களின் வடிவமைப்பு, கட்டுமானம், கட்டிடக்கலை மற்றும் சிற்பக்கலை மரபுகளைப் பற்றி மாணவர்கள் அறியச் செய்தல்.
- கப்பல் கட்டுதல், உலோகவியல், நாணய உற்பத்தி மற்றும் மணி தயாரித்தல் போன்ற பழந்தமிழர்களின் உற்பத்தித் தொழில்நுட்பங்களைப் பற்றிய அறிவை வழங்குதல்.
- தமிழர்களின் பாரம்பரிய வேளாண்மை, நீர்ப்பாசன முறைகள், கால்நடை பராமரிப்பு, மீன்வளம் மற்றும் கடல்சார் அறிவு குறித்த புரிதலை வளர்த்தல்.
- அறிவியல் தமிழ் மற்றும் கணித்தமிழின் வளர்ச்சி, தமிழ் மின்பதிப்பு, தமிழ் மென்பொருள் உருவாக்கம் மற்றும் இணையவழி தமிழ் வளங்களின் பயன்பாடு குறித்த விழிப்புணர்வை ஏற்படுத்துதல்

அலகு -1 நெசவு மற்றும் பானைத் தொழில்நுட்பம் **3**

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

அலகு -2 வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் **3**

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள்; சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை வடிவமைப்பு 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 இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு -3 உற்பத்தித் தொழில்நுட்பம் **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 -4 வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் 3

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

அலகு -5 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: 15 PERIODS

TEXT BOOKS/REFERENCE BOOK:

1. தமிழக வரலாறு மக்களும் பண்பாடும் – டாக்டர் கே.கே. பிள்ளை. (வெளியீடு தமிழ்நாடுபாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. தபொருநை – 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)

COURSE OUTCOMES

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

CO1 பழந்தமிழகத்தில் நடைபெற்ற நெசவுத் தொழிலின் தொன்மை மற்றும் மட்பாண்டக்கலையின் சிறப்பு முதலியவற்றை அறிந்து கொள்ளுதல்.

CO2 சங்ககால கட்டிட வடிவமைப்பு, சிற்பக்கலை, கோயில் கட்டிடக்கலை முதலியனவற்றின் சிறப்பை மாணவர்கள் உணர்தல்..

CO3 பழந்தமிழகதில் நடைபெற்ற அறிவியல் பூர்வமான தொழில்வகைகளின் சிறப்பை தெரிந்து கொள்ளுதல்.

CO4 பழந்தமிழகத்தில் நடைபெற்ற வேளாண்மை மற்றும் நீர்பாசனத் தொழில் நுட்பங்கள், கடல் சார் அறிவு முதலியவற்றை உணர்தல்.

CO5 அறிவியல் தமிழ் வளர்ச்சி மற்றும் கணினியின் இணையப் பயன்பாடு ஆகியவற்றின் பயன்பாட்டை உணர்தல்.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	0	0	0	2	1	0	1	0	2	1	0	0
CO2	2	2	1	0	0	3	1	0	1	0	2	1	0	0
CO3	3	2	2	1	1	2	1	0	1	0	2	1	1	1
CO4	2	2	1	0	0	3	1	0	1	0	2	2	1	2
CO5	2	1	1	0	3	2	1	0	2	1	3	3	2	3

GE25C02	TAMILS AND TECHNOLOGY	L	T	P	C
	(Common to All B.E / B.Tech & M.Tech (CSE-Integrated))	1	0	0	1

OBJECTIVES

- To introduce students to the technological advancements of ancient Tamils in weaving, pottery, and related crafts.
- To familiarize students with the design, construction techniques, architecture, and sculptural traditions of Tamil society from the Sangam period to later ages.
- To provide knowledge of the manufacturing technologies of ancient Tamils, including shipbuilding, metallurgy, coin minting, and bead production.
- To develop an understanding of traditional agricultural practices, irrigation systems, animal husbandry, fisheries, and maritime knowledge of the Tamils.
- To create awareness of the growth of Scientific Tamil and Computer Tamil, including digital publishing, Tamil software development, and online Tamil resources.

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: 15 PERIODS

TEXT BOOKS/REFERENCE BOOK:

1. தமிழக வரலாறு மக்களும் பண்பாடும் – டாக்டர் கே.கே. பிள்ளை. (வெளியீடு தமிழ்நாடுபாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித்தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. தபொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)
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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.

COURSE OUTCOMES

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

CO1 Explain the traditional weaving techniques and pottery-making practices of ancient Tamils.

CO2 Analyze the architectural designs, construction methods, and sculptural traditions of Tamil society from the Sangam period to later ages.

CO3 Apply knowledge of ancient Tamil manufacturing technologies, including shipbuilding, metallurgy, coin minting, and bead-making.

CO4 Examine the agricultural practices, irrigation systems, animal husbandry, fisheries, and maritime knowledge of ancient Tamils.

CO5 Demonstrate the use of digital tools and online resources for Scientific Tamil and Tamil Computing.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	0	0	0	2	1	0	1	0	2	1	0	0
CO2	2	2	1	0	0	3	1	0	1	0	2	1	0	0
CO3	3	2	2	1	1	2	1	0	1	0	2	1	1	1
CO4	2	2	1	0	0	3	1	0	1	0	2	2	1	2
CO5	2	1	1	0	3	2	1	0	2	1	3	3	2	3

ST. JOSEPH'S COLLEGE OF ENGINEERING CHENNAI - 600 119 You Choose, We Do It

EN25C10	PROFESSIONAL ENGLISH II (LAB INTEGRATED)	L	T	P	C
	(Common to all B.E / B. Tech and M. Tech (CSE-Integrated))	2	0	2	3

OBJECTIVES

- To engage learners in meaningful language activities to improve their reading and writing skills
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placements

UNIT – I MAKING COMPARISONS 6

Listening - Listening for descriptions of people; listening for opinions, Listening to the good and bad parts of a job; listening for complaints, Listening to people making, accepting, and declining requests, Listening to news stories; listening to messages and a podcast.

Speaking - Describing personalities; expressing likes and dislikes; agreeing and disagreeing; complaining, Talking about possible careers; describing jobs; deciding between two jobs, Making direct and indirect requests; accepting and declining requests, Narrating a story; describing events and experiences in the past.

Writing / Reading - Writing a description of a good friend, Reading about unusual social networking sites, Writing about two career choices, Reading about different types of workplaces, Writing a message with requests, Reading about talking to friends about difficult, Writing a personal account, Reading about the reliability of online content topics.

Grammar - Relative pronouns as subjects and objects; it clauses + adverbial clauses with when, Gerund phrases as subjects and objects; comparisons with adjectives, nouns, verbs, and past participles, Requests with modals, if clauses, and gerunds; indirect requests, Past continuous vs. simple past; past perfect.

UNIT – II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING 6

Listening - Listening for information about living abroad; listening to opinions about customs, Listening to complaints; listening to people exchange things in a store; listening to a conversation about a "throwaway culture", Listening to environmental problems; listening for solutions, Listening to a conversation with a guidance counselor; listening for additional information.

Speaking - Talking about moving abroad; expressing emotions; describing cultural expectations; giving advice, Describing problems; making complaints; explaining something that needs to be done, Identifying and describing problems; coming up with solutions, Asking about preferences; discussing different skills to be learned; talking about learning methods; talking about life skills

Writing/ Reading - Writing a pamphlet for tourists, Reading about moving to another country, Writing a critical online review, Reading about a problem with a ride-sharing service, Writing a post on a community website, Reading about a creative solution to lionfish on St. Lucia, Writing about a skill, Reading about different studying styles

Grammar - Noun phrases containing relative clauses; expectations: the custom to, (not) supposed to, expected to, (not) acceptable to, Describing problems with past participles as adjectives and with nouns; describing problems with need + gerund, need + passive infinitive, and keep + gerund, Passive in the present continuous and present perfect; prepositions of cause; infinitive clauses and phrases, Would rather and would prefer; by + gerund to describe how to do things

UNIT - III PROBLEM SOLVING 6

Listening - Listening to New Year's resolutions, Listening for dates and time periods; listening to predictions, Listening to descriptions of important events; listening to regrets and explanations, Listening for features and slogans.

Speaking - Talking about things you need to have done; asking for and giving advice or suggestions, Talking about historic events; talking about things to be accomplished in the future, Describing milestones; describing turning points; describing regrets and hypothetical situations, Describing qualities for success; giving reasons for success; interviewing for a job; talking about ads and slogans.

Writing / Reading - Writing a message of advice, Reading about young scientist Jack Andraka, Writing a biography, Reading about futurists and their predictions for the year 2050, Writing a message of apology, Reading about a conflict with a friend and advice on how to fix it, Writing a TV or web commercial, Reading about what makes some advertisements memorable.

Grammar - Get or have something done; making suggestions with modals + verbs, gerunds, negative questions, and infinitives, Referring to time in the past with adverbs and prepositions: during, in, ago, from…to, for, since; predicting the future with will, future continuous, and future perfect, Time clauses: before, after, once, the moment, as soon as, until, by the time; expressing regret with should (not) have + past participle; describing hypothetical situations with if clauses + past perfect and would/could have + past participle, Describing purpose with infinitive clauses and infinitive clauses with for; giving reasons with because, since, because of, for, due to, and the reason.

UNIT – IV THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY 6

Listening - Listening to explanations; listening for the best solution, Listening for parts of a movie, Listening for solutions to everyday annoyances; listening to issues and Opinions, Listening to past obstacles and how they were overcome; listening for people's goals for the future

Speaking - Drawing conclusions; offering explanations; describing hypothetical events; giving advice for complicated situations, Describing how something is done or made; describing careers in film, TV, publishing, gaming, and music, Giving opinions for and against controversial topics; offering a different opinion; agreeing and disagreeing, Giving opinions about inspirational sayings; talking about the past and the future

Writing / Reading - Writing about a complicated situation, Reading about unexplained events, Writing about a process, Reading about what the job of film extra is like, Writing a persuasive essay, Reading about plagiarism in the digital age, Writing a personal statement for an application, Reading about the athlete Michael Edward

Grammar - Past modals for degrees of certainty: must (not) have, may (not) have, might (not) have, could (not) have; past modals for judgments and suggestions: should (not) have, could (not) have, would (not) have, The passive to describe process with is/are + past participle and modal + be + past participle; defining and non-defining relative clauses, Giving recommendations and opinions with passive modals: should be, ought to be, must be, has to be, has got to be; tag questions for opinions, Accomplishments with the simple past and present perfect; goals with the future perfect and would like to have + past participle.

UNIT – V EXTENDED SKILL PRACTICE 6

Listening practice through worksheets (with audio – in class)
Grammar practice through worksheets*
Vocabulary practice through worksheets*
Writing practice through worksheets*
Speaking Skill Practice (in class) - 10-minute conversation practice sessions (with guidance from Placement Test)

LAB COMPONENT: **30**

Getting started - Talk about the workplace

Listening - Radio show: likeability; A problem; Conversation: life changes

Speaking - Work and training experiences; Interviewing classmates about technology use; Making and responding to suggestions; Sounding sympathetic or pleased; Talking about life changes

Reading - Article: Not the best interview I've ever had! Work and training experiences; Article: What's your favourite app? Reading an email about a new job Writing - An informal email; Adding new information

Grammar - Present perfect and past simple; Present perfect and present perfect continuous

Vocabulary – Work, technology

Pronunciation - Present perfect and past simple; Sentence stress: main verb / auxiliary verb; Sentence stress

Everyday English - Making and responding to suggestions.

Getting started: Talking about people

Listening - Radio show: successful people; Two monologues: personality types; Asking for help; Three monologues: websites

Speaking - Becoming successful at something; Describing a person; Question tags; Offering and asking for help; Things people use the Internet for

Getting started: Talk about different cultures

Listening - Three monologues: culture shock; Radio show: vending machines in Japan; A special gift; Three monologues: special occasions

Speaking - Describing different cultures; Describing a special meal; Asking for and giving recommendations; Expressing surprise; Place to go out

Reading - Article: Culture shock? There's an app to deal with that; Blog: Hungry adventures; Reviews of a café

Writing - Two reviews; Positive and negative language; Adverbs

Grammar - Modals of obligation; Comparatives and superlatives

Vocabulary - Compound nouns; Describing food

Pronunciation - Word stress: compound nouns; Sound and spelling; Sounding interested

Everyday English - Asking for and giving recommendations.

Reading - Article: When will I be famous? Article: Why the world needs introverts; Three online adverts

Writing - An informal online advert; The language of adverts

Grammar - Modals and phrases of ability; Articles

Vocabulary - Ability; Personality adjectives

Pronunciation - Stress with modal verbs, intonation in question tags

Everyday English - Offering and asking for help

Getting started: Talk about an interesting news story

Listening - Podcast: Pod-on-pod; Interview: fake reviews; A job interview; Monologue: a news story

Speaking - Giving opinions about podcasts; Describing experiences using reporting verbs; Generalising; Being vague; Air travel

Reading - Article: Thinking of making a podcast? Just give it a try!, Article: The restaurant that wasn't there, A news story
Writing - An email about a news story; Summarising information
Grammar - Reported speech; Verb patterns
Vocabulary - Sharing information; Reporting verbs
Pronunciation - Sound and spelling
Everyday English - Generalising and being vague
Getting started: Talk about different kinds of opportunities
Listening - Conversation: trying new activities; Making a marriage proposal; Monologue: volunteering
Speaking - Taking new opportunities; A past event that made life better; Talking about possible problems and reassuring someone; Changing the subject; Volunteering
Reading - Article: Searching for serendipity; A web page about volunteering; Emails giving advice
Writing - An email with advice; Advising a course of action
Grammar - Second conditional; Third conditional
Vocabulary - Sport; Adjectives and prepositions; Expressions with do, make and take
Pronunciation - Sentence stress: would, would and have; Sounding sure and unsure
Everyday English - Talking about possible problems and reassuring someone.

TOTAL: 30+30 PERIODS

TEXT BOOKS:

1. Interchange Level 3 - 5th edition published by Cambridge University Press & Assessment
2. English for Science & Technology Cambridge University Press 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, New Delhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

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COURSE OUTCOMES

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

CO1 Identify appropriate vocabulary for effective professional communication.

CO2 Apply basic grammatical structures correctly in right professional contexts.

CO3 Differentiate between denotative and connotative meanings while reading technical texts.

CO4 Compose structured definitions, technical descriptions, narrations, and essays on diverse topics.

CO5 Formulate targeted inquiry questions and organize topics for productive investigation

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	1	1	1	1	0	2	1	1	1	1	2	3	2
CO2	2	1	1	1	1	0	2	1	1	1	1	2	2	2
CO3	2	2	2	1	1	0	2	1	1	1	1	3	2	3
CO4	2	2	1	1	1	0	2	1	1	1	1	2	2	2
CO5	1	1	2	1	1	0	1	1	1	1	1	3	3	3

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AL25211	PYTHON PROGRAMMING LABORATORY	L	T	P	C
	(Common to AML, ADS, EEE, Mechatronics, Biotech & Chemical)	0	0	3	1.5

OBJECTIVES

- To develop the ability to use conditional statements to make decisions and looping technique to repeatedly execute a block of code.
- To understand the importance of functions and how to use them to make the code modular and reusable.
- To learn how to work with lists, tuples, dictionary and set.
- To develop an understanding of string manipulation techniques and the basics of file handling in Python.
- To understand object-oriented programming concepts.

LIST OF EXPERIMENTS

1. Programs using decision making
   - Check if a number is Positive, Negative, or Zero.
   - Check if a year is leap year or not.
2. Programs using looping
   - Find the sum of natural numbers
   - Printing multiplication table for a given number
3. Program using decision making and looping
   - Factorial computation.
   - Find prime numbers within a range.
4. Programs using Functions in Python
   - Find area of a circle.
   - Compute gcd, lcm of two numbers.
   - Fibonacci sequence using recursion.
5. Programs using List
   - Sum of all Elements in a List.
   - Find the maximum and minimum elements in a List.
   - Remove duplicates from a List.
6. Programs using Tuple
   - Creating and accessing a tuple.
   - Tuple unpacking.
   - Concatenate tuple.
7. Programs using Dictionary and Set
   - Creating and accessing dictionary.
   - Adding, updating and removing Dictionary elements.
   - Perform basic set operations.
   - Checking subset and superset.

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8. Programs using Strings
   - Count the number of Vowels in a String.
   - Check if a String is a Palindrome.
   - Check for Substring.
9. Python Program to read, write, and append to a file.
10. Python Program to calculate Student's grade using Class & Object.
11. Python Program to demonstrate multiple inheritance.
12. Python Program to perform operator overloading

TOTAL: 45 PERIODS

LAB REQUIREMENTS: (For a batch of 30 students)

Processors: Intel Core i5, i7, or newer. Operating systems: Ubuntu or any Linux distribution, Python (latest 3.x), IDLE or VS Code.

REFERENCE BOOKS:

1. Reema Thareja, "Python Programming using Problem Solving Approach", Oxford University Press,3rd Edition, 2025.
2. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. Rob Mastrodomenico, "The Python Book" , Wiley, 2022.

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COURSE OUTCOMES

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

CO1	Apply decision-making and looping constructs in python to solve basic computational and logical problems.
CO2	Develop programs using functions, recursion, and modular design to enhance code reusability and readability.
CO3	Implement and manipulate python data structures like lists, tuples, dictionaries, and sets for effective data handling.
CO4	Utilize string and file handling techniques for text processing and data storage applications.
CO5	Demonstrate object-oriented programming concepts such as classes, inheritance, and operator overloading to design real-world problem solutions.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	1	2	2	0	1	0	1	2	1	2	2
CO2	3	3	3	1	2	2	0	1	0	1	2	2	2	2
CO3	3	3	3	1	2	2	0	1	0	1	2	2	2	2
CO4	3	3	3	1	2	2	0	1	0	1	2	2	2	2
CO5	3	3	3	1	2	2	0	1	0	1	2	2	2	2

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CS25212	DIGITAL DESIGN LABORATORY	L	T	P	C
	(Common to CSE, CSBS, ADS, AML and M.Tech(CSE))	0	0	3	1.5

OBJECTIVES

- To understand the various basic logic gates.
- To design and implement the various combinational circuits.
- To design and implement combinational circuits using MSI devices.
- To design and implement sequential circuits.
- To understand and code with HDL programming

LIST OF EXPERIMENTS

1. Verification of Boolean Theorems using basic gates.
2. Design and implementation of combinational circuits using basic gates for arbitrary functions, code converters.
3. Design and implement half/full adder.
4. Design and implement combinational circuits using MSI devices:
   - 4-bit binary adder/subtractor
   - Parity generator/checker
   - Magnitude Comparator
   - Application using multiplexers
5. Design and implement shift-registers.
6. Design and implement synchronous counters.
7. Design and implement asynchronous counters.
8. Coding combinational circuits using HDL.
9. Coding sequential circuits using HDL.
10. Design and implementation of a simple digital system (Mini Project).

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1 Experiment Boolean simplification techniques to design a combinational circuit using logic gates.
CO2 Assess Boolean simplification techniques to design a combinational circuit using MSI Devices
CO3 Review different functional units in a digital computer system and model using VHDL/ Verilog HDL.
CO4 Build Combinational circuits and model using VHDL/ Verilog HDL
CO5 Build sequential circuits and model using VHDL/ Verilog HDL

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Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	1	2	0	0	0	0	0	2	2	2	2
CO2	3	3	3	1	2	0	0	0	0	0	2	2	2	2
CO3	3	2	3	2	3	0	0	1	1	1	3	2	2	2
CO4	3	2	3	2	3	0	0	1	1	1	2	2	2	3
CO5	3	2	3	3	3	0	0	1	1	1	3	2	2	3

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SD25C07	COMMUNICATIONS SKILLS ENHANCEMENT (Common to all branches & M. Tech (CSE-Integrated))	L	T	P	C
		0	0	2	0

OBJECTIVES

- To develop effective communication skills by improving students' listening, speaking, vocabulary, clarity, and verbal expression.
- To build confidence and self-awareness through personality development, professional grooming, positive attitude, and growth mindset.
- To develop essential behavioural competencies such as discipline, responsibility, time management, teamwork, prioritization, and professional etiquette.
- To enhance interpersonal and presentation skills through one-to-one interactions, group activities, public speaking, presentations, and structured communication.
- To develop emotional and professional skills for managing stress, handling conflicts, and maintaining positive relationships in professional and personal environments.

UNIT - I MOTIVATION, GOAL SETTING AND PERSONALITY DEVELOPMENT 6

- Growth mindset, positive attitude, and self-motivation
- Personal and academic goal setting
- Self-awareness, confidence building, and self-improvement
- Professional grooming and personality development
- Verbal and non-verbal behaviour

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UNIT - II BEHAVIOURAL COMPETENCIES AND INTERPERSONAL SKILLS 6

- Personal responsibility, discipline, and professional etiquette
- Time management, prioritization, and effective work habits
- Teamwork, collaboration, and respectful peer interaction
- Emotional awareness and empathy
- Interpersonal relationships and constructive conflict resolution
- Basic stress management techniques

UNIT - III FOUNDATIONS OF COMMUNICATION AND SPOKEN ENGLISH 6

- Principles and process of effective communication
- Formal and informal communication
- Communication barriers and strategies to overcome them
- Active listening, feedback, and appropriate response techniques
- Classroom communication etiquette
- Everyday functional communication, vocabulary building, and fluency development
- Clarity of expression and structured verbal responses

UNIT – IV PUBLIC SPEAKING, PRESENTATION AND PROFESSIONAL DIGITAL COMMUNICATION 6

- Fundamentals of public speaking and effective speaking techniques
- Structuring speeches and oral presentations
- Classroom presentations and presentation delivery techniques
- Professional content writing for digital platforms
- Creating and optimizing professional LinkedIn profiles
- Showcasing academic achievements and projects
- Professional networking etiquette and responsible digital presence

UNIT – V AI-ASSISTED LEARNING, PRACTICAL APPLICATION AND ASSESSMENT 6

- Fundamentals of prompt formulation and effective use of AI tools
- Applications of AI for learning, communication, and productivity
- Responsible and ethical use of AI technologies
- Role plays, simulations, and individual and group activities
- Practical demonstration of communication and behavioural competencies
- Trainer observations, peer review, constructive feedback, and self-assessment
- Performance review and continuous improvement strategies

SUGGESTED TEACHING–LEARNING METHODOLOGY

- Interactive sessions and experiential learning
- Individual and group activities
- Role plays, simulations, and case-based exercises
- Public speaking and presentation practice
- Guided digital communication activities
- Practical assessments and structured feedback **TOTAL: 30 PERIODS**

COURSE OUTCOMES

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

CO1 Develop a positive attitude, growth mindset, self-awareness, and confidence to establish personal and academic goals.

CO2 Demonstrate effective verbal, non-verbal, and interpersonal communication skills in academic, social, and professional interactions.

CO3 Apply behavioural competencies such as time management, personal responsibility, teamwork, emotional regulation, and conflict resolution in collaborative settings.

CO4 Deliver structured presentations and prepare professional digital content using appropriate communication etiquette and responsible AI tools.

CO5 Demonstrate professional readiness through practical communication activities, constructive feedback, stress management, and effective self-improvement strategies.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	0	0	0	0	0	2	0	0	0	2	2	1	1	1
CO2	0	0	0	0	0	0	0	0	2	3	0	1	1	1
CO3	0	0	0	0	0	2	0	2	3	2	2	2	2	2
CO4	0	0	0	0	2	0	0	2	1	3	0	2	2	2
CO5	0	0	0	0	0	2	0	2	2	3	2	2	2	2

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SD25C08	APTITUDE TRAINING COURSE – II	L	T	P	C
	(Common to all Branches and M. TECH(CSE))	0	0	2	0

OBJECTIVES

- To build strong fundamentals in commercial mathematics and problem-solving.
- To strengthen logical and critical reasoning abilities for competitive exams.
- To develop speed and accuracy in aptitude-based problem solving.
- To enable application of quantitative & reasoning skills to real-world scenarios.
- To prepare students for aptitude tests in **placements, SSC, Bank PO, and higher studies**.

UNIT – I PERMUTATIONS & COMBINATIONS 6

- Counting Principles (Addition, Multiplication)
- Permutations (with/without repetition, identical objects, word problems)
- Circular Permutations
- Combinations (properties, restrictions, real-life applications)
- Puzzle Practice Questions

UNIT – II PROBABILITY 6

- Basics of Probability: definitions, sample space, types of events
- Addition Rule of Probability
- Multiplication Rule of Probability
- Independent & Dependent Events
- Puzzle Practice Questions

UNIT – III TIME & WORK 6

- Work Efficiency Basics – Units of work, rate-time relationship, efficiency ratios
- Work Equations – Work = Rate × Time, combined work, partial work problems
- Work Sharing – Two/more persons, alternate days, joining/leaving scenarios
- Pipes & Cisterns – Inlet/outlet pipes, leakage, alternate working problems
- Practice Questions – Topic-wise & mixed

UNIT – IV TIME, SPEED & DISTANCE 6

- Concepts – Speed-distance-time, unit conversions, relative speed, average speed
- Problems on Trains – Crossing objects, platforms, overtaking, relative speed train problems
- Problems on Boats & Streams – Upstream/downstream, average speed, advanced word problems
- Practice Questions – Topic-wise & mixed

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UNIT – V LOGICAL REASONING – ADVANCED 6

- **Syllogism** – Categorical statements, Venn diagrams, possibility-based, reverse syllogism
- **Data Sufficiency** – Yes/No vs value-based, arithmetic & logical reasoning applications
- **Venn Diagrams** – Set theory, classification problems, application in DI & reasoning
- **Arrangement-Based** – Linear, circular, square, advanced puzzles (blood relations + seating)
- **Statement & Arguments** – Strong vs weak arguments, assumptions, traps in reasoning
- **Statement & Conclusions** – Inference vs conclusion, syllogism-based vs context-based
- **Cause & Effect** – Identifying causes, sequential chains, correlation vs causation

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1 Apply fundamentals of arithmetic, percentages, profit/loss, interest, time–work– speed

CO2 Analyze and solve advanced quantitative aptitude problems

CO3 Employ logical reasoning (syllogism, arrangements, data sufficiency, Venn)

CO4 Evaluate arguments, conclusions, and cause–effect relationships

CO5 Develop efficient strategies for aptitude-based tests

Mapping of COs with POs and PSOs

COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	0	0	0	0	0	2	3	2	1
CO2	3	3	2	2	1	0	0	0	0	0	2	3	3	2
CO3	2	3	2	2	1	0	0	0	0	0	2	3	2	1
CO4	2	3	2	2	1	1	1	0	1	0	3	2	3	2
CO5	2	2	2	1	1	0	0	0	1	1	3	2	2	2

SEMESTER III

MA25301	MATHEMATICS OF DISCRETE STRUCTURES	L	T	P	C
	(Common to CSE, CSE (CYBER), CS&BS, IT, ADS, AML, CSE(AML) and M.TECH(CSE))	3	1	0	4

OBJECTIVES

- To introduce Mathematical Logic, Inference Theory and proof methods.
- To provide fundamental principles on combinatorial counting techniques.
- To introduce partial ordering and some functions on a set.
- To introduce graph models, their representation, connectivity and traverseability.
- To explain the fundamental algebraic structures, groups and their algebraic properties.

UNIT – I LOGIC AND PROOFS 9+3

Propositional Logic – Propositional Equivalences – Normal Forms - Predicates and Quantifiers – Nested Quantifiers – Rules of Inference – Introduction to Proofs – Proof Methods and Strategy.

UNIT – II COMBINATORICS 9+3

Mathematical Induction – Strong Induction and Well Ordering – The Basics of Counting - The Pigeonhole Principle – Permutations and Combinations – Recurrence Relations - Generating Functions - Solving Linear Recurrence Relations Using Generating Functions – Inclusion – Exclusion – Principle and Its Applications..

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UNIT – III SETS AND FUNCTIONS 9+3

Set – Relation on Sets -Equivalence Relation – Functions –Partial ordering – Poset – Hasse diagram– Lattices as posets – Properties of lattices – Lattices as algebraic systems- Sub Lattices - Special Lattices (Modular, Distributive, Complement Lattices)

UNIT – IV GRAPHS 9+3

Graphs and Graph Models – Graph Terminology and Special Types of Graphs – Matrix Representation of Graphs and Graph Isomorphism – Connectivity – Euler and Hamilton Paths.

UNIT - V ALGEBRAIC STRUCTURES 9+3

Groups – Subgroups – Homomorphisms – Isomorphism - Normal Subgroup and Coset – Lagrange's Theorem

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw Hill Pub. Co.Ltd., Eighth Edition, Special Indian Edition, New Delhi, 2021.
2. Tremblay J.P. and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, Thirtieth Reprint, New Delhi, 2011.

REFERENCE BOOKS:

1. Ralph. P. Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction", Pearson Education, Fifth Edition, New Delhi, 2014.
2. Seymour Lipschutz and Mark Lipson," Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., Third Edition, New Delhi, 2013.
3. Thomas Koshy," Discrete Mathematics with Applications", Elsevier Publications, Boston, 2004.

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COURSE OUTCOMES

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

CO1 Apply logical equivalences, rules of inference, quantifiers, and proof techniques to construct and validate mathematical arguments

CO2 Analyze counting problems using the pigeonhole principle, permutations, combinations, and inclusion-exclusion, and Remember induction and recurrence relation techniques, including generating functions.

CO3 Analyze relations, functions, partial orders, and lattice structures to determine their properties and relationships.

CO4 Evaluate graph models, special types of graphs, and graph isomorphism, and Understand connectivity and Euler and Hamilton paths.

CO5 Apply group properties, subgroups, homomorphisms, isomorphisms, cosets, normal subgroups, and Lagrange's theorem to solve problems involving algebraic structures.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	1	1	0	0	0	1	2	2	2	1
CO2	3	3	2	2	1	1	0	0	0	1	2	2	2	1
CO3	3	3	2	2	1	1	0	0	0	1	2	2	2	1
CO4	3	3	2	2	1	1	0	0	0	1	2	2	2	1
CO5	3	3	2	2	1	1	0	0	0	1	2	2	1	1

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CS25301	DATA STRUCTURES	L	T	P	C
	(Common to CSE, IT, ADS, AML, CYBER, CSBS, M. Tech (CSE))	3	0	0	3

OBJECTIVES

- To understand the concepts of ADTs.
- To learn linear data structures like lists, stacks, and queues.
- To learn Non-linear tree data structures.
- To apply Graph structures
- To understand sorting 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 - doubly linked lists - circularly linked lists - applications of List: polynomial manipulation (Insertion, Deletion, Merge, Traversal)

UNIT – II LINEAR DATA STRUCTURES – STACKS, QUEUES 9

Stack ADT– applications of Stack: Evaluating arithmetic expressions-conversion of Infix to Postfix expression –Queue ADT– Circular Queue– applications of Queue: Priority Queue.

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 – Heap.

UNIT - IV NON LINEAR DATA STRUCTURES – GRAPHS 9

Definition – Representation of Graph – Types of graph – Graph traversal -Topological Sort – Bi-connectivity –Graph Algorithms – Single Source Shortest Path Algorithms: Dijkstra's Algorithm – All pair shortest Path Algorithms: Floyds warshall Algorithm–Minimum Spanning Tree: Prim's Algorithm–Kruskal's Algorithm–Applications of Graph.

UNIT – V SORTING AND HASHING TECHNIQUES 9

Sorting: Bubble sort – Selection sort – Insertion sort – Merge sort – Quick sort –Hashing: Hash Functions– Separate Chaining-Open Addressing–Rehashing–Extendible Hashing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 1997.

REFERENCE BOOKS:

1. ReemaThareja, "Data Structures Using C",Second Edition, Oxford University Press, 2011.
2. Michael T.Goodrich, Roberto Tamassia, Michael H.Goldwasser, Data Structures and ' Algorithms in Python, Wiley, 2013.
3. Bradley N.Miller, David L. Ranum, "Problem Solving with Algorithms and Data Structures using Python ", Second Edition, 2013.
4. Rance D. Necaise, Data Structures and Algorithms Using Python ,John Wiley & Sons, 2011.

COURSE OUTCOMES

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

CO1 Integrate abstract data types for linear data structures.

CO2 Apply the different linear data structures to problem solutions.

CO3 Implement abstract data types for non-linear data structures.

CO4 Experiment Graph data structure for the real-world problems.

CO5 Analyze the various sorting and hash functions that result in a collision free scenario for data storage and retrieval.

Mapping of COs with POs and PSOs

COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	0	3	0	1	2	1	0	1	2	2	1
CO2	3	3	3	0	2	0	1	2	1	0	1	2	3	2
CO3	3	3	3	2	2	0	1	2	1	0	1	2	2	2
CO4	3	3	3	2	2	0	1	2	1	1	2	2	3	3
CO5	2	3	3	0	2	0	0	1	2	1	2	2	3	2

CS25302	COMPUTER ARCHITECTURE	L	T	P	C
	(COMMON TO CSE, ADS, CSBS, M.Tech (CSE))	3	0	0	3

OBJECTIVES

- To learn the basic structure and operations of a computer.
- To learn the arithmetic and logic unit and implementation of fixed-point and floating-point arithmetic unit.
- To learn the basics of pipelined execution.
- To understand parallelism and multi-core processors.
- To understand the memory hierarchies and the ways of communication with I/O devices.

UNIT – I BASIC STRUCTURE OF A COMPUTER SYSTEM 9

Eight ideas-Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing.

UNIT – II DATA REPRESENTATION AND ARITHMETIC FOR COMPUTERS 9

Signed number representation, Addition and Subtraction – Multiplication – Division – Fixed-and Floating-Point Representation – Floating Point Operations.

UNIT – III DATA PATH AND CONTROL UNIT 9

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme – Pipelining – Pipelined data path and control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT – IV PARALLELISM 9

Parallel Processing challenges – Flynn‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures - Hardware multithreading – multi-core processors and other Shared Memory Multiprocessors - Introduction to Graphics Processing Units, Clusters, Warehouse Scale Computers and other Message-Passing Multiprocessors.

UNIT – V MEMORY AND PERIPHERAL DEVICES 9

Memory Hierarchy - memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB's – Accessing I/O Devices – Interrupts – Direct Memory Access – Bus structure – Bus operation – Arbitration – Interface circuits – USB.

TOTAL: 45 PERIODS

TEXT BOOKS:

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

REFERENCE BOOKS:

1. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.
2. John L. Hennessey and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.
3. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.
4. Jim Ledin, "Modern Computer architecture and Organization", Packet Publishing, 2020.
5. Douglas Comer, "Essentials of Computer Architecture", Taylor and Francis Group 2020

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COURSE OUTCOMES

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

CO1 Explain the basic structure, functional units, operations, instruction representation and addressing modes of a computer system.

CO2 Apply appropriate number representations and arithmetic techniques for performing fixed-point and floating-point.

CO3 Analyze data path, control unit and pipelined execution, including data and control hazards in a MIPS processor.

CO4 Integrate different forms of parallelism, processor architectures, multithreading, multicore systems and message-passing.

CO5 Correlate memory hierarchy, cache and virtual memory systems, and I/O communication mechanisms including interrupts, DMA and buses.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2	1	1	1	0	0	1	0	2	2	2	1
CO2	2	2	2	1	1	1	0	0	1	0	2	2	3	2
CO3	2	2	2	2	2	1	0	0	1	1	2	3	3	2
CO4	2	2	2	2	2	1	0	0	1	1	2	3	3	3
CO5	2	2	2	2	2	1	1	0	1	1	2	2	3	2

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IT25301	DATABASE DESIGN AND MANAGEMENT	L	T	P	C
	(Common to CSE, IT, ADS, AML,CSE(AML), CYBER, CSBS, M. Tech CSE)	3	0	0	3

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 – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

UNIT – II DATABASE DESIGN 9

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – 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.

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UNIT – III TRANSACTIONS 9

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support in SQL – Need for Concurrency – Concurrency control –Two Phase Locking- Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm

UNIT – IV IMPLEMENTATION TECHNIQUES 9

RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage– Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection, Sorting and join operations – Query optimization using Heuristics - Cost Estimation.

UNIT - V ADVANCED TOPICS 9

Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases. Database Security: Security issues – Access control based on privileges – Role Based access control-AI Integration in Database Systems.

TOTAL: 45 PERIODS

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
3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.

COURSE OUTCOMES

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

CO1 Apply relational algebra to construct SQL Queries

CO2 Design database using ER model and normalize the database

CO3 Apply transaction processing concepts to construct queries that maintain consistency of the database

CO4 Correlate various indexing strategies and apply the knowledge to tune the performance of the database

CO5 Appraise the difference of Relational Databases from advanced databases and choose a suitable database for any requirement.

Mapping of COs with POs and PSOs

COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	0	3	0	0	0	0	1	1	1	3	2
CO2	3	3	3	2	2	0	0	1	1	1	1	2	2	2
CO3	3	3	2	3	2	0	0	0	1	1	1	1	2	1
CO4	3	3	2	3	3	0	0	0	0	1	1	1	2	2
CO5	3	2	2	2	3	1	0	1	1	1	2	2	3	3

AD25301	ESSENTIALS OF DATA SCIENCE	L	T	P	C
	(Common to ADS, AML, CSE (AML))	3	0	0	3

OBJECTIVES

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python.

UNIT – I INTRODUCTION 9

Need for Data Science – Benefits and Uses – Facets of Data – Data Science Process – Setting the Research Goal – Retrieving Data – Cleansing, Integrating, and Transforming Data – Exploratory Data Analysis – Build the Models – Presenting and Building Applications. Data Mining – Data Warehousing – Basic Statistical descriptions of Data.

UNIT – II ORGANIZING AND SUMMARIZING DATA 9

Types of Data - Types of Variables -Describing Data with Tables and Graphs – Describing Data with Averages - Describing Variability. Handling large data on a single computer: Problems when handling large data – General techniques for handling large volumes of data.

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UNIT – III DESCRIBING RELATIONSHIPS 9

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.

UNIT – IV DATA WRANGLING 9

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping.

UNIT – V DATA VISUALIZATION 9

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three-dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016.
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017.
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016.

REFERENCE BOOKS:

1. Dr.Gypsy Nandi & Dr.Rupam Kumar Sharma, "Data Science Fundamentals and Practical Approaches: Understand Why Data Science is the Next", BPB Publisher, 2020.
2. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

COURSE OUTCOMES

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

CO1 Identify the stages involved in the data science process.
CO2 Categorize different types of data and summarize data using appropriate statistical measures.
CO3 Analyze relationships between variables using correlation and regression techniques.
CO4 Apply Python libraries for data wrangling and manipulation.
CO5 Construct appropriate visualizations and interpret data using Python visualization libraries.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	1	1	0	0	0	0	1	0	3	2	2
CO2	3	3	2	2	0	0	0	0	0	1	0	3	3	1
CO3	3	3	2	3	0	0	0	0	0	1	0	3	3	2
CO4	3	3	2	2	3	0	0	0	1	0	0	3	3	2
CO5	3	3	3	3	3	1	1	1	1	0	1	3	3	2

CS25308	OPERATING SYSTEMS (Lab Integrated)	L	T	P	C
	(COMMON TO CSE, IT, ADS, AML, CSBS, CYBER, M.Tech CSE)	2	0	2	3

OBJECTIVES

- To Introduce the fundamental concepts and design principles of operating systems.
- To Explain process management, CPU scheduling, synchronization, and deadlock handling.
- To Describe memory and file management mechanisms.
- To Provide practical exposure to system-level programming and simulation of OS concepts.
- To Enable students to relate theory to practice through Linux commands, shell scripting, and algorithmic simulation.

UNIT - I INTRODUCTION TO OPERATING SYSTEMS 6+6

Basic Concepts: Operating system objectives and functions, evolution of OS-OS Services, System Calls, Types of OS (Batch, Time Sharing, Distributed, Real-Time) -Operating System Structure – Layered, Monolithic, Microkernel, Modular.

Case Study: Linux System Structure.

Lab Integration:

- Practice basic **Linux/UNIX commands** for file, process, and user management.
- Simple **shell scripting** exercises.

UNIT – II PROCESS MANAGEMENT 6+6

Processes: Concept, States, Process Control Block (PCB).Process Scheduling: Scheduling criteria and algorithms – FCFS, SJF, RR, Priority. Threads: Multithreading models. Interprocess Communication (IPC).

Lab Integration:

- Implement **CPU Scheduling algorithms** in C/Python.
- Implement **Interprocess Communication** using pipes/message queues/shared memory.

UNIT – III PROCESS SYNCHRONIZATION AND DEADLOCK 6+6

Critical Section Problem, Semaphores, Monitors. Classical Synchronization Problems: Producer-Consumer, Reader-Writer, Dining Philosophers. Deadlock: Characterization, Prevention, Avoidance (Banker's Algorithm), Detection, and Recovery.

Lab Integration:

- Simulate **process synchronization** using semaphores or monitors.
- Implement **deadlock detection and avoidance** algorithms.

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UNIT – IV MEMORY MANAGEMENT 6+6

Memory Partitioning, Paging, Segmentation. Virtual Memory: Demand Paging, Page Replacement Algorithms – FIFO, LRU, Optimal Allocation Methods – Contiguous, Non-contiguous, Fragmentation.

Lab Integration:

- Simulate **memory allocation techniques** (First Fit, Best Fit, Worst Fit).
- Implement **page replacement algorithms**.

UNIT – V FILE SYSTEMS AND I/O MANAGEMENT 6+6

File Concepts, Access Methods, Directory Structure, File Allocation (Contiguous, Linked Indexed). File Protection and Access Control-Disk Scheduling: FCFS, SSTF, SCAN, C SCAN.I/O Hardware and Device Drivers overview.

Lab Integration:

- Simulate **file allocation techniques** and **disk scheduling algorithms**.
- Mini project: Build a **simple file system or process scheduler** simulation.

TOTAL: 30+30 PERIODS

TEXT BOOKS:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne — Operating System Concepts, 10th Edition, Wiley.
2. William Stallings — Operating Systems: Internals and Design Principles, Pearson, 9th Edition.

REFERENCE BOOKS:

1. Andrew S. Tanenbaum — Modern Operating Systems, Pearson.
2. D.M. Dhamdhere — Operating Systems: A Concept-Based Approach, McGraw Hill.
3. Achyut S. Godbole — Operating Systems, Tata McGraw Hill.

LAB SOFTWARE REQUIREMENTS: (For a batch of 30 students)

Operating System: Ubuntu / Linux

Languages: C / Python / Shell scripting

Compiler: GCC / Python3

Tools: Gedit / VS Code / Terminal

COURSE OUTCOMES

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

CO1 Summarize the fundamental concepts, services, system calls, types and structures of operating systems with basic Linux commands and shell scripting.

CO2 Apply process management concepts, CPU scheduling algorithms, multithreading and IPC mechanisms to solve process-related problems.

CO3 Analyse process synchronization problems and deadlock situations using appropriate synchronization and deadlock handling techniques.

CO4 Articulate memory management and virtual memory techniques to implement memory allocation and page replacement algorithms.

CO5 Implement file allocation and disk scheduling techniques and develop simple operating system simulations using system-level programming.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	0	2	0	1	0	0	0	2	2	2	1
CO2	3	3	2	2	3	0	0	1	0	1	2	3	3	2
CO3	3	3	2	3	3	0	0	1	0	0	2	2	3	2
CO4	3	2	2	2	3	0	0	1	0	0	2	2	3	2
CO5	3	3	3	3	3	0	0	2	1	2	3	2	3	3

CS25311	DATA STRUCTURES LABORATORY	L	T	P	C
	(Common to CSE, IT, ADS, AML, CYBER, CSBS, M. Tech CSE)	0	0	3	1.5

OBJECTIVES

- To explore data structures based on lists.
- To learn about linear data structures such as stacks and queues.
- To investigate tree-based (non-linear) data structures.
- To delve into graph algorithms and minimum spanning trees.
- To understand sorting and hashing algorithms.

LIST OF EXPERIMENTS:

1. IMPLEMENTATION OF LIST

Write C programs to

a) Array implementation of List ADT.

b) Design and implement Single Linked List.

c) Design and implement Doubly Linked List.

d) Design and implement Circular Linked List.

2. IMPLEMENTATION OF STACK AND QUEUE

Write C programs to

a) Design and implement Stack and its operations using List.

b) Design and implement Queue and its operations using List.

3. APPLICATIONS OF LINEAR DATA STRUCTURE

Write C programs for the following:

a) Design and implement polynomial ADT using list

b) Uses Stack operations to convert infix expression into postfix expression.

c) Uses Stack operations for evaluating the postfix expression

4. IMPLEMENTATION OF TREE

a) Write a C program to Design and implement binary Search tree.

b) Traverse the above binary tree recursively in pre-order, post-order & in-order.

5. IMPLEMENTATION OF ADVANCED TREE

a) Design and Implement AVL tree using Templates.

b) Design and Implement heap tree using Templates.

6. IMPLEMENTATION OF SHORTEST PATH ALGORITHMS

Write C programs for the following:

a) Design and Implement Dijkstra's algorithm

b) Design and Implement Floyd Warshall algorithm

7. IMPLEMENTATION OF MINIMUM SPANNING TREE

Write C programs for the following:

a) Design and Implement Kruskal's algorithm.

b) Design and Implement Prim's algorithm.

8. GRAPH TRAVERSAL & APPLICATIONS

Write C programs to implement the following algorithms:

a) Depth first search.

b) Breadth first search.

c) Topological Sorting.

9. SORTING AND HASHTABLE IMPLEMENTATION

a) Write C programs for implementing the following sorting techniques to arrange a list of integers in ascending order.

- Insertion sort
- Selection sort
- Quicksort
- Merge sort

b) Write C programs for implement Hashing–any two collision techniques Prim's algorithm.

TOTAL: 45 PERIODS

REFERENCE BOOKS:

1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C",2nd Edition, Pearson Education, 1997.

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WEB REFERENCES:

1. https://www.mygreatlearning.com/blog/data-structures-using-c/
2. https://www.faceprep.in/data-structures/data-structures-programs/

COURSE OUTCOMES

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

CO1 Implement and evaluate list-based data structures efficiently
CO2 Apply stacks and queues appropriately to solve algorithmic problems.
CO3 Apply tree structures for hierarchical data and analyse their operations.
CO4 Solve problems with graphs, apply traversal and minimum spanning tree algorithms.
CO5 Examine sorting and hashing algorithms and choose the right one for a problem.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	0	3	0	0	0	2	1	2	2	3	2
CO2	3	3	3	0	3	0	0	0	2	1	2	2	3	2
CO3	3	3	3	2	0	0	0	0	1	1	2	2	3	2
CO4	3	3	3	0	3	0	0	0	1	1	2	3	3	3
CO5	3	3	3	0	3	0	0	0	1	1	2	2	3	2

IT25311	DATABASE DESIGN AND MANAGEMENT LABORATORY	L	T	P	C
	(Common to CSE, IT, AML, CSE(AML), ADS, CYBER, CSBS, M.Tech(CSE))	0	0	3	1.5

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 AND MANAGE DATABASE TABLES

Create a database table, add constraints such as Primary Key, Unique, Check, and Not Null. Perform insert, update, and delete operations using SQL DDL and DML commands.

2. ESTABLISH TABLE RELATIONSHIPS

Create a set of tables, define foreign key constraints, and incorporate referential integrity between related tables.

3. QUERYING TABLES USING WHERE AND AGGREGATE FUNCTIONS

Execute SQL queries using different WHERE clause conditions and implement aggregate functions like COUNT, AVG, SUM, MIN, and MAX.

4. SUBQUERIES AND VARIOUS JOINS

Query database tables using subqueries and various joins (natural joins, equi joins, inner and outer joins) operations to retrieve related data.

5. PL/SQL PROGRAMMING: FUNCTIONS AND STORED PROCEDURES

Write SQL user-defined functions and stored procedures using PL/SQL for performing modular database operations.

6. TRANSACTIONS MANAGEMENT: TCL AND DCL COMMANDS

Execute complex transactions and demonstrate the use of Data Control Language (DCL) and Transaction Control Language (TCL) commands.

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7. TRIGGERS IN SQL

Write SQL triggers for insert, delete, and update operations to automate actions within a database table.

8. VIEWS AND INDEXES

Create database views and indexes for tables containing large numbers of records to improve performance and data abstraction.

9. XML DATABASE CREATION AND VALIDATION

Create an XML database and validate it using XML Schema (XSD).

10. NOSQL DATABASE IMPLEMENTATION

Create document-based, column-based, and graph-based data structures using NoSQL tools

11. CASE STUDY – REAL LIFE DATABASE APPLICATION

Choose one of the following applications and perform the complete database design and implementation:

a) Inventory Management for E-Mart Grocery Shop

b) Society Financial Management

c) Cop Friendly App – eSeva

d) Property Management – eMall

e) Star Small and Medium Banking and Finance

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TOTAL: 45 PERIODS

LAB REQUIREMENTS: (For a batch of 30 students**)**

1.Hardware: Intel® Core™ i3 Processor or above

2. Operating System: Windows / Linux

3. Software Tools: MySQL / Oracle / PostgreSQL / MongoDB / Any suitable NoSQL tool

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, 7th Edition, McGraw Hill Education, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, 7th Edition, Pearson Education, 2017.

WEB REFERENCES:

1. https://www.w3schools.com/sql/
2. https://www.geeksforgeeks.org/sql-tutorial/
3. https://www.mongodb.com/

COURSE OUTCOMES

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

CO1 Design and create relational database tables using SQL DDL and DML commands with constraints.

CO2 Apply SQL clauses, aggregate functions, and join operations to query and manipulate database tables.

CO3 Develop SQL triggers, stored procedures, and user-defined functions for database automation

CO4 Implement XML and NoSQL databases for structured and unstructured data management.

CO5 Design and develop a complete database-driven application with GUI integration.

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Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	1	3	0	0	0	1	1	1	1	2	2
CO2	3	3	2	2	3	0	0	0	1	1	1	2	3	2
CO3	3	3	3	2	3	0	0	0	1	1	1	1	2	2
CO4	3	2	2	2	3	1	0	1	1	1	2	2	3	3
CO5	3	3	3	3	3	1	0	1	2	2	2	2	2	3

SD25C11	Soft Skills and Professional Communications	L	T	P	C
	(Common to all B.E/B. Tech and M. Tech(CSE-Integrated))	0	0	2	0

A training program on Soft skills and Professional communications equips individuals with the intangible abilities needed to thrive in the workplace.

OBJECTIVES

- To build interpersonal relationships,
- To elevate leadership potential,
- To increase productivity,
- To refine both verbal and non-verbal communication

UNIT – I FOUNDATIONS OF COMMUNICATION 6

- Definition, Scope, Purpose and Importance of Communication
- Process and Types of Communication
- Barriers to Communication
- Introduction to Verbal, Non-verbal, Visual & Digital Communication
- Basics of Non-verbal Communication (Appearance, Gestures, Eye Contact, Posture)
- Significance of Communication in Academic & Engineering Contexts

UNIT – II LISTENING AND READING FOR ACADEMIC & REAL-LIFE CONTEXTS 6

Listening Skills

- Purpose of Listening
- Active Listening & Barriers to Listening
- Listening to Announcements: railway / bus / airport / sports / commentary
- Academic Listening: lectures, presentations, talks
- Note-taking Techniques

Reading Skills

- Purpose, Process and Methods of Reading
- Skimming, Scanning
- Levels of Reading
- Reading Comprehension Strategies
- Academic Reading Tips

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UNIT – III SPEAKING SKILLS AND EVERYDAY ORAL COMMUNICATION 6

Speaking Skills

- Importance & Status of Spoken English in India
- Basics of IPA (for clear pronunciation)
- Functional Spoken English in Real-life Situations:
    - Giving instructions
    - Seeking & giving permission
    - Expressing opinions
    - Agreeing/disagreeing
    - Asking for/giving suggestions or advice
    - Expressing sympathy
    - Demanding explanations

Non-verbal Skills in Speaking

- Body Language (Kinesics)
- Facial Expressions, Eye Contact
- Time Language & Silence
- Tips for Improving Non-verbal Skills

UNIT - IV WRITING SKILLS FOR ACADEMIC, PROFESSIONAL & EVERYDAY USE 6

Effective Writing

- Elements of Writing: Sentences, Phrases, Clauses
- Types of Sentences
- Paragraph Writing: Cohesion and Coherence
- Email Writing (formal/informal)
- Letter Writing
- Notices, Essays

Workplace & Everyday Technical Literacy

- Understanding technical words used in forms: bank challans, applications, manuals, instructions, terms & conditions
- Filling common forms, writing simple workplace documents

Remedial Grammar + Vocabulary Use

- Articles, Parts of Speech, Tenses, Modals
- Prepositions, Subject–Verb Agreement
- Error Correction: punctuation, Indianisms, slang
- Vocabulary: Synonyms/Antonyms, Confused Words, One-word Substitutes
- Word Formation (Prefixes, Suffixes, Roots)

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UNIT - V CAREER COMMUNICATION & PROFESSIONAL PREPARATION 6

- Identifying Job Openings
- Writing Cover Letters
- Resume / CV Preparation & Effective Profiling
- Interpreting job descriptions & workplace expectations
- Communication skills for interviews
- Professional vocabulary and etiquette
- Practical tasks:
  - Fill a job application form
  - Write a short professional email
  - Create a resume draft

TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1 Explain fundamentals, types, and barriers of communication in academic and professional contexts.

CO2 Demonstrate effective listening and reading strategies.

CO3 Apply verbal and non-verbal communication skills in real-life situations.

CO4 Develop structured written communication using proper grammar and vocabulary.

CO5 Prepare professional documents and perform effectively in interviews.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	0	0	0	0	0	0	0	1	1	3	1	2	1	1
CO2	1	1	0	1	0	0	0	0	0	3	2	2	2	1
CO3	0	0	0	0	0	0	0	1	3	3	1	3	2	2
CO4	0	0	0	0	1	0	0	1	1	3	2	3	2	2
CO5	1	1	1	0	1	1	0	2	3	3	2	3	2	2

SEMESTER IV

MA25401	PROBABILITY THEORY AND STATISTICS	L	T	P	C
(Common to CSE, IT, CSE(CYBER),CS&BS, ADS , AML, CSE(AML) and M.TECH(CSE))		3	1	0	4

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 phenomena.
- To understand the basic concepts of random processes which are widely used in engineering applications.
- To acquaint the knowledge of testing of hypothesis for small and large samples, which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT – I PROBABILITY AND RANDOM VARIABLES 9+3

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

UNIT – II TWO - DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Central limit theorem (for independent and identically distributed random variables).

UNIT – III MARKOV MODELS 9+3

Introduction to Discrete stochastic process - Definition and examples - Markov Process – Discrete Parameter Markov chain – Chapman Kolmogorov theorem (without proof) -State transitions- state probabilities - properties – steady state analysis – absorbing chains.

UNIT – IV STATISTICAL TESTING 9+3

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

UNIT – V DESIGN OF EXPERIMENTS 9+3

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

TOTAL: 60 PERIODS

TEXT BOOKS:

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2017.
2. Ibe, O.C., —Fundamentals of Applied Probability and Random Processes", Elsevier, 2nd Indian Reprint, 2014.

REFERENCE BOOKS:

1. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2017.
2. Tanvir Mustafy, Md. Tauhid Ur Rahman, "Statistics and Data Analysis for Engineers and Scientists", Springer Verlag,(first Edition), 2024.
3. Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2014.
4. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2017.
5. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 4thEdition, Elsevier, 2009.
6. Spiegel. M.R., Schiller. J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 2008.

COURSE OUTCOMES

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

CO1 Apply probability axioms, Bayes' theorem, moments, moment generating functions and some standard distributions.

CO2 Analyze two dimensional random variables with respect to joint, marginal, conditional distributions, covariance, correlation, linear regression and apply the central limit theorem on iid random variables.

CO3 Articulate stochastic processes, Markov chains and Evaluate steady state probabilities

CO4 Apply sampling distributions and parameter estimation, and Analyze hypothesis tests based on Normal, t, Chi-square, and F distributions.

CO5 Analyze completely randomized, randomized block, Latin square, and 2^2 factorial designs.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	3	2	1	0	0	0	1	1	3	2	1
CO2	3	3	2	2	2	1	0	0	0	1	1	3	2	1
CO3	3	2	2	1	1	1	0	0	0	1	1	3	2	1
CO4	3	3	2	3	3	2	0	0	0	2	2	3	2	1
CO5	3	3	2	3	2	2	0	0	0	2	2	2	1	1

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CS25401	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
	(Common to CSE, IT, ADS, AML, CYBER, CSBS, M. Tech CSE)	3	0	0	3

OBJECTIVES

- To learn the general framework for analyzing algorithm efficiency
- To be conversant with algorithms for common problems.
- To analyse the algorithms for time/space complexity.
- To write algorithms for a given problem using different design paradigms.
- To understand computational complexity of problems

UNIT - I INTRODUCTION 9

Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – The Analysis Framework – Asymptotic Notations and Basic Efficiency Classes – Mathematical Analysis of Non recursive and Recursive Algorithms – Empirical Analysis of Algorithms.

UNIT - II DECREASE AND CONQUER AND DIVIDE-AND-CONQUER 9

Decrease-and-Conquer: Insertion Sort – Binary Search – Computing a Median and the Selection Problem – Divide-and-Conquer: Merge Sort – Quicksort – The Closest –Pair and Convex Hull Problems by Divide and Conquer.

UNIT - III DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9

The Knapsack Problem and Memory Functions – Optimal Binary Search Trees – Warshall's and Floyd's Algorithm – Prim's, Kruskal's. Dijikstra's Algorithm - Huffman Trees and Codes.

UNIT - IV ITERATIVE IMPROVEMENT 9

The Simplex Method – The Maximum Flow Problem – Maximum Matching in Bipartite Graphs – The Stable Marriage Problem

UNIT - V COPING WITH THE LIMITATIONS OF ALGORITHM POWER 9

P, NP, and NP- Complete Problems – Backtracking: n-Queens Problem – Hamiltonian Circuit Problem – Subset-Sum Problem – Branch-and-Bound: Assignment Problem – Knapsack Problem – Traveling Salesman Problem

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, McGraw Hill, 2009.

REFERENCE BOOKS:

1. Horowitz, Sahani, Rajasekaran "Fundamentals of Computer Algorithms", Universities Press.
2. Thomas H. Cormen, "Introduction to Algorithms", PHI.
3. Harsh Bhasin "Algorithms Design and Analysis" Oxford.
4. I.Chandra Mohan " Design and Analysis of Algorithms" PHI

COURSE OUTCOMES

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

CO1 Analyze algorithms using asymptotic notations and efficiency measures for recursive and non-recursive algorithms.

CO2 Implement problems using algorithmic design techniques such as decrease and conquer and divide and conquer

CO3 Experiment dynamic programming and greedy techniques to solve optimization and graph-related problems.

CO4 Apply iterative improvement techniques to solve flow, matching and optimization problems.

CO5 Analyze computationally difficult problems and apply backtracking and branch-and-bound techniques to obtain solutions.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	2	0	0	3	0	2	3	2	3	2
CO2	3	3	3	3	2	0	0	3	0	2	3	2	3	2
CO3	3	3	3	3	2	0	0	3	0	2	3	3	3	3
CO4	3	3	3	3	2	0	0	3	0	2	3	2	3	2
CO5	3	3	3	3	2	0	0	3	0	2	3	2	3	2

CS25402	COMPUTER NETWORKS	L	T	P	C
	(Common to CSE, IT, CYBER, CSBS, M. Tech CSE)	3	0	0	3

OBJECTIVES

- To understand the protocol layering and physical level communication and to analyze the performance of a network.
- To analyze the contents of Data Link layer packet based on the layer concept.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport layer.
- To know about different application layer protocols.

UNIT - I INTRODUCTION AND PHYSICAL LAYER 9

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

UNIT - II DATA-LINK LAYER & MEDIA ACCESS 9

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

UNIT - III NETWORK LAYER 9

Network Layer Services – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4 – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol.

UNIT - IV TRANSPORT LAYER 9

Introduction – Transport Layer Protocols – Services – Port Numbers – User Datagram Protocol - Transmission ControlProtocol-Congestion ControlMechanisms-Streaming Control Transmission Protocol.

UNIT - V APPLICATION LAYER 9

WWW and HTTP – FTP – Email –Telnet –SSH – DNS – SNMP- Internet Multimedia.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Behrouz A. Forouzan, Data Communications and Networking, Fifth Edition TMH, 2013.
2. William Stallings, Data and Computer Communications, Tenth Edition, Pearson Education, 2014.

REFERENCE BOOKS:

1. Larry L. Peterson, Bruce S. Davie, Computer Networks: A Systems Approach, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012
2. Nader F. Mir, Computer and Communication Networks, Second Edition, Prentice Hall, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, Computer Networks: An Open-Source Approach, McGraw Hill Publisher, 2011
4. James F. Kurose, Keith W. Ross, Computer Networking, A Top-Down Approach Neil Smyth, Featuring the Internet, Sixth Edition, Pearson Education, 2013.

COURSE OUTCOMES

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

CO1 Understand the basic layers, functions in computer networks and to evaluate the performance of a network.

CO2 Analyze data-link layer protocols, media access mechanisms, Ethernet, wireless LANs and connecting devices.

CO3 Correlate IPv4/IPv6 addressing, packet forwarding and routing

CO4 Estimate transport layer services and protocols, including UDP, TCP, congestion control and SCTP.

CO5 Implement application layer protocols such as HTTP, FTP, email, DNS, SSH, SNMP and multimedia services for network applications.

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Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	1	1	1	1	0	0	1	3	2	3	2
CO2	3	3	3	2	1	1	1	0	0	1	3	2	3	2
CO3	3	3	3	2	1	1	1	0	0	2	3	3	3	2
CO4	3	3	3	2	1	1	1	0	0	2	3	2	3	2
CO5	3	3	3	2	1	1	1	1	0	2	3	3	3	3

AD25401	DATA EXPLORATION AND VISUALIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES

- To provide a comprehensive overview of exploratory data analysis (EDA) concepts and their role in data science.
- To equip students to perform data manipulation and visualization using Python libraries and modern BI tools.
- To enable learners to conduct univariate, bivariate, and multivariate data exploration.
- To introduce Tableau for professional visualization, dashboard design, and storytelling.
- To apply EDA and visualization techniques for discovering insights from real-world datasets

UNIT - I EXPLORATORY DATA ANALYSIS 9

EDA fundamentals – Understanding data science workflow – Significance of EDA – Making sense of data – Data understanding vs. data modeling – Visual aids for EDA – Overview of EDA tools and their roles in data science.

UNIT - II EDA USING PYTHON 9

Data manipulation using Pandas – Pandas objects – Data indexing and selection – Handling missing data – Hierarchical indexing – Combining datasets (concat, append, merge, join) – Aggregation and grouping – Pivot tables – Overview of Matplotlib and Seaborn plotting APIs.

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UNIT - III DATA EXPLORATION AND VISUALIZATION 9

Univariate and bivariate exploration – Frequency distribution, measures of central tendency and dispersion, skewness and kurtosis – Outlier detection – Boxplots, histograms, density plots – Covariance and correlation (Pearson, Spearman, Kendall) – Scatterplots, pairplots, and heatmaps – Cross-tabulation and contingency tables – Comparative plots for categorical and continuous variables – Visual interpretation and summary reporting.

UNIT - IV MULTIVARIATE AND TIME SERIES ANALYSIS 9

Multivariate visualization – 3D scatter plots, pairplots, heatmaps – Basics of time series data – Components: trend, seasonality, noise – Time-based indexing and resampling – Visualizing temporal trends using Matplotlib or Plotly.

UNIT - V VISUALIZATION AND DASHBOARDING USING TABLEAU 9

Introduction to Tableau – Connecting to data sources – Data preparation and cleaning in Tableau – Creating basic charts (bar, line, pie, map, scatter) – Filters, parameters, and calculated fields – Building interactive dashboards – Using Tableau stories for data storytelling – Publishing and sharing dashboards.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Suresh Kumar Mukhiya, Usman Ahmed, Hands-On Exploratory Data Analysis with Python, Packt Publishing, 2020. — (Units I–II)
2. Catherine Marsh, Jane Elliott, Exploring Data: An Introduction to Data Analysis for Social Scientists, Wiley, 2nd Ed., 2008. — (Units III–IV)
3. Molly Monsey & Paul Sochan, Tableau for Beginners: Getting Started with Data Visualization and Business Intelligence, Packt Publishing, 2023. — (Unit V)
4. Wes McKinney, Python for Data Analysis, 3rd Ed., O'Reilly, 2022. (Recommended companion text)

REFERENCE BOOKS:

1. Claus O. Wilke, Fundamentals of Data Visualization, O'Reilly, 2019.
2. Matthew O. Ward, Georges Grinstein, Daniel Keim, Interactive Data Visualization: Foundations, Techniques, and Applications, 2nd Edition, CRC Press, 2015.
3. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training Services, 2017.
4. Joel Grus, Data Science from Scratch: First Principles with Python, O'Reilly, 2019.

COURSE OUTCOMES

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

CO1	Summarize the fundamentals and significance of Exploratory Data Analysis (EDA) in the data science workflow.
CO2	Apply Python libraries for data manipulation, transformation, and visualization.
CO3	Analyze univariate and bivariate data to identify distributions, outliers, and relationships among variables.
CO4	Investigate multivariate and temporal data using appropriate visualization techniques.
CO5	Design interactive dashboards and data stories using Tableau for visual analytics.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	0	1	0	0	0	0	0	0	0	1	2	1
CO2	3	2	1	2	3	0	0	0	0	0	0	1	2	3
CO3	3	3	1	3	3	0	0	0	0	1	0	2	3	3
CO4	3	3	1	3	3	0	0	0	0	1	0	2	3	3
CO5	2	2	3	2	3	0	0	0	0	3	1	3	3	3

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AD25402	MACHINE LEARNING AND GENERATIVE AI	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the mathematical foundations and workflow of Machine Learning.
- To design predictive models using supervised and unsupervised learning algorithms.
- To explore advanced Machine Learning techniques and deep neural networks.
- To understand the architecture and engineering principles of Generative AI and Foundation Models.
- To develop responsible AI solutions using Machine Learning and Generative AI.

UNIT – I FOUNDATIONS OF MACHINE LEARNING 9

Introduction to Machine Learning – Learning Paradigms – Machine Learning Workflow – Data Representation – Feature Engineering – Training, Validation and Testing – Overfitting – Underfitting – Bias-Variance Trade-off – Model Evaluation Metrics.

UNIT – II MACHINE LEARNING ALGORITHMS 9

Linear Regression – Logistic Regression – Bayesian Learning – K-Nearest Neighbours – Decision Trees – Random Forest – Support Vector Machines – K-Means Clustering – Hierarchical Clustering – Principal Component Analysis – Model Selection and Cross Validation.

UNIT – III ADVANCED MACHINE LEARNING 9

Neural Networks – Multilayer Perceptron – Backpropagation Algorithm – Activation Functions – Ensemble Learning – Bootstrap Aggregation (Bagging) – Boosting – Gradient Boosting Machines – Reinforcement Learning – Deep Learning Fundamentals.

UNIT – IV FOUNDATIONS OF GENERATIVE AI 9

Introduction to Generative AI – Evolution of Generative Models – Generative vs Discriminative Models – Foundation Models – Transformer Architecture – Self-Attention Mechanism – Encoder–Decoder Architecture – Tokenization – Embeddings – Positional Encoding – Large Language Models – Prompt Engineering Principles.

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UNIT – V GENERATIVE AI ENGINEERING 9

Vector Databases – Retrieval-Augmented Generation (RAG) – Fine-tuning Concepts – Parameter-Efficient Fine-Tuning (Overview) – AI Agents (Concepts) – Multimodal AI – LLM Evaluation Metrics – Responsible AI – Ethical, Legal and Security Issues – Industrial Applications of Generative AI. Applications of Generative AI.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ethem Alpaydin, Introduction to Machine Learning, Fourth Edition, MIT Press, 2021.
2. Kevin P. Murphy, Probabilistic Machine Learning: An Introduction, MIT Press, 2022.
3. Sebastian Raschka, Build a Large Language Model (From Scratch), Manning Publications, 2024.

REFERENCE BOOKS:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
2. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
3. Aurélien Géron, Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow, 3rd Edition, O'Reilly, 2023.
4. Chip Huyen, AI Engineering, O'Reilly, 2025.
5. Lewis Tunstall, Leandro von Werra, Thomas Wolf, Natural Language Processing with Transformers, O'Reilly, 2022.
6. Russell & Norvig, Artificial Intelligence: A Modern Approach, 4th Edition, Pearson, 2021.

COURSE OUTCOMES

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

CO1 Identify the mathematical foundations, learning paradigms, workflow, feature engineering, and evaluation techniques of Machine Learning.

CO2 Apply supervised and unsupervised Machine Learning algorithms to develop predictive and clustering models for real-world datasets.

CO3 Analyze neural networks, ensemble learning, boosting, reinforcement learning, and deep learning techniques for solving complex learning problems.

CO4 Interpret the architecture and working principles of Foundation Models, Transformers, Self-Attention, and Large Language Models.

CO5 Design Generative AI applications using RAG, vector databases, fine-tuning concepts, AI agents, multimodal AI, and responsible AI practices.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	2	1	0	0	0	0	1	0	3	2	0
CO2	3	3	3	2	3	0	1	0	1	1	1	3	3	2
CO3	3	3	3	3	3	0	0	0	1	1	1	3	3	2
CO4	3	3	2	3	3	0	1	1	1	2	1	3	3	3
CO5	3	3	3	3	3	1	2	3	2	2	2	3	3	3

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AC25C01	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY	L	T	P	C
	(Common to all B.E / B. Tech and M. Tech (CSE-Integrated))	2	0	0	0

OBJECTIVES

- To develop a foundational understanding of environmental principles, ecosystems, and biodiversity
- To cultivate skills for pollution control and mitigation
- To equip students with a comprehensive understanding of different types of natural resources, including their extraction, utilization, and potential environmental impacts.
- To achieve sustainable development by balancing economic growth, social equity, and environmental protection, thereby addressing global challenges.
- To promote sustainable practices in waste management, resource utilization, energy efficiency, and urban development, aiming for environmental protection and socio-economic advancement

UNIT – I ENVIRONMENT AND BIODIVERSITY 6

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

UNIT - II ENVIRONMENTAL POLLUTION 6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.

UNIT - III RENEWABLE SOURCES OF ENERGY 6

Energy management and conservation, New Energy Sources: Need of new sources. Different types-new energy sources. Applications of - Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT - IV SUSTAINABILITY AND MANAGEMENT 6

Development, GDP, Sustainability- concept, needs and challenges-economic and social aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas Climate change- 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 – V SUSTAINABILITY PRACTICES 6

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: Energy Cycles-carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

TOTAL: 30 PERIODS

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. (2011)
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning. (2015)
6. Environment Impact Assessment Guidelines, Notification of Government of India, (2006).
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London.
8. A.Sheik Mideen and M.A. Mohamed Musthfa, Environmental Science and Sustainability, 1st Edition, Airwalk Publications, 2025.

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REFERENCE BOOKS:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. (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 "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. (2013).

COURSE OUTCOMES

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

CO1 Understand the fundamentals of the environment, ecosystems, and biodiversity.

CO2 Summarize the methods of pollution control and mitigation.

CO3 Illustrate the impacts of extraction and utilization of natural resources.

CO4 Apply techniques for environmental sustainability and management

CO5 Implement various sustainable practices in developmental initiatives.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	1	0	0	3	2	0	0	0	1	2	2	2
CO2	2	3	2	2	1	3	2	0	1	0	1	3	3	3
CO3	2	2	2	1	1	3	1	0	0	0	1	2	2	3
CO4	2	3	3	1	1	3	2	1	1	2	2	3	3	3
CO5	2	3	3	1	2	3	2	1	2	2	2	3	3	3

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AD25408	ADVANCED ARTIFICIAL INTELLIGENCE (LAB INTEGRATED)	L	T	P	C
		2	0	2	3

OBJECTIVES

- To design and implement intelligent agents using Python for real-world problem solving.
- To apply search, reasoning, and learning algorithms for intelligent decision-making.
- To solve constraint satisfaction and optimization problems effectively.
- To develop expert systems and multi-agent communication models.
- To explore robotics simulations and real-world intelligent system applications.

UNIT – I FOUNDATIONS OF INTELLIGENT SYSTEMS 6+6

Introduction – Definition and Evolution of Intelligent Systems – Foundation and History of AI – Future of AI – Characteristics of Intelligent Agents – Agents and Environments – Structure of Agents – Nature of Environments – Types of Agents – Rationality and Agent Programs – Overview of Intelligent Applications and Domains.

Lab Integration:

- Develop a simple reflex agent program in Python for the vacuum-cleaner world problem. This particular world has just two locations: squares A and B. The vacuum agent perceives which square it is in and whether there is dirt in the square. It can choose to move left, move right, suck up the dirt, or do nothing.

UNIT – II PROBLEM SOLVING AND SEARCH STRATEGIES 6+6

Problem Formulation – State Space Representation – Uninformed Search Strategies: Breadth First Search, Depth First Search, Uniform Cost Search – Informed Search Strategies: Greedy Best First Search, A* Algorithm – Heuristics and Admissibility – Local Search and Optimization Problems – Hill Climbing, Simulated Annealing, Genetic Algorithms – Constraint Satisfaction Problems – Backtracking and Constraint Propagation – Game Playing – Minimax and Alpha–Beta Pruning.

Lab Integration:

- Solve the 8-puzzle problem, which consists of a 3×3 board with eight numbered tiles and a blank space. A tile adjacent to the blank space can slide into the space. The objective is to reach a specified goal state as given below. Find the minimum number of steps required to reach the goal.
- Write a Python program to solve the N Queen Problem using backtracking. The N Queen is the problem of placing N chess queens on an N×N chessboard so that no two queens attack each other.
- Write a Python program for a path search problem to find a path from point A to point B using A* Search Algorithms.
- Using Hill Climbing Search Algorithm, find the solution for a Travelling Salesman Problem, which has to find the shortest route from a starting location and back to the starting location after visiting all the other cities.

UNIT – III KNOWLEDGE REPRESENTATION AND LEARNING 6+6

Knowledge Representation – Syntax and Semantics of Propositional Logic and First Order Predicate Logic – Unification – Forward and Backward Chaining – Resolution – Ontological Engineering – Categories and Objects – Events and Mental States – Knowledge Representation for Reasoning Systems – Learning from Observations – Inductive Learning – Decision Tree Learning – Ensemble Learning – Naïve Bayes and Neural Networks.

Lab Integration:

- Apply Bayes' Rule to a scenario of drug screening, which is a mandatory testing for federal or many other jobs which promise a drug-free work environment.
- Perform text classification for a real-world example. Consider a model capable of predicting whether a given movie review is positive or negative. Use people's sentiments which are classified into different categories and based upon the text classification give either a positive or a negative review.

UNIT – IV UNCERTAINTY, REASONING, AND DECISION MAKING 6+6

Uncertainty and Probability – Bayes' Theorem – Bayesian Networks: Representation, Semantics, and Inference – Other Models for Uncertainty: Dempster-Shafer Theory – Fuzzy Sets and Fuzzy Logic – Utility Theory and Decision Theory – Decision Networks – Sequential Decision Problems – Value and Policy Iteration – Decision-Theoretic Agents – Value of Information – Trust and Reputation in Multi-Agent Systems.

Lab Integration:

- Write a Python program to create a fuzzy control system which models how you might choose to tip at a restaurant. When tipping, you consider the service and food quality, rated between 0 and 10. You use this to leave a tip of between 0 and 25%.
- Formulate a decision tree, which is applicable in the field of medical sciences that will
- help predict whether or not a patient has diabetes.

UNIT – V ROBOTICS AND INTELLIGENT APPLICATIONS 6+6

Introduction to Robotics – Robot Hardware Components – Sensors and Actuators – Robotic Perception and Vision – Motion Planning and Control – Planning in Continuous and Uncertain Environments – Multi-Agent Planning – Applications of Intelligent Systems in Robotics, Healthcare, Business, and Smart Cities – Expert Systems: Architecture, Knowledge Acquisition, and Examples (MYCIN, DART).

Lab Integration:

- Demonstrate the use of MYCIN: a medical expert system. Implement a small example of an expert system; which defines a few contexts, parameters, and rules, and presents a rudimentary user interface to collect data about an infection in order to determine the identity of the infecting organism.
- A robot moves in a plane starting from the original point (0, 0). The robot can move toward UP, DOWN, LEFT and RIGHT with a given step. Write a program to compute the distance from current position after a sequence of movement and original point. If the distance is a float, then just print the nearest integer.

TOTAL: 30+30 PERIODS

TEXT BOOKS:

1. Artificial Intelligence: A Modern Approach (4th Edition) by Stuart Russell & Peter Norvig — Published 2024.
2. Russell S. and Norvig P., Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2009.
3. Kevin Knight and Elaine Rich, Nair B., Artificial Intelligence (SIE), McGraw Hill, 2008.

REFERENCE BOOKS:

1. Gerhard Weiss, Multiagent Systems: A Modern Approach to Distributed Artificial Intelligence, MIT Press, Second Edition, 2013.
2. Bing Liu, Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data, Springer, 2011.
3. Christopher D. Manning, Introduction to Information Retrieval, Cambridge University Press, 2008.
4. Peter Jackson, Introduction to Expert Systems, Pearson Education, Third Edition, 2007.

COURSE OUTCOMES

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

CO1 Explain intelligent systems and develop simple agents for AI problem solving.

CO2 Apply search and optimization algorithms for intelligent decision-making.

CO3 Implement knowledge representation, learning, and probabilistic reasoning methods

CO4 Analyze reasoning and communication models using decision and link analysis frameworks.

CO5 Apply intelligent techniques in robotics, expert systems, and real-world applications.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	1	3	0	0	0	0	0	0	2	2	3
CO2	3	3	2	2	3	0	0	0	0	0	0	3	3	3
CO3	3	3	2	3	3	0	0	0	0	1	0	3	3	3
CO4	3	3	2	3	3	0	0	0	0	1	0	3	3	3
CO5	3	3	3	2	3	1	1	1	1	2	1	3	3	3

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AD25411	DATA EXPLORATION AND VISUALIZATION LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES

- To perform Exploratory Data Analysis (EDA) and visualization using Python libraries.
- To manipulate, summarize, and visualize datasets using Pandas, Matplotlib, Seaborn, and Tableau.
- To interpret univariate, bivariate, and multivariate relationships.
- To create interactive dashboards and communicate insights effectively.
- To apply visualization and dashboarding for real-world datasets.

LIST OF EXPERIMENTS:

1. Introduction to Python Libraries for EDA:

a. Install and verify NumPy, Pandas, Matplotlib, Seaborn.

b. Load the tips dataset and explore its structure (head(), info(), describe()).

2. Data Manipulation using Pandas:

a. Load the dataset from a URL and perform indexing, filtering, and sorting operations.

b. Perform merging (concat, merge) and grouping (groupby) to summarize student scores by gender or test preparation course.

3. Handling Missing and Outlier Data:

a. Detect missing values using isnull() and handle them using fillna() or dropna().

b. Identify and handle outliers using boxplots and z-scores on numerical features like Age and Fare.

4. Univariate Analysis on Benchmark Dataset (e.g., Titanic/Iris):

a. Compute mean, median, variance, skewness, and kurtosis for each numeric feature.

b. Visualize distributions using histograms, boxplots, and KDE plots for sepal and petal measurements.

5. Bivariate Analysis and Correlation Study:

a. Compute Pearson and Spearman correlation coefficients among features.

b. Visualize relationships using scatterplots, pairplots, and heatmaps with Seaborn.

6. Regression Analysis (Linear & Multiple):

a. Apply simple linear regression (TV advertising vs. Sales) using scikit-learn.

b. Apply multiple linear regression using TV, Radio, and Newspaper variables; visualize regression lines and residuals.

7. Categorical Data Analysis:

a. Perform cross-tabulation of Sex vs. Survived and conduct a chi-square test of independence.

b. Visualize results using bar plots, count plots, and violin plots for categorical comparisons.

8. Visualization and Dashboarding using Tableau – Basic Charts:

a. Connect Tableau to a dataset (e.g., Titanic or Iris).

b. Create bar, line, pie, map, and scatter charts. c. Apply filters, parameters, and calculated fields.

9. Data Storytelling and Interactive Dashboards in Tableau:

a. Combine multiple charts into an interactive dashboard. b. Add legends, filters, and parameters for interactivity.

b. Create a Tableau Story to present insights and publish the dashboard.

10. Mini Project – End-to-End Data Analysis and Visualization:

a. Perform data cleaning, EDA, and visualization on a selected real-world dataset.

b. Generate a final EDA summary report with insights, correlation matrix, and key plots.

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TOTAL: 45 PERIODS

TOOLS AND LIBRARIES:

Programming: Python 3.x Libraries: NumPy, Pandas, Matplotlib, Seaborn, Plotly, Statsmodels, scikit-learn **. Platform:** Jupyter Notebook / Google Colab

COURSE OUTCOMES

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

CO1	Implement Python libraries for exploratory data analysis of structured datasets.
CO2	Apply data manipulation, cleaning, and preprocessing techniques to real-world datasets.
CO3	Analyze data relationships and patterns using statistical, correlation, and regression techniques.
CO4	Interpret univariate, bivariate, multivariate, and time-series visualizations to derive analytical insights.
CO5	Design interactive visualizations and dashboards using Tableau to communicate analytical insights

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	2	3	0	0	0	0	2	0	1	2	3
CO2	3	3	1	2	3	0	0	0	0	2	0	1	2	3
CO3	3	3	1	3	3	1	0	0	0	2	0	2	3	3
CO4	3	3	2	3	3	2	1	0	0	3	3	2	3	3
CO5	2	2	3	2	3	2	1	1	3	3	3	3	3	3

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AD25412	MACHINE LEARNING AND GENERATIVE AI LABORATORY	L	T	P	C
		0	0	3	1.5

OBJECTIVES

- To implement Machine Learning algorithms using Python.
- To evaluate supervised and unsupervised Machine Learning models.
- To develop neural network-based predictive models.
- To build Generative AI applications using Large Language Models.
- To integrate Machine Learning and Generative AI for real-world applications.

LIST OF EXPERIMENTS:

1. Data Preprocessing and Exploratory Data Analysis

Perform data cleaning, feature engineering, feature scaling, and exploratory data analysis using Python libraries.

2. Supervised Learning

Implement and compare Linear Regression and Logistic Regression models using appropriate evaluation metrics.

3. Classification Algorithms:

Implement K-Nearest Neighbours (KNN), Decision Tree, Random Forest, and Support Vector Machine (SVM) classifiers and compare their performance.

4. Unsupervised Learning:

Implement K-Means and Hierarchical Clustering algorithms and visualize the generated clusters.

5. Dimensionality Reduction and Ensemble Learning:

Apply Principal Component Analysis (PCA) for dimensionality reduction and implement Bagging and Gradient Boosting models.

6. Neural Networks:

Develop a Multilayer Perceptron (MLP) model using TensorFlow/Keras for classification or Prediction.

7. Prompt Engineering with Large Language Models

Design and evaluate prompts for text summarization, question answering, code generation, and content generation using a Large Language Model.

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8. Embeddings and Retrieval-Augmented Generation (RAG):

Generate text embeddings, perform semantic search, and develop a simple Retrieval-Augmented Generation (RAG) application

9. AI Agent Development:

Develop an AI agent using an LLM framework to perform tasks such as document question answering or conversational assistance.

10. Mini Project – Intelligent AI Application:

Develop an end-to-end application integrating Machine Learning and Generative AI for a real-world problem such as:

- Intelligent Document Analyzer
- Medical Question Answering System
- Smart Recommendation System
- Resume Analyzer
- Customer Support Chatbot

TOTAL: 45 PERIODS

TOOLS AND LIBRARIES:

Software Required: Windows / Linux, Python 3.10 or above, Anaconda Distribution (optional) /Visual Studio Code /PyCharm

Libraries Required: Python 3.x, Jupyter Notebook / JupyterLab / Google Colaboratory, NumPy, Pandas, Matplotlib, Scikit-learn, TensorFlow / Keras, Hugging Face Transformers, Sentence Transformers, LangChain, FAISS or ChromaDB (Vector Database), Ollama / LM Studio (for local LLM deployment) or OpenAI API (where available), Git and GitHub (for version control)

COURSE OUTCOMES

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

CO1	Apply data preprocessing and exploratory data analysis techniques for Machine Learning applications.
CO2	Evaluate supervised and unsupervised Machine Learning models using appropriate performance metrics.
CO3	Implement neural network and ensemble learning models for predictive analytics.
CO4	Construct Generative AI applications using prompt engineering, embeddings, Retrieval-Augmented Generation, and AI agents.
CO5	Design intelligent applications by integrating Machine Learning and Generative AI techniques for real-world problems.

Mapping of COs with POs and PSOs														
COs	**Programme Outcomes (POs)**											**Programme Specific Outcomes (PSOs)**		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	1	2	3	0	0	0	0	0	0	2	2	3
CO2	3	3	2	3	3	0	0	0	0	1	0	3	3	2
CO3	3	3	2	3	3	0	0	0	0	1	0	3	3	2
CO4	3	3	3	2	3	0	0	0	0	2	0	3	3	3
CO5	3	3	3	3	3	1	1	1	1	3	1	3	3	3

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SD25C16	DATA STRUCTURES TRAINING (C & JAVA)	L	T	P	C
	(Common to all Branches and M.TECH(CSE))	0	0	2	0

OBJECTIVES

- To strengthen problem-solving fundamentals using mathematical techniques, pattern-based problems, recursion, and recursive problem analysis.
- To develop proficiency in arrays and strings through systematic approaches to manipulation, traversal, matrix operations, and problem solving.
- To introduce efficient searching techniques including linear search, binary search, and search-based problem-solving strategies.
- To develop understanding of sorting-based problem solving using merge-sort and cycle-sort concepts, bit manipulation and hashing techniques, applications and their optimizing data processing.
- To develop advanced problem-solving techniques using two-pointer and sliding-window approaches for placement-oriented coding problems.

TOPIC – 1 MATHS, PATTERN & RECURSION

Recursion, Analysis of Recursion, Sum of Naturals, Count Digits, Prime Testing, Prime Factors, All Divisors

TOPIC – 2 ARRAY & STRING

Subtopics / Concepts:

Array, String, Matrix introduction, Problems - Multiply with Adjacent, Reverse in Groups, Rotate, Arrange by Sign, Stock with single transaction. Stock with Multiple Transactions

Same Strings, Toggle Case, Remove Occurrences, Remove Spaces, Check Subsequence, First Non-Repeating, Pangram, Sum of all subarrays, Max Product Subarray

2D Array: Diagonal Traversal, Magic Square, Boundary Traversal, Matrix Spiral, Toeplitz Matrix, Matrix Zig-Zag, Transpose of Matrix, Rotate a matrix by 90, Conway's Game of Life, Queries in a Matrix, Set Matrix 0

TOPIC – 3 SEARCHING

Subtopics / Concepts:

Linear Search: Largest, Second Largest, Local Min & Max

Binary Search: Insertion Position, Lower Bound, Upper Bound, Single Element, Missing Natural, Count Occurrences, 2D Search, Sorted & Rotated, Sorted & Rotated II, K Closest, Search in Almost Sorted, Peak, Peak in 2D, Range-based Counts, Kth Missing, Search in Row-Column Sorted

Search on Two: Median of two sorted, Kth of two sorted

TOPIC – 4 SEARCHING

Subtopics / Concepts:

Merge & Merge Sort Based: Union of 2 Sorted, Intersection of 2 Sorted, Merge Without Extra Space, Minimum Platforms, Inversion Count, Surpasser Count

Cycle Sort Based: Cycle Sort, Minimum Missing Positive, Min Swaps to Sort

TOPIC – 5 BIT MANIPULATION

Subtopics / Concepts:

Problem- Swap without Third, Kth Set Bit, Power of two, Sort by Set bits, Power of 4, Binary is palindrome, Rotate Bits, Swap Odd Even

Bit with Arrays: Max Consecutive 1s, One Odd, Two Odds, Palindrome Permutation, Missing & Repeating, Unique Numbers II, n-bit Gray Codes, Hamming Distance

TOPIC – 6 HASHING

Subtopics / Concepts:

Problems - Distinct in Array, Is Subset, Union, Intersection, Fizz Buzz, Pair Sums Divisible by k, Roman to Integer, Isomorphic Strings

Hashing for Frequency: Count Frequencies, Most Frequent, Max Subsets, Anagrams

TOPIC – 7 TWO POINTER

Subtopics / Concepts:

Two-Pointer Introduction

Problem - 2 Sum in Sorted, Smallest Subarray, Unique Elements, Sentence Palindrome, 3 Sum, Celebrity Problem, Closest Pair from 2, Container with Most Water, Common in 3, Reverse Words, Policemen catch thieves, 4 Sum, Closest Triplet, Count Triplets

TOPIC – 8 SLIDING WINDOW

Subtopics / Concepts:

Sliding Window Introduction, Problem Fixes, Length Window: Max Sum Subarray of size K

Variable Length: Maximise Ones, Equal substring with cost less than K, Fruit Into Baskets, Subarray with given sum

Minimum length: Smallest subarray with sum greater than x, Minimum Window Subsequence, Minimum Window Substring, Smallest containing 0, 1 and 2

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TOTAL: 30 PERIODS

COURSE OUTCOMES

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

CO1	Apply mathematical, pattern-based, and recursive techniques to solve programming problems and analyze recursive solutions.
CO2	Implement efficient solutions for array, string, and matrix-based problems using appropriate traversal and manipulation techniques.
CO3	Apply linear search, binary search, and related search techniques to solve problems involving sorted, rotated, two-dimensional, and range-based data.
CO4	Apply sorting, bit manipulation, and hashing techniques to solve problems involving merging, inversion counting, minimum swaps, set bits, unique elements, frequency analysis, missing and repeating values, anagrams, and related optimization and data-processing tasks.
CO5	Apply two-pointer and sliding-window techniques to solve problems involving pairs, triplets, arrays, substrings, and variable-size windows efficiently.

Mapping of COs with POs and PSOs														
COs	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	1	1	3	0	0	0	0	0	3	2	3	2
CO2	3	3	2	1	3	0	0	1	0	0	3	2	3	2
CO3	3	3	1	1	3	0	0	0	0	0	3	2	3	2
CO4	3	3	2	1	3	0	0	1	0	0	3	2	3	3
CO5	3	3	2	1	3	0	0	2	1	0	3	2	3	3

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